

**Summer Training at
Wockhardt Hospital, Nagpur
(April 3 to June 2, 2017)**

**Report on Clinical Audit on Fractional Flow Reserve in Wockhardt Heart
Hospital and Call Bell Response Time in Wockhardt Super Speciality
Hospital, Nagpur**

**By
Sumit M. Bilgaye**

**Under the guidance of
Dr. Susmit Jain**

**MBA Hospital & Health Management
2016-2018**


**Institute of Health Management Research
The IIHMR University, Jaipur
2017**

CERTIFICATE

This is to certify that **Dr. Sumit M. Bilgaye** has undergone summer training in **Wockhardt Hospital, Nagpur** from **3rd April to 2nd June 2017**.

The candidate himself completed the project assign to him during summer training. His approach to the project was sincere and proactive. This summer training is in partial fulfillment of the course requirement recommended for the award of MBA in Hospital and Health Management.

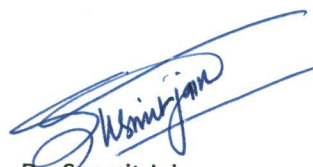
I wish him success in all his future endeavors.



Dr. Ashok Kaushik

Dean (Academic & Students Affairs)

The IIHMR University, Jaipur



Dr. Susmit Jain

Assistant Professor & Mentor

The IIHMR University, Jaipur

June 05, 2017

TO WHOM SO EVER IT MAY CONCERN

This is to certify that **Dr. Sumit M. Bilgaye** (Student of IIHMR University, Institute of Health Management Research, Jaipur) has successfully completed his Summer Training from 03/04/2017 to 02/06/2017

He has done project on

1. Clinical audit on FFR at Wockhardt Heart Hospital
2. Time Motion Analysis at Wockhardt Heart Hospital
3. Study on call bell response time at Wockhardt Superspecialty Hospital
4. Study on patient orientation on admission at Wockhardt Superspecialty Hospital
5. Study on hospital signage requirement at Wockhardt Superspecialty Hospital

During his aforesaid tenure, he has been found to be extremely honest, regular and sincere.

For Wockhardt Hospitals Ltd.,



Abhijeet Pagade
Dy. Manager-HR

Acknowledgement

Any idea is not revolutionary or feasible enough, if it's not supported, improvised or trimmed enough before its implementation. A single page is not sufficient enough to thank all those people who helped me during the summer training, but a few important contributors do worth a mention.

I feel deeply privileged in expressing our deep sense of gratitude to Dr. Anupam Verma (President), Dr. Clive Fernandes' (Clinical Director), Dr. Sujatha.K (Centre Head, Nagpur) Wockhardt Group of Hospitals, for their expert guidance and encouragements which helped in the process of making this report. Without their support exploring such a vast organization could not have been possible.

An Endeavour over a period can be successful only with the advice and support of a mentor. I would like to express my sincere thanks to Dr. Rajesh Gade, and Dr Vikas Choudhari, Head of Quality Department, for mentoring me in decision making with positive and supportive attitude and for the continuous encouragement. I choose this moment to acknowledge his contribution.

I would extend my sincere gratitude towards Dr. Ashok Kaushik, Dean (Academic & students affairs), IIHMR University, Jaipur and my mentor Dr.Susmit Jain, Assistant professor, IIHMR University, Jaipur for their time and efforts which helped me to conduct my study. I owe a debt of gratitude to all my teachers for grooming me and my colleagues for the inspiration needed to work with dedication and motivation.

Last but not the least, I would like to thank all my batch mates of MBA-HM 2016-18 for being there through thick and thin and making this summer training a great learning & memorable experience.

Dr Sumit M Bilgaye

MBA HM 21

Roll no- 0507

Table of content

Sr no	Content	Page no
1	Acknowledgement	1
2	Abbreviation	3
3	1) Observation learning 1.1) Introduction 1.2) Objective 1.3) Methodology 1.4) General finding 1.5) Conclusive findings	4-9
4	Specific Project	10-29
5	2) Clinical audit on FFR in Wockhardt Hospital 2.1) Introduction 2.2) Problem statement 2.3) Objective 2.4) Standards 2.5) Methodology 2.6) Analysis 2.7) Result 2.8) Conclusion 2.9) Recommendation 2.10) Way forward 2.11) Reference	10-18
6	3) Study on call bell response time 3.1) Introduction 3.2) Problem statement 3.3) Rationale 3.4) Aim 3.5) Objective 3.6) Methodology 3.7) Analysis 3.8) Result 3.9) Recommendations 3.10) Reference	19-28

Abbreviations / Acronyms

SIHD –: Stable ischaemic heart disease

FFR –: Fractional flow reserve

iFR –: Instant wave free ratio

PTCA –: Percutaneous transluminal coronary angioplasty

CABG –: Coronary artery bypass grafting

PCI –: Percutaneous coronary interventions

Pd –: Mean distal coronary pressure

Pa –: Mean aortic pressure

TKR –: total knee replacement

THR –: total hip replacement

Observational learning

1.1) Introduction

Dr. Habil Khorakiwala who represents Founder Chairman and Group CEO founded Wockhardt in the year of 1967. Wockhardt Group extends and excels today as India's leading research-based global healthcare enterprise with relevance in the field of Super Specialty Hospitals. Pharmaceuticals, Active Pharmaceutical Ingredients (API) and Biotechnology.

