

SUMMER TRAINING AT
APOLLO BSR HOSPITALS
BHILAI CHHATTISGARH
(8th APRIL, 2013 – 6st JUNE, 2013)



Institute of Health Management Research, Jaipur
2013

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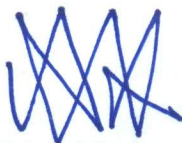
CERTIFICATE

This is to certify that Dr. Siddharth Mishra, student of Post Graduate Diploma in Hospital and Health Management (PGDHM) from Institute of Health Management Research, Jaipur Batch 17th has undergone summer training in Apollo BSR Hospitals Bhilai [C.G.] and has done following project:

1. Medical Equipments - Basic Safety and Essential Performance.

The candidate has successfully carried out the mentioned studies assigned to him during summer training from 8th April 2013 to 8th June 2013 and his approach to study has been sincere, scientific and analytical.

I wish him success in all his future endeavors.



Dr. Alok Mathur
Associate Professor and Mentor
IHMR, Jaipur



Dr. Ashok Kaushik
Dean, Academics and Student Affair
IHMR, Jaipur

ACKNOWLEDGEMENT

I extend my sincere gratitude to **Mr. Abid** and **Mr Sanjay Shrivastav**, for giving me the opportunity to do this study and undergoing the process of learning at APOLLO BSR BHILAI. I thank them for all the trust and faith they posed in me and I only hope that I have been able to live up to their expectations. Their guidance and support was helpful in enhancing my work.

I extend sincere gratitude towards **Ms. Najiya Rizvi**, who has been my mentor for the summer internship program & has been instrumental in helping me shape this study in a desirable way.

I would also like to thank **Mr. Sanjay Borkar** and **Mrs Shreekala** Quality department, for supporting my work all along. I would also like to extend my thanks to **Mr. Sunil (HOD Biomedical department)**, **Mr. Jafar** , **Mr. Sanjeev** – engineers at Bio medical department Apollo BSR Bhilai for helping me through my study.

Last but not the least; I would like to thank the entire **staff of APOLLO BSR HOSPITALS BHILAI** for their support and guidance.

I would like to express my sincere thanks to **Dr. S.D. Gupta**, Director, IHMR, **Dr. P.R. Sodani**, **Dr Suresh Joshi**, **Dr. Alok Mathur (mentor)** and all my faculty members for the proper guidance and cooperation extended by them. I am also grateful to my parents, my family and my friends for giving me moral support.

However, I accept the sole responsibility for any possible error of omission and would be extremely grateful to the readers of this project report if they bring such mistakes to my notice.

Date – 11TH June, 2013

Dr. Siddharth Mishra

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PREFACE

Summer internship is an integral part of the PGDHM curriculum. As a part of the course; students of first year are required to undergo summer placement at any reputed organization to get in depth exposure of various departments in the organization and better understanding of the health care delivery system and its functions.

The major objectives of the summer training programme are as follows:

- 1) To understand and learn day to day operational management of a Hospital / Health Care Organization and its service centers.
- 2) To study identified issues/ problems associated with some specific operational area /programme.
- 3) To acquire more knowledge on roles and responsibilities of key players and stakeholders in the hospital. To understand various functions in hospital by interactions with key stakeholders, policy makers, academicians and researchers.
- 4) To work on the project/task assigned by summer training organization.

During the training period I had an **Overview of various departments of the hospital**. I also carried out a study titled “**Medical equipments- basic safety and essential performance**”

The aim of the study was to identify the various medical equipments needed in various departments and to access the operating technician’s knowledge of basic safety measures for patient and operator’s safety while working with the equipment and to access the maintenance of the equipment done by technician for some critical and high end equipment.

ABOUT THE ORGANISATION

Apollo BSR is a multi specialty hospital with a motto to provide quality healthcare at affordable cost. It has a fully equipped centre of international standard for cardiac intervention and surgeries.

VISION:

“ To be the most preferred Health care service provider in the community by continuously improving the existing standard of Medicare”

MISSION:

“Apollo BSR Hospitals always provide comprehensive and modern healthcare solutions to patients with a humane approach”

The Journey:

The group started with a diagnostic centre in the year 1993 at Bhilai. Over a period of time all modern diagnostic facilities like 1.5 T MRI, 64 slice cardiac CT, Multi slice spiral CT scan, 4-D real time color Doppler, Ultra modern Pathology, Endoscopy, Bronchoscope, mammography, echocardiography, UltraSonography , Digital X-Ray etc. have been installed at our various centers. Thereafter similar centers have been established at other locations such as Nagpur, Raipur, Korba and Rajnandgaon.

In the year 2000 the group ventured into establishing ultra modern super specialty cancer hospital in Bhilai- BSR Cancer hospital which is the only comprehensive cancer management centre in Chhattisgarh. After 17 year into being called a pioneer and leader in diagnostics in central India and 8 years in comprehensive cancer management, BSR health care is now well known name in healthcare sector.

BSR realized the need for a multispecialty Tertiary care hospital in Central India and prompted by desire to extend high quality Medicare beyond the confines of the rich class . BSR Healthcare has set up Super specialty Hospital at Bhilai, Apollo BSR hospital, Bhilai became operational from September 2007.

Commitment to the community.

“Caring for the community”

Those simple words describe the past, present, and future of Apollo BSR hospitals Bhilai. Their roots run deep in the community, starting with the 1st high tech diagnostic centre in 1993. After 15 years of being pioneer in diagnostics in entire central India , BSR healthcare started comprehensive cancer management hospital- BSR Cancer hospital and Research centre at Bhilai in June 2001.

Apollo BSR is 175 bedded Super Specialty Hospital providing secondary and tertiary level healthcare at affordable cost in association with Apollo Hospitals Chennai. The inpatient beds are classified into deluxe suite, private room, double bed wards, shared wards and dedicated cancer wards.

The hospital enjoys the reputation of being the first and only hospital to have a digital flat panel Cath lab and 4 modular OTs with laminar air flow and HEPA filters for coronary Bypass surgeries, Coronary Angioplasty and other special surgeries. They are having 42 bedded ICU including cardiac, surgical, Medical, neonatal and pediatric ICU.

Apollo BBSR at bhilai is an attempt to integrate the best and most qualified medical professionals and doctors by providing them the best infrastructure, latest technologies in Biomedical engineering and health care services along with a dedicated team of nurses, technicians, staff and professional management in such a way that our super speciality hospital can provide the best health care services so that the patients in C.G. as well as neighboring states could be benefited.

Already they have got a very good response from the patients in this region and they are regularly getting the patients not only from C.G. but also from neighboring states. They are recognized and empanelled by Govt. Of Chhattisgarh, CSEB, NSPCL, FCI, BSNL, CISF, NMDC, SECL, and various insurance companies\TPAs. They have also started more departments like Infertility clinic, , cosmetology, joint replacement surgery, high end ophthalmology etc.

They have plans to increase beds from 175 beds to 200 beds which will include 10 more beds in ICU, since bhilai is very well connected by air (nearest airport Raipur 40 kms), Rail (nearest Railway station Durg 5 kms), and Road (on main National Highway NH6).

Various departments in the hospital are

Clinical Services:

- 24-hour Accident &Emergency Services (Trauma Unit)
- Anaesthesia
- Cardiology
- Cardiothoracic Surgery
- Dental
- Dermatology and Venrology
- Endocrinology & Diabetology
- ENT
- Gastroenterology
- General & Laparoscopic Surgery
- Health Check-Ups

- Infertility Clinic-(IVF,IUI)
- Internal Medicine
- Medical Oncology
- Nephrology
- Neurology
- Neurosurgery
- Obs. & Gyanaecology
- Ophthalmology
- Orthopaedics
- Paediatrics/ Neonatology
- Pain Management
- Plastic Surgery/Cosmetic Surgery
- Psychiatry & Psychotherapy
- Respiratory Medicine
- Surgical oncology
- Urology

Critical Care Units

- Medical Intensive care unit
- Cardiac Intensive unit
- Surgical intensive care unit
- Neonatal Intensive care unit
- Intensive Cardiac care unit

Diagnostic Services

- Laboratory
- Radiology (MRI Service delivery at BSR Diagnostic centre)
- Radiotherapy Department (Service delivery at BSR Cancer Hospital)
- Nuclear Medicine Department (Service delivery at BSR Cancer Hospital)

Therapeutic services

- Clinical consultation services
- Clinical inpatient service
- Operation theatres
- Labour room
- Digital Cath Lab
- Dialysis Unit
- Bronchoscopy
- Endoscopy
- ECG, Echo, TMT, EEG, EMG, PSG, Spirometry

Ambulatory Care Area

- Outpatient services
- Emergency services

- Pharmacy services (IP- 24 Hrs, OP Pharmacy)
- Physiotherapy Department

Auxiliary Services

- Dietary services
- Central Sterile and Supplies Department
- Laundry
- Stores (general, medical) & Substores
- Mortuary
- MGPS (Cylinders and piped medical gases)
- Engineering services
- Housekeeping
- Security
- Medical record department
- Hospital Management Information System
- Administrative Office
- Ambulance & Non ambulances

SPECIFIC PROJECT:

MEDICAL EQUIPMENTS- BASIC SAFETY AND ESSENTIAL PERFORMANCE:

OBJECTIVES

- Listing of the individual medical equipments in each department of the hospital.
- To find out the basic safety measures followed by the operator for patient and operator safety while working with the equipment and to assess the gap present if any.
- To assess the operating technicians knowledge about the maintenance and operation of the equipment.
- To identify the training needs if any for the operating technicians.

The areas covered for this project are as follows:

1. All ICUs (Medical, Surgical, Neonatal, Cardiac)
2. ITU
3. Casualty
4. Pathology
5. Radiology

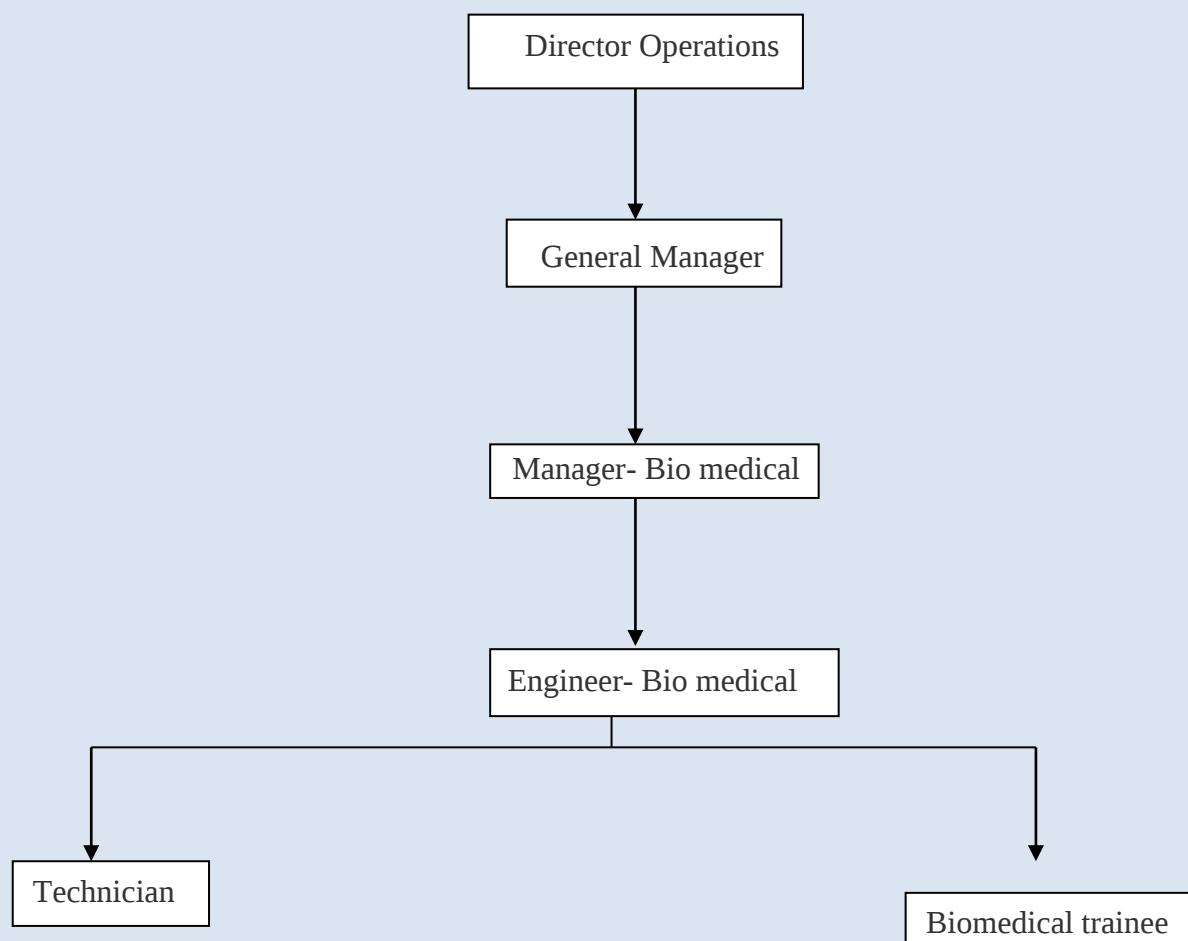
INTRODUCTION

Biomedical engineering department generally known as BMD has its strong presence right from Equipment planning to obsolescence. BMD helps in optimizing the equipment usage and in-house maintenance saves a lot on after sales service's cost. A strong MIS/database is generated which help the management to decide about future purchase/up gradations/obsolescence. The BME dept. is located in the basement and its services are available 24x7x365 days.

