

Study Protocol

A Study of Optimal Utilization of Radio-diagnostics at Acharya Vinoba Bhave Rural hospital, Wardha, India

Abstract-

Background: Radiology has its own role in day to day healthcare services especially in diagnosis, patient management and treatments. Current advances in technology allows for exploring every tissue, organ and problem in details. The radio diagnostic imaging modalities include ultrasonography, X-ray, CT, MRI etc. Diagnosis is influenced by proper utilization of imaging equipment and techniques. These modern amenities need a huge investment and maintenance cost. This study insisted on assessment of working condition, level of utilization, and barriers in the utilization of the radiological facilities in AVBRH, India.

Methodology- This cross sectional study will be conducted at AVBRH , Wardha. A structured questionnaire will be used for data collection through interviews of selected professionals and health care workers. It will assess the utilization of radiodiagnostic equipment's in radiology department of AVBRH, breakdown occurrences and cost of repair, turn-around time, repair and maintenance contract.

Expected Results: Data on radio diagnostic equipment's in radiology department of AVBRH, breakdown occurrences and cost of repair, turn-around time, repair and maintenance contract will be generated and gaps in service delivery will be outlined.

Conclusion: Key critical gaps in efficient equipment use and service delivery will be outlined.

Keywords: Radiology, Functional Status, Imaging equipment, X-ray, CT Scan, MRI, workload, Utilization Rate, Turnaround, Maintenance cost.

INTRODUCTION:

We cannot imagine today's modern medical science without Radiological investigation and imaging technique. It won't be an exaggeration if we would call medical imaging the heart of the medical science. Most of the medical health condition diagnosis cannot be confirmed without the help of the Radiology and imaging equipment¹. Most of Indian or Asian hospital lead sufficient man power to operate the equipment and much equipment lose their shelf life due to inappropriate handling and physical infrastructure¹.

Medical equipment have already been used for diagnostic intension, medical care any illness or injury purpose or reason². In recent time the medical world has experienced rapid development in technology and that's the reason of rapid substitution of old equipment with

new advanced equipment and modalities. The latest device become outdated very soon due to rapid technology innovation and development, which ultimately lead to extreme difficulty in maintaining the continuous utilization of exciting defective, malfunctioning or outdated radiology and imaging equipment³. Nobel Prize winner in 1895 made a revolution in medicine field and over the period of time. At an MRI became two main radiology equipment which entitled or consider the application or investigator make progress in examining the inner physical health by imaging service³. These two inventory equipment have been adopted widely worldwide in last 3-4 decade use of these of kind or sort of equipment has become necessary, essential or important thing of hospital setup. Ct utilization in rapidly growing and it can be observed in national trends but increased usage is also a origin to analyze increased cost radiological circle and increased radiation dose⁴. CT is very familiar stream of source in many countries US and it's approximately 75% of radiation exposures, MRI and all imaging equipment are high technology material which is a combination of electronic and mechanical engineering with a functional design. With every passing year the progress in technology offers considerable improvement in term of quality and security both far diagnostic and therapeutic imaging sector⁴. Increase in spatial and temporal resolution, combined with a better lesion characterization, which ultimately leads to identification and diagnosis of smaller lesion which greatly impact on patient care. Example in cancer, in sports injury and other medical issue where even a small lesion can be very detrimental for patient. Besides providing fast and accurate diagnosis, advances in radiology equipment offer new and previously non existing options for treatment guidance with quite low morbidity, resulting in improvement in health outcome and quality of life of patient⁵. The conditions and state of the equipments can also be affected by its handling, utilization and maintenance⁵.

Medical technology advancement is playing a pivotal role in diagnosing and saving lives. It's positive impact is not only limited to the upper crust of the society but also helping the poorer a lot by reduction in mortality and morbidity rate in various health issue. Morbidity rate in various health issues. Example incubator, warmers, PRP treatment interventional radiology, betters other equipment etc⁶. The physician are becoming more and more equipment oriented due to the goggle and social media, the patient are much informed of the modern facilities available in the country and abroad. They start expecting and demanding the same⁶. Utilization can be termed appropriately utilize equipments to its full prospective. Sight or observation clarity is of utmost importance regarding the usage of equipments. Optimization of equipment utilization must be a prerequisite to obtain a maximum return for invested capital in these equipments.

