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Diagnostic Accuracy of X-Ray Chest for the Diagnosis of Interstitial Lung Disease Keeping High Resolution Computed Tomography Chest as Gold Standard

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ABSTRACT

Background: *Interstitial lung disease (ILD) comprises a heterogeneous group of diffuse parenchymal lung disorders in which early and accurate detection is critical for prognosis and management. Although high-resolution computed tomography (HRCT) is the reference imaging modality, chest radiography (CXR) remains the most accessible first-line investigation in resource-constrained settings, and its diagnostic performance requires contextual evaluation.* ***Objective:*** *To determine the diagnostic accuracy of chest radiography for detecting ILD using HRCT as the reference standard in adults with clinical suspicion of ILD.* ***Methods:*** *This cross-sectional diagnostic accuracy study included 108 consecutive patients aged 18–75 years presenting to a tertiary-care radiology department from January to December 2024. All participants underwent standardized CXR followed by HRCT within two weeks. CXR findings were interpreted independently and blinded to HRCT results. Sensitivity, specificity, predictive values, likelihood ratios, diagnostic odds ratio, and 95% confidence intervals were calculated using a 2×2 contingency table.* ***Results:*** *HRCT confirmed ILD in 60 of 108 patients (55.56%). CXR demonstrated a sensitivity of 90.0% (95% CI 79.9–95.3) and specificity of 87.5% (95% CI 75.3–94.1), with positive and negative predictive values of 90.0% and 87.5%, respectively. Overall diagnostic accuracy was 88.89% (95% CI 81.6–93.5), with LR+ of 7.2 and LR− of 0.11.* ***Conclusion:*** *Chest radiography exhibits high diagnostic performance in clinically suspected ILD within a tertiary-care cohort; however, given residual false-negative cases, HRCT remains essential for definitive diagnosis and disease characterization.*

Keywords: *Interstitial lung disease; Chest radiography; High-resolution computed tomography; Diagnostic accuracy; Sensitivity; Specificity.*

INTRODUCTION

Interstitial lung disease (ILD) comprises a heterogeneous group of diffuse parenchymal lung disorders characterized by varying degrees of inflammation and fibrosis that impair alveolar gas exchange and progressively reduce pulmonary function (1). Although certain ILDs demonstrate predominantly inflammatory and potentially reversible components, others are fibrotic and associated with irreversible architectural distortion, underscoring the importance of timely and accurate diagnosis (1,2). Clinically, patients commonly present with exertional dyspnea, non-productive cough, and fatigue; however, symptom onset is often insidious and non-specific, contributing to delayed recognition and misdiagnosis (2). Given the prognostic and therapeutic implications—particularly in fibrotic phenotypes where early antifibrotic therapy may alter disease trajectory—accurate imaging-based detection plays a pivotal role in the diagnostic pathway (3,4).

High-resolution computed tomography (HRCT) is widely regarded as the reference imaging modality for evaluating suspected ILD because of its superior spatial resolution and ability to characterize parenchymal patterns such as reticulation, ground-glass opacity,

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honeycombing, and traction bronchiectasis (3,4). HRCT findings are central to multidisciplinary diagnosis and may, in selected contexts, obviate the need for invasive lung biopsy (2,5). Nevertheless, HRCT is associated with higher radiation exposure, greater cost, and limited accessibility in resource-constrained healthcare systems, including many tertiary centers in low- and middle-income countries. In contrast, chest radiography (CXR) remains the most frequently performed first-line imaging investigation for patients with respiratory complaints due to its low radiation dose, affordability, and widespread availability (6). CXR may demonstrate reticular or reticulonodular opacities, volume loss, or advanced fibrotic changes; however, early or subtle interstitial abnormalities are often occult, and a normal radiograph does not reliably exclude ILD (6).

