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RESEARCH ARTICLE

REPEAT PROFILE ANALYSIS IN AN X-RAY DEPARTEMENT

Anishka Negi[1], Abhishek Bhatt[1], Kripanand Yadav[2], Nirnaya Panday[1], Aman Goswami[1] and Shikha Sharma[3]

1. MSc. RIT Student, Maharishi Markandeshwar University Mullana, Ambala, Haryana.
2. Assistant Professor in Radiography Maharishi Markandeshwar University Mullana, Ambala, Haryana.
3. Tutor in Radiography, Maharishi Markandeshwar University Mullana, Ambala, Haryana.

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Abstract

The International Commission on Radiological Protection (ICRP) advises that medical exposure be maintained as low as reasonably possible, or ALARA, since the use of ionizing radiation in medical practice accounts for most of the man-made exposure to the public. Given the rise in radiological examinations, it is critical to think about patient and staff safety, particularly in developing nations where radiation usage is unregulated by law. Patients frequently receive recurrent radiation exposure, which raises their yearly exposure. Given the detrimental effects of radiation, it is imperative to maintain the overall exposure level as low as is compatible with industry standards. A quality assurance program that incorporates protocols to guarantee the daily, satisfactory operation of radiography x-ray equipment is one method of accomplishing this Most hospitals in developing nations, regrettably, do not offer this kind of program. Analyzing the causes of rejected or re-watched films is another first strategy that is covered in this paper. A type of subjective assessment of image quality is called repeat film analysis, in which images deemed to be of low quality are grouped by reason [(1)]. One in six patients having a diagnostic examination had at least one film retaken, according to a report. Therefore, to minimize excessive patient exposure and the ensuing carcinogenic risk, it is critical to assess the frequency of such repeat radiographs and identify the primary causes of them. The extensive range of work that must behand led for a thorough investigation is reflected i n the examination of state-of-the-art "repeat analysis." Repeat film analysis is a kind of subjective assessment of image quality in which low-quality images are categorized based on their underlying causes. The ratio of the number of films that were used again to the total number of films utilized clinically during the same data collection period is known as the repetition rate in this study. Investigating recurring features and causes in radiology departments is the aim of the study. The frequency of repeats and the connection between examination kinds and repeat rates are thoroughly examined. A quality assurance (QA) program, which comprises protocols that serve to verify satisfactory performance of radiography X-ray equipment daily, is one technique to reduce the needless exposure. A QA programs goal is to deliver quality that is acceptable, dependable, economical, and satisfactory. In diagnostic radiology, quality assurance (QA) is a way to uphold imaging standards and strive toward reducing patient and staff dose. Numerous physical factors that impact the X-ray imaging system's performance have been investigated to achieve these goals. The parameters studied include tube potential, tube current, exposure period, radiation output linearity and repeatability, half-value layer, X-ray and light-field alignment, perpendicularity of the light beam diaphragm, and focal spot size.

Introduction:-

The International Commission on Radiological Protection (ICRP) advises that medical exposure be maintained as low as reasonably possible, or ALARA, since the use of ionizing radiation in medical practice accounts for most of the

Corresponding Author:- Kripanand Yadav
Address:- Assistant Professor in Radiography Maharishi Markandeshwar University Mullana, Ambala, Haryana.

man-made exposure to the public. Given the rise in radiological examinations, it is critical to think about patient and staff safety, particularly in developing nations where radiation usage is unregulated by law. Patients frequently receive recurrent radiation exposure, which raises their yearly exposure. Given the detrimental effects of radiation, it is imperative to maintain the overall exposure level as low as is compatible with industry standards. A quality assurance program that incorporates protocols to guarantee the daily, satisfactory operation of radiography x-ray equipment is one method of accomplishing this Most hospitals in developing nations, regrettably, do not offer this kind of program. Analyzing the causes of rejected or re-watched films is another first strategy that is covered in this paper. A type of subjective assessment of image quality is called repeat film analysis, in which images deemed to be of low quality are grouped by reason [(1)]. One in six patients having a diagnostic examination had at least one film retaken, according to a report. Therefore, to minimize excessive patient exposure and the ensuing carcinogenic risk, it is critical to assess the frequency of such repeat radiographs and identify the primary causes of them. The extensive range of work tha tmust behand led for a thorough investigation is reflected in the examination of state-of-the-art "repeat analysis." Repeat film analysis is a kind of subjective assessment of image quality in which low-quality images are categorized based on their underlying causes. The ratio of the number of films that were used again to the total number of films utilized clinically during the same data collection period is known as the repetition rate in this study. Investigating recurring features and causes in radiology departments is the aim of the study. The frequency of repeats and the connection between examination kinds and repeat rates are thoroughly examined. A quality assurance (QA) program, which comprises protocols that serve to verify satisfactory performance of radiography X-ray equipment daily, is one technique to reduce the needless exposure. A QA program's goal is to deliver quality that is acceptable, dependable, economical, and satisfactory. In diagnostic radiology, quality assurance (QA) is a way to uphold imaging standards and strive toward reducing patient and staff dose. Numerous physical factors that impact the X-ray imaging system's performance have been investigated to achieve these goals. The parameters studied include tube potential, tube current, exposure period, radiation output linearity and repeatability, half-value layer, X-ray and light-field alignment, perpendicularity of the light beam diaphragm, and focal spot size.