Wockhardt Ltd is fifth largest Pharmaceutical and Healthcare company in india. Wockhardt ltd, is present in across twenty countries in the world and planning to grow more.

Wockhardt Hospitals became a leading health care service provider which is strongly present in the western parts of India specifically in Nagpur, Mumbai, Nasik, Surat & Rajkot. This chain of nine hospitals intended to satisfy the need of the community in its chosen and provided areas like nephrology, Cardio-medicine, Orthopaedics, Gastro-enterology, etc.

They ensure process driven and evidence based quality services that stick to international standards of clinical care. Along with multi-disciplinary capabilities and fully equipped infrastructure and advance technology, they attempt to add to each patient's quality of life paying greatest respect to human dignity, confidentiality in a nurturing environment.

Many of the wockhardt chains of hospital are NABH accredited centres (National Accreditation Board of Hospitals & Healthcare). A quality driven approach is needed to meet the standards of the hospital which begins from the patients entry into hospital upto exit and follow ups(registration, admission, pre-surgery & post-surgery protocols, discharge from the hospitals to follow ups after discharge).

They have entered strategic alliances with partners medical international, USA to pursue its vision of establishing state-of-the-art medical facilities in India along with a high degree of clinical excellence. Wockhardt also has access to Harvard's expertise and experience in the surgical and internal medicine field.

Their Partners medical International (a non-profit organisation) acts as a catalyst, they bring together healthcare professionals from all over the globe to improve the delivery of healthcare, education and implement vision of every global citizen to have access to quality healthcare within country.

Today, with selective collaborations of Harvard Medical International with medical communities, Wockhardt group of hospitals is also one of them.

In India, Wockhardt has become preferred destination for patients from Africa, USA, Europe, South Asia and Middle East. The Healthcare Professionals are the ones who have adequate training and expertise from some of the best medical institutions of advanced countries.

1.2) Objectives

"Wockhardt Hospitals will strive with excellence to fulfil the needs of the community in its chosen field of medical treatment"

Because of their emphasis on high teamwork they bring together all the disciplines and skills from the many resources of their organization to serve our patients better and attempt to set the wockhardt care in a league of its own.

"To serve and enrich the quality of life of patients suffering from diseases, through the efficient deployment of technology and human expertise, in a caring and nurturing environment with the greatest respect for human dignity and life."

Mode of data collection – data is collected by observation

1.3) General Findings

WOCKHARDT_HEART_HOSPITAL, NAGPUR

Wockhardt Heart Hospital, Nagpur commenced in 2004. It has the privilege of being the first hospital in the city to do the Radial method of Angiography. With a full time expert team of cardiologists and cardiosurgeons they provide world class cardiac services. 24x7 hours services of ICU provides quality care in cardiac emergencies. It has additional support of skilled and qualified nursing staff, fully equipped with advanced technology.

Provision of 50 beds, 2 Cardithoracic operation theatres, 1 cardiac catheterization lab and 1 dedicated cardiac ambulance, it gives round the clock Emergency Heart line services.

The Lab consists of

- the Philips Integris HM2000 with C-arm geometry

- HF generators
- High Resolution II/TV system
- Digital Imaging System
- CD recording system

It performs High resolution angiographies, angioplasties stenting procedures and other interventional vascular procedures.

It is the preferred accessible healthcare destination for patients in areas of Vidarbha region also from the neighboring states of Madhya Pradesh and Chhattisgarh.

Wockhardt Heart Hospital, Nagpur has:

1. 50 patient beds out of which 12 ICU and 7 SICU beds are there
2. Cardiac Ambulance and 24-Hour Emergency Heartline.
3. Cardiac Catheterization Lab
4. Interventional radiology system
5. DSA, stent boost and x-ray dose monitoring for enhanced image quality
6. IVUS and FFR facility helping in diagnosis of vessel blockage
7. Operation theatres maintained with a AHU system and laminar flow assembly
8. Both gas & electric driven assembly High-end OT table, anaesthesia machine, LED OT lights, Pacemaker, IABP machine
9. Back up of 7 bedded SICU with all necessities to manage cardiac surgery patients.

WOCKHARDT SUPERSPECIALITY HOSPITAL, NAGPUR

Wockhardt super speciality hospital, Nagpur was established in 2007 on the premise of twenty years of involvement in top of the line Super Specialty care, Wockhardt super speciality hospital, nagpur was set up as fitting image pof befitting the trust of the general population of central india, which has guaranteed that the officially extitent heart clinic at Nagpur crosses desires accordingly encouraging accreditation with NABH.

The people of central india would now be able to profit of super speciality medicinal care in the ranges of Neurology, Orthopedics, minimal access surgery and critical care, alongside the administrations in the fields of urology, nephrology, surgical oncology, Endocrinology, Gynecology, Pediatrics, Emergency care and preventive healthcare officially accessible in Nagpur.

Wockhardt super speciality Hospital, Nagpur is the preferred location for patients in zones, for example, vidarbha region (Akola, Amravati, etc) and neighboring states of Chhattisgarh and Madhya Pradesh.