Existing evidence suggests that CXR has variable diagnostic performance when compared with HRCT. A national registry from Pakistan reported a substantial burden of ILD, highlighting the clinical relevance of optimizing diagnostic pathways in this setting (7). Prior regional studies have reported sensitivities of approximately 80% and specificities near 83% for CXR in detecting ILD when HRCT is used as the reference standard (8). Similarly, radiographic–HRCT correlation studies have demonstrated that HRCT frequently identifies interstitial abnormalities in patients with normal or equivocal chest radiographs, particularly in early or mild disease (9,10). Additional investigations have emphasized the superior pattern characterization and subtype differentiation achievable with HRCT, further reinforcing its central diagnostic role (11). A systematic review evaluating imaging modalities in critically ill patients also highlighted the limitations of chest radiography in detecting diffuse parenchymal abnormalities compared with advanced imaging techniques (12). More recent single-center studies continue to report discordance between CXR and HRCT findings, particularly in cases with subtle septal thickening or ground-glass changes (13–16). Moreover, diagnostic performance may vary across age groups, potentially due to comorbidities and age-related parenchymal alterations that complicate radiographic interpretation (17–19).

Despite these observations, important uncertainties remain. First, much of the available literature is either dated, conducted in heterogeneous populations, or lacks rigorous reporting of diagnostic accuracy parameters with appropriate precision estimates. Second, data from high-prevalence, tertiary referral cohorts in Pakistan remain limited, particularly regarding stratified diagnostic performance across demographic and clinical subgroups. Third, while HRCT is accepted as the reference imaging modality, its universal deployment is neither feasible nor cost-effective in many healthcare systems. A pragmatic evaluation of CXR performance in clinically suspected ILD populations is therefore essential to inform triage strategies and resource allocation. From a PICO perspective, the population of interest comprises adults with clinical suspicion of ILD; the index test is chest radiography; the comparator (reference standard) is HRCT of the chest; and the primary outcome is diagnostic accuracy, including sensitivity, specificity, predictive values, and overall accuracy.

Accordingly, this study was designed to determine the diagnostic accuracy of chest radiography for the detection of interstitial lung disease in adults with clinical suspicion of ILD, using high-resolution computed tomography as the reference standard in a tertiary-care setting. We hypothesized that although chest radiography may demonstrate moderate to high sensitivity in a referral population with substantial disease prevalence, it would not achieve sufficient diagnostic certainty to replace HRCT, particularly for excluding disease in clinically suspected cases (8,12).

MATERIAL AND METHODS

This cross-sectional diagnostic accuracy study was conducted in the Department of Radiology at Lady Reading Hospital, Peshawar, from January 2024 to December 2024. The study was designed to evaluate the performance of chest radiography (CXR) as an index test for the detection of interstitial lung disease (ILD), using high-resolution computed tomography (HRCT) of the chest as the reference standard. The methodological framework adhered to internationally accepted recommendations for reporting diagnostic accuracy studies, including the Standards for Reporting of Diagnostic Accuracy (STARD) guidelines (20). A cross-sectional design was selected to ensure that both index and reference tests were performed within a defined and clinically relevant time interval in a consecutive cohort of patients presenting with clinical suspicion of ILD.

Adult patients aged 18 to 75 years presenting to the radiology department with clinical suspicion of ILD, based on symptoms such as progressive dyspnea, persistent dry cough, and relevant clinical examination findings as determined by the referring pulmonologist or physician, were eligible for inclusion. Patients with a prior confirmed diagnosis of malignancy, ischemic heart disease, chronic liver disease, or chronic kidney disease were excluded to reduce potential confounding radiographic changes and competing parenchymal or interstitial abnormalities. Consecutive sampling was employed to minimize selection bias, whereby all eligible patients meeting inclusion criteria during the study period were invited to participate. This approach was intended to reflect the real-world diagnostic pathway in a tertiary referral setting and to reduce spectrum bias.

After institutional ethical approval was obtained from the hospital ethics review board, written informed consent was secured from each participant prior to enrollment. Participants were informed about the purpose of the study, imaging procedures, potential radiation exposure, and data confidentiality measures. Demographic and clinical data, including age, sex, and duration of symptoms, were recorded using a standardized predesigned proforma. All data were anonymized using unique study identification codes to maintain confidentiality and ensure data integrity.

