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A SURVEY ON RADIOGRAPHERS TO ASSESS THE REASON OF REJECTING X RAY IMAGES

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ABSTRACT

Background: Reject analysis is a critical aspect of quality assurance in medical imaging departments, serving to identify the causes of image rejection and enhance radiographer training, departmental workflow, and radiation safety by reducing patient exposure.

Aim: The primary objective of this study was to evaluate the reasons for X-ray image rejection among radiographers in the Delhi-NCR region of India.

Methods: A cross-sectional study was conducted involving 288 participants, including radiographers . Data were collected using a structured, self-administered questionnaire consisting of 34 questions, distributed via Google Forms. The questionnaire covered demographic information and reasons for image rejection.

Results: A significant proportion of respondents (82.3%) reported challenges in effectively communicating reasons for image rejection to other team members. Although 76.7% indicated the existence of a standardized process for reporting rejected images, the findings suggest room for system-wide improvement. Pediatric imaging was identified by 49.7% of participants as the most challenging area for exposure factor adjustments. Enhanced quality control measures were recommended by 37.5% of respondents to minimize rejections, while 38.9% highlighted the need for better collaboration between radiographers and other departments. Additionally, the study revealed a gap in the general understanding and assessment skills among radiology students.

Conclusion: This study provides critical insights into the prevalent causes of X-ray image rejection and underscores the need for targeted interventions in training, workflow communication, and interdepartmental coordination. Addressing these issues can lead to improved diagnostic image quality and optimized clinical outcomes.

Keywords: Image Rejection, Image Quality, Rejection Criteria, Quality Assurance.

Introduction

X-ray imaging is a cornerstone of diagnostic radiology, providing critical information for the diagnosis and management of various medical conditions.[1] Despite its importance, the quality of X-ray images is crucial for accurate diagnosis and patient care.[2] High-quality images facilitate clear visualization of anatomical structures and pathological conditions, whereas suboptimal images can lead to misdiagnosis, delayed treatment, and unnecessary additional imaging, thereby increasing patient exposure to radiation.

In clinical practice, image rejection refers to the process of discarding X-ray images that do not meet the required diagnostic quality standards. Rejection of X-ray images not only impacts the efficiency of the diagnostic workflow but also has implications for patient safety and radiation exposure. For instance, errors in positioning, incorrect

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exposure settings, and poor technique are common causes of image rejection. Additionally, issues with imaging equipment, such as calibration errors or hardware failures, can compromise image quality. The impact of image rejection is multifaceted. Clinically, rejected images may necessitate repeat imaging, leading to increased patient radiation dose and delayed diagnosis. Operationally, it adds to the workload of radiographers and can strain healthcare personals.

Every hospital's radiology departments adhere to the ALARA *as low as reasonably achievable* guidelines, which guarantee the provision of high-quality images while protecting patients from needless ionizing radiation exposure.[1] Overexposure can raise the chance of harmful health outcomes, such as malignancies and stochastic effects, as this form of radiation can have biological effects[2] . A number of international organizations have established recommendations for pediatric radiography that prioritize appropriate image quality and the delivery of radiation doses in order to ensure patient safety.

(a) (b)

Fig: a) Computed Modality b) Digital Modality

The proportion of diagnostic images not applied for diagnostic purposes is an indicator of image quality, safety, and efficiency in radiography.[3] Despite increased awareness, image rejection is still a substantial problem and needs continued observation and targeted measures. Reject analysis is described as 'the critical evaluation of radiographs which are used as part of the imaging service but do not play a useful part in the diagnostic process.[4] Image reject analysis (RA) is a quality control (QC) process and an important component of quality assurance (QA) programs to measure the efficiency of radiology departments by determining the rates and reasons for rejected images. Developing new examination protocols, assessing the level of image quality and keeping track of reducing unnecessary radiation dose to the patient.[5,6]