Key Statistics - Situated in the heart of the city, Wockhardt Super Specialty Hospital, Nagpur is furnished with 118 beds, AHU system, Laminar flow assembly, SICU, OT, complete Karl Storz Laparoscopy system, Carl Zeiss HD neuro, CUSA, Bipolar cauterization system.

It also has committed bipolar cauterization system, ortho surgical system, navigation system to have better quicker processes.

1.4) Conclusive learning – Floor wise department

Level 0	Physiotherapy Department Emergency Department
Level 1	Main Reception Outpatient Billing OPD No. 1 to 11 ECG/TMT/ECHO Radiology Department In patient billing TPA Desk Pharmacy Phlebotomy (sample collection)
Level 2	Cath lab Cardiac ICU OPD No. 12 to 23 EEG/EMG Administration Department IT Department
Level 3	Medical ICU Cafeteria Library Relative waiting lounge
Level 4	Laboratory Dialysis Bed No. 401 to 446 Medical Records Department Biomedical Department
Level 5	Bed No.501 to 532 CSSD Blood storage centre Play room Relative waiting lounge
Level 6	Operation theatre Surgical ICU Endoscopy Main Store

Core speciality in wockhardt hospitals are as follows-

- Wockhardt doctor's facilities includes cardiovascular techniques, cardiothoracic surgery methods, pediatric, emergency heart conditions and numerous more heart medical facilities and offerings.

- Paediatric orthopaedics, sports medicine, orthopaedics, TKR, THR, oncology, and so forth are carried out.
- Non-surgical neurological facilities like administration of headache, dementia, stroke and rehab, Parkinson's infection, Alzheimer's sickness, and so forth. Surgical procedures incorporate microsurgery for brain, spinal tumours, endoscopic cerebrum surgery, cerebrum surgery for epilepsy, spine injury, and so on.
- The surgery and gastroenterology department in wockhardt hospital provides assortment of symptomatic and restorative therapies for all infections identified with gastrointestinal tract, liver and pancreas.

SCOPE OF SERVICES

- Bariatric Surgery
- Cardiovascular Thoracic Surgery
- Cardiology and Vascular Surgery
- Critical Care
- Emergency medicine
- ENT
- Gastroenterology
- General medicine
- Gynecology
- Kidney Transplantation
- Medical Oncology
- Minimal access surgery
- Nephrology
- Ophthalmology
- Orthopedics
- Pediatric Cardiac Surgery
- Plastic Surgery
- Psychiatry

Wockhardt hospital provides wide range of medical and clinical services which is important to satisfy the demand of the community.

Project - 1

Clinical Audit on FFR at Wockhardt Heart Hospital, Nagpur

2.1) Introduction

Fractional flow reserve (FFR) helps to find out the functional significance of a coronary stenosis.

FFR is a trans-lesional functional assessment and an important adjunct to coronary angiography for making an objective evaluation of stenosis severity.

FFR is defined as “the ratio of mean distal coronary pressure (Pd) to mean aortic pressure (Pa) during maximum hyperaemia, usually induced by adenosine and represents the percentage of normal flow across a coronary stenosis.”

$$\text{FFR} = \text{Pd} / \text{Pa}$$

Clinical audit is defined as “a quality improvement process that seeks to improve patient care and outcomes through systematic review of care against explicit criteria and the implementation of change.”

The goal of clinical audit is to calculate the gap between ideal practice determined from evidence, guidelines, recommendation's and actual practice carried out. If audit is done correctly, it can bring about change and can improve practice and clinical effectiveness.

It helps in improving record keeping continuous professional development and hence increasing accountability and responsibility.

2.2) Rational – FFR helps in cases to diagnose exact functional status of disease so that surgery can be avoided and can be treated with medical management. It will help in avoiding unnecessary surgeries so there by patient satisfaction.

2.3) Research question- whether clinical application of FFR in hospital is in line with evidence based practice?

2.4) Aim

To assess whether the clinical implication of fractional flow reserve in management of coronary artery disease is in line with evidence based practice

2.5) Objective

- to collect and analyse data for FFR studies
- to identify gap between actual application of FFR against explicit standards
- to ensure consistent approach to provide evidence based practice
- to recognize areas of concern and prepare a action plans to resolve these matters
- to give evidence based assurance that clinically efficient practice is carried out within service

2.6) Standards

Recommendations according to “A consensus statement of the society of cardiovascular angiography and interventions (NOV 2013)”, are

- FFR must be used to determine the functional significance of intermediate coronary stenoses [50%-70%] and also of more severe stenoses [$<90\%$] in stable ischemic heart disease (SIHD).
- FFR allows guiding decision concerning revascularization procedures by CABG or PCI in patients with triple vessel diseases.
- In SIHD, when PCI of lesions having $FFR < 0.80$ improves symptom control along with decreases the necessity for hospitalization requiring urgent revascularization as compared with the medical therapy management alone.
- In SIHD, medical therapy management is recommended for an angiographically intermediate stenosis of not clear clinical significance where $FFR > 0.80$.