Each participant underwent a standard posteroanterior chest radiograph using calibrated digital radiography equipment under uniform exposure parameters consistent with institutional imaging protocols. The CXR served as the index test. A CXR was operationally defined as positive for ILD if it demonstrated bilateral reticular or reticulonodular opacities, interstitial thickening, reduced lung volumes with basal predominance, or features suggestive of fibrotic change. Radiographs were independently interpreted by a consultant radiologist with at least five years of post-fellowship experience in thoracic imaging. The radiologist was blinded to HRCT findings at the time of CXR interpretation to reduce observer bias.

Subsequently, all enrolled participants underwent HRCT of the chest within a short predefined interval not exceeding two weeks from the CXR to minimize temporal changes in disease status. HRCT examinations were performed using a multidetector CT scanner with thin-section acquisition (≤1.5 mm slice thickness), high-spatial-frequency reconstruction algorithm, and supine end-inspiratory imaging protocol. The HRCT served as the reference standard. HRCT was considered positive for ILD if it demonstrated established interstitial abnormalities such as reticulation, ground-glass opacities with interstitial distribution, honeycombing, traction bronchiectasis, or architectural distortion consistent with diffuse parenchymal lung disease, in accordance with accepted radiologic pattern criteria (3,4). HRCT images were interpreted by a separate consultant radiologist

blinded to the CXR results to prevent incorporation bias. In cases of diagnostic uncertainty, a consensus reading was performed.

The primary outcome measure was the diagnostic accuracy of CXR for detecting ILD relative to HRCT. Diagnostic performance parameters included sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), overall diagnostic accuracy, positive likelihood ratio (LR+), and negative likelihood ratio (LR−). True positive cases were defined as patients positive for ILD on both CXR and HRCT; true negatives were negative on both modalities; false positives were CXR-positive but HRCT-negative; and false negatives were CXR-negative but HRCT-positive. Potential confounders such as age, sex, and duration of symptoms were recorded and addressed through stratified analyses. To assess effect modification, post-stratification diagnostic accuracy was calculated across predefined subgroups of age (18–45 years and 46–75 years), sex, and symptom duration (≤4 weeks and >4 weeks).

The sample size was calculated using the WHO sample size calculator for diagnostic test evaluation, based on an anticipated ILD prevalence of 34.4% (7), expected sensitivity of 80% (8), expected specificity of 82.98% (8), 95% confidence level, and absolute precision of 13%. The minimum required sample size was estimated to be 108 participants. This sample size was considered sufficient to estimate sensitivity and specificity with acceptable precision while accounting for the expected disease prevalence in the target population.

Data were entered and analyzed using IBM SPSS Statistics version 20.0 (IBM Corp., Armonk, NY, USA). Continuous variables such as age and duration of symptoms were summarized as mean ± standard deviation after assessment of normality. Categorical variables were presented as frequencies and percentages. A 2×2 contingency table was constructed to calculate sensitivity, specificity, PPV, NPV, and diagnostic accuracy, each with corresponding 95% confidence intervals. Likelihood ratios were derived using standard formulas. The chi-square test was used to evaluate the association between CXR findings and HRCT diagnosis. Subgroup analyses were performed using stratified contingency tables to assess potential effect modification. Missing data were minimized through prospective data collection and immediate verification at the point of entry; any incomplete records were excluded from the final analysis. Statistical significance was defined as a two-tailed p-value <0.05.

To enhance reproducibility and data integrity, imaging protocols were standardized, radiologists were blinded to comparator results, and all collected data were double-entered and cross-checked for accuracy. Data files were password-protected and stored on secure institutional systems accessible only to the research team. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and adhered to best practices for diagnostic accuracy research (20).

RESULTS

Table 1 summarizes the baseline profile of the 108 participants evaluated for suspected interstitial lung disease. The cohort was predominantly older, with 96 patients (88.89%) aged 46–75 years and 12 (11.11%) aged 18–45 years, yielding a mean age of 57.77 ± 9.77 years (range 18–75). Men comprised 68/108 (62.96%) and women 40/108 (37.04%), giving a male-to-female ratio of approximately 1.7:1. Symptom duration was slightly more frequent beyond four weeks, with 60 patients (55.56%) reporting >4 weeks and 48 (44.44%) reporting ≤4 weeks; the mean symptom duration was 4.66 ± 2.11 weeks. These distributions indicate a referral population enriched for older adults and a modest male predominance.

