ELIMINATE TB PROJECT

Use of an AI-powered chest X-ray machine for TB screening. Photo Credit: MSH

TECHNICAL BRIEF

AI-POWERED CHEST X-RAY SCREENING FOR TB CASE FINDING: FIELD EXPERIENCE FROM ETHIOPIA

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BACKGROUND

Tuberculosis (TB) remains one of the leading infectious disease killers. Ethiopia is among the 30 high-burden countries identified by the World Health Organization (WHO), with a case detection rate that has historically remained below 80%, leaving a substantial proportion of infectious cases remaining undiagnosed and untreated in the community (WHO Global TB report 2025).

Symptom-based TB screening has long been practiced in Ethiopia and remains essential. However, it systematically misses asymptomatic cases and individuals who do not recognize or report symptoms, limiting its sensitivity as a standalone strategy (Churchyard et al. 2010; Divala et al. 2022). Reducing TB incidence and transmission therefore requires integration or more sensitive diagnostic tools.

AI-powered chest X-ray (AI CXR) interpretation offers a scalable solution. Chest X-ray has long served as a frontline TB screening tool, but deployment at scale has been constrained by shortages of trained radiologists, quality-controlled reading infrastructure, and digital imaging equipment, particularly in rural and remote health facilities. AI CXR platforms, including Qure.ai and CAD4TB (Delft), address this bottleneck through automated, standardized image triage without radiologist dependency. These tools generate a probability score or binary flag for TB-suggestive abnormalities, directing patients toward confirmatory GeneXpert testing or clinical evaluation (Mbulayi et al. 2025).

Prospective multi-site validation has demonstrated that AI CXR is non-inferior to radiologists for active pulmonary TB triage in populations with a high TB and HIV burden (Kazemzadeh et al. 2024). Systematic review and meta-analysis further confirm that AI software assists accurate and rapid clinical-decision making for TB diagnosis (Han et al. 2025), and that AI algorithms can outperform human readers in high-burden settings (Qin et al. 2021). Importantly, AI CXR has demonstrated benefits in resource-limited settings, enhancing TB detection and patient outcomes in high-volume public healthcare facilities (Raval et al. 2025).

Beyond TB, AI CXR has shown potential for detecting other pulmonary pathologies. A study from Japan identified other lung conditions in 11% of individuals screened for TB, highlighting the tools' broader clinical value (Kazemzadeh et al. 2024).

In Ethiopia, the national TB program—through the National TB and Leprosy/Lung Disease Directorate (NTBLLD)—introduced AI CXR capacity beginning with 4 machines (3 procured by REACH Ethiopia and 1 by Management Sciences for Health [MSH]) prior to 2023. Building on early field experience generated by MSH and partners, NTBLLD expanded AI CXR to 225 health facilities across 91 zones and 201 woredas. This expansion followed sustained advocacy highlighting AI CXR for detecting asymptomatic TB as a major milestone toward TB elimination. More than 70% of zones and 80% of woredas are within the Eliminate TB Project's supported regions.

Despite the rapid scale-up, field-level program data documenting AI CXR performance in Ethiopia have not previously been systematically reported. This technical brief describes the performance and operational experience of AI CXR screening across four project-supported regions from January 2025 to March 2026, using routine program data.

ELIMINATE TB PROJECT'S ROLE IN AI CXR IMPLEMENTATION

The Eliminate TB Project, led by MSH, was the first USG-supported initiative in Ethiopia to implement systematic AI CXR screening of high-risk asymptomatic individuals across its seven supported regions (Sidama, Amhara, Oromia, South Ethiopia, Central Ethiopia, Tigray, and Southwest Ethiopia) beginning in 2023.

Findings from an initial pilot in 10 hospitals were presented at the TB Research Advisory Council (TRAC) conference in Gondar, Ethiopia in 2023, where the project advocated for national scale up of AI CXR as a TB screening tool. In that pilot, 1,494 asymptomatic TB high-risk groups were identified, of whom 14% (205) had abnormal CXR and 13.3% (194) were diagnosed with TB, predominantly clinically diagnosed pulmonary TB (82%).