2.7) Methodology

- **Study design** – Descriptive retrospective study based on medical records within specified period.
- **Study area** – Wockhardt Heart Hospital
- **Data collection** – data is collected from medical records within period 1st April 2016 to 30th April 2017. Data is collected of all those cases in which FFR is done and based on which further management is done.
- **Ethical considerations** – Ethical approval to conduct the study is granted by hospital. Confidentiality was taken care while collecting data only IPD no was recorded and no names were written on data collection sheet. The information obtained from the records was used only for the purpose of this study.
- **Sampling method** – Total cases with FFR studies within study duration
- **Sample size** – 57 cases in FFR is carried out
- **Time duration** – 1st April 2016 to 30th April 2017
- **Target group of patients** - patients diagnosed with coronary artery disease in which FFR is carried out.
- **Study tool** – Pie charts

2.8) Analysis

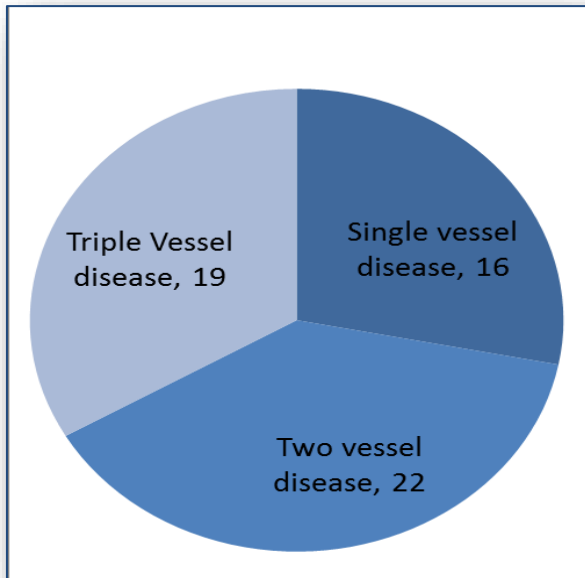


Fig1 -Description of CAD cases (in which FFR is done)

Table 1 - Distribution of cases

FFR value	No of vessels
FFR value 0.8 or less than 0.8	23
FFR value more than 0.8	52
total	75

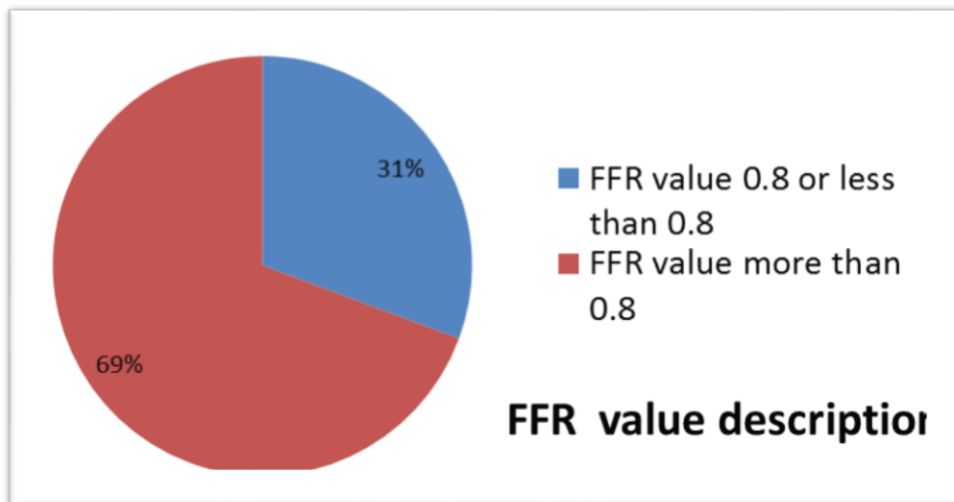


Fig 2 - Fractional flow value description

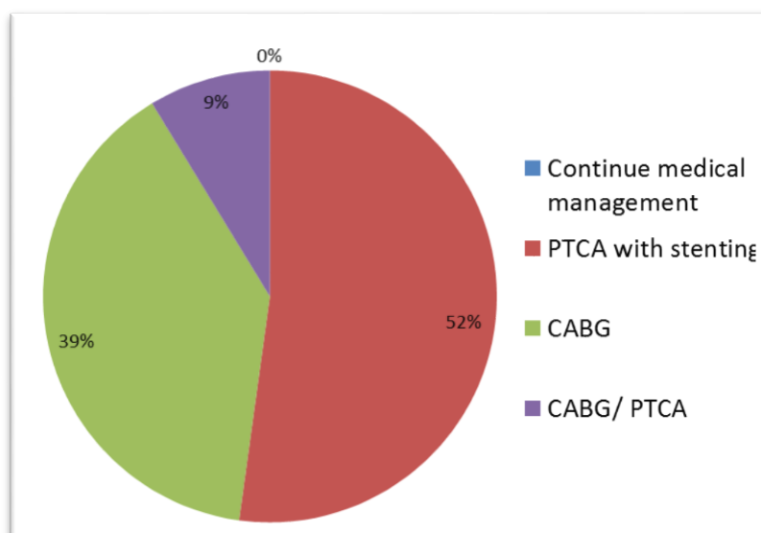


Fig 3 - Management of patients with FFR value 0.8 or less than 0.8 no of instances