Optimum utilization of the equipments can give

- Best or most favorable patient management and fast income.
- Slightest cost feasible
- Qualitative patient supervision
- Customer's/patient fulfillment or pleasure⁶.

Utilization also means the use rates of imaging services and utility is the state of being useful to some valuable end, like accurate diagnosis⁷. Doctor no longer had relied only on external sign and patient history, but could see pathologic processes directly. A radiology aphorism was born "one look is worth a thousand listen"⁷.

All health care practitioners' including physicians, dentist, surgeons, physiotherapists are acquiring an integral skill of selection and interpretation of appropriate diagnostic imaging modalities but this is also a major contributing factor for rising health care cost⁸. But we should keep in mind that all these radiological equipments has a definite life span, there could be unavoidable breakdown at any given point of time and there could be decrease or loss of image quality as well. Other problem is few important and most useful equipment like magnetic resonance imaging scanner (MRI) and computed tomography units which constitutes most of the investment in the medical instrument in the hospital being costly their shelf life also remain small or little with high cost maintenance. When differentiated with beginning expenditure made during installation⁹. Technology advancement also comes with added expenditure therefore careful evaluation of manpower, regular inspection of equipment is necessary to establish an efficient, cost effective and with minimum out of action day's radiology service⁹. The important of efficient utilization of expensive imaging equipment has been brought to full public attention by the current health care debates¹⁰. Drastic consciousness or recognition of the cost linked with diagnostic imaging and its installation and maintenance is closely ever present with the ongoing discussion regarding sky rocketing health care cost¹⁰. Few researches tried to survey or investigate the corporation between utilization of diagnostic imaging facilities and socio-economic status. Population with higher socio-economic status shows significant utilization of enlightened or urbane modalities such as CT and MRI, whereas population assorted by low economic status has more access to less sophisticated and routine modalities such as radiography or ultrasound¹¹.

Direct costs of imaging modalities are mainly depend on three factors.

- The equipment and installation cost
- The duration for the procedure
- Desired level of access to the equipments¹².

It's very important to find an appropriate balance between intensity of usage and access to these imaging modalities¹².

Health system in whole world must be in developed or developing modern or upgraded countries, making efforts over the challenge how to come over the health care delivery in condition of resource constraint. Unavailability of functional equipment has a destructive effect on healthcare in resources poor setting. It is frequently alter that most of the diagnostic equipment in developing world damaged or shattered with estimate extend up to 96% out of order or not available for use. Most of the laboratory and diagnostic equipment resources pour setting are out of order¹³. It is found that 61% of the total radiological equipments from well known hospitals and various health facilities are in working conditions at one specific time. Inefficient management of medical equipments has abrupt impact on delivering adequate health care¹³. Develop or increase class or standard and restrain cost of hospital supervision are important two factor of health polices in many other countries¹⁴. Modern practice of Radiology involves several different healthcare professional working as a team. Radiology report is the important aspect to any particular decision making so including time bond for report is not worth. Radiologist should take as much as time for evaluation of disease, cancer or not etc. Now days public are so aware and always expect for positive response or will show it to TV drama, Scandal , media, creating an issue, harming the doctor¹⁵. Over the decades of modern era the new technology according the new modern radiologists work as a part of multi- disciplinary clinical team, the selection, from the body of available intervention that have been shown to be efficacious for a disorder of the

intervention that is most likely to produce the outcome desired by the individual patient. Treatment contrast, communication or direct involvement with patient for report discussion. Mask on exits or compounding factor. Work load of radiologist is higher in term of report. There are many non- rostered clinical activities in normal working time¹⁶.