Activities of BME dept. are:

- Preparing and formulating pre installation requirement and commissioning of new equipment in following points:
 1. Site preparation.
 2. Shipment verification for shipment, damages and wrong shipment.
 3. Recording minute details of installation.
 4. Commissioning of equipments by test runs and heat run tests.
 5. Awarding ownership and assuring accountability of the complete sets of equipments,
 6. Handing over the equipments.
 7. Assuring proper user and technical training from suppliers and principals.
- Routine maintenance
- Periodic maintenance
- Attending breakdown calls.
- Co-ordination and liasioning with vendors for speedy supply of spares and consumables required for day to day working of equipments.
- Vendor development for cost effective solutions in repairs and consumables.
- Documentation of service reports, installation reports, history sheets for each equipment i.e. filling of all relevant documentation to track the history of each equipment.
- Computerization of relevant information regarding breakdown and repair costs involved.
- AMC/CMC management.
- Conceptual training to users.
- To prepare a data bank of all major and minor equipments covering the technical specifications, market perception, installation base, after sales services etc. this will help in future up gradation and purchases of equipment in hospital benefit.

ORGANOGRAM:



DATA COLLECTION & METHODOLOGY

Data Collection:

The procedure followed is enumerated below:

- i. A study of the duties of each individual was conducted to understand the roles and responsibilities of the technician and nursing staff.
- ii. Nursing and operating personnel in each department was interviewed in detail to know about the procedures carried out by them while operating the equipment, in addition observation of the staff while operating the equipment was done whenever possible.
- iii. A semi-structured equipment specific questionnaire was prepared by referring to the operating manual and discussion with the biomedical staff which was used to interview the staff of the respective departments, which is given in the annexure. In addition a general checklist was also prepared for observation, containing records of EPM, IPM, Safety measures and trainings performed.

Methodology:

Study Type – Cross-sectional study.

Study Area –various ICUs of the Hospital (medical, surgical, neonatal, cardiac, ITU), casualty, Pathology, Radiology.

Sampling method – Convenient sampling method

Study Participants: staff of the respective departments.

Sample size – 22 staff directly involved with operating and maintenance of equipment.

Study Technique – Interview, checklist.

Study Tool – Semi- structured questionnaire, Checklist.

Data Collection Plan – This study surveyed 22 staff members. For collecting the data interviews and observation of the equipment was carried out after taking authorization from concerned authorities of these departments.

Data analysis – done with the aid of MS-Excel sheets. The data was entered in sheets equipment wise and then analyzed with the help of graphs.

Ethical Considerations- purpose of the study was clearly explained. The respondents were assured of the data confidentiality.

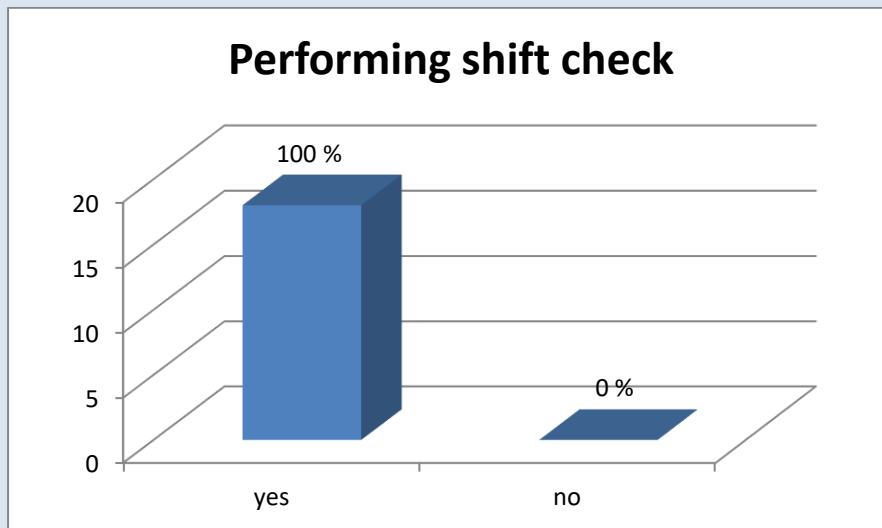
Data Analysis, Compilation and Interpretation:

Equipments were categorized into Critical and Diagnostic equipments for analysis. The equipment wise analysis of the data is as follows:

i. Critical Care Equipments:

1. Defibrillator:

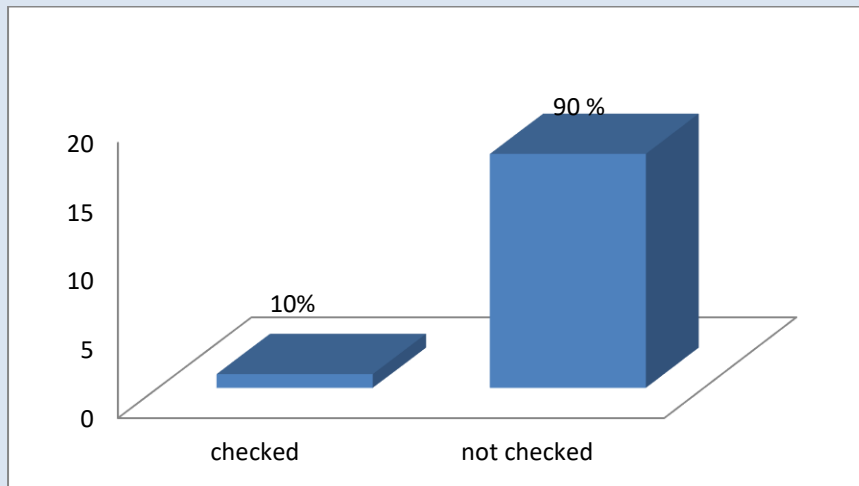
Q.1 System check performed at every shift?



- According to each of the staff interviewed shift/system check was done every day and record was maintained on a regular basis.

Q.2 whether operator inspected the equipment before every shift check?

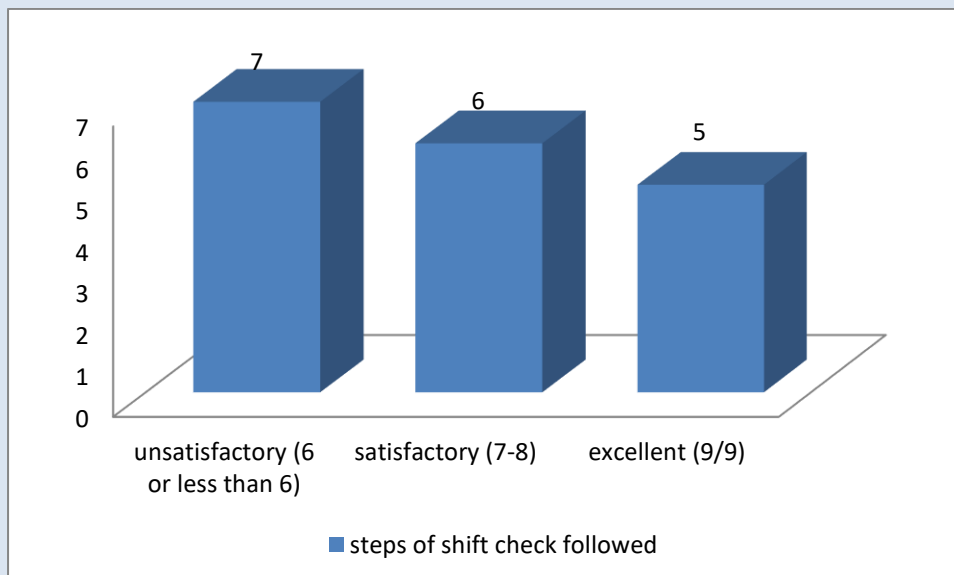
According to equipment manual 4 steps were taken into consideration. Out of which 1st step is optional other three is mandatory.



- Out of 18 ICU staff only one performed preliminary inspection (10%) although if done regularly it could greatly increase efficiency as it may help in spotting the faults beforehand.

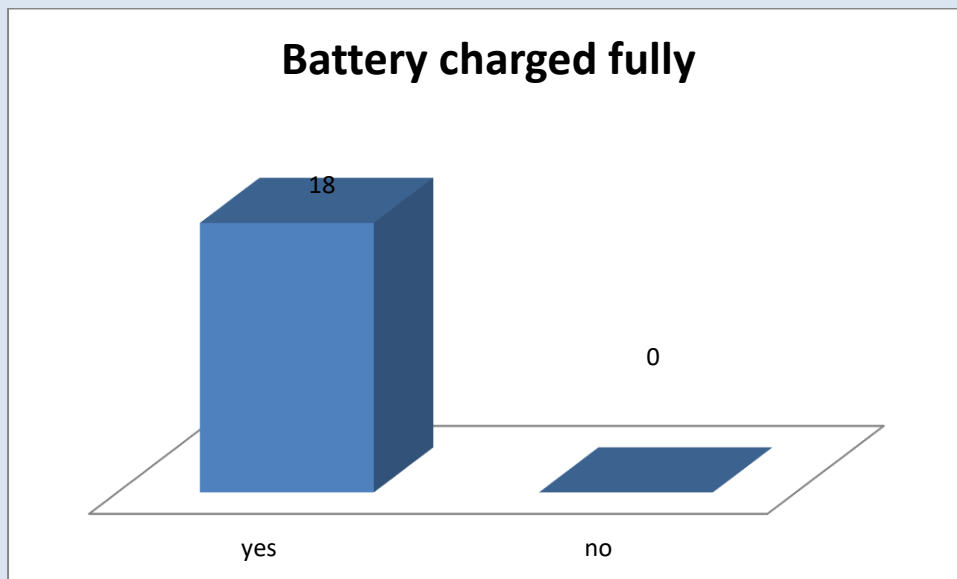
Q.3 steps of system check followed?

In this the steps to be followed for shift check ideally were noted down and 1 mark was given for every step followed correctly, so out of the highest 9 marks possible:



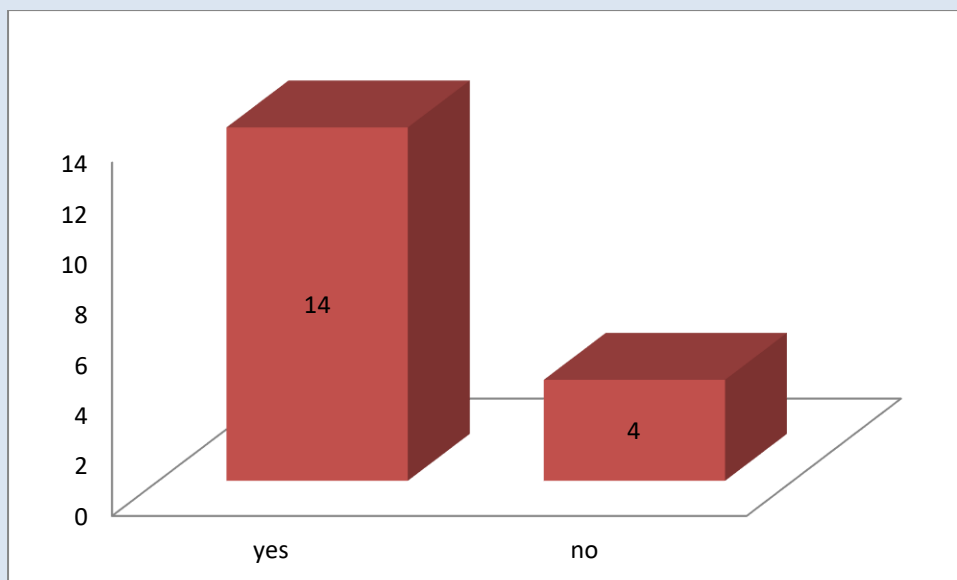
As we can see that out of 18 ICU staff about 7 didn't had adequate knowledge about performing system check(40%) while 6 had satisfactory knowledge(35%) but not complete and only 5 had complete knowledge about performing shift check.(25%)

Q.4 battery fully charged?



All of the staff interviewed had knowledge about battery charging and kept battery fully charged all the time.

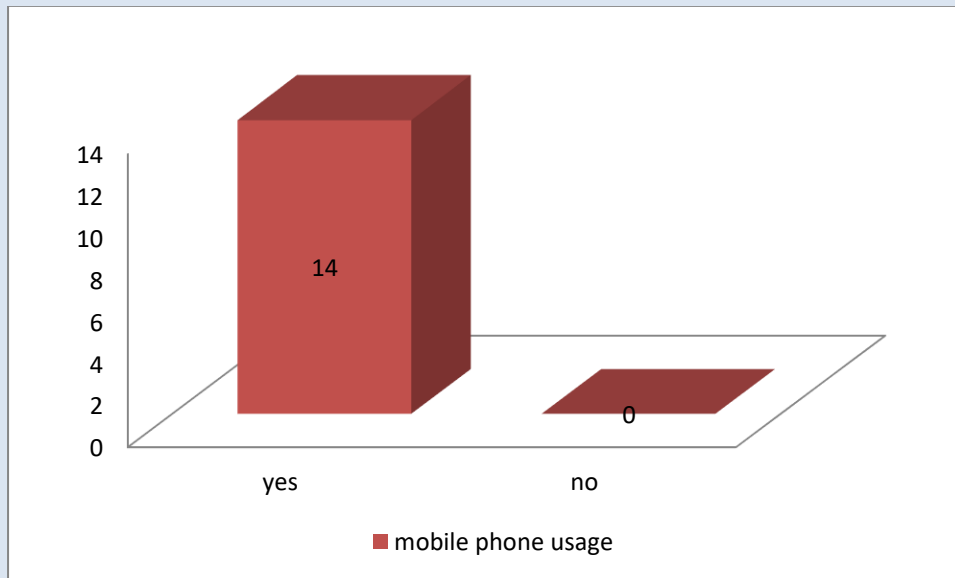
Q.5.Cleaning done regularly?