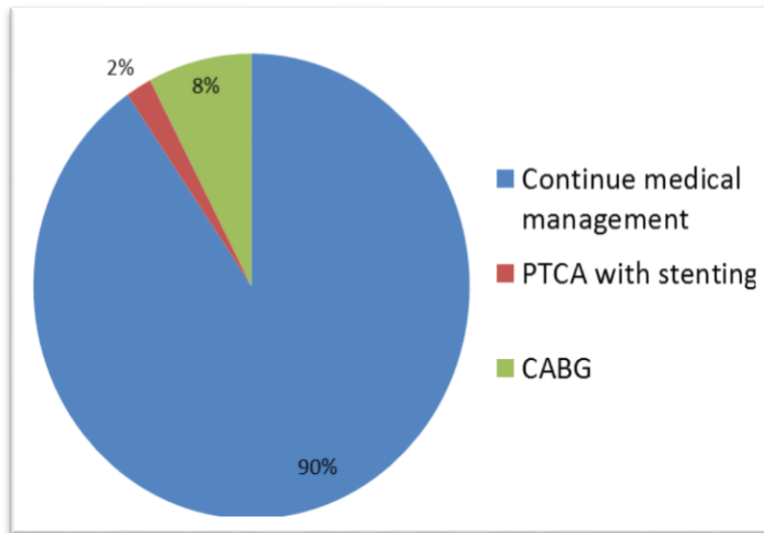


Fig 4 - Management of patients with FFR value more than 0.8

Table 2- overall distribution of cases

FFR VALUE	CABG	PTCA with stenting	CABG/ PTCA with stenting	continue medical management	Total
FFR value less than 0.8 or 0.8	9	12	2	0	23
FFR value more than 0.8	4	1	0	47	52
TOTAL	13	13	2	47	75

Table 3 - Explanations for cases

FFR value	Line of management advised	Elaboration
LAD- 0.84 Ramus- 0.89 RCA- 0.89	Elective CABG	The patient is advised to continue medical management and undergo elective CABG since angiography revealed LCX 90%, LAD 60%, RCA- 60% stenosis.
LAD- 0.75, DIAGONAL- 0.88, RCA- 0.60	CABG	The patient is advised to undergo CABG since FFR value for LAD, RCA are well below 0.8 and angiography revealed triple vessel disease
RCA- 0.83, LAD- 0.75	CABG	Since angiography revealed triple vessel disease and in view of diffuse LAD disease, patient advised CABG
RCA- 0.82	CABG	In view of diffuse LAD and RCA disease patients is advised CABG
Mid RCA – 0.81	PTCA to RCA	PTCA with stenting to PLV done. Post op ECG revealed ST elevation with chest heaviness and backache so PTCA to RCA is done.

2.9) Results

It is observed from analysis that in almost all cases where FFR is done, line of management for patients with coronary artery disease is as per recommendations.

2.10) Conclusion

FFR has been used efficiently in the cath lab to assess functional significance of coronary lesions and guiding in treatment plan for intermediate coronary artery disease.

2.11) Recommendations

There is need for spread of awareness for application of FFR for management of for coronary artery disease among community and among medical staff to avoid unnecessary PCI or CABG.

As FFR is independent of baseline flow, relatively simple and cost effective, there is need for spread of awareness among clinician.

2.13) Way forward

FFR adoption has cost benefits resulting from elimination of unnecessary treatments and reduction in readmissions.

FFR requires adenosine which is expensive in IV form, iFR (instant wave free ratio) provide a good cost saving alternative.

It does not need adenosine (a step that can be time consuming and costly). Adenosine can be contraindicated in some patient.

Hence iFR may add to patient satisfaction by improved outcome and reduction in costly readmissions.

2.14) Reference

- 1) Eiman Jahangir, Fractional flow reserve measurement Peri-procedural care, oct2016.
- 2) Expert consensus statement on use of FFR – a consensus statement of the society of the society Cardiovascular Angiography and Intervention, November 2013.
- 3) Serruys, P.W., et al., Non-invasive fractional flow reserve: scientific basis, methods and perspectives. *EuroIntervention*, 2012. **8**(4): p. 511-9.
- 4) Grunau, G.L., J.K. Min, and J. Leipsic, Modeling of fractional flow reserve based on coronary CT angiography. *Curr Cardiol Rep*, 2013. **15**(1): p. 336.
- 5) Rajani, R., et al., Virtual fractional flow reserve by coronary computed tomography – hope or hype? *EuroIntervention*, 2013. **9**(2): p. 277-84.

Project - 2

Study on call bell response time at Wockhardt Multispecialty hospital

3.1) Introduction

A call bell system provides a primary means of communication between patient and staff (nursing, medical, paramedical staff). It has a button found around the clinic bed that permits patients in hospital services settings to alarm a nurse or other service staff member remotely of their requirements for offer assistance. At the point when the button is tapped, a signal alert staff at the nursing station and normally a medical caretaker, nurse and other staff react to such a call.

The call bell is essential patient communication interface during hospital stays and is really one of only a handful couple of means by which cognitively intact patients would be able to exercise some significant control over their care.