This field evidence contributed to the formal integration of AI CXR into Ethiopia's national TB and TB/HIV guidelines. NTBLLD procured and introduced 225 machines to use for screening high-risk population groups, including people living with HIV (PLHIV), prison inmates, people with diabetes, TB contacts, and health care workers (HCWs). The project provided technical support for distribution, screening, and interpretations. In collaboration with NTBLLD, the project facilitated onsite orientation and training for technicians and clinicians. The project developed and piloted AI CXR service request formats and registration for screening, which was later adopted by the national TB program. The optimal use of the AI CXR at the community and facility levels has also been facilitated and coordinated by the project.

This analysis covers screening activity across project-supported regions. Screening was conducted in two modalities: facility-based (static CXR units) and community/vulnerable population outreach. Data was collected through routine program monitoring using a structured aggregate reporting tool during screening. The project tracks a full diagnostic cascade from screening through treatment initiation and, where applicable, TB preventive treatment (TPT). Data spans January 2025 to March 2026 (15 months).

TB SCREENING ALGORITHM

In Ethiopia, high-risk priority groups for TB includes household contacts, PLHIV, HCWs, people with diabetes, malnourished individuals, prison inmates, internally displaced persons (IDPs), miners, and people in congregate settings, who are eligible for facility- and community-based AI CXR screening. At health facilities, asymptomatic high-risk individuals undergo AI CXR screening, and those with TB-suggestive findings (e.g., computer aided detection [CAD] score >0.6) receive rapid diagnostic testing, followed by treatment initiation if positive or clinical assessment if negative. At the community level, both high-risk and general populations undergo simultaneous symptom and AI CXR screening, with different CAD thresholds guiding eligibility for GeneXpert testing (figure 1).