Out of the 18 ICU staff interviewed 14 had knowledge about regular cleaning of the equipment or they themselves performed cleaning and disinfecting(70%) while 4 showed no knowledge about cleaning the equipment(30%).

2. VENTILATOR:

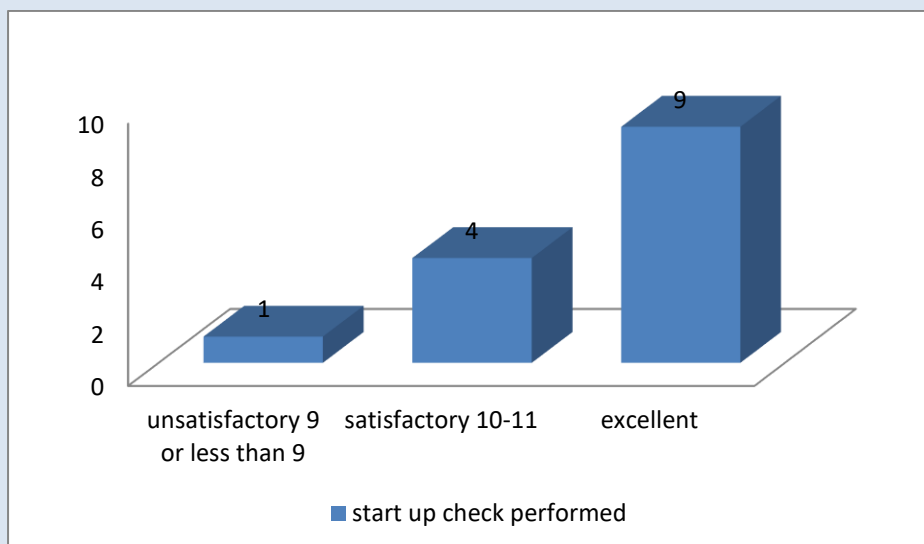
Q.1 Usage of mobile phones near equipment:



Out of the 14 staff interviewed for ventilator all of the staff used mobile phones near ventilator According to the manual can be harmful for the equipment and patient as it can lead to inaccurate readings by the equipment.

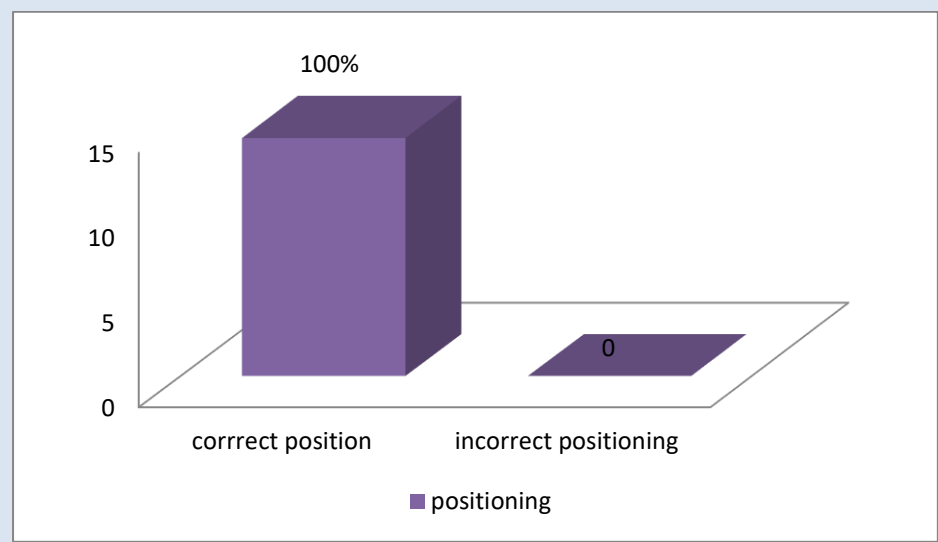
Q.2 Start up check performed?

Steps of startup check to be done ideally were noted down from the manual and then staff was scored according to the steps followed:



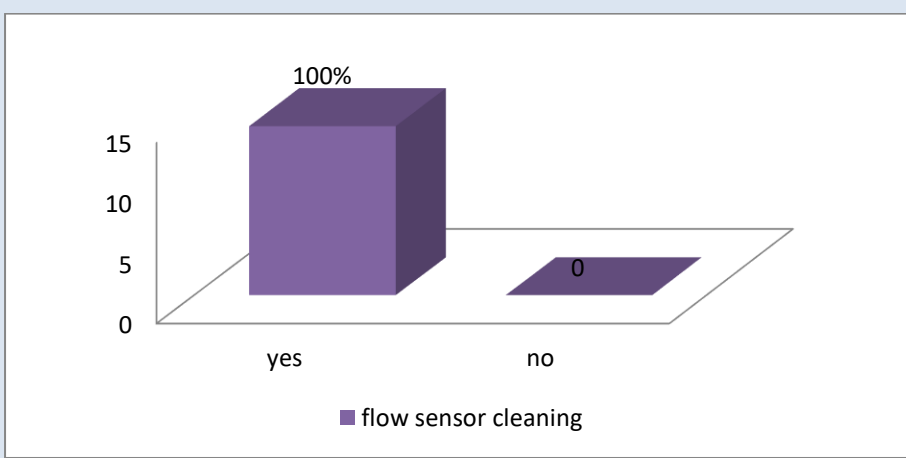
Out of 14 staff 1 had inadequate knowledge about startup test(10%) while 4 had satisfactory knowledge about it(30%) and 9 had complete knowledge about the steps involved in startup test(60%).

Q.3. whether equipment was positioned in such a way that performance is affected?



All the staff while working positioned equipment in correct manner.

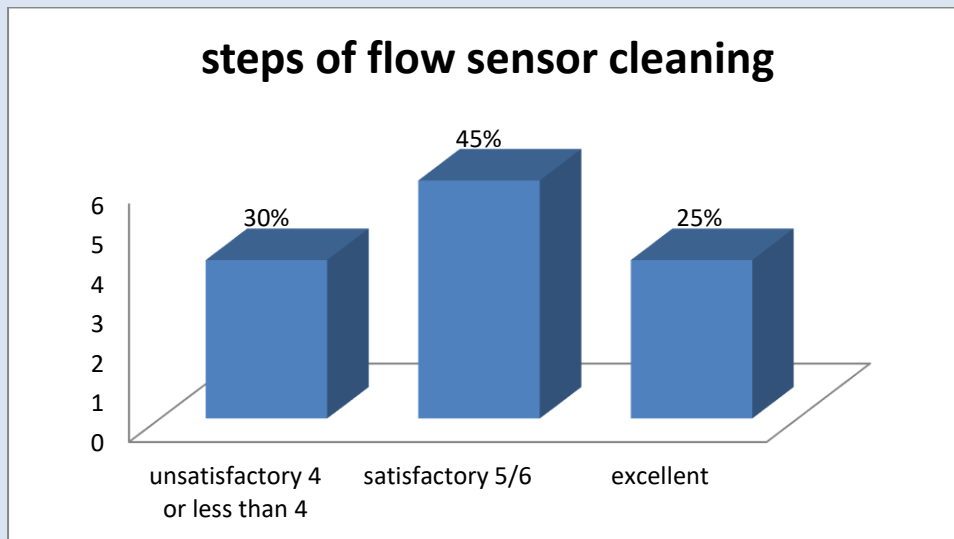
Q.4. Regular flow sensor cleaning done?



All of the staff interviewed had knowledge about regular cleaning of flow sensor.

Q.5 steps of flow sensor cleaning followed?

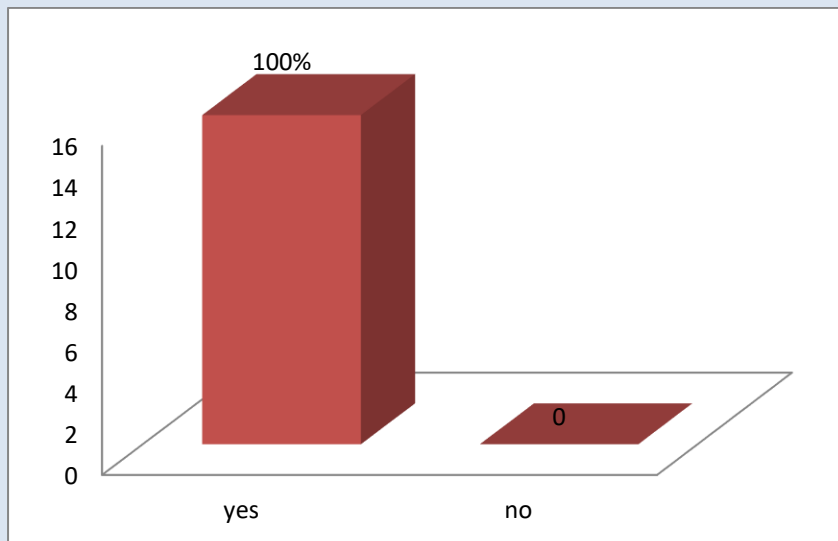
Steps were noted down and staff was scored accordingly:



Out of 14 staff 4 had inadequate or no knowledge about flow sensor cleaning (about 30%) while 6 had satisfactory although not complete knowledge (about 45%) and only 4 had complete knowledge about flow sensor cleaning (about 25%).

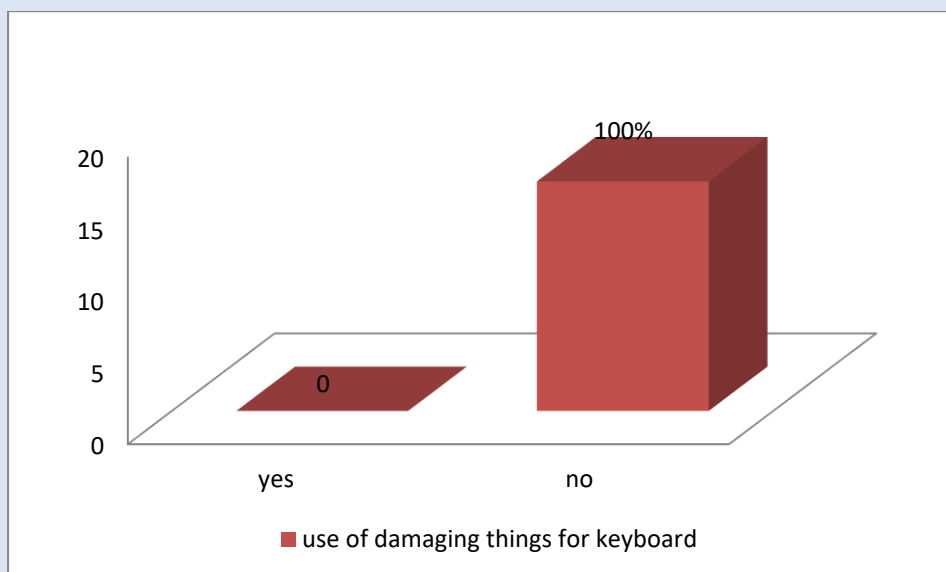
3. SYRINGE PUMP:

Q.1 Whether there was use of specified syringes?



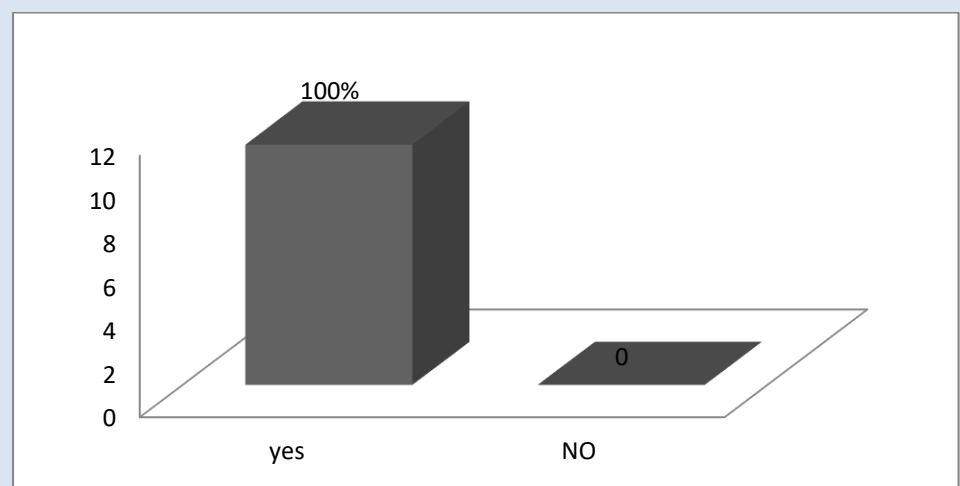
-There was use of specified syringes in all the cases.