Dose measurements and test in gone radiography recording systems may not be meaningful unless the beam quality is known. A 10 kV difference has been demonstrated to have a 20–40% impact on the patient's integral dosage. In a diagnostic radiology department, an effective quality control programisnecessarytoguaranteethebestpossibleimagequal ityforprecisediagnosis. A program of this kind will reduce the needless repetition of radiography, which will also save money. To measure the radiation that patients receive via diagnostic X-ray exams, other dose quantities have been employed, including Dose–Area Product (DAP) and entrance surface dose for specific organs. All of these numbers allow for a direct comparison of the radiation risk across various tests. For a few weeks, repeat data was continuously gathered in mmdu. The information is being examined to illustrate the different aspects of the study. The most important areas of radiological imaging were covered in this paper. Sexuality, age groupings, or the causes for recurrence are the factors that are part of the study [(2)].

Aim:-

This study analyzes the incidence and causes of repeat X-ray examinations to improve image quality, reduce unnecessary radiation exposure and uphold radiological quality standards.

Objective:-

Determine the Repeat Rate –
Quantify the percentage of repeated X-ray examinations within the department.

Identify Causes of Repeats –
Analyze the common reasons for repeat imaging, such as positioning errors, motion artifacts, incorrect exposure settings, or technical failures.

ImproveRadiographicTechniques–
Identif yareas where radiographers may need additional training to reduce errors and improve first-time image quality.

Method and Material:-

Study Place:
The study was carried out in the radiology department.

Sample Size:
100 patients were taken for the purpose of research.

Method:-
Images were scanned by Allengers X-Ray machine.

Procedure of Measurement:-
Data collected was analyzed and described by using descriptive statistical tools, frequency, mean and percentage.

Instrument For Data Collection:
Allengers X-Ray machine(500mAs).
Allengers X-Ray machine (800 mAs).
Control console unit

Method of Data Collection:-
Patient was classified according to age group, sex, body parts and reason for repetition.

Inclusion Criteria:
OPD Patients
IPD Patients
Trauma Patient

Exclusion Criteria:
Pediatrics
Pregnancy
Data Analysis

Table 1:- Distribution of patients according to Gender.

GENDER	PATIENTS	PERCENTAGE
Male	57	57%
Female	43	43%
Total	100	100%

During this survey, a total of 100 cases were collected with repeat x ray. These instances were classified according to gender/sex ratio, revealing 57males (comprising 57%) and 43 female patients (comprising 43%) out of the total.

Figure 1:- Pie Chart representing distribution of patients according to gender.

