Advancing Tuberculosis Diagnosis in Vietnam: Implementation of AI-Integrated Chest X-Ray Interpretation in Health Facilities

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BACKGROUND

Vietnam at-a-glance

A home for 98.8 million people across 63 provinces[1]

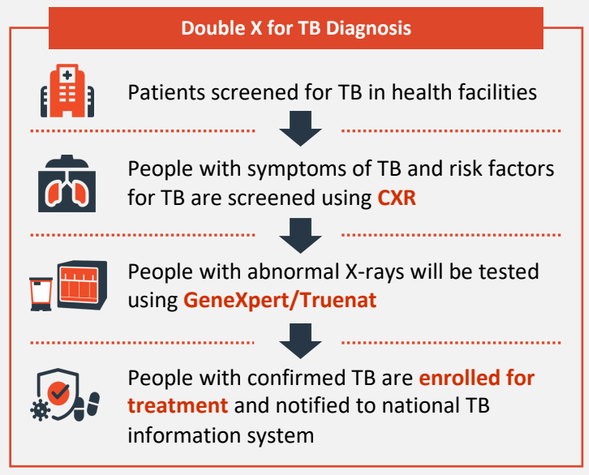
Among 30 high TB burden countries, with an estimated incidence of 182/100,000 population, 57% treatment coverage[2]

CAD-AI on demand

Quality of Chest X-ray (CXR) interpretation is critical for accurate triage for GeneXpert (Xpert) testing in the Double X model (2X)

Computer-aided Detection Artificial Intelligence (CAD-AI) was integrated programmatically into TB screening and triage 2X algorithms in health facilities in Vietnam

Double X strategy in health facilities



INTERVENTION

The USAID Support to End TB project integrated CAD-AI into the clinical workflow for TB diagnosis in priority provinces.

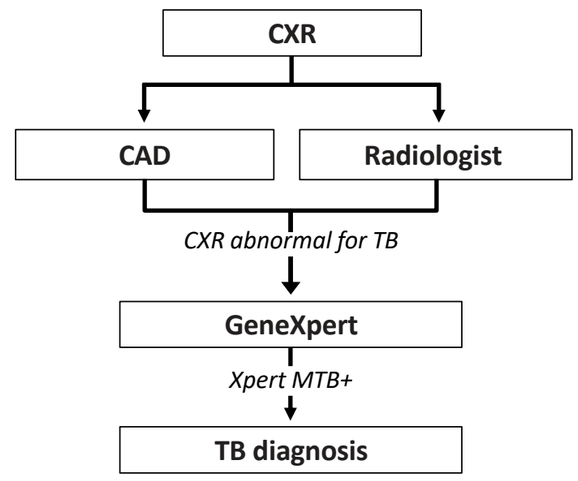
Analyzed **68,519 CXRs** in 2020-2021 to define thresholds and pilot two real-time models: AI-first and AI-parallel

Since 2022, CAD-AI has been applied in selected health facilities based on TB burden, CXR volume, and leadership commitment

Evidence-based standard operating procedure, specifying CAD-AI threshold and integration model