Over past decades indisputable or not plan to disagreement advantage or profit gained from, increased longevity is one of the modern world's greatest achievements. Growth show an image of or throw back new technologies and application, along with modern technology ministration (ultrasonography, x-ray, etc.) factor or favor component development in whatever way or regardless of how it can be ascribe a work to the over utilization of imaging services. Over utilization lead to increase in high exposure of patient which is very dangerous for patient we can say as unnecessary exposure for a patient¹⁷. In history, before there were no objective or opinions in considering and representing facts method of measuring time officially compulsory or otherwise considered essential for report to give as early as possible in routine working time. If something is done in real time, there is no noticeable delay between the actions; it will be done in actual time, if workload is less for radiologist. Time spent to discover or identify the presence of existence to discover or to investigate a minor component is radiologist workload¹⁸. In recent study it is also shown that number of imagining is been record whereas less has been published because of some factors affecting such as image equipment or area of the imagining¹⁹.

OBJECTIVES:

1. To assess the utilization radio-diagnostic equipment's in radiology department in Acharya Vinoba Bhave Rural Hospital.
2. To count the breakdown occurrences in radiology department at AVBRH hospital.
3. To count the down time frequency.
4. To evaluate the cost of repair.
5. To determine the turn-around time.
6. To assess agreement with service provider for repair and maintenance/ comprehensive maintenance contract.
7. To evaluate the cost of annual maintenance contract/ comprehensive maintenance contract.
8. To evaluate the average number of tests performed per machine.

METHODOLOGY:

Looking closely or examining both open- and closed ended questions and it took Amount over a period of 10min time to complete the questionnaire. The data was collected through one-to-one conversation between people responsible for carrying out the administration. A formal assessment or report on or evaluation will be done daily through questionnaire for appropriate, precise, the quality of transparency was carried out. Institutional ethical committee, clearance was acquired and gained. Consent form was filled before asking them any questions. Questionnaire was checked prior to examination. In this study a person will answer our questionnaire giving us a information about it, format that we have with us. Having official permission or approval along with the questionnaire before asking something to anyone. Closely connected or appropriate to what is being done or considered in the department. Appropriate to the current time, period or circumstances of a contemporary interested person to answered us properly. Different checklist will be used to collect data of

functional equipments; date of installation, beginning date will be noted of radiology and imaging equipment.

Study design: - Descriptive cross-sectional study.

Sample collection: - Random sampling technique.

Place of study: - Acharya Vinoba Bhave Rural Hospital (AVBRH)

Expected Result: Result will show the status of radiological and imaging equipment utilization at AVBR hospital.

Inclusion criteria: - All working and non-working equipment used for radiological investigation purpose.

Exclusion criteria: - 1. All condemned machines 2 . All other Machines not used for radiological investigation purpose

EXPECTED RESULTS:

Study proceed to recognize or distinguish the status of utilization of an imaging equipment at AVBRH . After completing data analysis and collection, result will be available from this study.

There are many equipment in hospital are available, them few can be non-working or nonfunctional and other all are working. Some are functional but not in use. Through this actual work time, down time, factor affecting and other things, parameters will be known.

DISCUSSION:-

Study was done to known about the breakdown occurrence, count down time frequency, to evaluate the cost of repair, to determine the turn- around time, annual maintenance evaluate the average number of test performed per machine in the hospital. Most existing studies in India, look attentively at rapid growth in technology is one of cause for the utilization. Related evidences are reflected from GBD studies²⁰⁻²⁷. Just came before studies have no detail analysis about how digitalization or computerization to affect or change how something develops , the utilization cost. It's being impressive that the present studies ruling out about factor affecting utilization rate.

Radiology is emergency point of care and foremost important like ultrasound etc. Strength are task, our study contain as part of a whole utilized data, linking or connection at the separate level, validation of data and specified state of large data set. According to the study some are working or functional equipment, some are condemned machine which can no longer be in use. Some are working but not in use. The reasons of non-functional or non working equipment we're found that there spare - parts are not available or unavailable due to some reason, some due to unavailable servicing manpower.²⁹⁻³¹

CONCLUSION:

Most of curial factor have an effect on or make a difference to utilization of radiology equipment as a way in which something is regarded , understood or interpreted of the current , something outdated and no longer used or process of becoming obsolete, restricted to obtained and delays in repairing. The state of being otherwise occupied or not being free to do something of professional radiologist and the cost or price we're the main two factor, it does not cause any problem to equipment utilization. A number of days it will be found out for each diagnostic equipment individually when it can't be available for use and it's caused will be analyzed. It begins to the utmost or most absolute extent ,or quite evident that the equipment utilization can cynshia wasted no more time before getting down due to days wasted.