Q.2. whether the operator used pen, pencil etc to operate membrane keyboard?



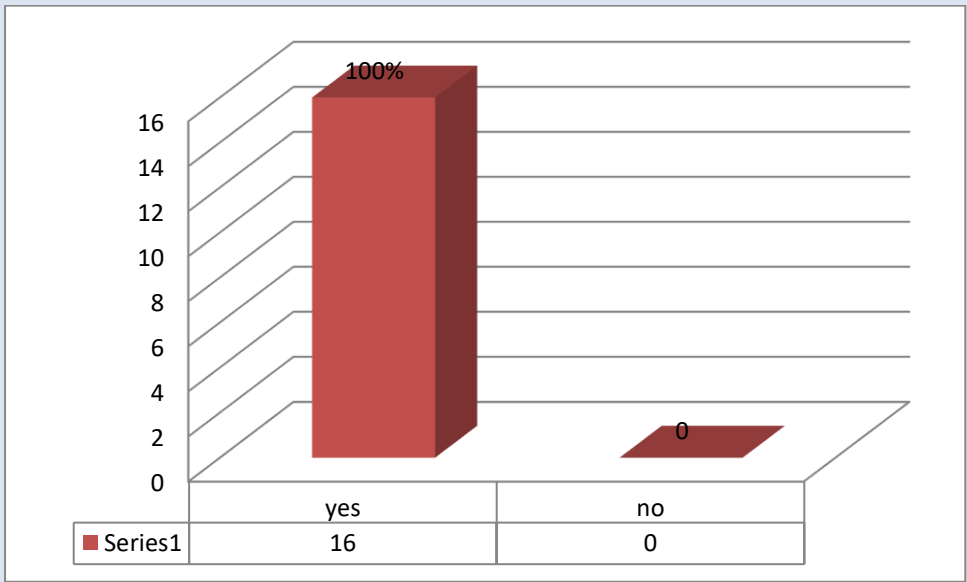
-Foreign materials like pen, pencil, keys etc. i.e. the things which can damage membrane keyboard were not used to operate the equipment by all the staff interviewed.

Q.3. startup test performed?



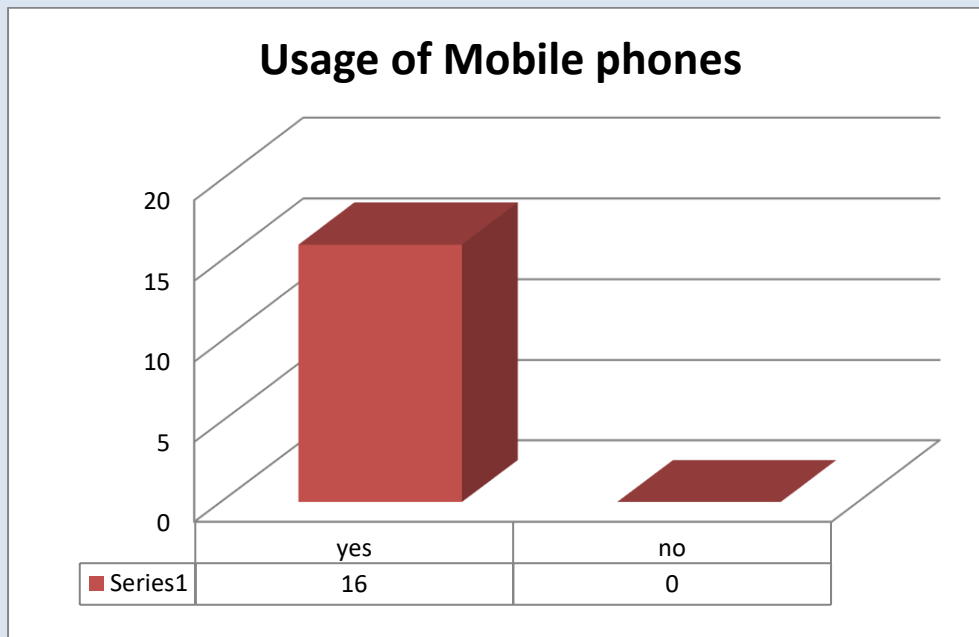
All of the staff performed startup test. The sample size is 11 since the startup test in this Q. is for syringe pump of PLENUMTECH ASPIRE model, Rest of the staff was assessed for another type of syringe pump.

Q.4. safe storage of syringe pump was there?



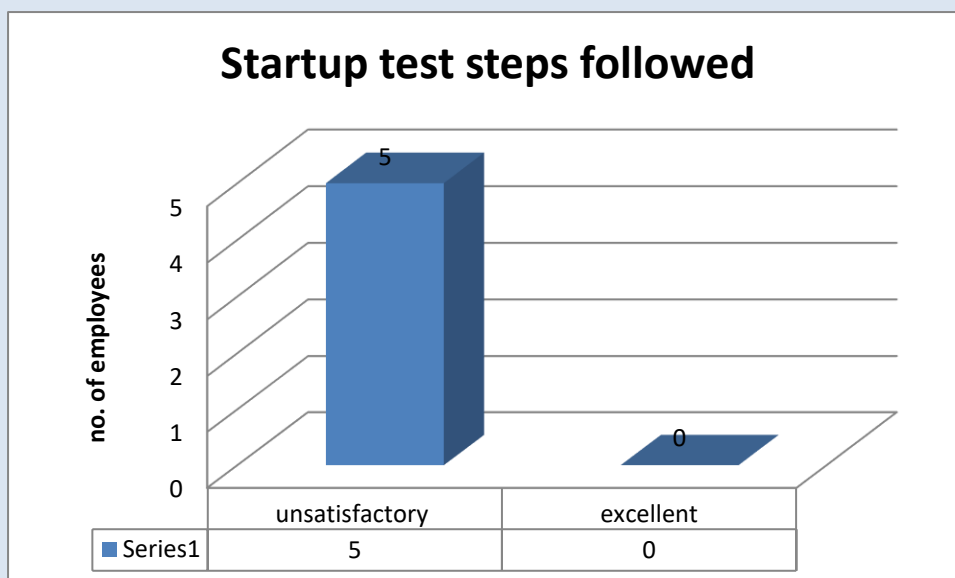
The syringe pump when not in use was stored safely and effectively.

Q.5 .Whether there was usage of mobile phones near equipment?



- All of the staff interviewed used mobile phones near equipment which can be harmful as the radio waves generated by mobile phones can hamper with proper functioning of the equipment.

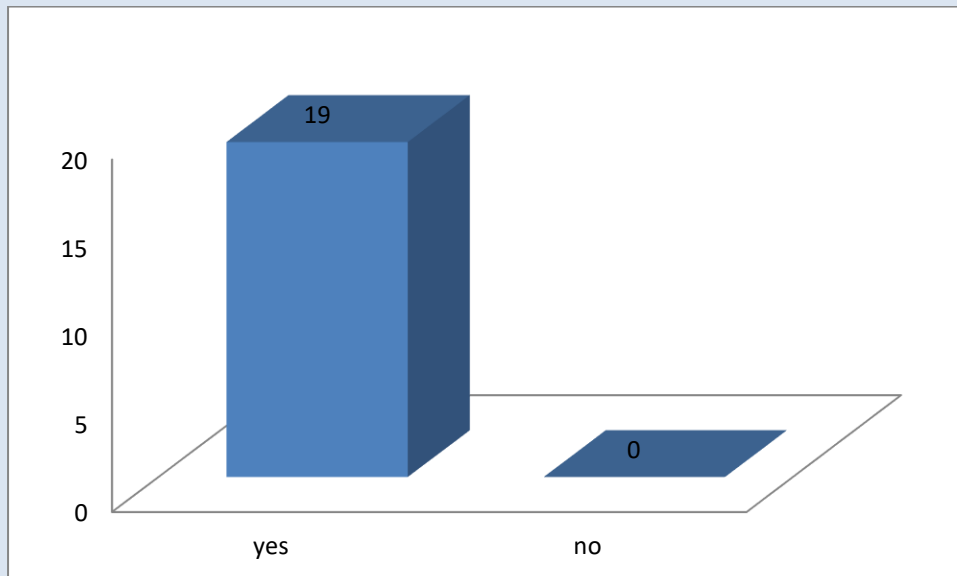
Q.6. Startup test steps followed for syringe pump of INJECTOMAT AGILIA model?



- Out of the 5 employees interviewed for INJECTOMAT AGILIA model none had knowledge about startup test performed (100%) for this model which according to the manual is necessary and should be performed regularly for calibration and checkup of equipment.

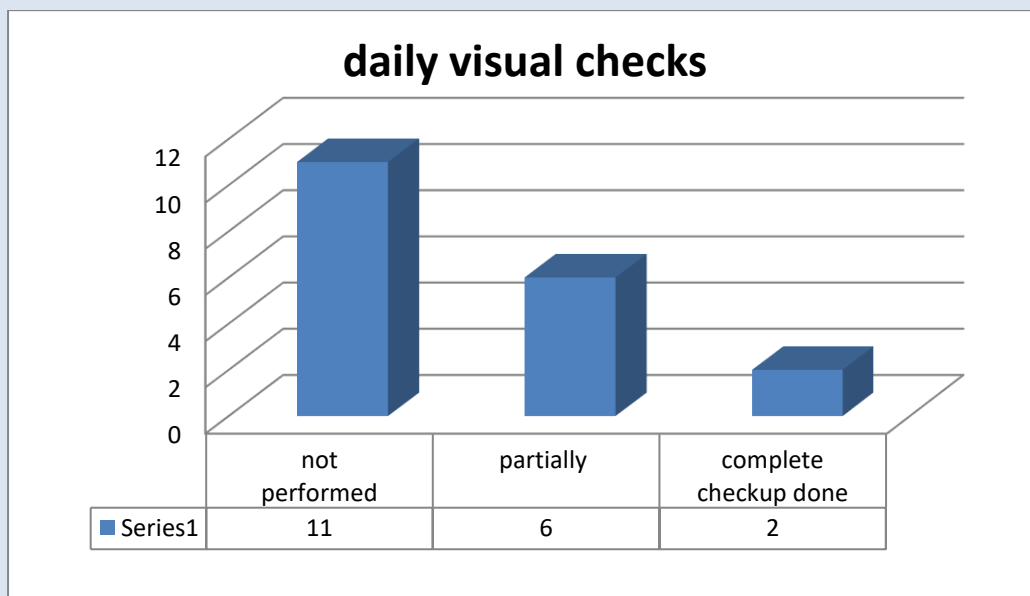
4. MONITOR:

Q.1 Whether regular cleaning and disinfecting was done?



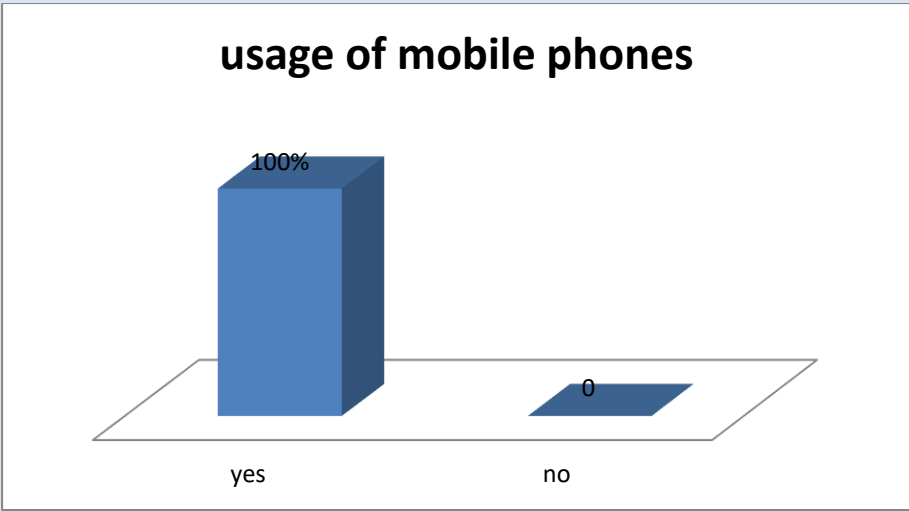
- All of the staff interviewed performed regular cleaning and disinfecting of the equipment.

Q.2. whether operator performed daily visual checks?



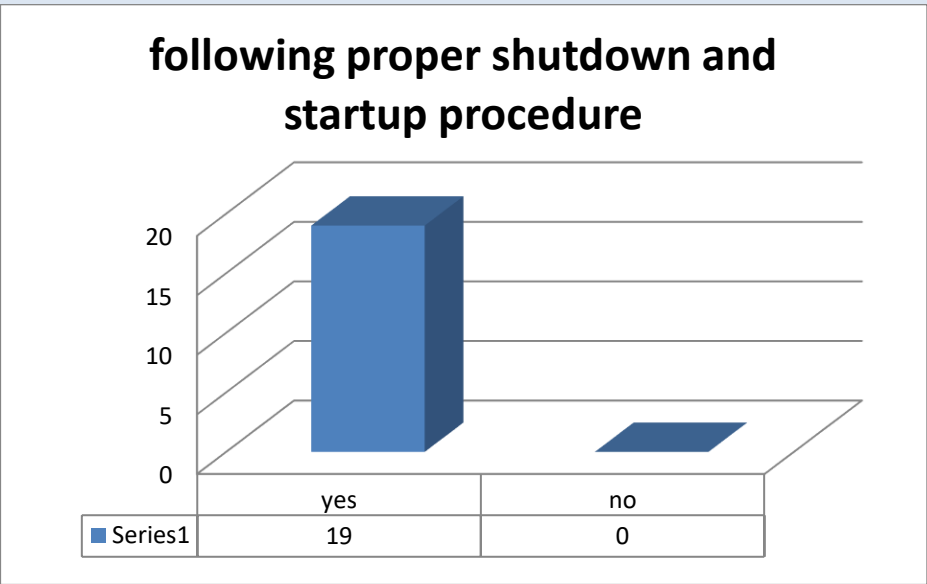
- Out of the 19 staff interviewed only 2 (15%) performed visual checks regularly while 6(35%) either did it partially or irregularly and 11 never performed any check. (50%)

Q.3.whether there was usage of mobile phones near monitor?