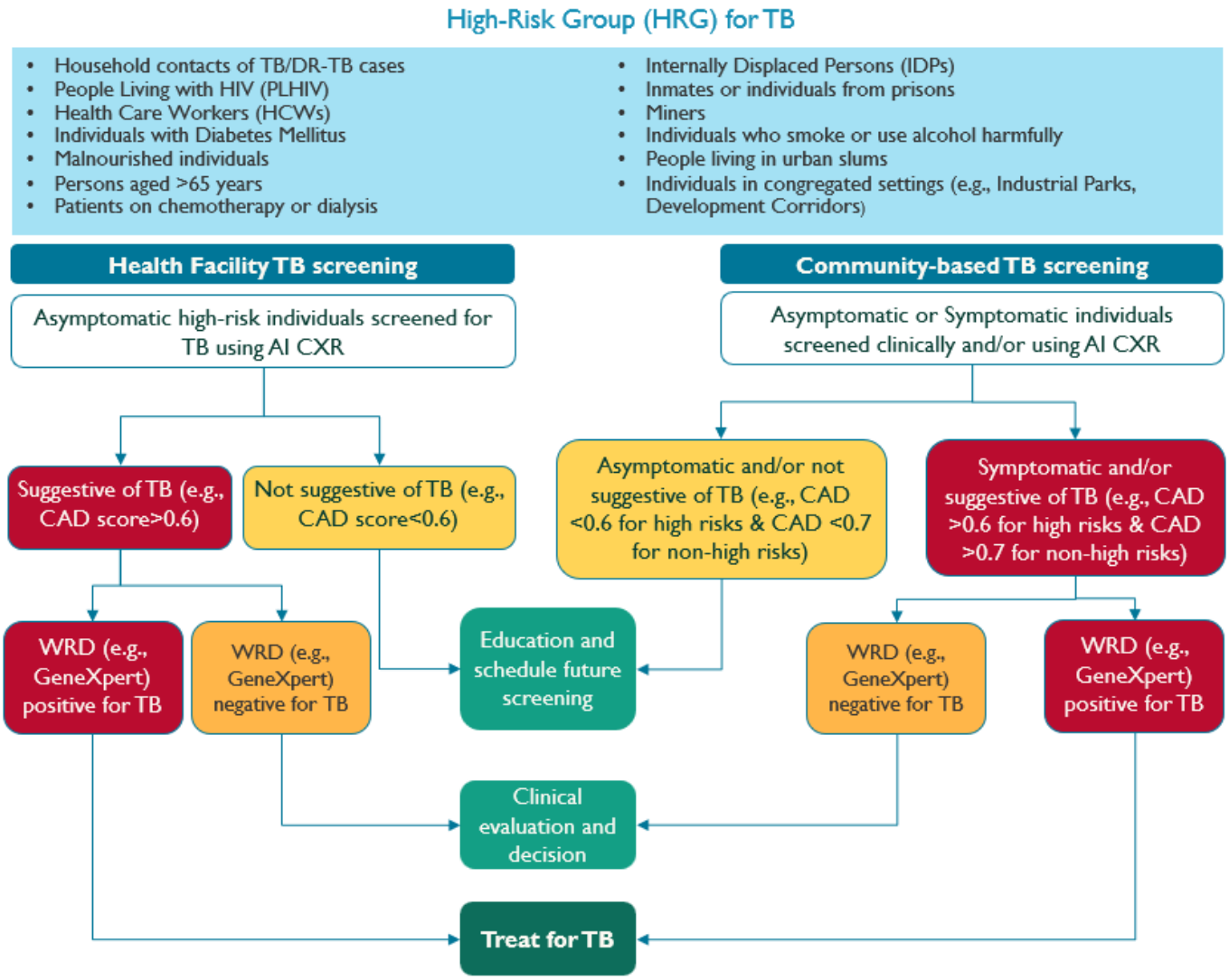

Figure 1. Approaches of using AI CXR at health facilities and community-based screening

Note: WRD = WHO-recommended rapid diagnostic test

RESULTS AND ACHIEVEMENTS

PERFORMANCE BY HIGH-RISK POPULATION GROUP

Nationally, between 2023-2025, a total of 138,157 individuals were screened using AI CXR where 22,752 (16.4%) were people with presumed TB and 3,550 (3%) had TB. Project-supported regions contributed to 93,628 (68%) of nationally screened, 15,615 (69%) of the identified people with presumed TB, 13,735 (67%) of GeneXpert tests, and 2,974 (84%) of TB cases detected (figure 2).