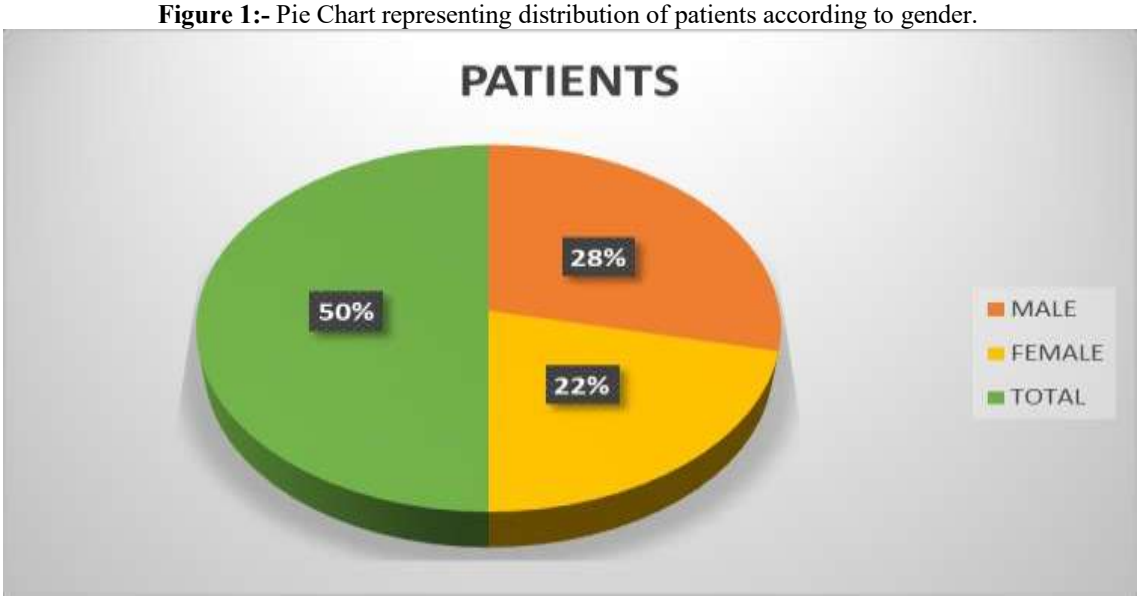
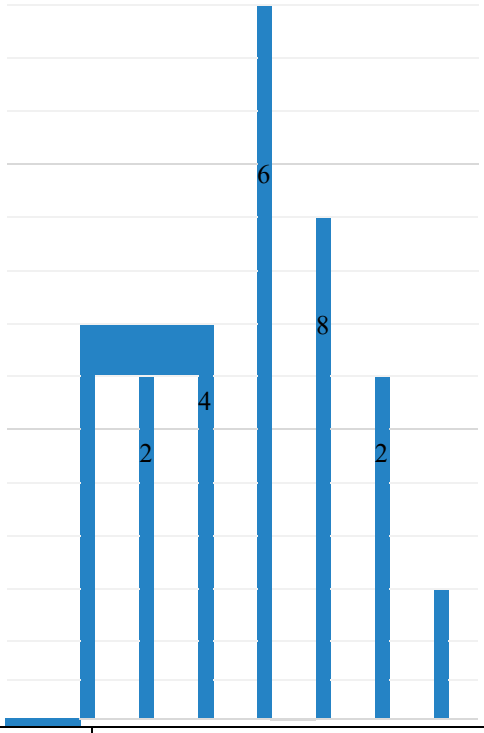


Table 2:- Distribution of patients according to age group.

AGEGROUPS	NO. OF PATIENT	PERCENTAGE
10-19yr	1	1%
20-29yr	14	14%
30-39yr	12	12%
40-49yr	14	14%
50-59yr	26	26%
60-69yr	18	18%
70-79yr	12	12%
80-89yr	3	3%

The study's 100 patients' age-wise distribution is displayed in the table along with the number of patients and their corresponding percentages. While the 10–19 age group is the least represented (1%,1patient), the50–59age group is the most(26%,26patients). Each of the age categories of 20-29, 40-49, makes up 14% (7 patients) & 30-39, 70-79 makes up 12% (12 patients) while 18% (18 patients) are in the 60–69 age and 3% in 80-89yrgroup. The entire proportion adds up to 100%, giving a comprehensive picture of the study population's demographics.



BODY PARTS	NO OF PATIENTS	TOTAL PERCENTAGE
KNEE	8	8%
LSSPINE	16	16%
KUB	2	2%
CHEST	30	30%
FEMUR	4	4%
ABDOMEN	3	3%
FOOT	2	2%
SHOULDER	5	5%
PELVIS	7	7%
CERVICAL	9	9%

ELBOW	1	1%
LEG	3	3%
DLSPINE	1	1%
SKULL	2	2%
HAND	2	2%
ANKLE	1	1%
COCCYX	1	1%
PNS	1	1%
STN	2	2%

Table 3:- Distribution of patient according to the body parts.

Figure 2:- Column diagram showing distribution of patients according to age group.

