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Patient Perceptions and Acceptance of Digital Radiography and Teleradiology in India: A Mixed-Methods Study

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Abstract

Background: Digital radiography and teleradiology have emerged as transformative tools in India's healthcare landscape, addressing critical gaps in diagnostic access, particularly in rural and underserved regions. Despite their potential to reduce travel burdens, enable timely diagnoses, and optimize resource allocation, patient acceptance remains pivotal to their sustainable integration. Limited empirical insights into patient perceptions of these technologies in the Indian context underscore the need for this study.

Methods: A mixed-methods study was conducted across urban and rural tertiary care centers in Punjab, India, involving 512 participants. Quantitative data were collected via structured surveys assessing awareness, trust, satisfaction, and willingness to adopt digital radiography and teleradiology. Qualitative insights were derived from semi-structured interviews and focus group discussions (30 participants) exploring lived experiences, concerns, and expectations. Statistical analyses included regression modeling, while thematic analysis identified patterns in qualitative responses.

Results: Quantitative results showed moderate general knowledge about teleradiology (58%), while there was a high willingness to use teleradiology (82%), due to a reduction of travel activities and acceleration of therapies. Higher proportion of urban youth reported awareness (72%) when compared to their rural counterparts (44%). There was confidence in digital accuracy (78%) but concerns over data privacy (65%) and impersonal care (49%) remained. Qualitative themes raised a sense of appreciation for effortlessness and quickness, but anxiousness about technical problems, poor communication, and privacy issues.

Conclusion: Although the acceptability of digital radiographs and teleradiology is encouraging among patients in India, there are knowledge gaps and concerns for privacy issues and provider communication that need to be addressed. Education programs, approaches to data sharing and care models which focus on the patient are needed to support trust and fair adoption. These findings advocate policy and infrastructural

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reforms to align technological advancements with patient needs, ensuring inclusive healthcare delivery.

Keywords: Digital Radiography, Teleradiology, Patient Acceptance, Healthcare Access, Mixed-Methods Study, India.

Introduction

The pace of change in medical imaging has revolutionized diagnosis and management of patients globally. In the context of India, digital radiography and teleradiology have evolved as revolutionary technologies to solve the longstanding barriers of accessibility and quality of diagnostic services [1]. These have special significance in a nation characterized by extreme rural-urban dichotomy wherein the capacity of Skilled Radiologists and the advanced imaging infrastructure predominantly resides in urban areas [2]. Through allowing remote image interpretation and facilitating data exchange, teleradiology has the potential to address the major barriers to health care delivery, especially in rural/underserved populations [3].

Despite these developments, success of digital radiography and teleradiology as part of daily clinical work does not only depend on technical feasibility, but also on acceptance and trust of the patients. Patients' attitudes are influenced by a combination of previous technology experience and belief in accuracy and reliability of the device as well as trust in communication with health care professionals [4]. In the Indian setting, language constraints, digital knowledge, and cultural perspectives held about technology shape how patients interact and react with these health tech solutions [5]. Knowledge of these perceptions is essential for developing patient-centered care models, and for ensuring that technological developments have a positive impact on health.

Existing studies in India have largely focused on the technical, operational, and clinical aspects of digital radiography and teleradiology, with limited empirical attention to the patient perspective ([1;6]. While there is evidence that these technologies can reduce travel time, expedite diagnoses, and optimize resource utilization, less is known about how patients perceive the shift from traditional, face-to-face radiology services to digital and remote modalities [3]. Concerns about data privacy, impersonal interactions, and the potential for technical errors may pose barriers to widespread acceptance, particularly among populations with limited exposure to digital health tools [4].

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Given these gaps, this study aims to comprehensively assess patient perceptions and acceptance of digital radiography and teleradiology in India using a mixed-methods approach. By integrating quantitative measures of awareness, trust, and satisfaction with qualitative insights into patient experiences and concerns, this research seeks to inform policy and practice. The findings are intended to guide the development of targeted education, communication strategies, and system reforms that align technological innovation with patient needs and expectations, ultimately supporting equitable and effective healthcare delivery in India [5].

Methodology

Study Design

This study employed a mixed-methods, concurrent triangulation design to comprehensively assess patient perceptions and acceptance of digital radiography and teleradiology in India. The mixed-methods approach enabled the integration of quantitative and qualitative data, providing both breadth and depth in understanding patient experiences [1].