- Out of 19 staff interviewed all of the staff agreed that they used mobile phones near equipment in spite of that it is harmful for the equipment and it will result to inaccuracy of result.

Q.4. whether operator is following proper startup, shutdown procedure?

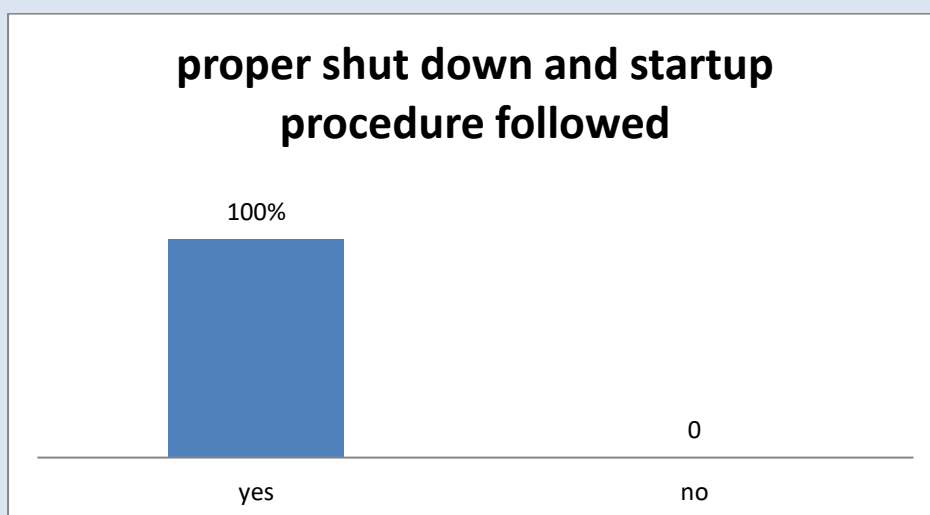


The entire operators are aware and following proper shutdown and startup procedure.

ii. DIAGNOSTIC EQUIPMENTS:

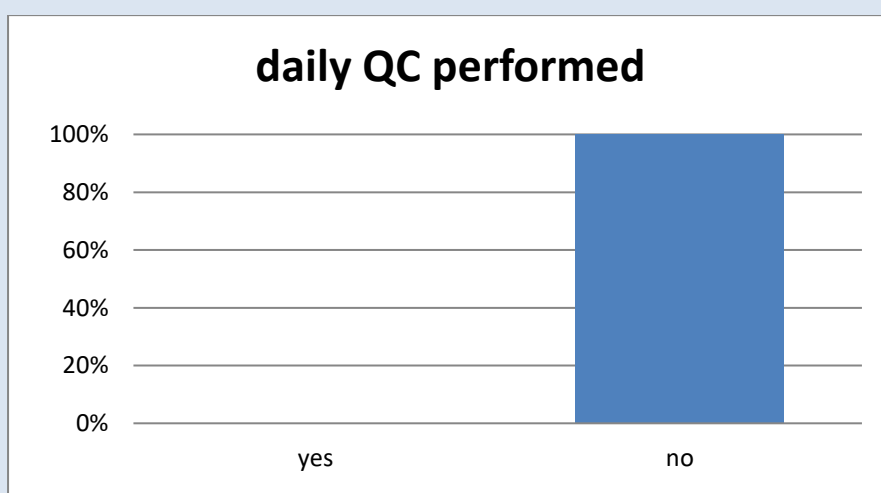
1. ARTERIAL BLOOD GAS ANALYSER (COBAS E 121):

Q.1. whether the operator is following proper startup and shutdown procedure?



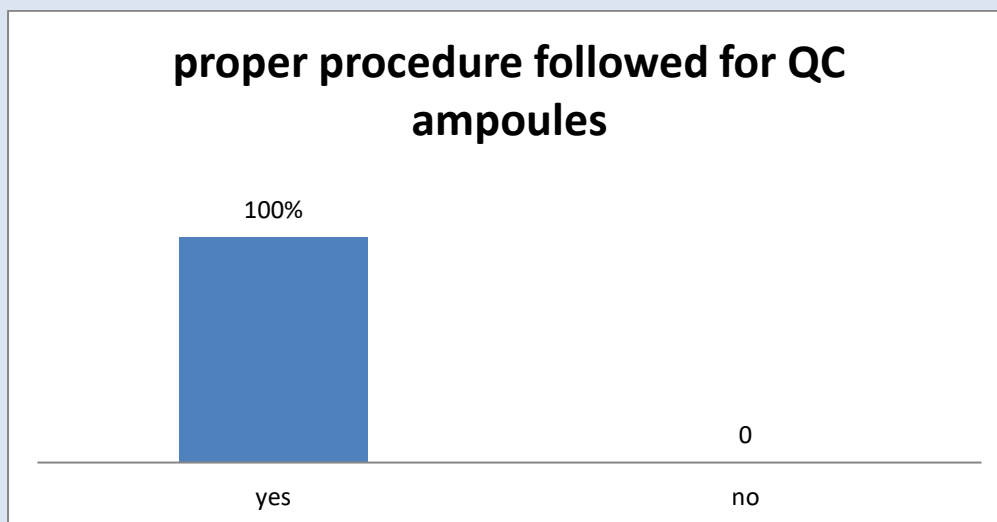
- All the staff interviewed had knowledge about proper startup and shutdown procedure. And same is following

Q.2. Does the operator performed Daily QC on all 3 levels?



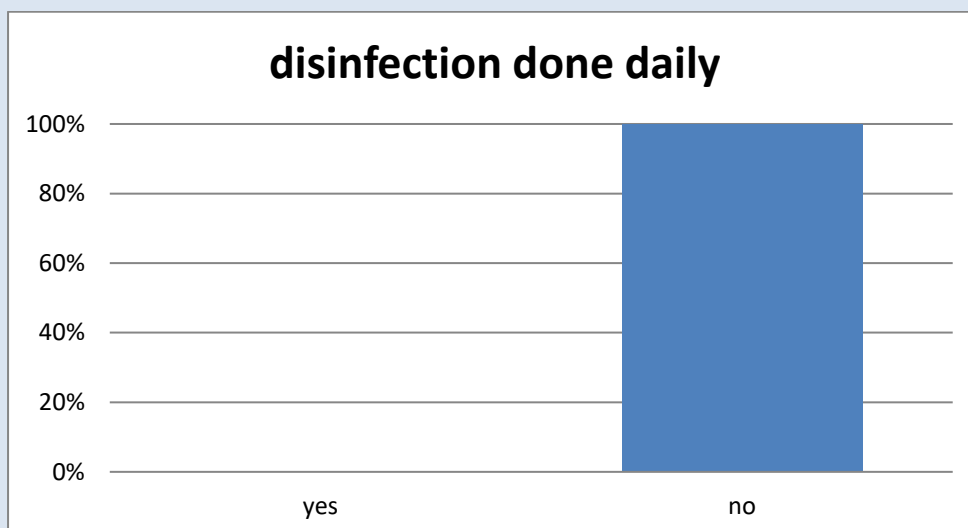
- 100 % of the staff didn't performed QC check for ABG machine which may lead to inaccurate readings by the machine.

Q.3. when using the ampoules for manual QC does the operator uses them directly out of refrigerator or let it rest for some time at room temp.?



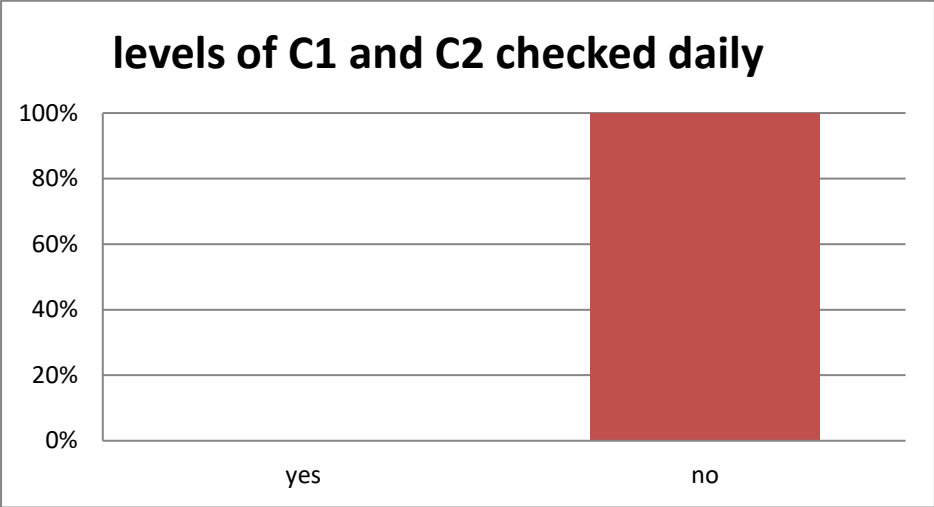
The staff followed correct procedure for ampoules for performing Manual QC.

Q.4. is disinfection carried out daily?



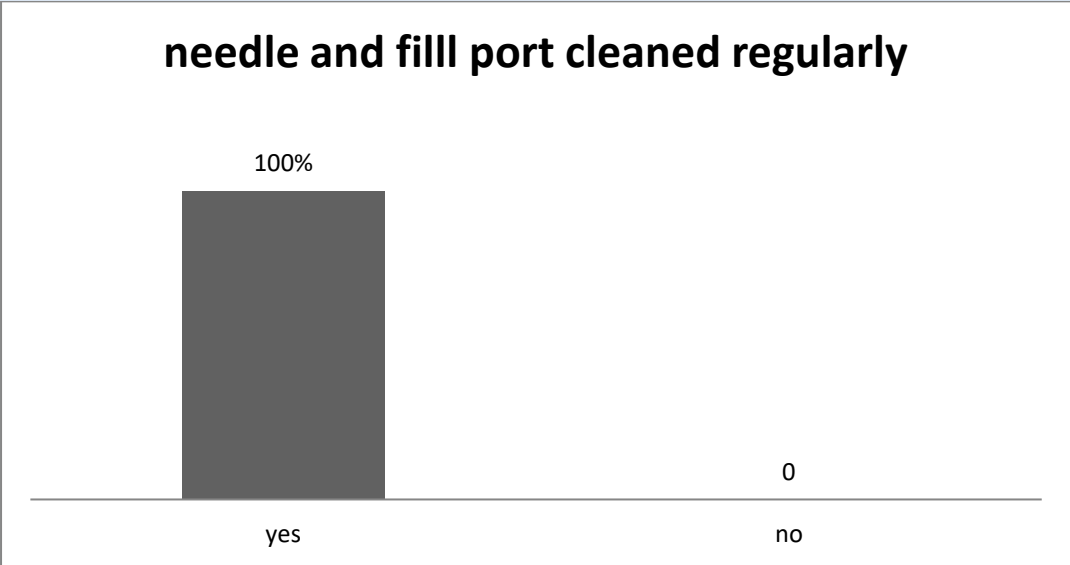
The staff didn't performed daily disinfection of the equipment.

Q.5. the levels of soln. C1 and C2 checked regularly?



The staff didn’t check the levels of C1 and C2 regularly and changed it whenever the machine went into breakdown due to emptying of C1and C2.

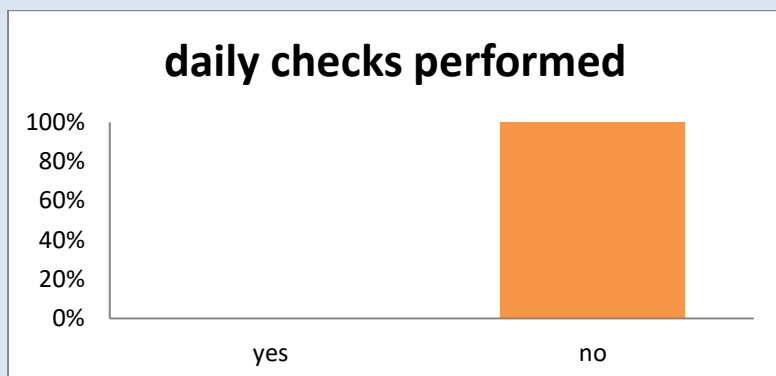
Q.6. whether the needle and fill port cleaned regularly?



The staffs had knowledge about cleaning the needle and fill port regularly and were following the same.