Call bell response time is the time it takes for responsible staff to physically address the patients need or demand. Least call bell reaction time enables patient care taker to address patients' needs more rapidly and enables patient satisfaction to improve. Deferred reaction time to call bell is often thought to be connected to persistent disappointment and patients tend to be less happy with the services.

Hospitalized patients invest most of their time in room requiring utilization of call bell to have their necessities met. It is usually accepted that if a medical attendant reacts to a call more rapidly, the patient may have less chance to fall. However, call lights are seen by a few medical attendants as mere noise and an intrusion to nursing errands, rather than a vital approach to ask for help.

3.2) Problem statement

Patients in hospital are often in pain and are usually uncomfortable and are not capable of performing simple tasks what they may normally/generally do independently for instance, using the bathroom, ambulation or changing positions, etc.

“Unfamiliar with hospital routines and how to get needs met, patients access the primary mechanism at their disposal: the nurse call button” [Mitchell, Trotta, Lavenberg and Umscheid, 2012].

Staff timely responsiveness to patient's call bell is a critical and important component of the patients experience on a hospital stay.

Staff unresponsiveness is related to overall dissatisfaction with patient's hospital experience and also with future visits.

Press Ganey Associates (2012) comments as, "positive experiences will promote a stronger customer base and increased market share".

Conversely, patients with negative and not good experiences are highly unlikely to return to same facility again in future, which may cause missed chances for future earnings and also bad message is conveyed out.

3.3) Rationale

Staff timely responsiveness to patient started call bell is a critical and important component of the patients experience on a hospital stay and admissions.

Determining call bell response time and exploring common reason for call bell well help to find ways improve the call bell response time which will add to patient satisfaction. So, the study is significant considering patient experience in hospitals and patient satisfaction.

3.4) Research question

Is the current call bell response time satisfactory?

If not satisfactory, then reason for delay in call bell response time?

3.5) Aim

To find out call bell response time and common reason for which nursing call is made and reasons for delay in responding to call bell and to find out ways to improve call bell response time.

3.6) Objective

- 1] To determine call bell response time in wards
- 2] To identify common reason for call bell from patients
- 3] To assess whole process of responding to call bell from patients
- 4] To find out for delay in call bell response
- 5] To give recommendations for call bell response time

3.7) Standards

According to SOP for hospital a nurse should respond to call bell immediately. (as soon as possible)

3.8) Methodology

Study design - observational study

Study area – ward at level 4 and ward at level 5 in Multispeciality Wockhardt hospital

Study duration –data is collected from 5 may to 15 may

Sample size – 200 observations are taken from both wards. 100 observations are taken in each ward.

Sampling method – convenience sampling

Data collection technique – primarily data is collected by actual recording of timings and reason for call bell by observing whole process.

Secondary data is collected from patient feedback and patient's complaints.

Call bell response time is the time it takes for assigned provider to physically address the patients need or request.

The time when patient initiated the call bell and when the nurse responded to call bell is noted along with the reason for call bell.

3.9) Analysis



Fig 4 -Total number of observation per ward

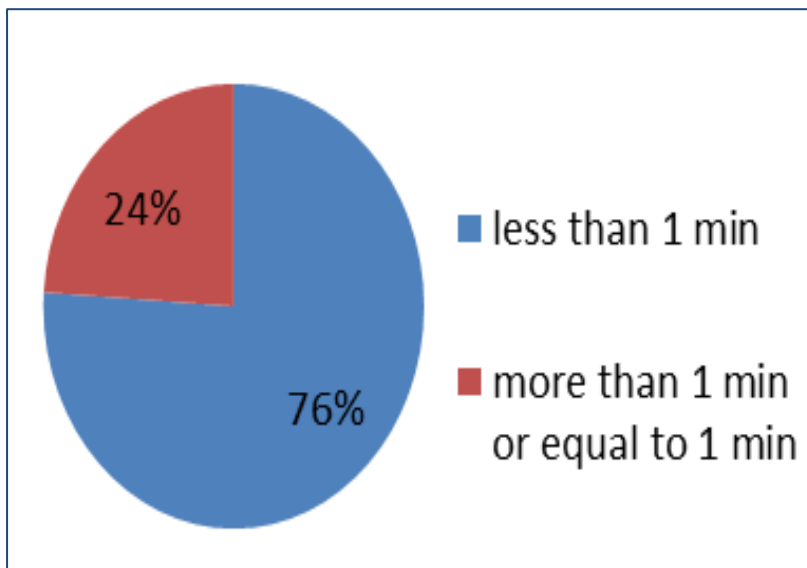


Fig 5 - Observation at ward 4

Table 3 – Observations at ward at level 4

Average call bell response time	52 sec
Maximum call bell response time	3:08 min
Minimum call bell response time	10sec
No of observations less than 1 min	76
No of observations more than or equal to 1 min	24

