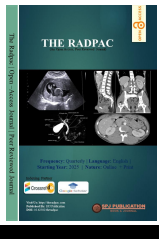
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Original Article

A Cross-Sectional Analysis of Patient Waiting Time and Contributing Factors in Diagnostic Radiology

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ABSTRACT

Background: Patient waiting time is a key indicator of service quality and operational efficiency in diagnostic radiology departments. Prolonged waiting times may delay clinical decision-making, reduce patient satisfaction, and reflect underlying workflow inefficiencies.
Aim: To assess patient waiting time in a diagnostic radiology department and identify factors influencing delays in imaging services.
Materials and Methods: A hospital-based cross-sectional study was conducted over six months in a diagnostic radiology department. A total of 560 patients undergoing X-ray, ultrasound, CT, and MRI examinations were included. Patient waiting time was measured from registration to completion of the imaging procedure. Data on demographics, imaging modality, and referral source were collected using a structured proforma. Descriptive statistics and comparative analyses were performed, with a p-value <0.05 considered statistically significant.
Results: The overall mean patient waiting time was 48.6 ± 21.4 minutes. MRI examinations demonstrated the longest waiting time (76.9 ± 24.1 minutes), followed by CT (58.7 ± 20.4 minutes), ultrasound (45.8 ± 18.2 minutes), and X-ray (32.4 ± 12.6 minutes). Emergency referrals had significantly shorter waiting times compared to outpatient and inpatient referrals (p <0.001). Imaging modality and referral source were significant determinants of waiting time.
Conclusion: Patient waiting time in diagnostic radiology varies significantly across imaging modalities and referral categories. Advanced imaging modalities are associated with longer delays, while emergency prioritization effectively reduces waiting time. Regular monitoring and workflow optimization are essential to improve service efficiency and patient satisfaction.

Keywords: Patient Waiting Time, Diagnostic Radiology, Workflow Efficiency, Imaging Modality

INTRODUCTION

Efficient delivery of diagnostic imaging services is a cornerstone of modern healthcare systems, as radiological investigations play a vital role in diagnosis, treatment planning, and disease monitoring. Patient waiting time in diagnostic radiology departments has emerged as a key indicator of service quality, operational efficiency, and patient-centered care. Prolonged waiting times not only delay clinical decision-making but also contribute to patient anxiety, dissatisfaction, and reduced confidence in healthcare services. [1-3] Diagnostic radiology departments frequently experience high patient volumes due to increasing dependence on imaging modalities such as X-ray, ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI). This growth is driven by aging populations, expanding indications for imaging, and the rise of chronic diseases requiring repeated examinations. As a result, managing patient flow efficiently has become a persistent challenge, [4] particularly in public and high-volume healthcare facilities. Patient waiting time in radiology typically encompasses several stages, including registration, scheduling, preparation, image acquisition, and, in some settings, preliminary reporting. [5-6] Delays may arise at any point in this pathway due to factors such as inadequate staffing, limited equipment availability, emergency case prioritization, workflow inefficiencies, or administrative bottlenecks. Studies have shown that excessive waiting times are closely linked to lower patient satisfaction scores and negative perceptions of care

quality, even when diagnostic accuracy remains high. From an operational perspective, prolonged waiting times may indicate suboptimal utilization of resources, poor appointment systems, or lack of coordination between clinical and radiology teams. In developing and resource-constrained settings, these issues are often intensified by shortages of trained radiographers and radiologists, outdated equipment, and growing patient demand . Conversely, reducing waiting times has been associated with improved workflow efficiency, enhanced patient experience, and better overall departmental performance. [7-9] Given the importance of timely imaging services, systematic evaluation of patient waiting time is essential for identifying workflow gaps and implementing targeted improvements. Cross-sectional studies provide valuable insights into current operational performance and help establish baseline data for quality improvement initiatives. Therefore, this study aims to assess patient waiting time in a diagnostic radiology department and analyze contributing factors, with the ultimate goal of enhancing service efficiency and patient satisfaction.

AIM AND OBJECTIVES

Aim: To assess patient waiting time in a diagnostic radiology department and evaluate factors influencing delays in the delivery of radiological services.