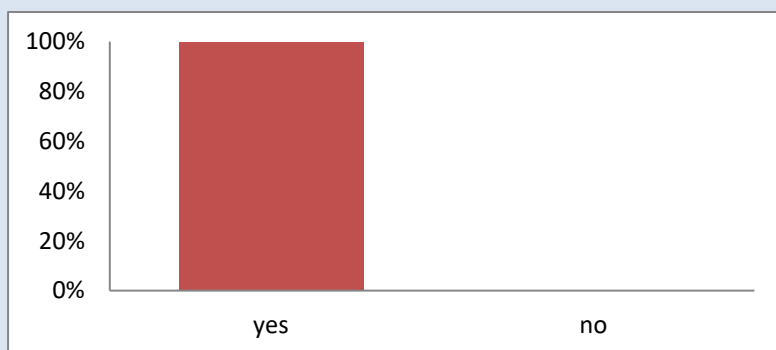
2. CELL COUNTER SYSMEX XS 1000i:

Q.1. daily checks performed?



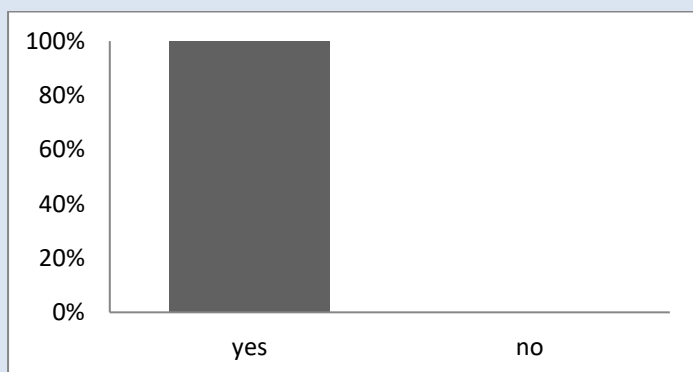
None of the staff performed daily checks regularly.

Q.2. Does the operator performed daily QC?



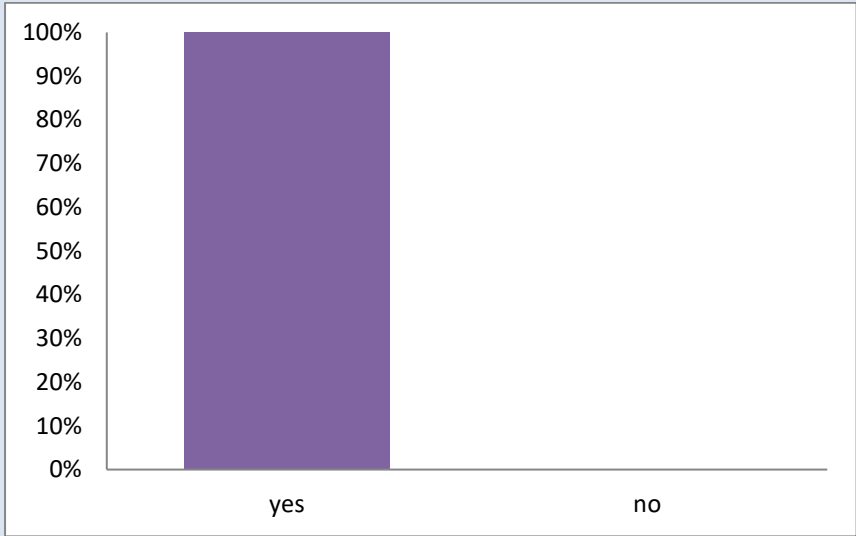
All of the staff performed daily QC for Cell counter.

Q.3. does the operator performed monthly rinse procedure regularly?



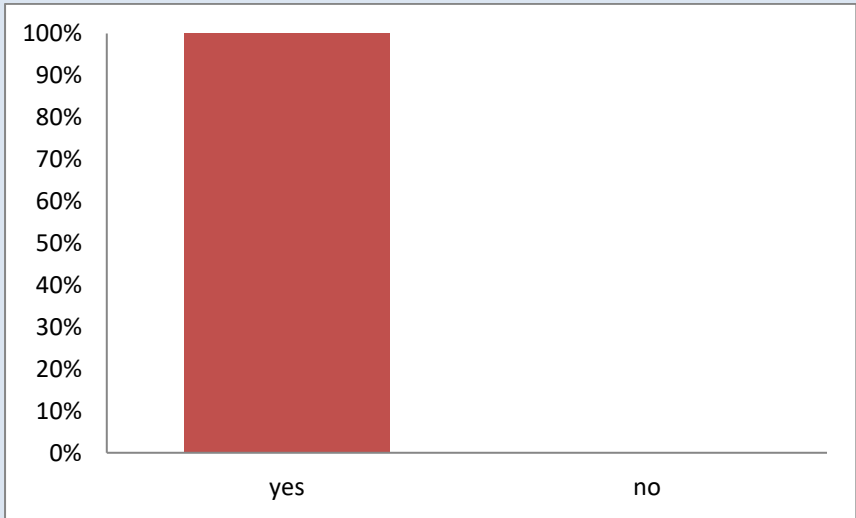
The operator had knowledge about the monthly rinse procedure and replied that they carry it out regularly.

Q.4. was there use of mobile phones near equipment?



There was usage of mobile phones near equipment by all the staff interviewed.

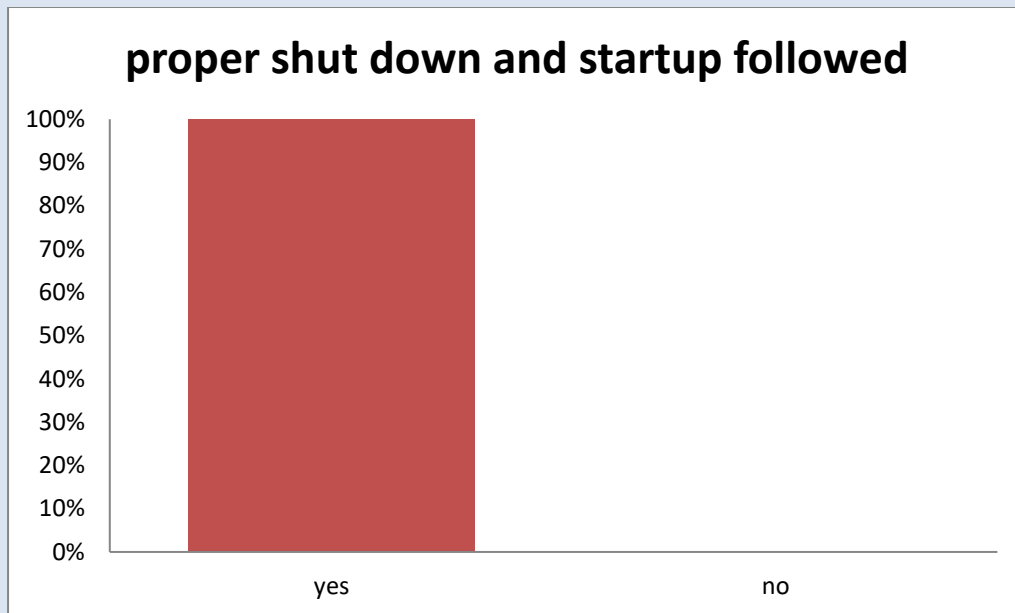
Q.5. is the operator following proper shutdown and startup procedure?



All operators followed proper startup and shutdown procedure.

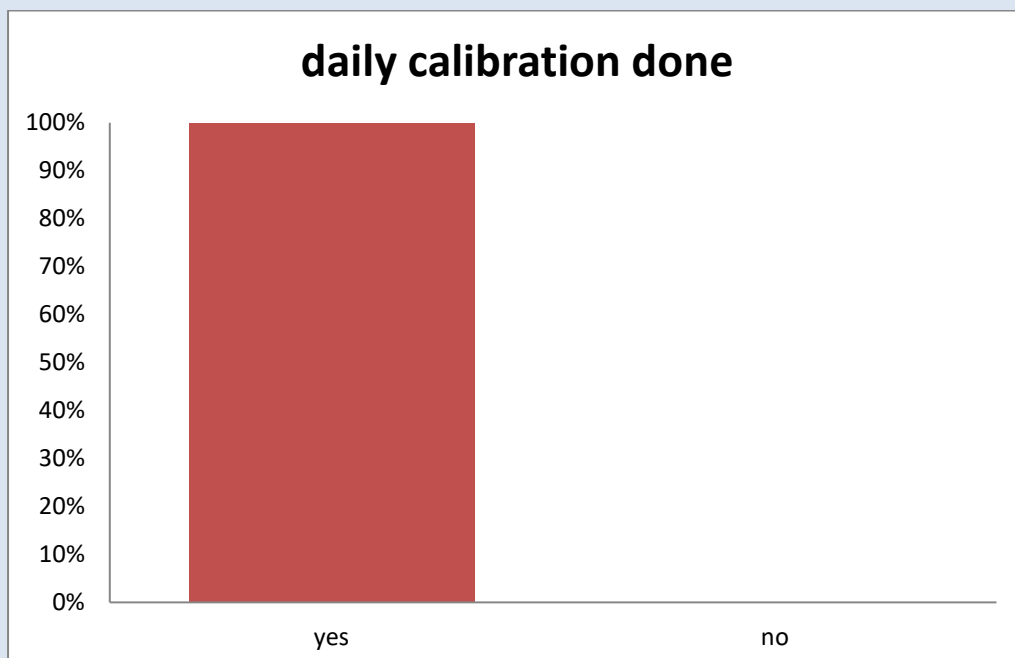
3. BS-400:

Q.1. is the operator following proper shutdown and startup procedure?



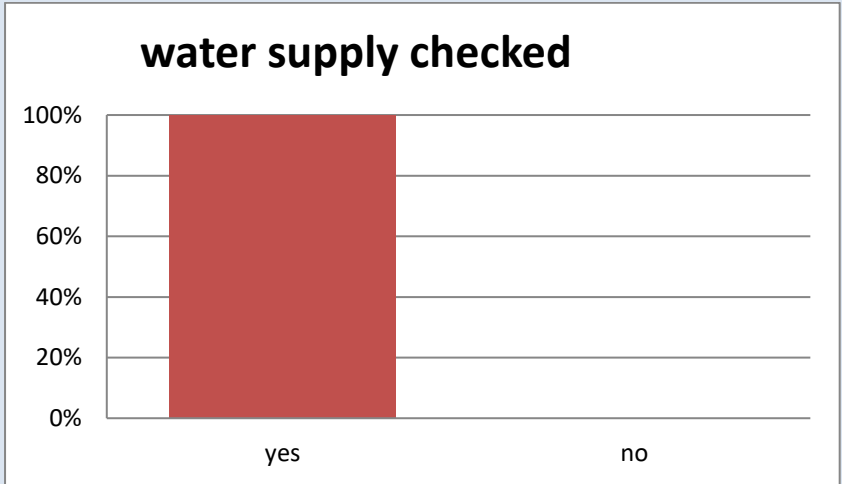
The operators followed proper startup and shutdown procedure.

Q2. Operator performs daily calibration?



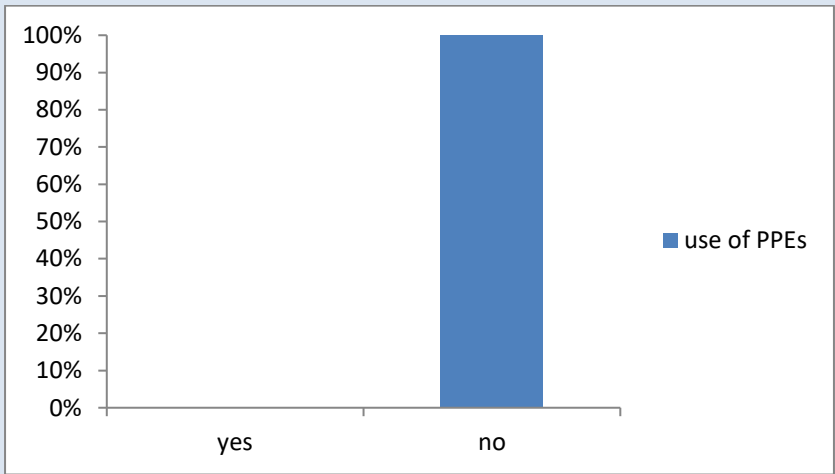
The operator performed daily calibration regularly.

Q.3. does the operator checks the water supply of the machine before starting the machine?



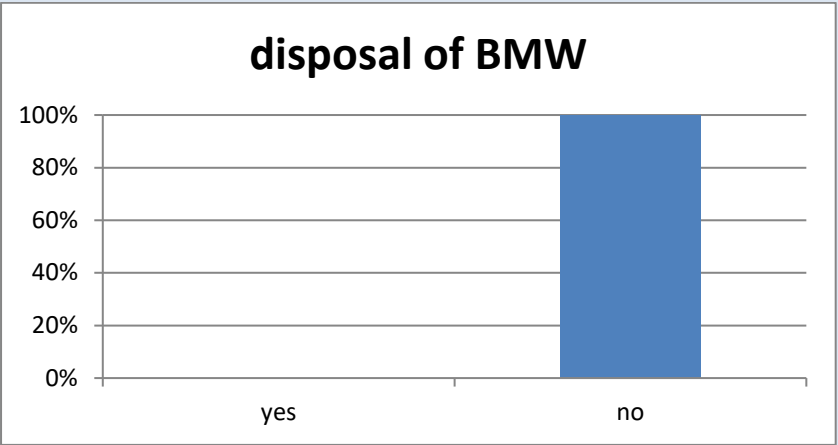
The operator performed checking of water supply before starting the machine.

Q.4. whether the operator used PPEs while working with the sample?