A rejected image is an unacceptable radiograph with inadequate diagnostic value regarding image quality, evaluated by technologists based on technical qualities. Repeatedly taking X-ray images exposes patients to unnecessary ionizing radiation, which poses a substantial risk of cancer development even at prolonged low-dose exposure[7]. Therefore, it is crucial to actively reduce the need for image retakes, as it helps minimize X-ray exposure, mitigates patient inconvenience, and optimizes the allocation of medical resources for quality assurance purposes in healthcare settings. The analysis of rejected images serves as a foundation for identifying the reasons for image rejection, and it is also used to evaluate radiographer training and workflow for quality assurance. Risk analysis helps identify other underlying issues, such as deficiency in staff training and increasing the department's performance by decreasing retakes to reduce waiting time.[8] When the image is of poor quality, it is likely to be rejected, and its repetition will expose patients and staff to unnecessary ionizing radiation [9]. The rejected images drastically affect the department's efficiency and patient satisfaction, which in turn raises the department's expenditures[10] Jones et al. state that rejected images are integral to X-ray imaging, where patient positioning and alignment are vital components of image quality[4]. During a radiological procedure, patient motion, positioning, and artifacts unique to the image receptor technology can result in repeated images and are reported as the major reasons for image retakes. Examining the underlying causes for image rejections assists to identify any technical or training issues required in a radiology department[11].

It was expected that reject rates would decrease with the introduction of digital radiography (DR)[12]. The reject rates reported for CR were around 5%. Departments with a combination of CR and DR are now reporting reject rates ranging from 4% to11%[1]. Most Australian medical imaging departments are now solely using DR equipment, due to incentives offered by the Australian government through the Medicare Benefits Schedule (capital sensitivity and financial rebates)[13].

The three most important factors to consider when producing good image quality in digital imaging include appropriate selection of (i) tube voltage (ii) tube current (iii) exposure time. However, pre and post processing image manipulation is available for all digital radiography and enables manipulation of the resultant image hence, the selection of these technical factors may be perceived to play a less critical role in providing a good diagnostic image [15]. Studies have highlighted the trend for staff to overexpose rather than underexpose patients as this reduces

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quantum mottle on the resultant image and improves image quality[16].

Material & Methodology

The present study was conducted in Delhi Hospital. Data was collected from 288 participants through online survey. The study was conducted over one year, from July 2024 and concluding in December 2024. In this study targeted population were Radiation technologist. The study consisted of a self-structured survey divided into two sections, the questionnaire's first section included demographic information such as (age, gender, qualification, experience). The second of the questionnaire included 28 questions designed to assess rejection rate.

Inclusion Criteria

Medical imaging technologists/radiographers and health professionals was part of the study.

Exclusion Criteria

Other health professionals than medical imaging/radiography will not be part of the study.

All data were gathered through an online survey conducted via google forms. The survey consisted multiple choice questionnaire (MCQ). The study was approved by Institutional Ethics Committee (SU/R/2024/1344).

Result

There were 288 respondents in this survey. The median age of respondents were 25 years. Regarding gender distribution, there is a slight predominance of females. Out of 288 participants, 159 (55.2%) are female, while 129 (44.8%) are male. In terms of qualifications, the majority of participants hold higher education degrees. The largest group consists of those with a Bachelor's degree in MIT, accounting for 145 individuals or 50.3% of the respondents. This is followed closely by those with a Master's degree in MIT, comprising 121 participants or 42.1%. A smaller portion, 22 individuals or 7.6%, hold a Diploma in MIT. The institutional affiliation of the participants reveals that most work in larger healthcare settings. The majority (150 participants or 52.1%) are employed in universities or hospitals. Another substantial group (99 participants or 34.4%) work in medical centers or diagnostic centers. A smaller proportion (32 participants or 11.1%) are employed in regional general hospitals. Only a small fraction (7 participants or 2.4%) work in other types of institutions. Career experience data shows that the vast majority of participants are in the early to mid-stages of their careers. 235 participants (81.6%) have between 1 to 10 years of experience. This is followed by two smaller groups: those with less than one year of experience (26 participants or 9.0%) and those with 11-20 years of experience (24 participants or 8.3%). Only a very small number (3 participants or 1.0%) have over 20 years of experience.