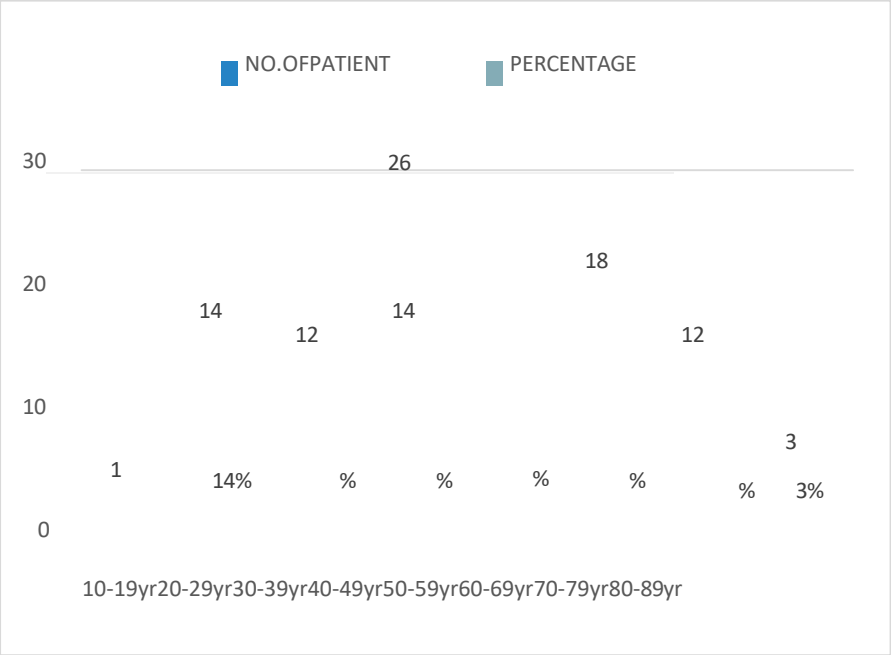
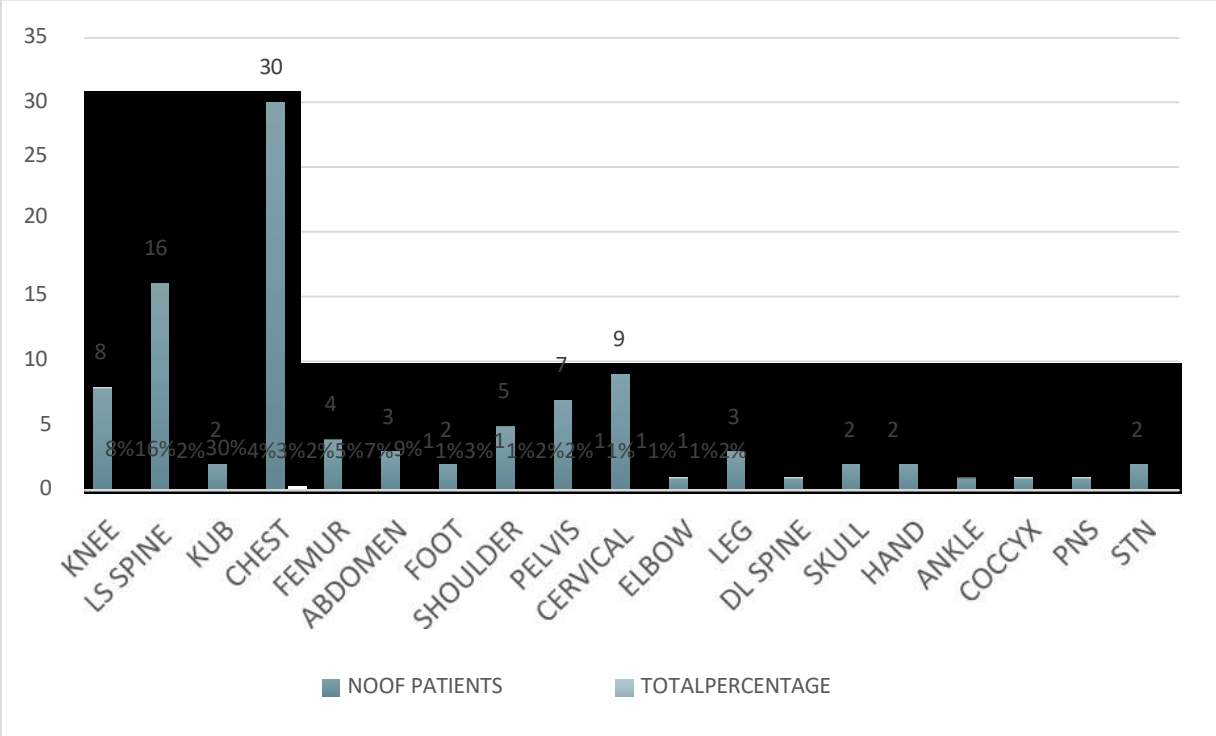


Figure 3:- Column representing distribution of patients according to the body parts.