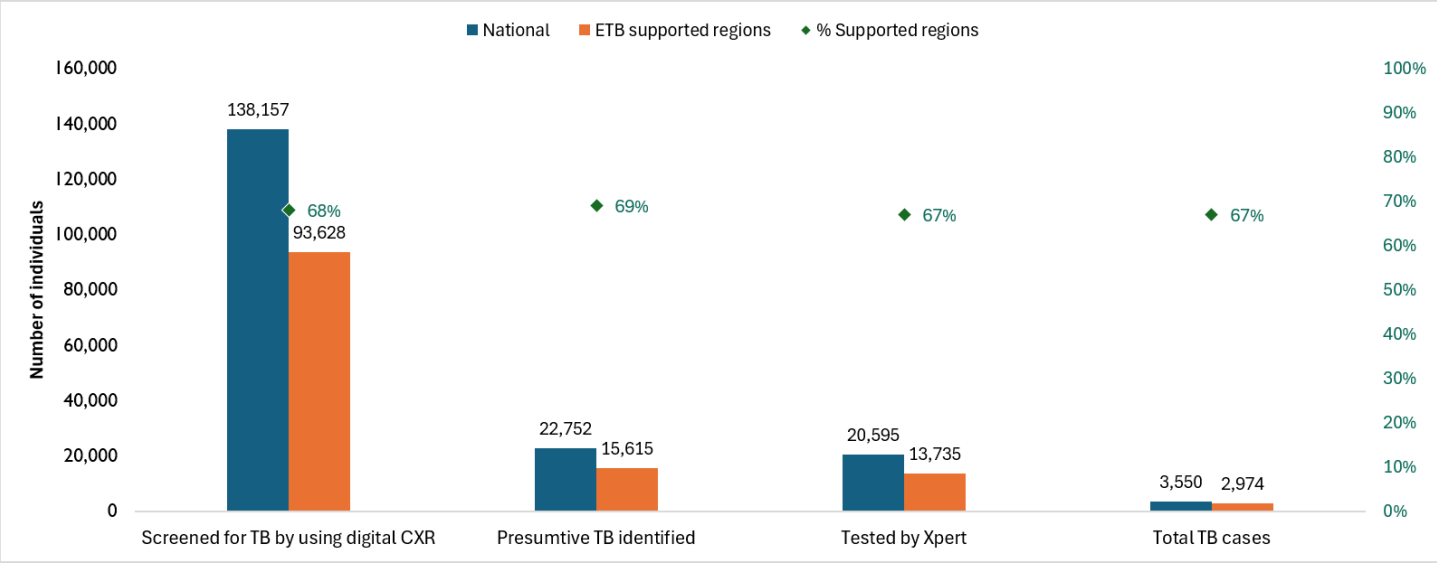

Figure 2. TB screening of AI-powered CXR performance, 2023–2025

Of the screened vulnerable populations, the people with presumed TB were higher in community-based screening sites (25.6%), and among those with diabetes or other noncommunicable diseases (22.9%) and IDPs (67.6%). Of the screened, 22.6% (7,100) were identified as presumed with TB and 73.2% of those with presumed TB (5,189) were tested using GeneXpert. Of those tested, 1,660 TB cases were identified, 54.9% were bacteriologically confirmed TB (BCTB) cases, and 45.1% were cases clinically diagnosed with TB (table 1).

Table 1: Performance of AI CXR by population in project-supported regions, January 2025–March 2026

Vulnerable population	Screened	Suggestive of TB		Xpert test		TB cases			NNS	NNT
	#	#	%	#	%	# BCTB	# total	%		
IDPs (5	593	401	67.6	107	26.7	11	30	36.7	20	4
Community	18,152	4,650	25.6	3,088	66.4	592	1,123	52.7	16	3
Contacts	4,525	882	19.5	864	98.0	128	201	63.7	23	4
OPD/DM	3,490	799	22.9	762	95.4	127	206	61.7	17	4
HCWs	781	60	7.7	60	100.0	1	2	50.0	391	30
HIV	876	92	10.5	92	100.0	14	26	53.8	34	4
Prison	2,959	216	7.3	216	100.0	39	72	54.2	41	3
Total	31,376	7,100	22.6	5,189	73.2	912	1,660	54.9	19	3

Note: NNS = number needed to screen; NNT = number needed to test

PERFORMANCE BY SCREENING SETTINGS

The proportion of individuals identified with presumed TB was higher in facility-based screening than in community-based screening (25.4% versus 16.7%). Among diagnosed TB cases, bacteriological confirmation was higher in community-based screening (65.3%) than in facility-based screening (51.0%) (table 2). The lowest number needed to screen was observed in Oromia (16), followed by health facility screening (18), and diabetes/outpatient department screening (17).

Table 2: Performance of AI CXR screening by facility and community in project-supported regions, January 2025–March 2026

Setting	Screened	Presumed with TB		GeneXpert tested		TB cases		
	#	#	%	#	%	BCTB	Total	% BCTB
Communi	10,125	1,687	16.7	1,710	101.4*	301	461	65.3
Facility	21,282	5,413	25.4	3,746	69.2	611	1,199	51.0
Total	31,407	7,100	22.6	5,456	76.8	912	1,660	54.9

Note: Some cases are referral tests therefore the numerator became larger than the denominator.

INCIDENTAL FINDINGS: NON-TB LUNG PATHOLOGY

In the screening activity at Assela hospital, there were 552 individuals that underwent screening using AI CXR. About 8% (44) were found to be suggestive of TB, where 93% (41) were tested, and 29% (12) had TB and were put on anti-TB drugs. Among the screened individuals, 41% (228) were not suggestive of TB but had other lung lesions, indicating another dimension of the use of AI beyond TB for other lung diseases, contributing to the priorities of the NTBLLD of the Federal Ministry of Health.