Ethical approval and Consent

Institutional ethical committee, clearance was acquired and gained. Consent form was filled before asking them any questions.

REFERENCES:

1. Hossian MD, Sultana P, Shahjahan M, Cross -sectional study on utilization of radiology and imaging equipment in the district hospital of Bangladesh. January-juns 2017;5(1):21-28.
2. Gupta V, Gupta N, Sarode G, Sarode S, Patil S, "Assessment of equipment utilization and maintenance schedule at dental institute in Bengaluru ,India". Jp-journal-10015-1421. 2017
3. Chibunna A, Ibrahim Z, Utilization of radiation monitoring devices among radio-diagnostic staff of secondary and tertiary hospital in jos, Nigeria: a comparative study.
4. Boone J, Brunberg J, Computed tomography utilization in a tertiary care university hospital. J am call radiology.2008 Feb: 5(2): 132-138.
5. Mathew N , Appalah V , Bhatt A, "A study on utilization of equipment and quality assurance in the department of a tertiary care hospital."Vol.-2,issue-10, oct-2016
6. Chaudhary P, Kaul P, "factor affecting utilization of medical diagnostic equipment: A study at a tertiary health care setup of Chandigarh. 2015;2:316-23.
7. Lysdahl K, "Utilization and utility of diagnostic imaging". 2012
8. Lewiss R, Chan W, Sheng A, Soto J, Castro A , Meltzer A, Cherney A, Kumaravel M, Cody D, Chen E."Research priorities in the utilization and interpretation of diagnostic imaging: Education, Assessment, and Competency.2015 by the society for academic emergency medicine.
9. "Renewal of Radiology equipment" European society of Radiology (ESR) 18 Sept. 2014
10. Hu M, A study on medical imaging equipment productivity and utilization. 2011 industrial engineering research conference.
11. Demeter S, Reed M, Lix L, Macwilliam L, Leslie W, " Socioeconomic status and the utilization of diagnostic imaging in an urban setting". 2005 CAM media inc. Or it's licensors.
12. Butz D, Lee D, " Optimal utilization of Advanced diagnostic imaging equipment: Principal and implications". 2006 AMIC
13. Ademe B, Tebeje B, Molla A, "Availability and utilization of medical device in jimma zone hospital, south west Ethiopia : a case study." Ademe et al. BMC health services research (2016) 16:287
14. Wei Y, Yu H, Geng J, Wu B, Guo Z , He L, Chen Y, Hospital efficiency and utilization of hightechnology medical equipment:A panel data analysis. 2 Feb 2018.