The given data represents that chest examinations are the most common, accounting for 30% of total cases, indicating a high frequency of chest-related imaging. Spinal assessments (LS {16%}, Cervical {9%}, DL {1%}) collectively make up 26%, reflecting a strong focus on spine-related concerns. Lower limb cases, including the knee (8%), femur (4%), foot (2%), leg (3%), and ankle (1%), contribute 18%, showing their notable presence. Other frequently examined areas include the pelvis (7%), shoulder (5%), and abdomen (3%), while less common cases like the elbow, hand, coccyx, and PNS each represents 1%.

Table 4:- Distribution of patients according to cause of repeat x-ray.

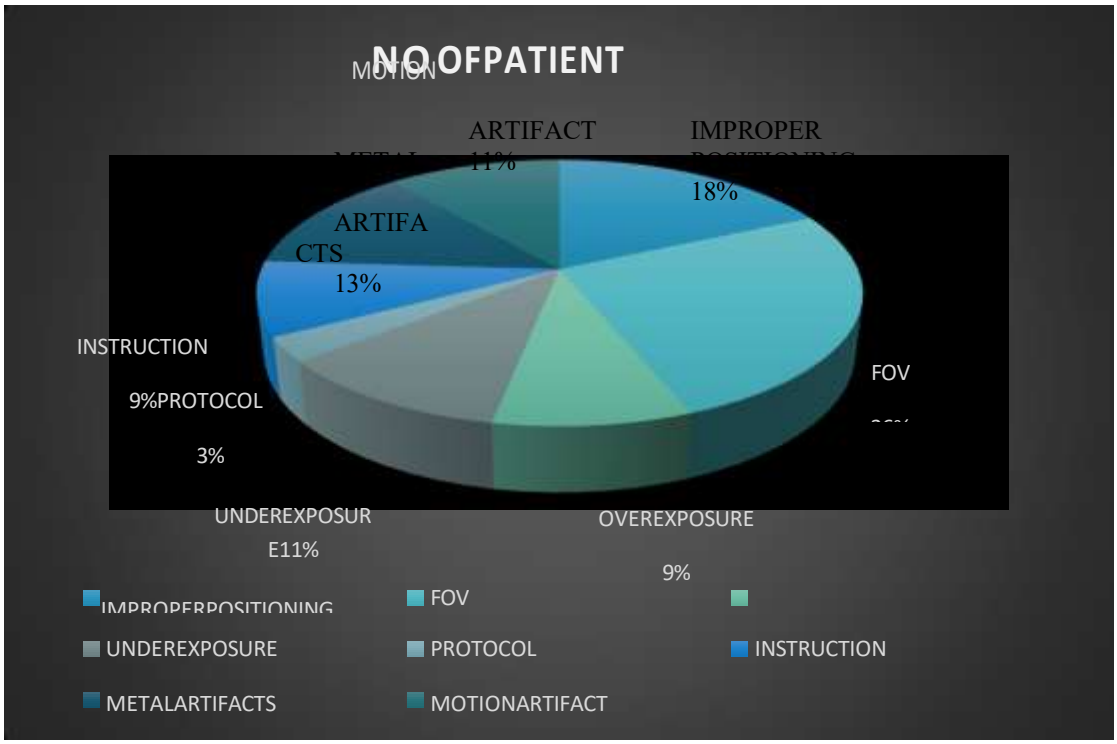
CAUSEOFREPEAT X-RAY	NO OF PATIENTS	TOTAL PERCENTAGE
Improper Positioning	18	18%
Field of View	26	26%
Over Exposure	9	9%
Under Exposure	11	11%
Protocol	3	3%
Instruction	9	9%
Metal Artifacts	13	13%
Motion Artifact	11	11%

Data shows the percentage distribution of repeat x-ray causes among 100 patients. Field of view (FOV) issues are the leading cause at 26%, followed by improper positioning (18%) and metal artifacts (13%). Underexposure and motion artifacts each account for 11%, while overexposure and instruction errors both contribute 9%. Protocol-related issues are the least common at 3%, with all percentages summing up accurately to 100%.