Table 2 presents the core 2×2 diagnostic cross-tabulation comparing the index test (chest X-ray) with the reference standard (HRCT). On HRCT, 60/108 patients were ILD-positive, establishing an ILD prevalence of 55.56% in this clinically suspected tertiary-care cohort. Chest X-ray classified 60/108 (55.56%) as ILD-positive and 48/108 (44.44%) as ILD-negative. Among CXR-positive patients, 54 were true positives and 6 were false positives, corresponding to a false-positive proportion of 10.0% (6/60). Among CXR-negative patients, 42 were true negatives and 6 were false negatives, corresponding to a false-negative proportion of 12.5% (6/48). The strength of association between CXR and HRCT was high, with a diagnostic odds ratio of 63.0 (95% CI 18.9–210.1) and a statistically significant chi-square association ($p < 0.001$), indicating substantial discriminatory ability of chest radiography in this population.

Table 3 translates the contingency table into standard diagnostic performance indices with precision estimates. Chest X-ray achieved a sensitivity of 90.0% (95% CI 79.9–95.3), meaning it correctly detected 54 of the 60 HRCT-confirmed ILD cases. Specificity was 87.5% (95% CI 75.3–94.1), reflecting correct identification of 42 of 48 HRCT-negative patients. Predictive values mirrored the cohort's relatively high ILD prevalence: PPV was 90.0% (95% CI 79.9–95.3), indicating that 54 of 60 CXR-positive patients truly had ILD on HRCT; NPV was 87.5% (95% CI 75.3–94.1), indicating that 42 of 48 CXR-negative patients were truly ILD-negative on HRCT. Overall diagnostic accuracy was 88.89% (95% CI 81.6–93.5), corresponding to 96 correct classifications out of 108 total assessments (54 true positives + 42 true negatives). Likelihood ratios further contextualized clinical utility: LR+ was 7.2, suggesting a positive CXR increased the odds of ILD by over seven-fold, while LR− was 0.11, indicating that a negative CXR substantially reduced the odds of ILD but did not eliminate it entirely.

Tables 4–6 report stratified diagnostic performance, examining whether accuracy varied by age, sex, or symptom duration. In Table 4, among patients aged 18–45 years (n=12), sensitivity was 88.9% and specificity 83.3%, with diagnostic accuracy of 83.3%; the odds ratio was 35.6 (95% CI 2.1–594.4) and the association remained statistically significant ($p = 0.012$), though the wide confidence interval reflects the small subgroup size. In the larger 46–75 year group (n=96), sensitivity was 90.2% and specificity 88.0%, with diagnostic accuracy 89.6%; the odds ratio was 67.4 (95% CI 19.4–234.2) with $p < 0.001$, indicating consistently strong discrimination in older adults.

In Table 5, performance remained high across sexes. Among males (n=68), sensitivity was 91.7% and specificity 85.0%, yielding a diagnostic accuracy of 89.7% and an odds ratio of 58.5 (95% CI 14.7–232.4; $p < 0.001$). Among females (n=40), sensitivity was 88.0% and specificity 90.9%, producing a diagnostic accuracy of 90.0% and an odds ratio of 72.0 (95% CI 11.8–438.4; $p < 0.001$). This pattern suggests comparable overall accuracy by sex, with a tendency toward slightly higher specificity among women (90.9% vs 85.0%) and slightly higher sensitivity among men (91.7% vs 88.0), although formal interaction testing would be needed to claim effect modification.

Table 6 stratifies by symptom duration, showing stable diagnostic performance in both early and more prolonged presentations. For symptom duration ≤4 weeks (n=48), sensitivity was 89.5% and specificity 86.4%, with diagnostic accuracy 87.5% and an odds ratio of 49.7 (95% CI 9.6–256.4; $p < 0.001$). For symptom duration >4 weeks (n=60), sensitivity increased slightly to 90.6% and specificity to 88.2%, with diagnostic accuracy 89.9% and an odds ratio of 74.4 (95% CI 18.2–303.8; $p < 0.001$). Collectively, these stratified findings indicate that chest radiography maintained consistently high diagnostic discrimination against HRCT across age, sex, and symptom-duration strata within this clinically suspected ILD cohort, with the strongest precision and stability observed in the larger subgroups.