15. Brady A , Laoide R, McCarthy P, McDermott R, "Discrepancy and Error in Radiology: Concepts, Causes and Consequences" *Ulster Med J* 2012;81(1):3-9
16. Board of the Faculty of Clinical Radiology -The Royal College of Radiologists" *Clinical radiology workload: guidance on radiologists' reporting figures*. 2008
17. Hendee W, Becker G , Borgstede J, Bosma J, Casarella W , Erickson B ,
18. Maynard D, Thrall J, Wallner D Addressing Overutilization in Medical Imaging. *radiology.rsna.org* n *Radiology: Volume 257: Number 1—October 2010*
19. Cowan I, MacDonald S and Floyd R, Measuring and managing radiologist workload: Measuring radiologist reporting times using data from a Radiology Information System. *Journal of Medical Imaging and Radiation Oncology* 57 (2013) 558–566.
20. Bindman R, Miglioretti D, Larson E, " Rising use of Diagnostic medical imaging in a large integrated health system: health aff (Millwood).2008;27(6): 1491-1502.
21. Murray, Christopher J L, Aleksandr Y Aravkin, Peng Zheng, Cristiana Abbafati, Kaja M Abbas, Mohsen Abbasi-Kangevari, Foad Abd-Allah, et al. "Global Burden of 87 Risk Factors in 204 Countries and Territories, 1990–2019: A Systematic Analysis for the Global Burden of Disease Study 2019." *The Lancet* 396, no. 10258 (October 2020): 1223–49. [https://doi.org/10.1016/S0140-6736\(20\)30752-2](https://doi.org/10.1016/S0140-6736(20)30752-2).
22. Vos, Theo, Stephen S Lim, Cristiana Abbafati, Kaja M Abbas, Mohammad Abbasi, Mitra Abbasifard, Mohsen Abbasi-Kangevari, et al. "Global Burden of 369 Diseases and Injuries in 204 Countries and Territories, 1990–2019: A Systematic Analysis for the Global Burden of Disease Study 2019." *The Lancet* 396, no. 10258 (October 2020): 1204–22. [https://doi.org/10.1016/S0140-6736\(20\)30925-9](https://doi.org/10.1016/S0140-6736(20)30925-9).
23. Wang, Haidong, Kaja M Abbas, Mitra Abbasifard, Mohsen Abbasi-Kangevari, Hedayat Abbastabar, Foad Abd-Allah, Ahmed Abdelalim, et al. "Global Age-Sex-Specific Fertility, Mortality, Healthy Life Expectancy (HALE), and Population Estimates in 204 Countries and Territories, 1950–2019: A Comprehensive Demographic Analysis for the Global Burden of Disease Study 2019." *The Lancet* 396, no. 10258 (October 2020): 1160–1203. [https://doi.org/10.1016/S0140-6736\(20\)30977-6](https://doi.org/10.1016/S0140-6736(20)30977-6).
24. Kinyoki DK, Ross JM, Lazzar-Atwood A, Munro SB, Schaeffer LE, Abbasalizad-Farhangi M, et al. Mapping local patterns of childhood overweight and wasting in low- and middle-income countries between 2000 and 2017. *Nat Med* 2020;26(5):750-759.
25. Lozano R, Fullman N, Mumford JE, Knight M, Barthelemy CM, Abbafati C, et al. Measuring universal health coverage based on an index of effective coverage of health services in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 2020.
26. Gondivkar SM, Indurkar A, Degwekar S, Bhowate R. Evaluation of gustatory function in patients with diabetes mellitus type 2. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2009 Dec 1;108(6):876-80.
27. Behere PB, Das A, Yadav R, Behere AP. Religion and mental health. *Indian journal of psychiatry*. 2013 Jan;55(Suppl 2):S187.
28. Nagrale AV, Herd CR, Ganvir S, Ramteke G. Cyriax physiotherapy versus phonophoresis with supervised exercise in subjects with lateral epicondylalgia: a randomized clinical trial. *Journal of Manual & Manipulative Therapy*. 2009 Jul 1;17(3):171-8.
29. Bourne R, Steinmetz JD, Flaxman S, Briant PS, Taylor HR, Resnikoff S, Casson RJ, Abdoli A, Abu-Gharbieh E, Afshin A, Ahmadi H. Trends in prevalence of

- blindness and distance and near vision impairment over 30 years: an analysis for the Global Burden of Disease Study. *The Lancet Global Health*. 2021 Feb 1;9(2):e130-43.
30. Borle RM, Nimonkar PV, Rajan R. Extended nasolabial flaps in the management of oral submucous fibrosis. *British Journal of Oral and Maxillofacial Surgery*. 2009 Jul 1;47(5):382-5.
31. Franklin RC, Peden AE, Hamilton EB, Bisignano C, Castle CD, Dingels ZV, Hay SI, Liu Z, Mokdad AH, Roberts NL, Sylte DO. The burden of unintentional drowning: global, regional and national estimates of mortality from the Global Burden of Disease 2017 Study. *Injury prevention*. 2020 Oct 1;26(Supp 1):i83-95.

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