Parameter	Category	N	%
Gender	Female	159	55.2
	Male	129	44.8
Qualification	Diploma (MIT)	22	7.6
	Bachelor's (MIT)	145	50.3
	Master's (MIT)	121	42.1
Institution Size	University or hospitals	150	52.1
	Medical center or diagnostic center	99	34.4
	Regional general hospital	32	11.1
	Other	7	2.4
Career Experience	Less than one year	26	9.0
	1-10 years	235	81.6
	11-20 years	24	8.3
	above 20 year	3	1.0

Table1: Demographic Data

A significant majority (82.3%) of respondents reported facing challenges in communicating the reasons for image rejection to other team members. The standardized process for communicating rejected images to radiographers is in place for 76.7% of respondents, indicating that while most departments have a system, there's still room for improvement. Regarding image quality, 25.3% strongly agreed that images were too dark or underexposed, while 23.3% strongly agreed they were too bright or overexposed. Interestingly, 38.2% remained neutral on both these issues.The most common reason for rejecting x-ray images was blurring due to patient movement (39.2%), followed by improper collimation (27.8%) and incorrect exposure (26.7%). This aligns with the finding that patient movement is considered one of the main factors affecting image quality (32.3%). More than half of the respondents (51.7%) report rejecting x-ray images on a weekly basis, with technical issues being the most frequent reason (39.6%), followed by patient movement (30.2%). Motion artifacts were reported as the most common type (40.6%), which aligns with the high percentage of rejections due to patient movement. Issues with image contrast were the most frequently reported image quality artifact (44.4%). When evaluating x-ray images for acceptance or rejection, tube current (MAS) was the most considered exposure factor (51.0%). Similarly, when adjusting exposure settings, modifying MA settings was prioritized by 44.4% of respondents. Pediatric imaging was identified as the most challenging scenario for exposure factor adjustments (49.7%). To reduce the likelihood of rejected x-ray images, enhanced quality control was the most suggested improvement (37.5%). 38.9% of respondents indicated that radiographer collaboration with other departments needs improvement. The involvement of radiology quality assurance programs in addressing exposure factor issues is occasional for 40.3% of respondents.

Discussion

The need for reject analysis has been challenged by the introduction of digital radiography (DR) because of low reported reject rates and because criteria for improperly exposed images were lacking. Most DR systems include quality control (QC) workstations that are capable of modifying the appearance of images before release, and also of deleting poor images before they are analyzed[17]. As observed in this investigation, the image retake rate before guideline introduction was 4.85%, which is much smaller than the conventional radiography with a reported retake rates of DR found in the United Kingdom (5.5%) as well as in Australia and the united states.[18] It is clear that imaging procedures due to position error represents the highest cause of repeat rate the positioning errors beside the considerable inequality in radiographer reject rate suggest that the standards of image quality in the radiology department may not be harmonious.[19].

There are some discrepancies in the results of the reason for deleting image in our and Andersen's study. For example, found an overall positioning errors of 77% while our results showed 82.3% (centering and other positioning errors). There is a tradeoff between the validity of the result on reject rate and on reasons for reject. This further adds various patients factor like movement, not able to hold breath and non-compliance of instructions by patients were responsible for the rejection of the x-ray films[20]. This study pointed out that the repeat rate in the Shahied Motahari hospital is relatively higher compared to other hospitals. This hospital is dedicated to infants, children and women. So, it seems that the application of some special considerations for this radiology department is necessary. Overall, the findings highlight key areas for improvement in communication, quality control, and collaboration within radiographic imaging practices. Addressing these issues could significantly enhance image quality and reduce the frequency of rejections.