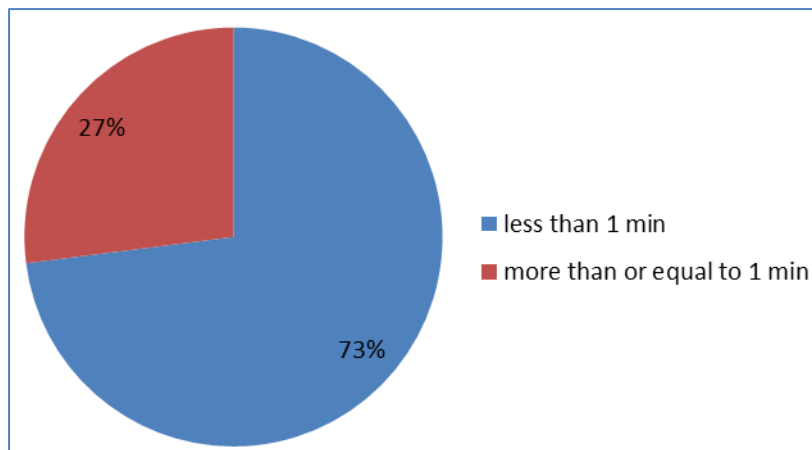
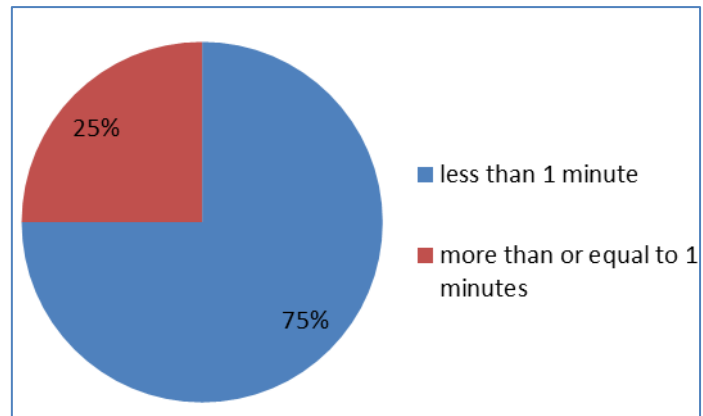


Fig 6- Observations at ward at level 5

Table 4 – observations at ward level 5

Average call bell response time	49 sec
Maximum call bell response time	2:40 min
Minimum call bell response time	20
No of observations less than 1 min	73
No of observations more than or equal to 1 min	27



25% of total observations were having call bell response time less than 1min.

Fig 7- Percentage of observations with respect to call bell response time

Table 5- Analysis of total observations

Average call bell response time	50 sec
Maximum call bell response time	3:08 min
Minimum call bell response time	10 sec
No of observations less than 1 min	150
No of observations more than or equal to 1 min	50

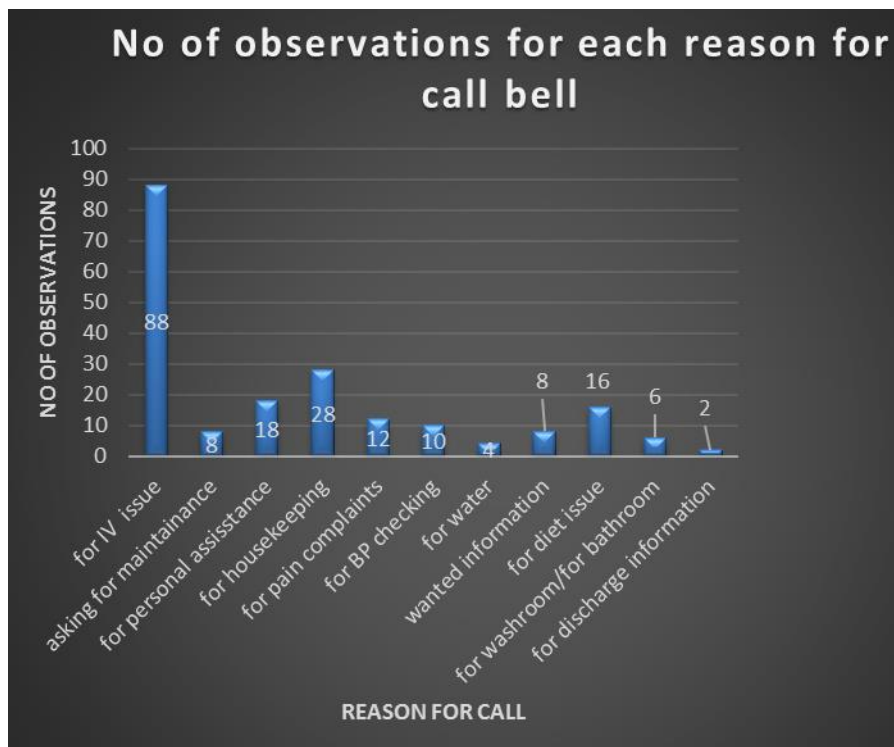


Fig 8 -Reason for call bell initiated from patients

Leading reason for call bell is

- 1) Intravenous drip/ canula related issue
- 2) For housekeeping/ bathroom/washroom
- 3) For pain/ urgent issues/ personal assistance