Objectives

1. To measure the average patient waiting time for diagnostic radiological examinations from registration to completion of the procedure.
2. To compare waiting times across different imaging modalities, including X-ray, ultrasound, computed tomography (CT), and magnetic resonance imaging (MRI).
3. To identify key operational factors contributing to prolonged waiting times, such as patient volume, staffing levels, and scheduling practices.
4. To assess variations in waiting time between outpatient, inpatient, and emergency department referrals.
5. To generate baseline data that can support workflow optimization and quality improvement initiatives aimed at enhancing patient satisfaction and service efficiency in the diagnostic radiology department.

MATERIALS AND METHODS

Study Design and Setting: A hospital-based cross-sectional observational study was conducted in the Diagnostic Radiology Department of a tertiary care teaching hospital. The study was designed in accordance with the stated aim and objectives to evaluate patient waiting time and associated operational factors across multiple imaging modalities.

Study Duration: The study was carried out over a defined period of six months from January 2025 to June 2025.

Study Population and Sample Size: A total of 560 patients who underwent diagnostic radiological examinations during the study period were included. Patients were selected using a consecutive sampling method to minimize selection bias and to reflect routine departmental workload.

Inclusion Criteria

- Patients aged 18 years and above
- Patients referred for routine diagnostic imaging, including **X-ray, ultrasound, CT, and MRI**
- Outpatients, inpatients, and emergency department referrals
- Patients who provided informed consent to participate

Exclusion Criteria

- Patients requiring immediate life-saving imaging where waiting time measurement was not feasible
- Patients undergoing interventional radiological procedures
- Patients with incomplete registration or imaging time records
- Pediatric patients below 18 years of age

Data Collection Procedure: Patient waiting time was defined as the interval between registration at the radiology reception and completion of the imaging examination. Time stamps were recorded at multiple workflow points, including registration, examination start, and examination completion. Data were collected using a structured data collection form designed specifically for the study. Demographic variables such as age, gender, referral source (outpatient, inpatient, emergency), and imaging modality were documented. Operational variables including daily patient load, staffing availability, and examination type were also recorded to assess their influence on waiting time.

Outcome Measures: The primary outcome measure was the mean patient waiting time for each imaging modality. Secondary outcomes included comparison of waiting times between referral categories and identification of factors associated with prolonged delays.

Statistical Analysis: Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Descriptive statistics were used to summarize patient characteristics and waiting times, expressed as mean ± standard deviation. Comparative analysis between groups was performed using independent t-tests and one-way ANOVA where applicable. A p-value of less than 0.05 was considered statistically significant.

RESULTS

A total of 560 patients were included in the study to assess patient waiting time in the diagnostic radiology department. The analysis was performed in accordance with the stated aim and objectives, focusing on demographic characteristics, imaging modality, referral source, and waiting time distribution.

Demographic Characteristics of the Study Population: Among the 560 patients, 312 (55.7%) were male and 248 (44.3%) were female. The majority of patients belonged to the 31–50 years age group, reflecting the highest utilization of diagnostic imaging services in this age range.

Table 1. Demographic distribution of patients (n = 560)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	312	55.7
	Female	248	44.3
Age group (years)	18–30	126	22.5
	31–50	238	42.5
	51–70	154	27.5
	>70	42	7.5

Distribution According to Imaging Modality: Conventional X-ray constituted the largest proportion of examinations (42.9%), followed by ultrasound (26.8%), CT (19.6%), and MRI (10.7%).

Table 2. Distribution of patients by imaging modality

Imaging modality	Number of patients (n)	Percentage (%)
X-ray	240	42.9
Ultrasound	150	26.8
CT	110	19.6
MRI	60	10.7
Total	**560**	**100**

Referral Source of Patients: Most patients were referred from the outpatient department (52.5%), followed by inpatient referrals (31.4%) and emergency cases (16.1%).

Table 3. Referral source distribution

Referral source	Frequency (n)	Percentage (%)
Outpatient	294	52.5
Inpatient	176	31.4
Emergency	90	16.1
Total	560	100

Overall Patient Waiting Time: The overall mean waiting time across all imaging modalities was 48.6 ± 21.4 minutes, with a range of 10 to 130 minutes. Emergency patients demonstrated significantly shorter waiting times compared to outpatient and inpatient referrals.

Waiting Time by Imaging Modality: MRI examinations showed the longest mean waiting time, while X-ray examinations had the shortest waiting time.