Discussion:-

The study identifies key factors leading to repeat X-rays, with incorrect field of view (26%), improper positioning (18%), and motion artifacts (11%) as major causes. Metal artifacts (13%) and exposure errors (20%) also contribute significantly. The chest (30%), lumbar spine (16%), and cervical spine (9%) are the most frequently imaged regions. Improving positioning, optimizing exposure, and minimizing artifacts through training and quality assurance can reduce repeat imaging, enhancing efficiency and patient safety.

Figure 4:- Pie chart illustrating patient distribution based on the reasons for repeat X-rays.



Conclusion:-

The analysis of repeat X-ray causes highlights several key factors affecting image quality and patient diagnosis. The most common cause of repeat X-rays is Field of View (FOV) issues (26%), indicating that improper framing or coverage of the area of interest is a major problem. Improper positioning (18%) also plays a significant role, suggesting the need for better patient alignment techniques.

Other contributing factors include metal artifacts (13%), motion artifacts (11%), and underexposure (11%), which emphasize the impact of patient movement, technical settings, and external interference on image quality. Overexposure (9%) and instruction errors (9%) suggest that both radiation dose optimization and patient cooperation are areas that need improvement. The least common issue is protocol errors (3%), implying that standardized procedures are generally followed but still require occasional refinements.

To reduce the need for repeat X-rays, radiology departments should focus on enhanced technician training, stricter quality control, improved patient instructions, and optimized imaging protocols. Addressing these issues will improve efficiency, reduce patient radiation exposure, and enhance overall diagnostic accuracy.

Referenes:-

1. Bassey CE, Ojo OO, Akpabio I. Repeat profile analysis in an x-ray department. Journal of Radiological Protection. 1991 Sep 1;11(3):179.
2. A. Al-Malki M, H. Abulfaraj W, I. Bhuiyan S, A. Kinsara A. A study on radiographic repeat rate data of several hospitals in Jeddah. Radiation protection dosimetry. 2003 Mar 1;103(4):323-30.
3. Akintomide AO, Egbe NO, BasseyDE, Eduwem DU, Oyama EA. An Analysis of repeated examinations in conventional film–screen radiography (FSR). Journal of Radiography and Radiation Sciences. 2011;25(1):14-20.
4. Ofori EK, Antwi WK, Arthur L, Yeboah CA, Dzefi-Tettey K. Analysis and economic implications of X-ray film repeat/reject in selected hospitals in Ghana. West AfricanJournal of Radiology. 2013 Jan 1;20(1):14-8.
5. Fatukasi JI, Osho ES, Olowookere CJ, Ogunsemoyin AO. Evaluation of Repeat Analysis and Dose Burdens of Patients Examined in the Radiology Department of a Medical University Teaching Hospital in Nigeria. Journal of Applied Sciences and Environmental Management. 2022 May 31;26(5):793-9.
6. Rochmayanti, D., Adi, K., & Widodo, C. (2023). Repeat analysis program as a quality assurance system for radiology management: Causal repeat and challenges. E3S Web of Conferences, 448, 05004. https://doi.org/10.1051/e3sconf/202344805004
7. Steffen, A., Neitzel, U., & Förger, K. (2006, March). Image repeat analysis for a digital radiography system. Presented at ECR 2006.
8. Nol J, Isouard G, Mirecki J. Digital repeat analysis; setup and operation. J Digit Imaging. 2006 Jun;19(2):159-66. doi: 10.1007/s10278-005-8733-1. PMID: 16421768; PMCID: PMC3045180.
9. Tzeng,W.-S.,Kuo,K.-M.,Liu,C.-F.,Yao,H.-C.,Chen,C.-Y.,&Lin,H.-W.(2012).
10. Managing Repeat Digital Radiography Images—A Systematic Approach and Improvement. JournalofMedicalSystems,36(5), 2697–2704.
11. REPEAT ANALYSIS PROGRAM AS A QUALITY ASSURANCE SYSTEM FOR RADIOLOGYMANAGEMENT:CAUSALREPEATANDANOVERVIEW
12. Rochmayanti, Dwi et al. Journal of Medical Imaging and Radiation Sciences, Volume 54, Issue 3, S31.