

Beyond The Radiologist’s Eye: A Meta-analysis of Artificial Intelligence-Assisted Chest X-ray for Pulmonary Tuberculosis Detection

Faiq Mustafa, Momina Mustafa
Department of Radiology Technology, KMU-IHS, Hazara.

BACKGROUND

- TB is a major global health challenge, with an approx. 10.7M people developing TB and 1.23M dying from the disease in 2024.
- Despite the accessibility and scalability of CXR, interpretation is limited by shortages of trained radiologists and substantial inter-reader variability, particularly in high-burden and resource-constrained settings.
- Artificial intelligence (AI)-based computer-aided detection (CAD) systems offer a scalable approach for automated CXR interpretation and TB triage.

OBJECTIVE

To evaluate the diagnostic performance of AI-assisted CXR systems for pulmonary TB detection and assess their potential role in screening and triage.

METHODOLOGY

5,651 records



21 studies



5 AI platforms analyzed



1 question: Can AI make TB

detection faster and more scalable?

- **4 major databases** searched:
 - PubMed • Web of Science
 - Embase • Cochrane Library
- **5 AI/CAD platforms evaluated:**
 - JF • CXR-1qXR • Lunit INSIGHT CXR
 - CAD4TB • InferRead DR Chest
- **Intervention:** AI-assisted CXR interpretation for pulmonary TB
- **Standard:** Microbiological or composite diagnostic standards
- **Diagnostic outcomes:**
 - Sensitivity • Specificity
 - Area under Curve

Pooled Diagnostic Performance of AI-assisted CXR

AI PLATFORM	Sensitivity %	Specificity %	AUC
CAD4TB	91	60	0.90
qXR	90	64	0.89
Lunit INSIGHT CXR	90	63	0.91
InferRead DR Chest	89	59	0.82
JF CXR-1	86	80	0.90

High Sensitivity → Better Case-Finding

Moderate Specificity → Confirmatory Testing still required



CXR processed by an AI/CAD system demonstrates automated identification and localization of radiographic abnormalities suggestive of pulmonary TB. Heat-map outputs can highlight regions requiring further clinical assessment.

RESULTS

- **Sensitivity:** 86–91% across five AI platform
- **Specificity:** 59–80%
- **AUC:** 0.82–0.91, indicating good discriminatory performance.
- Performance varied with software version, population, disease prevalence, and threshold selection.
- At thresholds targeting ~90% sensitivity, reported specificity was approximately 54–61% for CAD4TB, Lunit, and qXR.

WHY IN PAKISTAN?

- High TB Burden
- Limited Radiology capacity
- Proven scalability
- >1.2M people screened across >11,000 mobile camps (2017–2021)
- >7,600 TB cases detected through screening
- AI should support—not replace

KEY TAKEAWAYS

- ✓ AI can detect abnormalities that may be missed on CXR.
- ✓ AI-assisted CXR can expand TB screening capacity, especially where radiologists are scarce.
- ✓ Diagnostic performance varies with thresholds, populations, and disease prevalence.
- ✓ AI is best used for rapid, scalable triage—not standalone diagnosis.
- ✓ Molecular testing remains essential for confirmation following AI-based screening.

CONCLUSION

AI-assisted CXR shows promising potential as a high-sensitivity screening tool, but performance should be interpreted in the context of the clinical setting and intended use.

faiqmustafa985@gmail.com