Table 4. Mean waiting time by imaging modality

Imaging modality	Mean waiting time (minutes) ± SD
X-ray	32.4 ± 12.6
Ultrasound	45.8 ± 18.2
CT	58.7 ± 20.4
MRI	76.9 ± 24.1

A statistically significant difference in waiting time was observed among different imaging modalities ($p < 0.001$, one-way ANOVA).

Waiting Time by Referral Category: Emergency patients experienced the least waiting time, reflecting prioritization protocols, whereas outpatient services showed longer delays.

Table 5. Waiting time based on referral source

Referral source	Mean waiting time (minutes) ± SD
Outpatient	55.2 ± 19.8
Inpatient	46.5 ± 17.3
Emergency	28.7 ± 11.9

The difference in waiting times between referral categories was statistically significant ($p < 0.001$).

Factors Associated with Prolonged Waiting Time: Higher patient load days and advanced imaging modalities (CT and MRI) were associated with longer waiting times. Limited scanner availability and longer examination duration contributed significantly to delays in CT and MRI services.

DISCUSSION

This cross-sectional study evaluated patient waiting time in a diagnostic radiology department and identified key factors influencing delays in imaging services. The findings demonstrate that patient waiting time remains a significant operational challenge, particularly for advanced imaging modalities such as CT and MRI. The overall mean waiting time of approximately 49 minutes observed in this study is comparable to values reported

in similar hospital-based studies, indicating that delays in radiology are a widespread concern rather than an isolated institutional issue.

The shortest waiting times were observed for conventional X-ray examinations. This can be attributed to high equipment availability, shorter examination duration, streamlined workflow, and relatively simple patient preparation requirements. In contrast, MRI examinations exhibited the longest waiting times. This finding is consistent with existing literature and reflects longer scan durations, limited scanner availability, complex patient screening, and higher demand for MRI services. CT examinations also showed prolonged waiting times, likely due to their frequent use in emergency and inpatient settings, which increases competition for scanner access. Referral source was a significant determinant of waiting time. Emergency patients experienced substantially shorter waiting times compared to outpatient and inpatient referrals. This result highlights the effectiveness of prioritization protocols implemented for emergency imaging, ensuring rapid diagnosis and timely clinical intervention. However, the longer waiting times observed among outpatient services suggest potential inefficiencies in appointment scheduling, patient flow management, and resource allocation during peak hours.

The influence of patient volume on waiting time was evident, with higher delays observed during periods of increased workload. Limited staffing and high dependency on a small number of imaging units further contributed to bottlenecks, particularly in advanced imaging sections. These findings align with previous reports that link prolonged waiting times to inadequate workforce planning and suboptimal utilization of imaging resources. From a quality-of-care perspective, prolonged waiting times may negatively affect patient satisfaction and perceived service quality, even when diagnostic accuracy is maintained. Addressing workflow inefficiencies through improved scheduling systems, optimized staffing patterns, and adoption of digital workflow tools may help reduce delays. The study underscores the need for continuous monitoring of waiting time as a performance indicator in radiology departments.

CONCLUSION

This study demonstrates that patient waiting time in diagnostic radiology varies significantly according to imaging modality and referral source. Advanced imaging modalities, particularly MRI and CT, were associated with longer waiting times, while emergency referrals benefited from effective prioritization and reduced delays. The findings highlight the impact of workload, equipment availability, and workflow organization on service efficiency. Regular assessment of patient waiting time is essential for identifying operational gaps and guiding quality improvement initiatives. Implementing targeted strategies such as optimized scheduling, resource reallocation, and workflow optimization may contribute to reduced waiting times, improved patient satisfaction, and enhanced overall performance of diagnostic radiology departments.

DECLARATION

Ethical Approval: The study was conducted in accordance with institutional ethical guidelines. As this was an observational study involving routine diagnostic procedures, no additional risk or radiation exposure was imposed on the participants.

Informed Consent: Informed consent was obtained from all participants prior to inclusion in the study.

Conflicts of Interest: The authors declare that there are no conflicts of interest related to this study.

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Data Availability: The data generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Authors' Contributions: All authors contributed equally to the study design, data collection, analysis, manuscript preparation, and final approval of the manuscript.

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