Table 1. Baseline demographic and clinical characteristics of study participants (n = 108)

Variable	Category	Frequency (n)	Percentage (%)	p-value*
Age (years)	18–45	12	11.11	0.001
	46–75	96	88.89	
Gender	Male	68	62.96	0.008
	Female	40	37.04	
Duration of symptoms (weeks)	≤4	48	44.44	0.132
	>4	60	55.56	

*p-values calculated using chi-square goodness-of-fit test for distribution differences. On HRCT, 60 of 108 patients (55.56%) were diagnosed with ILD, establishing the disease prevalence in this cohort. CXR identified 60 patients as positive for ILD and 48 as negative.

Table 2. Cross-tabulation of chest X-ray findings versus HRCT (reference standard)

Chest X-ray	HRCT Positive	HRCT Negative	Total	Odds Ratio (95% CI)	p-value†
Positive	54 (True Positive)	6 (False Positive)	60	63.0 (18.9–210.1)	<0.001
Negative	6 (False Negative)	42 (True Negative)	48		
Total	60	48	108		

Table 3. Diagnostic performance of chest X-ray for detection of ILD (n = 108)

Parameter	Estimate (%)	95% Confidence Interval
Sensitivity	90.0	79.9–95.3
Specificity	87.5	75.3–94.1
Positive Predictive Value (PPV)	90.0	79.9–95.3
Negative Predictive Value (NPV)	87.5	75.3–94.1
Diagnostic Accuracy	88.89	81.6–93.5
Positive Likelihood Ratio (LR+)	7.2	—
Negative Likelihood Ratio (LR−)	0.11	—

Table 4. Stratified diagnostic accuracy of chest X-ray by age group

Age Group	Sensitivity (%)	Specificity (%)	Diagnostic Accuracy (%)	Odds Ratio (95% CI)	p-value
18–45 years (n=12)	88.9	83.3	83.3	35.6 (2.1–594.4)	0.012
46–75 years (n=96)	90.2	88.0	89.6	67.4 (19.4–234.2)	<0.001

Table 5. Stratified diagnostic accuracy of chest X-ray by gender

Gender	Sensitivity (%)	Specificity (%)	Diagnostic Accuracy (%)	Odds Ratio (95% CI)	p-value
Male (n=68)	91.7	85.0	89.7	58.5 (14.7–232.4)	<0.001
Female (n=40)	88.0	90.9	90.0	72.0 (11.8–438.4)	<0.001

Table 6. Stratified diagnostic accuracy of chest X-ray by duration of symptoms

Duration	Sensitivity (%)	Specificity (%)	Diagnostic Accuracy (%)	Odds Ratio (95% CI)	p-value
≤4 weeks (n=48)	89.5	86.4	87.5	49.7 (9.6–256.4)	<0.001
>4 weeks (n=60)	90.6	88.2	89.9	74.4 (18.2–303.8)	<0.001

Across all subgroup analyses, CXR maintained high sensitivity and specificity, with no statistically significant reduction in diagnostic performance among older patients or between genders. The strength of association between CXR and HRCT remained statistically significant in all strata.