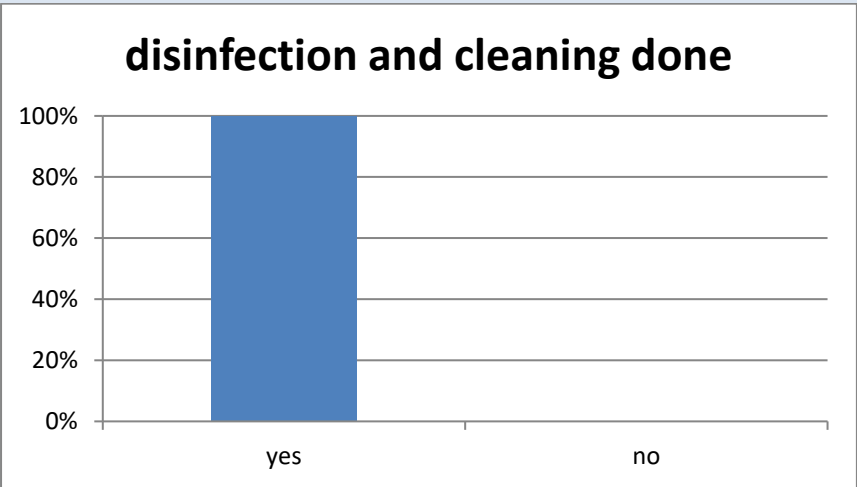
The operator didn't used PPEs while working with the samples although the samples were of human blood and serum and possibly contaminated.

Q.5. does the operator disposes of the biomedical waste properly?



The operator didn't disposed BMW properly and flushed it out directly in the sink used for hand washing.

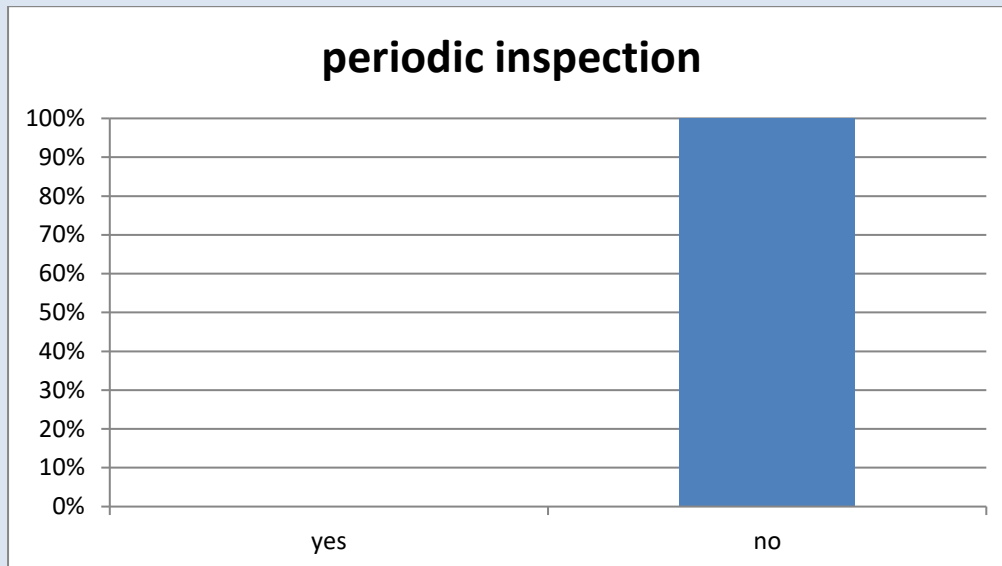
Q.6. Cleaning and disinfection of the equipment done regularly?



Disinfection and cleaning of machine was done regularly according to the operator.

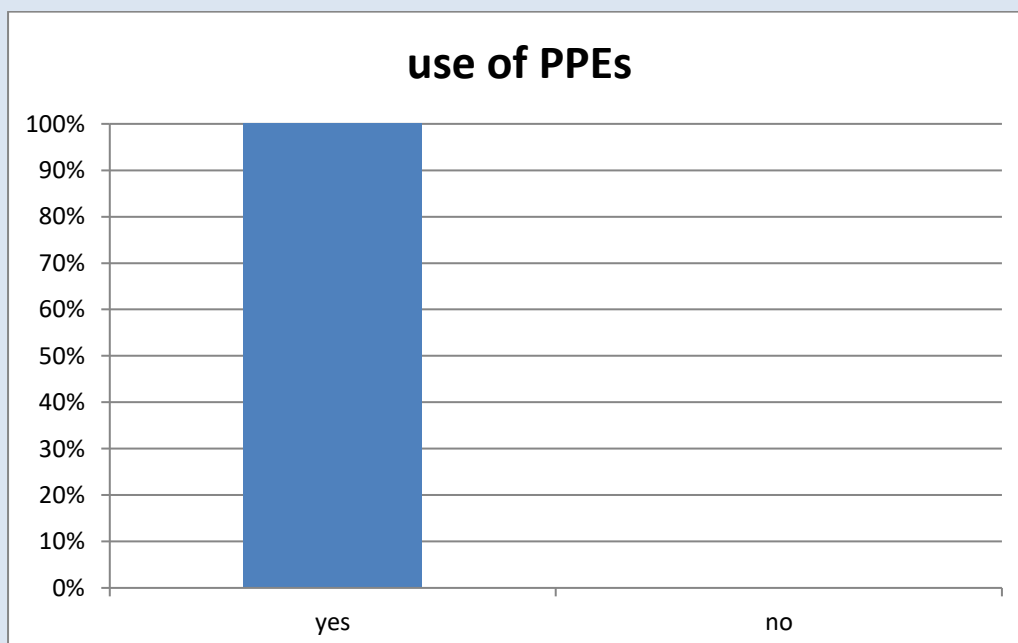
4. X—RAY (DX-300):

Q.1. periodic inspection of the X-Ray equipment and shielding features by the department staff?



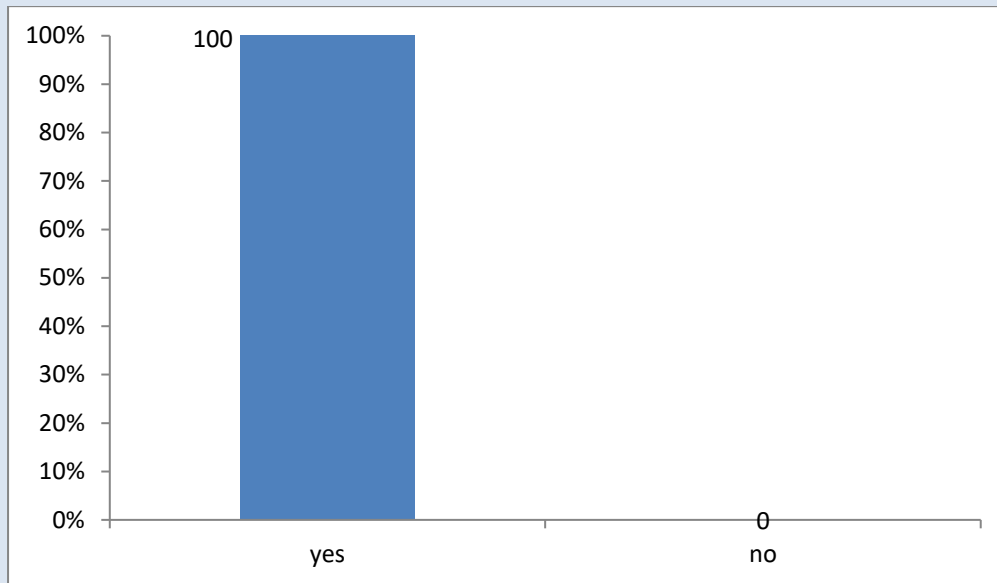
The operators didn't performed periodic inspection of the equipment and shielding features.

Q.2. whether there was Use of PPEs while performing radiological procedures?



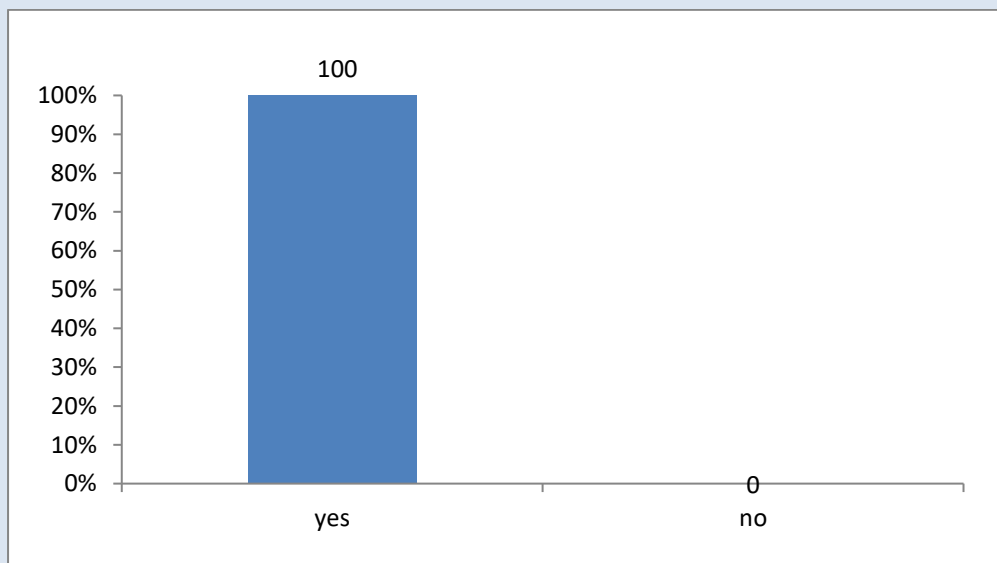
The operator used PPEs while working with the X-Ray equipment.

Q.3. is the operator using proper specifications for each procedure?



The operator used proper specifications for different procedures to reduce X-Ray exposure to patient.

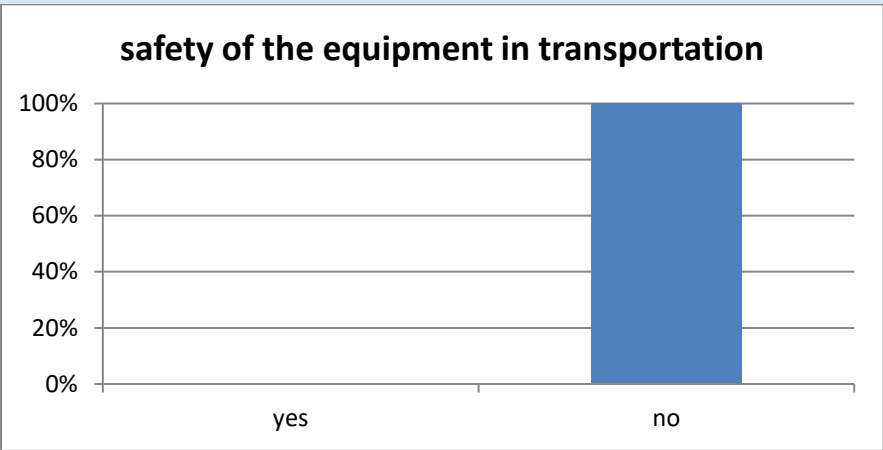
Q.4. whether the operator took adequate measures for ensuring safety of patient and visitors?



The operator was taking adequate measures to ensure safety of patient and visitors.

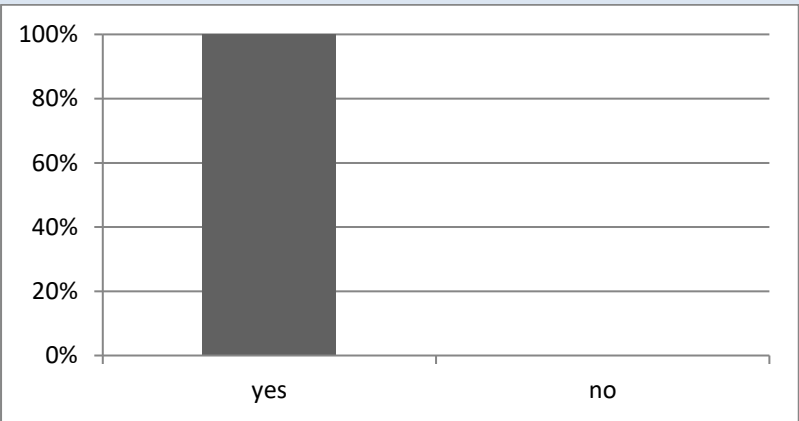
5. Mobile x-ray (genius 60):

Q.1.does the operator ensures safety of the equipment while transportation?



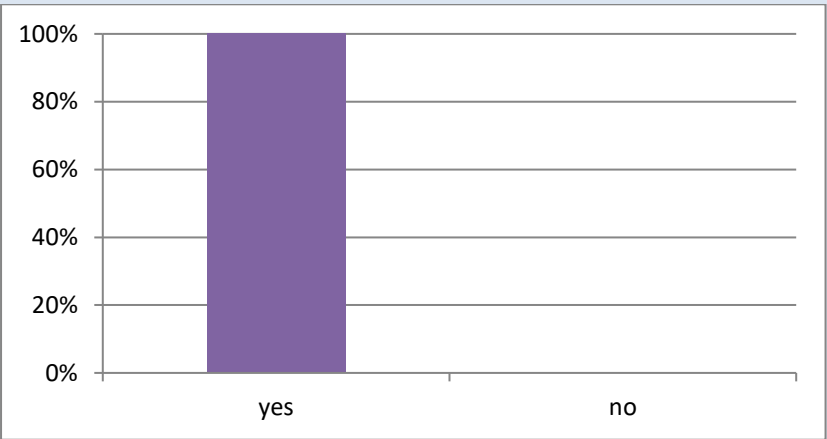
The operator didn't have knowledge about safe transportation of the mobile unit.