Conclusion

The survey results highlight several critical areas for improvement in radiographic imaging practices. The predominantly young and highly educated workforce, with most respondents holding advanced degrees and employed in larger healthcare settings, reflects a dynamic and evolving field. However, significant challenges remain, particularly in communicating reasons for image rejection, of respondents reporting difficulties. Despite having standardized processes in place, the effectiveness of these systems varies, indicating a need for better communication strategies. The high frequency of x-ray image rejections due to blurring from patient movement and technical issues underscores the importance of enhancing quality control measures. Furthermore, the variability in perceptions of image quality, with issues related to exposure and contrast frequently reported, suggests that standardizing evaluation criteria could improve consistency. Pediatric imaging presents additional challenges, highlighting the need for tailored exposure adjustment strategies. To address these issues, respondents advocate for improved quality control, better interdepartmental collaboration, and more consistent involvement of quality assurance programs. Overall, addressing these concerns could significantly enhance image quality and operational efficiency in radiographic imaging.

Recommendation:

All radiographers must regularly review and practice key technical skills, including exposure settings, collimation, and proper use of imaging equipment. This can help reduce errors and improve image quality.

Additionally, hospitals regularly audit their inventory of radiological practice, reduce the frequency of X-ray image rejection, and improve overall diagnostic accuracy. If these approaches have improved Radiation Technologist comfort, further assessment can be done. To create a safer atmosphere for imaging, radiation technologists must also follow the rules set by several national and international organizations.