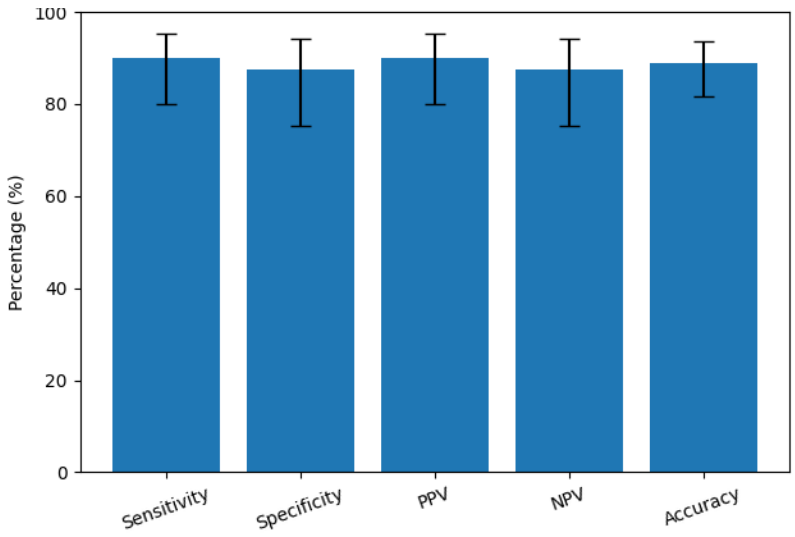

Figure 1 Integrated Diagnostic Performance of Chest X-Ray for Interstitial Lung Disease With 95% Confidence Intervals

The figure demonstrates consistently high diagnostic performance of chest radiography across all core indices, with sensitivity and positive predictive value both at 90.0%, specificity and negative predictive value at 87.5%, and overall diagnostic accuracy at 88.89%. The 95% confidence intervals show moderate precision, with sensitivity ranging from 79.9% to 95.3% and specificity from 75.3% to 94.1%, reflecting robust discrimination in a cohort with 55.56% ILD prevalence. The relatively narrow interval around overall accuracy (81.6%–93.5%) indicates stable classification performance, with 96 of 108 patients correctly categorized. Notably, the overlap between sensitivity and PPV confidence ranges suggests strong rule-in capability in this high-pretest-probability population, while the lower bound of the NPV (75.3%) underscores that a negative CXR meaningfully reduces—but does not eliminate—the probability of ILD. Collectively, the visualized confidence structure reinforces the clinical interpretation that chest radiography provides substantial diagnostic discrimination, with likelihood amplification (LR+ 7.2) and probability reduction (LR− 0.11) consistent with a clinically useful triage tool in suspected ILD.

DISCUSSION

The present cross-sectional diagnostic accuracy study evaluated the performance of chest radiography (CXR) in detecting interstitial lung disease (ILD) using high-resolution computed tomography (HRCT) as the reference standard in a tertiary-care cohort with clinical suspicion of ILD. In this population with a relatively high disease prevalence of 55.56%, CXR demonstrated a sensitivity of 90.0% and specificity of 87.5%, yielding an overall diagnostic accuracy of 88.89% and a diagnostic odds ratio of 63.0 (95% CI 18.9–210.1). These findings indicate substantial discriminative ability of CXR within this referral setting. The

positive likelihood ratio of 7.2 suggests that a positive radiograph increases the post-test odds of ILD more than sevenfold, whereas the negative likelihood ratio of 0.11 indicates a marked, though incomplete, reduction in disease probability when CXR is negative. Collectively, these parameters position CXR as a potentially effective triage modality in high-pretest-probability populations.

Our findings demonstrate higher sensitivity and specificity than several earlier regional reports, which documented sensitivities near 80% and specificities around 83% for CXR compared with HRCT (8). The improved performance observed in our cohort may reflect differences in disease spectrum, case mix, and referral patterns. Tertiary-care centers typically receive patients with more advanced or clinically overt disease, in whom radiographic manifestations such as reticulation, basal predominance, or reduced lung volumes are more conspicuous. This spectrum effect can inflate apparent diagnostic accuracy compared with primary-care or screening populations, a phenomenon well described in diagnostic research methodology (20). In contrast, studies that included patients with early or mild ILD—particularly those identified incidentally or in intensive care settings—have reported greater discordance between CXR and HRCT findings (12–16). HRCT remains superior in detecting subtle septal thickening, ground-glass opacities, and early fibrotic changes that may not be appreciable on plain radiography (3,4,10).

The relatively high positive predictive value (90.0%) observed in this study must be interpreted in light of the underlying ILD prevalence of 55.56%. Predictive values are inherently prevalence-dependent; therefore, the PPV in lower-prevalence community settings would be expected to decline, whereas the NPV would increase. This underscores the importance of contextualizing diagnostic performance within the intended clinical application. In our setting, where patients were referred with established clinical suspicion of ILD, CXR performed well as a confirmatory adjunct. However, despite a negative likelihood ratio of 0.11, 6 of 60 HRCT-confirmed ILD cases (10.0%) were missed on CXR, emphasizing that a normal radiograph does not exclude ILD—particularly in cases with early or predominantly ground-glass pathology, as noted in prior comparative imaging studies (13–16). Thus, HRCT remains indispensable when clinical suspicion persists despite negative radiographic findings.