FIGURE 1. CAD-Parallel Model

CAD-AI Parallel Model in health facilities



CAD-AI parallel, threshold ≥ 0.6: software and human readers both interpret

RESULTS

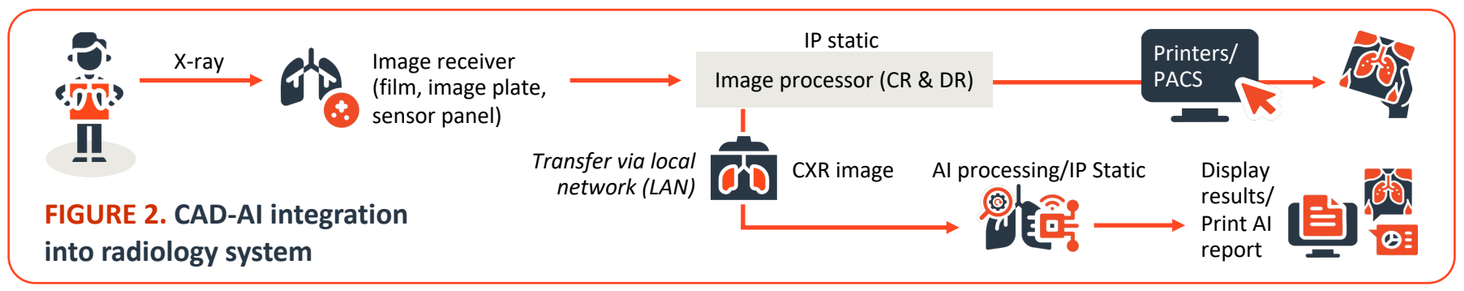


FIGURE 2. CAD-AI integration into radiology system

TABLE 1. TB detection results with CAD-AI integration

71,932 CXRs evaluated using CAD-AI

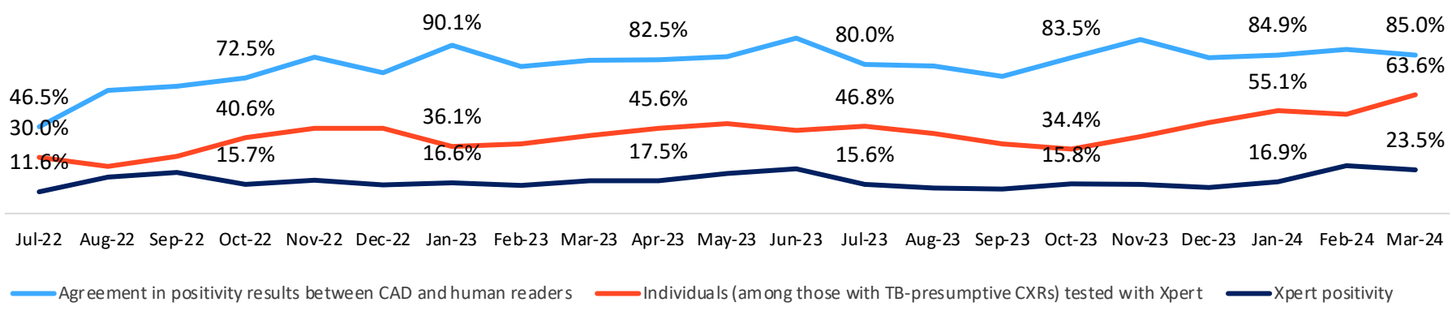
19.3% flagged as TB-presumptive

6,406 GeneXpert tests with **23.5% (+)** rate

1,644 TB notifications with yield of **2,286 per 100,000 CXRs**

Year	# of evaluated CXRs	# (%) of TB-presumptive CXRs	# (%) of people tested with GeneXpert (among TB-presumptive CXRs)	# (%) of people with positive Xpert results (among those with valid tests)	# of TB confirmed	Yield (per 100,000 CXRs)
Q3-2022	9,724	**1,390 (14.3%)**	**506 (36.4%)**	**156 (30.8%)**	179	**1,841**
Q4-2022	12,698	2,111 (16.6%)	1,015 (48.1%)	228 (22.5%)	244	1,922
Q1-2023	9,302	1,993 (21.4%)	867 (43.5%)	203 (23.4%)	222	2,387
Q2-2023	8,021	**1,850 (23.1%)**	**893 (48.3%)**	**231 (25.9%)**	251	**3,129**
Q3-2023	10,215	2,046 (20.0%)	878 (42.9%)	189 (21.5%)	199	1,948
Q4-2023	12,942	2,590 (20.0%)	1,182 (45.6%)	229 (19.4%)	254	1,963
Q1-2024	9,030	**1,859 (20.6%)**	**1,065 (57.3%)**	**272 (25.5%)**	295	**3,301**
Total	**71,932**	**13,839 (19.2%)**	**6,406 (46.3%)**	**1,508 (23.5%)**	**1,644**	**2,286**

FIGURE 3. CAD-AI integration results over time



In health facilities, we observed improvements in key areas, including increased concordance between AI and human readers, suggesting better alignment in diagnostic interpretations. The number of individuals tested with Xpert also rose, indicating wider use of this tool. Additionally, the Xpert positivity rate increased, possibly reflecting more accurate detection

CONCLUSIONS

Leveraging CAD-AI for chest X-ray analysis has significantly enhanced the accuracy, efficiency, and scalability of TB detection.

CAD-AI plays a transformative role in the future of TB detection, revolutionizing the process by improving accessibility, speed, and accuracy.

By equipping district-level facilities with advanced AI tools, CAD-AI bridges healthcare gaps and promotes greater health equity for the people and communities.

Radiologist using CAD-AI at health facilities. Credit: Trang Le/FHI 360

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References:
1. World Bank Report, 2023
2. WHO Global TB report, 2024

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