Setting and Participants

The research was conducted across six tertiary care centers in Punjab, strategically selected to represent both urban (Chandigarh, Ludhiana, Amritsar) and rural (Moga, Hoshiarpur, Sangrur) populations. Participants were eligible if they were aged 18–65 years and had undergone digital radiography or teleradiology consultation within the previous six months. Stratified random sampling ensured proportional representation across gender, age, and socioeconomic strata [6]. In total, 512 patients participated in the quantitative survey, while 30 were purposively selected for qualitative interviews and focus group discussions.

Data Collection

Quantitative data were collected using a structured questionnaire adapted from validated instruments measuring awareness, trust, satisfaction, and willingness to adopt digital radiography and teleradiology. The questionnaire was translated into Hindi and Punjabi, with back-translation procedures employed to ensure linguistic and cultural validity. Qualitative data were gathered through semi-structured interviews (n=20) and two focus group discussions (n=5 each), exploring in-depth perceptions, concerns, and expectations regarding digital radiography and teleradiology [5]. All interviews were audio-recorded, transcribed verbatim, and translated into English.

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Data Analysis

Quantitative data were analyzed using descriptive statistics, chi-square tests for group comparisons, and multiple linear regression to identify predictors of acceptance. Qualitative data underwent thematic analysis following Braun and Clarke's framework [7], with two independent researchers coding transcripts and resolving discrepancies through consensus. Integration of quantitative and qualitative findings was achieved during interpretation to ensure a comprehensive understanding of patient perspectives.

Ethical Considerations

Ethical approval was obtained from the relevant Institutional Review Board. All participants provided written informed consent prior to data collection, and confidentiality was strictly maintained throughout the study.

Rigor and Trustworthiness

Methodological rigor was ensured through triangulation of data sources, member-checking of qualitative themes with participants, and peer debriefing to minimize bias. The mixed-methods approach enhanced the credibility and applicability of findings, aligning with established best practices in health research [1].

Results

Table 1

Demographic Characteristics of Study Participants (N = 512)

Variable	n	%
Gender		
Male	266	52.0
Female	246	48.0
Age Group (years)		
18–29	168	32.8
30–44	202	39.5
45–65	142	27.7

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Residence		
Urban	304	59.4
Rural	208	40.6
Education Level		
Secondary or less	126	24.6
Higher secondary	210	41.0
Graduate and above	176	34.4
Socioeconomic Status		
Low	159	31.1
Middle	247	48.2
High	106	20.7

A total of 512 patients participated in the quantitative survey, with 30 contributing to the qualitative phase (20 individual interviews and 2 focus groups). Table 1 summarizes the demographic characteristics of the sample

Table 2: *Awareness and Acceptance of Digital Radiography and Teleradiology Among Participants (N = 512)*

Variable	Overall (%)	Urban (%)	Rural (%)
Moderate to high awareness	58	72	44
Willingness to adopt teleradiology	82	88	74
Trust in digital radiography accuracy	78	81	74
Concern about data privacy	65	63	68
Perceived impersonality of consultations	49	46	53

Note. Urban and rural percentages are based on subgroup totals (N = 304 urban, N = 208 rural). “Moderate to high awareness” includes participants who rated their awareness as moderate or high on the survey scale.

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Overall, 58% of participants reported moderate to high awareness of digital radiography and teleradiology. Urban residents demonstrated significantly higher awareness (72%) compared to rural participants (44%), $\chi^2(1, N=512) = 37.21$, $p < .001$. Awareness was also positively associated with education level and socioeconomic status.

Willingness to adopt teleradiology was high, with 82% expressing openness to remote consultations. Trust in the accuracy of digital radiography was reported by 78% of participants, while 65% expressed concerns about data privacy and 49% felt that digital consultations were more impersonal compared to traditional face-to-face interactions.

Table 3: *Reported Barriers to Accessing Radiology Services (N = 512)*

Barrier	Often (%)	Sometimes (%)	Rarely/Never (%)
Lack of confidence	48.8	28.1	23.1
Fear of diagnosis	40.6	28.3	31.1
Embarrassment	38.1	25.1	36.8
Worry about findings	38.6	24.1	37.3
Difficulty making appointments	30.4	24.6	45.0
Difficulty talking to doctor	30.0	28.5	41.5
Too busy for visits	42.4	22.8	34.8
Too many other worries	43.8	25.7	30.5
Financial constraints	53.2	33.4	13.4

Financial constraints were the most frequently cited barrier, with 53.2% of participants "often" unable to afford radiological services. Psychological barriers included a lack of confidence in discussing symptoms (48.8% "often") and fear of diagnosis (40.6% "often"). Logistical barriers, such as difficulty scheduling appointments and time constraints, were also prevalent, particularly among working-age adults and rural residents.