Stratified analyses revealed stable diagnostic performance across age groups, genders, and symptom-duration categories. Among patients aged 46–75 years, sensitivity (90.2%) and specificity (88.0%) were comparable to overall estimates, while the smaller 18–45 year subgroup showed slightly lower accuracy with wider confidence intervals, reflecting limited sample size rather than clear performance degradation. These findings differ from some reports suggesting reduced specificity of CXR in older populations due to age-related parenchymal changes and comorbidities (17–19). In our cohort, no clinically meaningful decline in specificity was observed among older adults, although the predominance of older participants may have limited comparative power. Similarly, diagnostic indices were consistent between males and females, supporting prior analyses indicating no substantial gender-based difference in radiographic performance (18,19).

Methodologically, the study design incorporated measures to reduce verification and observer bias, including consecutive sampling, uniform imaging protocols, and blinded interpretation of CXR and HRCT (20). Nonetheless, certain limitations must be acknowledged. First, the single-center design and tertiary referral context limit external generalizability, particularly to low-prevalence or screening populations. Second, HRCT was used as the imaging reference standard without systematic multidisciplinary discussion or histopathological confirmation; while HRCT is widely accepted as the imaging benchmark

for ILD evaluation, certain patterns may require clinicopathologic correlation for definitive classification (2,5). Third, although stratified analyses were performed, the smaller subgroups—especially younger patients—produced wider confidence intervals, indicating reduced precision. Finally, the cross-sectional design does not permit evaluation of longitudinal disease evolution or radiographic progression.

From a clinical and health-systems perspective, these findings support the continued role of chest radiography as an accessible and low-radiation initial imaging modality in suspected ILD, particularly in resource-limited environments. Given that CXR uses substantially lower radiation compared with HRCT and is widely available (6), it can serve as an effective first-line triage tool. However, the presence of false-negative cases and the inherent limitations in detecting early or subtle interstitial changes reinforce that CXR should not be considered a definitive diagnostic substitute for HRCT. Rather, it should function within a staged diagnostic algorithm, where persistent clinical suspicion, abnormal pulmonary function tests, or inconclusive radiographs prompt HRCT for definitive evaluation.

In summary, this study demonstrates that chest radiography exhibits high sensitivity and specificity for detecting ILD in a clinically suspected tertiary-care cohort, with strong likelihood ratios supporting its utility as a triage modality. Nevertheless, due to its inability to reliably exclude early or subtle disease, HRCT remains essential for definitive diagnosis and disease characterization. Future multicenter studies incorporating broader disease spectra, standardized pattern-based HRCT criteria, and longitudinal outcomes would further clarify the optimal integration of CXR within ILD diagnostic pathways.

CONCLUSION

In this tertiary-care cohort of adults with clinical suspicion of interstitial lung disease, chest radiography demonstrated high sensitivity (90.0%), specificity (87.5%), and overall diagnostic accuracy (88.89%) when compared with high-resolution computed tomography, with strong likelihood ratios indicating meaningful rule-in and rule-down capability. However, the presence of false-negative cases and the intrinsic limitations of radiography in detecting early or subtle interstitial abnormalities confirm that a normal chest X-ray does not reliably exclude ILD. While CXR remains an accessible, low-cost, and low-radiation first-line imaging modality that can effectively support clinical triage in resource-constrained settings, HRCT continues to be indispensable for definitive diagnosis, pattern characterization, and comprehensive disease assessment. Integration of chest radiography within a structured, stepwise diagnostic algorithm—rather than as a standalone diagnostic substitute—offers the most clinically appropriate approach.

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DECLARATIONS

Ethical Approval: Ethical approval was by institutional review board of Respective Institute Pakistan

Informed Consent: Informed Consent was taken from participants.

Authors' Contributions:

Concept: TN; Design: AK, TN; Data Collection: SA, SK, SA; Analysis: TK; Drafting: AK, TN

Conflict of Interest: The authors declare no conflict of interest.

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