Q.2.whether oiling and greasing done regularly?



Oiling and greasing of the equipment was done regularly according to the operator.

Q.3. whether equipment cleaned regularly?



The equipment was cleaned regularly according to the operators.

GENERAL FINDINGS DEPARTMENT WISE:

The department wise general findings based on the general checklist are as follows:

(The highlighted areas are excerpts from the general checklist used for observation, showing the criteria with 0 score i.e. the criteria not followed)

CASUALTY:

In casualty the cleaning and disinfection of defibrillators and monitors was not being done on a regular basis.

Q.9 cleaning	0		0
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RADIOLOGY:

In Radiology the sticker of Preventive maintenance could not be found on the equipment even with the help of the 2 operators.

		X-RAY	
1. EPM		0	NO STICKER
2. IPM		0	NO STICKER

PATHOLOGY:

In pathology the cell counter SYSMEX didn't had any sticker of EPM or IPM during the study, when asked it was told that machine is brand new that's why didn't had any sticker.

Also the pathology department staff didn't used any PPEs while working with the specimens and sample although their working area was in continuous contact with blood and body fluid when asked they replied that they don't feel comfortable with the PPEs while working, they use it whenever there is inspection. Also the training for the equipment was not conducted for the staff interviewed and they just learned by observing and doing themselves but they had filled training feedback forms.

		BS-400		ABG		CELL COUNTER	
1. EPM		1		N/A		N/A	NEW MACHINE
2. IPM		1		1		N/A	NEW MACHINE
3. training		0		0		N/A	NEW MACHINE
4. infection control		0		0		0	
5. equipment disinfected		0		0		0	
6. awareness of risks and hazards		0		1		0	
7. PPEs used regularly		0		0		0	

MICU:

in MICU problem was not observed related to equipment maintenance, training and safety measures during the study period, although the compliance of the staff there is very poor for maintenance of equipments and staff is more careless than other departments (Source: discussion with the biomedical staff).

CCU:

in CCU no problem was observed related to equipment maintenance, training and safety measures during the study period.

SICU:

in SICU no problem was observed related to equipment maintenance, training and safety measures during the study period.

ITU:

In ITU during discussion with the staff it was found that training for Ventilator was not conducted and if conducted it was not frequent and they learned it from each other and by doing on their own.

		VENTILATOR
7.training		0

NICU:

In NICU no problem was observed related to equipment maintenance, training and safety measures during the study period.

CONCLUSION AND RECOMMENDATIONS:

1. In Critical Care equipments (Defibrillator, Ventilator, Syringe pump, and Monitor) the staff needs to be trained for performing startup test, cleaning (flow sensor cleaning for Ventilator) and preliminary inspection.
2. In Diagnostic equipments (ABG, cell counter, and Biochemical analyzer) the staff needs to be trained for use of PPEs and safe disposal of Biomedical Waste.
3. QC soln. for ABG needs to be supplied regularly to the staff to perform QC and they should be made aware about the importance of performing daily QC.
4. The quality and frequency of training given to the staff should also be looked over and if the training is found lacking then it should be improved and trainers should also be trained “(Train the Trainers).” Trainings should be closely monitored to ensure trainers adherence to the training schedule
5. In the training feedback forms name and employee code of the employees should not be taken as it may lead to biased feedbacks from the employees.
6. There should be proper mobile phone usage policy in place clearly specifying the area where they should not be used and staff should be made accountable to not use mobile phones in these areas containing sensitive equipments like ECG, Ventilator, Monitor, ABG etc. as it may lead to inaccurate measurement by these machines which could be life threatening to the patient.
7. Positioning and storage of the equipment during and after use should be specified and staff should be made accountable to carry out this task as incorrect positioning and storage of the equipment could lead to damage and inefficiency

REFERENCES

1. Essentials of hospital services by Dr. Ashok Kaushik IIMR Jaipur.
2. Equipment operating and installation manual for Defibrillator- HEARTSTART XL.
3. Equipment operating and installation manual for ventilator- ENGESTROM CARESTATION.
4. Equipment operating and installation manual for monitor- PHILLIPS AND SCHILER.
5. Equipment operating and installation manual for syringe pump and infusion pump of- PLENUM TECH ASPIRE AND INJECTOMAT AGILIA.
6. Equipment operating and installation manual of X-Ray – DX-300 and Mobile X-Ray- GENIUS 60.
7. Equipment operating and installation manual for Arterial Blood Gas analyzer- COBAS e 121.
8. Equipment operating and installation manual for Cell Counter- SYSMEX XS 1000i.
9. Equipment operating and installation manual for Biochemical Analyzer-BS-400.
10. Equipment operating and installation manual for CT scan.
11. Medical devices- Best practices for patient safety 1st Edition by Jitendar Kumar Sharma.

ANNEXURE

List of activities carried out in the hospital:

Date	departments
9/04/2013-14/4/2013	Observation of various departments of hospital and their working.
17/4/2013-30/4/2013	Audit of medical records of February and March and going through the operating manual for the equipments selected.
1/5/2013-10/5/2013	Preparation of questionnaires and checklist for individual equipments. Listing of individual Medical equipments in each and every department of hospital, noting down their BME id and IPM and EPM schedule.
10/5/2013-30/5/2013	Interview and observation of the operating staff for the equipments selected, discussion with the BMEs, recording the breakdown records and training records and discharging the results of the interview with BMD staff.
31/5/2013-10/6/2013	Data analysis and Interpretations and preparation of report.

ACRONYMS AND ABBREVIATIONS:

OT	Operation Theatre
ICU	Intensive Care unit(Medical, Surgical, Neonatal, Cardiac)
BME	Biomedical engineer
BMD	Biomedical department
ITU	Intensive therapy Unit
PPE	Personal Protective Equipments
EPM	External preventive maintenance
IPM	Internal Preventive Maintenance

Questionnaire and checklists used:

i. CRITICAL CARE EQUIPMENTS

1. Defibrillator Heartstart XL:

1. Whether “shift/system check” was performed every shift?
2. Before performing shift checks whether the operator checks for following to make sure that:
 - Paper is in printer
 - Test load is attached
 - Data card with enough space is inserted (optional)
 - Charged battery is inserted
3. Whether the operator followed following procedure to perform shift check:
 - Turn machine off.
 - If used regularly, insert data card
 - Unplug AC power
 - Insert charged battery
 - Be sure paddles are fully seated in their holders
 - While pressing “strip” turn the energy select knob to manual or AED
 - Follow the prompts on display to proceed with the test.
 - Reconnect to AC
 - Printing of report
4. Whether the battery is fully charged regularly?
5. Cleaning done regularly with Isopropyl alcohol (70%) or Mild soap and water or chlorine bleach (3%) or Quaternary ammonium compounds like Lysol (10%)?

2. Ventilator (Engestrom Carestation):

1. Whether there was usage of radio/TV/Mobile phones near equipment?
2. Whether following steps were followed before preparing ventilator for a patient:
 - Plug power cord
 - Turn system switch On
 - Check whether there are 2 distinct audio alarm tones
 - Ensure alarm LEDs blink
 - Ensure all water traps & filters are clean prior to using.
 - If everything normal patient setup menu is displayed.
 - Select checkout.
 - Attach patient circuit.
 - Occlude the patient wye.
 - Select start check.
 - Checkout complete appears after checkout is finished and highlight moves to delete trends, select yes or no depending on preference.
 - If all checks passed select previous menu.
3. Whether the equipment was covered or positioned in such a way that operation or performance is adversely affected?
4. Whether the flow sensor cleaning was done regularly and before connecting the ventilator to the patient?
5. Cleaning of flow sensor done in following sequence:
 - Remove flow sensor by pulling it away
 - Rinse it immediately after removal
 - Clean flow sensor by detergent and warm water
 - Check for cracks or damage
 - Reposition it when dry
 - Complete system checkout prior to use.

3. Infusion pump (Plenum aspire):

1. Whether specified syringes were used by the operator? (Dispo van, BD precise, BD plastic pack, B Brawn's perfusor)
2. Was the operator using things like pen, pencils, and fingernails to operate the membrane keyboard?
3. Whether startup test was performed before attaching infusion pump to the patient?
4. When not in use, was the pump stored safely or in such a way that might result in damage?
5. Whether mobile phones were used near the equipment?

Injectomat Agilia:

Whether the operator performs the User test for Quick check which is as follows:

1. Check state of device- absence of impact marks and noises; presence of all labels.
2. Connect device to main and press ON. Check good functionality of display and indicators.
3. Open the syringe barrel clasp
4. Install a 50cc syringe and place syringe barrel clap and pusher in infusion position
5. Confirm syringe and select flow rate of 0.1 ml/hr.
6. Infusion in progress is signaled by a man or moon sign.
7. Open the syringe barrel clasp- syringe installation alarm activates.
8. Close syringe barrel clasp.
 - Disengage and move pusher backwards- disengagement and plunger head alarm activates.
 - Return pusher to infusion.
9. Note the stopper position/syringe volume and start a 5ml. bolus. Check that syringe stopper has moved to 5ml+ 0.5ml.
10. Disconnect mains, mains indicator turns off and the battery symbol activates.

4. MONITOR (PHILIPS, SCHILLER):

1. Does the operator perform cleaning and disinfecting regularly? (lint free cloth moist with warm water and soap; disinfection- 70% alcohol)
2. Does the operator perform daily visual checks before using the equipment?
 - Physical damage.
 - Damaged patient leads or electrodes.
 - Inspection of all accessories like cables, transducer, sensors etc.
3. Whether the operator is using mobile phones near the equipment?
4. Is the operator following proper shutdown, startup as well as battery charging procedure to ensure performance of the equipment?

ii.DIAGNOSTIC EQUIPMENTS:

1. ARTERIAL BLOOD GAS ANALYSER (COBAS E 121):

1. Is the operator following proper startup and shutdown procedure?
2. Does the operator perform QC check daily on all 3 levels (low, normal, high) after starting the instrument?
3. When using the ampoules for manual QC does the operator uses them directly out of refrigerator or lets it rest for some time at room temp. before using?
4. Is disinfection of the equipment carried out daily?
5. The levels of solution C1 and C2 and waste container are checked regularly?
6. Whether the needle and fill port are cleaned regularly?

2. CELL COUNTER (SYSMEX XS 1000i):

1. Is the operator performing following checks daily before starting the equipment?
 - Reagent inspection- levels and replacement if any.
 - Instrument inspection- tubing, cable connection and power cord.
2. Does the operator perform QC/calibrations daily?
3. Does the operator runs monthly rinse procedure regularly?
4. Does the operator uses any RF generating equipments like cell phones, radio etc. near the equipment?
5. Is the operator following proper shut down and start up procedure?

3. BIOCHEMICAL ANALYSER (BS-400):

1. Is the operator following proper shut down and start up procedure?
2. Does the operator perform daily calibration checks for the equipment?
3. Does the operator checks the water supply of the machine and ensures that water supply is adequate before starting the machine?
4. Is the operator following personal safety measures while working with the sample?
5. Is the operator following proper waste disposal guidelines for disposing the waste generated by the machine?
6. Is the machine cleaned and disinfected regularly?

4. X-RAY (DX-300):

1. Is the operator performing periodic inspection of X-Ray equipment and shielding features?
2. Is the operator using PPEs while performing radiological examinations?
3. Is the operator using proper specifications for each procedure to minimize the X-Ray exposure to the patient and produce best results? (like using specified ranges of
4. Is the operator taking adequate measures for ensuring safety of patient and visitors? (like a red light at the door to warn visitors of the radiation hazard in the room or using gonad shield when appropriate etc.)
5. Whether the operator switches OFF the room lights before taking an X-Ray?

5. MOBILE X-RAY (GENIUS 60):

1. Does the operator ensures safety of the equipment while transportation?
 - Tube head arm folded and locked and tube head in lowest position.
 - Loose supply wire in wire net to avoid inadvertent wire breakage.
 - Shutting off light bulb of collimator when not in use.
2. Is the oiling and greasing of the machine done regularly?
 - Is the equipment cleaned regularly?

GENERAL CHECKLIST USED:

CRITERIA:	YES	NO	N/A	COMMENTS
Whether the external preventive maintenance/calibration is performed on schedule?				
Whether the internal preventive maintenance is performed regularly and on schedule?				
Whether the equipment was handled by trained personnel?				
ELECTRICAL SAFETY:				
Wires and cords in good condition?				
No exposed electrical connections?				
Does a multi plug adapter if used have overload protection?				
TRAINING:				
Whether training for equipment is conducted regularly?				
SAFETY MEASURES:				
Whether infection control measures are followed by the employees while working with the equipment?				
Is the equipment cleaned/disinfected regularly?				
Whether the person operating the equipment is aware of any risks/potential hazard associated with the equipment?				
Is Personal protective equipments (PPEs) used regularly while working by the operator/technician?				
Is the operator/technician has knowledge about the use of PPEs while working with the equipment?				
Whether the operator took measures for patient safety while performing Radiological procedures?				

Thank you