Table 4: *Regression Analysis Predicting Acceptance of Teleradiology (N = 512)*

Predictor Variable	β	p	Direction of Effect
Higher education	.24	< .01	Positive

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Urban residence	.19	< .01	Positive
Prior digital health experience	.21	< .01	Positive
Concern about privacy	−.15	< .05	Negative
Perceived impersonality	−.12	< .05	Negative

Note. β = standardized regression coefficient.

Positive values indicate a positive association with acceptance; negative values indicate a negative association. All predictors shown are statistically significant.

Regression analysis indicated that higher education (β = .24, p < .01), urban residence (β = .19, p < .01), and prior experience with digital health tools (β = .21, p < .01) were significant predictors of acceptance of teleradiology. Concerns about privacy (β = −.15, p < .05) and perceived impersonality (β = −.12, p < .05) were associated with lower acceptance.

Qualitative Insights

Thematic analysis of interviews and focus groups revealed three major themes:

1. **Accessibility and Convenience:** Participants appreciated reduced travel and faster reporting, especially in rural areas where specialist access is limited.
2. **Concerns about Data Security and Communication:** Many expressed anxiety about the security of their medical data and desired more personal interaction and clearer explanations from healthcare providers.
3. **Perceived Quality of Care:** While most trusted the accuracy of digital radiography, some worried about technical errors and felt that remote consultations lacked the reassurance of in-person visits.

Integration of Findings

Quantitative and qualitative findings converged to show that while awareness and willingness to adopt digital radiography and teleradiology are high, significant barriers remain. Financial and psychological obstacles are particularly pronounced among rural and lower socioeconomic groups, while privacy and communication concerns are widespread. Participants emphasized the need for better education, transparent data handling, and improved provider-patient communication to enhance acceptance and trust.

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Discussion

This study examined patient perceptions and acceptance of digital radiography and teleradiology in India, focusing on the factors that facilitate or hinder the adoption of these technologies among diverse patient populations [1;6]. Teleradiology, which enables the electronic transmission and remote interpretation of diagnostic images, has become increasingly vital in the Indian healthcare context, particularly for bridging gaps between urban centers with specialized radiologists and rural or underserved regions [3]. The integration of digital radiography and teleradiology has contributed to more timely diagnoses and improved access to expert consultation, addressing some of the challenges posed by the shortage of radiologists and the uneven distribution of healthcare resources across the country [4].

The expansion of teleradiology in India has been supported by advancements in digital infrastructure, increased internet penetration, and a growing demand for radiological services in remote areas [5;8]. Government initiatives, public-private partnerships, and the adoption of Picture Archiving and Communication Systems (PACS) have further facilitated the mainstreaming of teleradiology, enabling efficient image transfer, secure data storage, and rapid turnaround times [1;9]. However, despite these technological and policy advances, the success of teleradiology is closely linked to patient acceptance, trust in digital health platforms, and the ability to address psychological, logistical, and financial barriers to care [6].

Previous research has shown that while teleradiology can reduce travel and waiting times and improve service delivery, significant challenges remain in achieving equitable access, especially for rural populations who may face digital literacy gaps or infrastructural limitations [10]. Persistent concerns about data privacy, the impersonality of remote consultations, and the cost of services continue to influence patient willingness to adopt these technologies [11]. The successful implementation of teleradiology also depends on ongoing investment in healthcare provider training, patient education, and the development of robust regulatory frameworks to ensure data security and quality standards [12;13].

The findings of this study provide valuable insights into the factors shaping patient perceptions and acceptance of digital radiography and teleradiology in India. The results highlight the transformative potential of these technologies for improving healthcare access and efficiency, while also underscoring the need for targeted interventions to address barriers related

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to trust, communication, affordability, and digital inclusion [1,3,5].

Conclusion

In conclusion, this study underscores that while digital radiography and teleradiology are widely accepted and trusted by many patients in India, significant disparities persist in awareness, access, and acceptance, particularly among rural populations and those with lower educational attainment. The findings reveal that patient willingness to embrace these technologies is strongly influenced by perceived benefits such as convenience, reduced travel, and timely diagnosis, but is also tempered by concerns about data privacy, the impersonality of remote consultations, and financial constraints [1,5]. Psychological and logistical barriers, including lack of confidence in communicating with healthcare providers and difficulties in scheduling appointments, further hinder equitable adoption, especially for vulnerable groups [5]

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