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BIBLIOGRAPHY

1. Hasaneen, M., AlHameli, N., AlMinhali, A., Alshehhi, S., Salih, S., & Alomaim, M. M. (2023). Assessment of image rejection in digital radiography. *Journal of Medicine and Life*, *16*(5), 731–735. https://doi.org/10.25122/jml-2022-0341
2. B. Hofmann 2023- Image- rejects- in digital -skeletal -radiography in -two public, hospitals- inNorway-1063-1067(2023)https://doi.org/10.1016/j.radi.2023.09.003.
3. Gabriela Bantas BMedImag Rhonda-Joy Sweeney Sibusiso Mdletshe - Digital radiography- reject–analysis- A -comparison -between -two – radiology- 137-144 doi: 10.25122/jml-2022-0341 (2023).
4. Prieto, C., Vano, E., Ten, J. I., Fernandez, J. M., Iñiguez, A. I., Arevalo, N., Litcheva, A., Crespo, E., Floriano, A., & Martinez, D. (2009). Image retake analysis in digital radiography using DICOM header information. *Journal of Digital Imaging*, *22*(4), 393–399. https://doi.org/10.1007/s10278-008-9135-y
5. Moradian, S. A., Zamani, H., & Dalvand, S. (2025). An analysis of the rate and reasons for rejected radiographs in emergency and non-emergency radiology departments in Yasuj, Iran. *Frontiers in Biomedical Technologies*. https://doi.org/10.18502/fbt.v12i1.17737
6. Kjelle, E., & Chilanga, C. (2022). The assessment of image quality and diagnostic value in X-ray images: a survey on radiographers' reasons for rejecting images. *Insights into Imaging*, *13*(1), 36. https://doi.org/10.1186/s13244-022-01169-9
7. Alaa Ibrahim Ahmed, Ahmed Ali Babiker , Sayed Mansour Abbas , Norah Alsulayyim , Ghada bin Duos, Ghadeeer Alanazi , Maram Almuhanna , Hissah Alotabi , Alanoud Almawashn- Reject Analysis -in –Digital-Radiography- Prospective- Study- Department of Radiological Sciences, Inaya Medical College, Riyadh, Saudi Arabia-DOI: 10.36347/sjams.2022.v10i06.006 896-899. (2022).
8. Yazeed Alashban, Nasser Shubayr, AbdulraA. Alghamdi, SamiA. Alghamdi, Sami Boughattas Reject Analysis-Reject Rate-Medical imagine 219-223(2022).https://doi.org/10.1016/j.jrras.2022.01 .
9. Kjelle, E., Schanche, A. K., & Hafskjold, L. (2021). To keep or reject, that is the question - A survey on radiologists and radiographers' assessments of plain radiography images. *Radiography (London, England: 1995)*, *27*(1), 115–119. https://doi.org/10.1016/j.radi.2020.06.020
10. Alashban, Y., Shubayr, N., Alghamdi, A. A., Alghamdi, S. A., & Boughattas, S. (2022). An assessment of image reject rates for digital radiography in Saudi Arabia: A cross-sectional study. *Journal of Radiation Research and Applied Sciences*, *15*(1), 219–223. https://doi.org/10.1016/j.jrras.2022.01.023
11. Saade, C., Siblini, L., Karout, L., Khalife, S., Hilal, H., Abbas, S., Salman, R., & Naffaa, L. (2021). To repeat or not to repeat: Radiologists demonstrated more decisiveness than their fellow radiographers in reducing the repeat rate during mobile chest radiography. *Radiography (London, England: 1995)*, *27*(2), 304–309. https://doi.org/10.1016/j.radi.2020.09.003
12. Awad, F., Naem, F. A., Gemea, A., Wedaa, N., Mohammed, Z., & Elser, S. T. (2021). X-ray film reject analysis in radiology departments of port Sudan hospitals. *International Journal of Radiology and Imaging Technology*, *7*(1). https://doi.org/10.23937/2572-3235.1510072 .
13. Stephenson-Smith, B., Neep, M. J., & Rowntree, P. (2021). Digital radiography reject analysis of examinations with multiple rejects: an Australian emergency imaging department clinical audit. *Journal of Medical Radiation Sciences*, *68*(3), 245–252. https://doi.org/10.1002/jmrs.468
14. Atkinson, S., Neep, M., & Starkey, D. (2020). Reject rate analysis in digital radiography: an Australian emergency imaging department case study. *Journal of Medical Radiation Sciences*, *67*(1), 72–79. https://doi.org/10.1002/jmrs.343
15. Alyousef, K. A., Alkahtani, S., Alessa, R., & Alruweili, H. (2019). Radiograph reject analysis in a large tertiary care hospital in Riyadh, Saudi Arabia. *Global Journal on Quality and Safety in Healthcare*, *2*(2), 30–33. https://doi.org/10.4103/jqsh.jqsh_24_18
16. Walz-Flannigan, A. I., Brossoit, K. J., Magnuson, D. J., & Schueler, B. A. (2018). Pictorial review of digital radiography artifacts. *Radiographics: A Review Publication of the Radiological Society of North America, Inc*, *38*(3), 833–846. https://doi.org/10.1148/rg.2018170038
17. Nose, H., & Shiraishi, J. (2017a). Clinical utility of ultra-low-dose pre-test exposure to avoid unnecessary patient exposure due to positioning errors: a simulation study. *Radiological Physics and Technology*, *10*(4), 489–495. https://doi.org/10.1007/s12194-017-0422-5
18. Lin, C.-S., Chan, P.-C., Huang, K.-H., Lu, C.-F., Chen, Y.-F., & Lin Chen, Y.-O. (2016). Guidelines for reducing image retakes of general digital radiography. *Advances in Mechanical Engineering*, *8*(4). https://doi.org/10.1177/1687814016644127

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19. Mount, J. (2016). Reject analysis: A comparison of radiographer and radiologist perceptions of image quality. *Radiography (London, England: 1995)*, *22*(2), e112–e117. https://doi.org/10.1016/j.radi.2015.12.001
20. Taylor, N. (2015). The art of rejection: Comparative analysis between Computed Radiography (CR) and Digital Radiography (DR) workstations in the Accident & Emergency and General radiology departments at a district general hospital using customised and standardised reject criteria over a three year period. *Radiography (London, England: 1995)*, *21*(3), 236–241. https://doi.org/10.1016/j.radi.2014.12.003