TB PREVENTIVE TREATMENT UPTAKE

TPT was initiated for 1,275 (79% of the eligible) individuals among vulnerable populations with results not suggestive for TB after AI CXR screening was conducted. The coverage was 81% for the vulnerable population, excluding the general community screening, which was only 45% (table 3).

Table 3: TPT provision for eligible population after AI-powered CXR screening, January 2025–March 2026

Category	Variable	Eligible for TPT	Put on TPT	TPT coverage %
Regions	Amhara	5	5	100.0
	Oromia	824	530	64.3
	South Ethiopia	314	262	83.4
	Southwest Ethiopia	478	478	100.0
	Total	1,621	1,275	78.7
Settings of screening	Health facility	224	195	87.1
	Community	1,397	1,080	77.3

Category	Variable	Eligible for TPT	Put on TPT	TPT coverage %
	Total	1,621	1,275	78.7
Vulnerable population	IDP	40	38	95.0
	Community	93	42	45.2
	Contacts	200	178	89.0
	DM/OPD	90	78	86.7
	PLHIV	40	31	77.5
	Prison	1,158	908	78.4
	Total	1,621	1,275	78.7

Note: TPT = TB preventive treatment; IDP = internally displaced person; DM = diabetes mellitus; OPD = outpatient department; PLHIV = people living with HIV.

OPERATIONAL CHALLENGES

Scale-up of AI CXR in Ethiopia has surfaced several operational challenges that require programmatic attention:

- **Operational guidance gaps**: Clear, standardized protocols for machine management, calibration, and troubleshooting in field settings are not yet fully established.
- **Data harmonization**: Differences in data collection methodologies across sites and platforms complicate pooled analysis and routine monitoring. Standardization of aggregate reporting tools is an ongoing need.
- **Technical maintenance capacity**: Building a sustainable pool of trained technicians to maintain AI CXR machines in decentralized settings remains a priority.
- **Non-TB lung findings**: The significant proportion of incidental non-TB abnormalities identified by AI CXR (41.3% at Assela Hospital) poses a challenge in the absence of adequate radiologist capacity for clinical follow-up and management of these findings.

LESSONS LEARNED AND WAY FORWARD

Screening using AI CXR detected a high proportion of people with suggestive TB (22.6%), which is far higher than the routine presumptive TB identification of outpatient department screening (<5%). Additionally, the proportion of TB cases identified is (5.3%) also much higher than the routine clinical screening (<0.1%). Community-based tailored AI CXR screening after mapping hotspot settings and vulnerable populations was shown to be a higher yield than health facility-based screening. Very importantly, the proportion of BCTB was as high as 65%, indicating that, had it not been for AI CXR, 912 asymptomatic infectious TB cases could have been missed in the community (33%) and health facilities (67%), fueling TB transmissions.

AI CXR has the potential to support integrated screening for TB and other lung conditions. The identification of a substantial number of non-TB lung abnormalities suggests that AI CXR screening may be cost-efficient when incorporated into broader respiratory health services. It remains a key tool for detecting

asymptomatic TB cases and can also support clinical evaluation of patients with TB-suggestive findings, contributing to progress toward TB elimination. Regular facility- and community-based screening should be scheduled and tailored to TB hotspot settings and high-risk populations.

The scale up of AI CXR resulted in the detection of asymptomatic infectious TB cases that could have fueled TB transmission in the community. AI CXR screening could contribute to the elimination of TB in Ethiopia by implementing systematic screening of high-risk populations for TB.

RECOMMENDATIONS

- Expand systematic AI CXR screening to additional high-yield settings, prioritizing community outreach in high-burden woredas and congregate settings (prisons, IDP camps, diabetes clinics).
- Strengthen data systems by integrating AI CXR reporting into DHIS2 to enable real-time monitoring of the screening cascade, reduce reliance on parallel aggregate tools, and improve data quality.
- Develop tele-radiology capacity or referral pathways to address the significant volume of incidental non-TB lung findings detected at scale.
- Explore integration of AI CXR into broader respiratory health programming to maximize the cost-efficiency of the infrastructure already deployed.

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