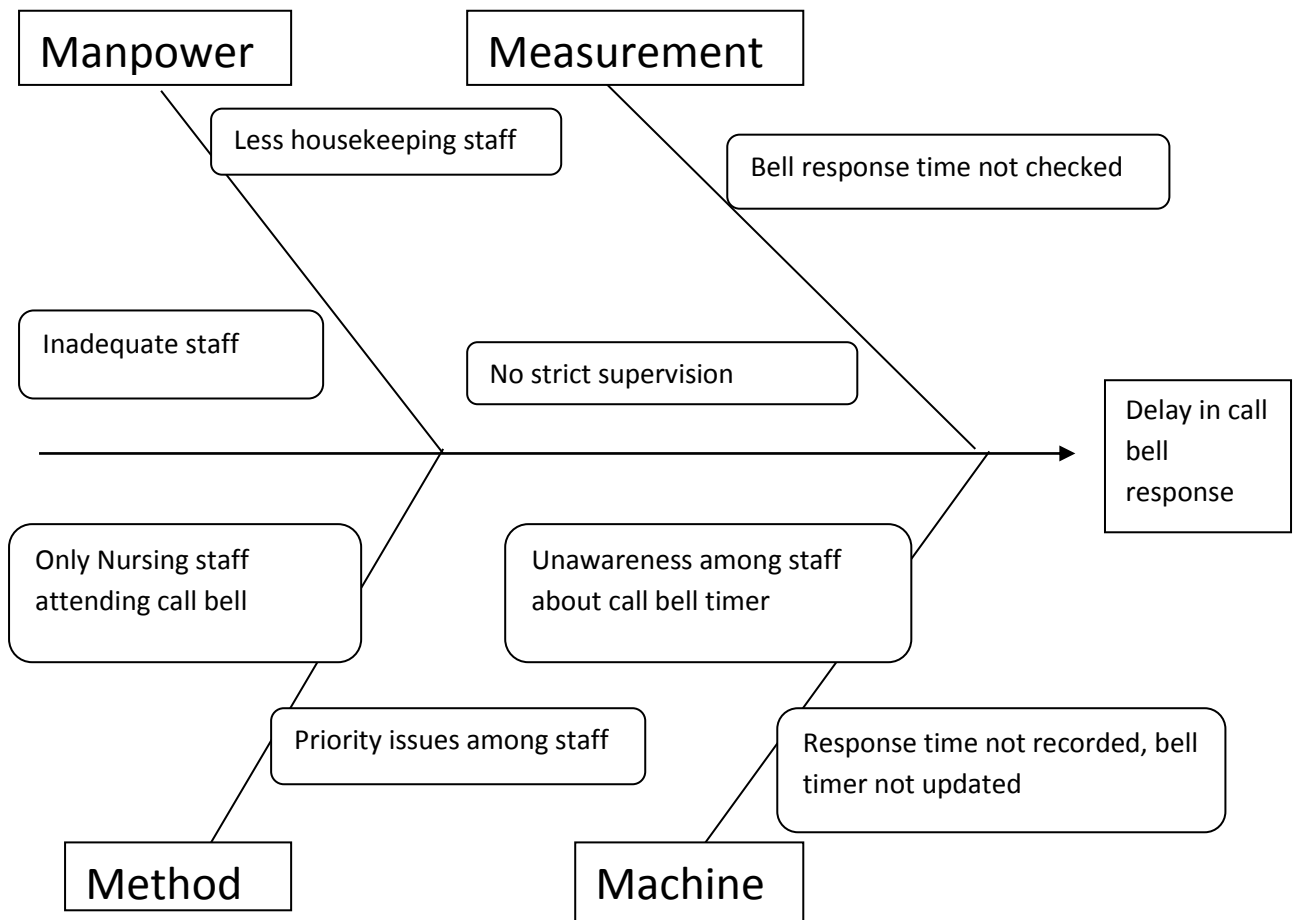


Fig 9 -Reason for delay in call bell response

3.10) Recommendations

- There should be strong leadership from nursing head to focus on the significance of prompt call bell response
- Responding promptly to call bell should be prioritise.
- Raising staff awareness to respond to call bell immediately need to be focused.
- Having round proactively to address patient need would help in dealing with this issue.
- There should be strict supervision over and recording of data on call bell response time. Regular progress reporting and evaluation of call bell need to done.

- Call bell system that have the tracking and reporting capabilities to document staff response time can be an option.
- Education and updating standards/benchmarking on call bell response time.

3.11) REFERENCE

1. Robin Digby, the effects of raising awareness of call bell response on how promptly staff attend, patient falls and satisfaction, 2011, Volume 23.
<http://journals.rcni.com/doi/pdfplus/10.7748/nop2011.07.23.6.22.c8586>
2. Doshia B. Williams, Improving Staff Responsiveness to Patient-Initiated Call Lights, 12th dec 2014.
<http://repository.usfca.edu/cgi/viewcontent.cgi?article=1062&context=capstone>
3. Roszell S, Call bell requests, call bell response time, and patient satisfaction, Jan 2009
<https://www.ncbi.nlm.nih.gov/pubmed/19092482>
4. Simon Taylor, Call bell response times, Jan 2015
5. G D Kunders, Hospitals facilities planning and management, Tata Mcgraw – Hill Publishing company limited, Second print 2006
6. R C Goyal, Hospital administration and human resource management, fourth edition, 2005
7. C. Charles, Hospital Automation and Information Management, Anmol publication, 2005