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CAD4TB's precision play: Threshold 45% optimizes TB screening in West Nile's high burden setting of Uganda.

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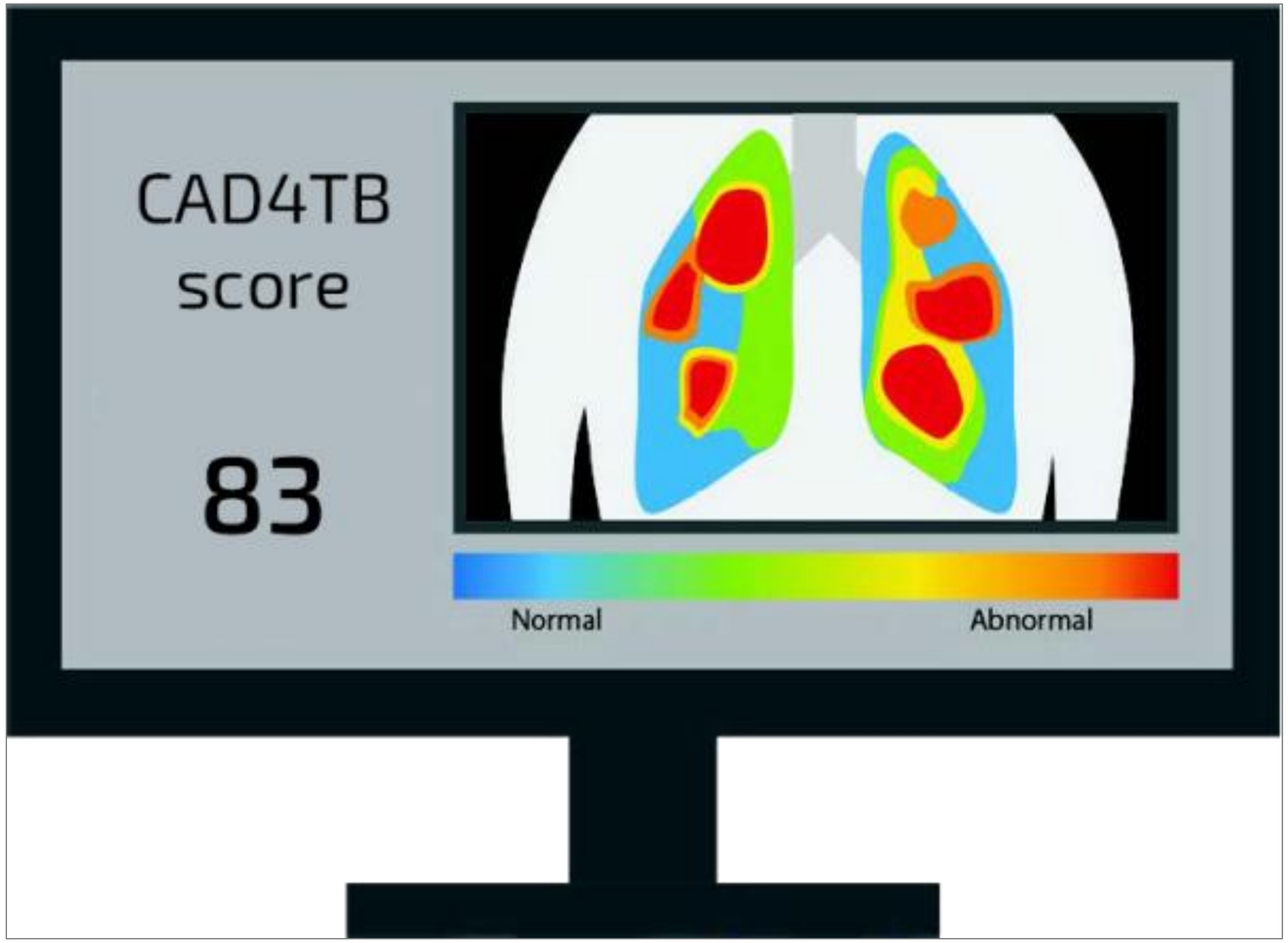
BACKGROUND

- Uganda adopted the use of artificial intelligence (AI)-assisted tuberculosis (TB) screening using computer-aided diagnosis for TB (CAD4TB) software for interpretation (scores of 0-100).
- Nationally, a CAD4TB score of 50% and above identifies presumptive TB patients triggering sample collection for GeneXpert confirmation.
- While this threshold balances sensitivity and specificity, West Nile's high TB burden suggests that locally adjusted thresholds could improve case detection.
- The 2024 CAST+ campaign applied a lower threshold of 30% to maximize detection, but this approach led to substantially higher referral rates.

STUDY OBJECTIVE

- The main objective was to evaluate CAD4TB v7 in West Nile to identify an optimal threshold against these standards of 30% and 50%.

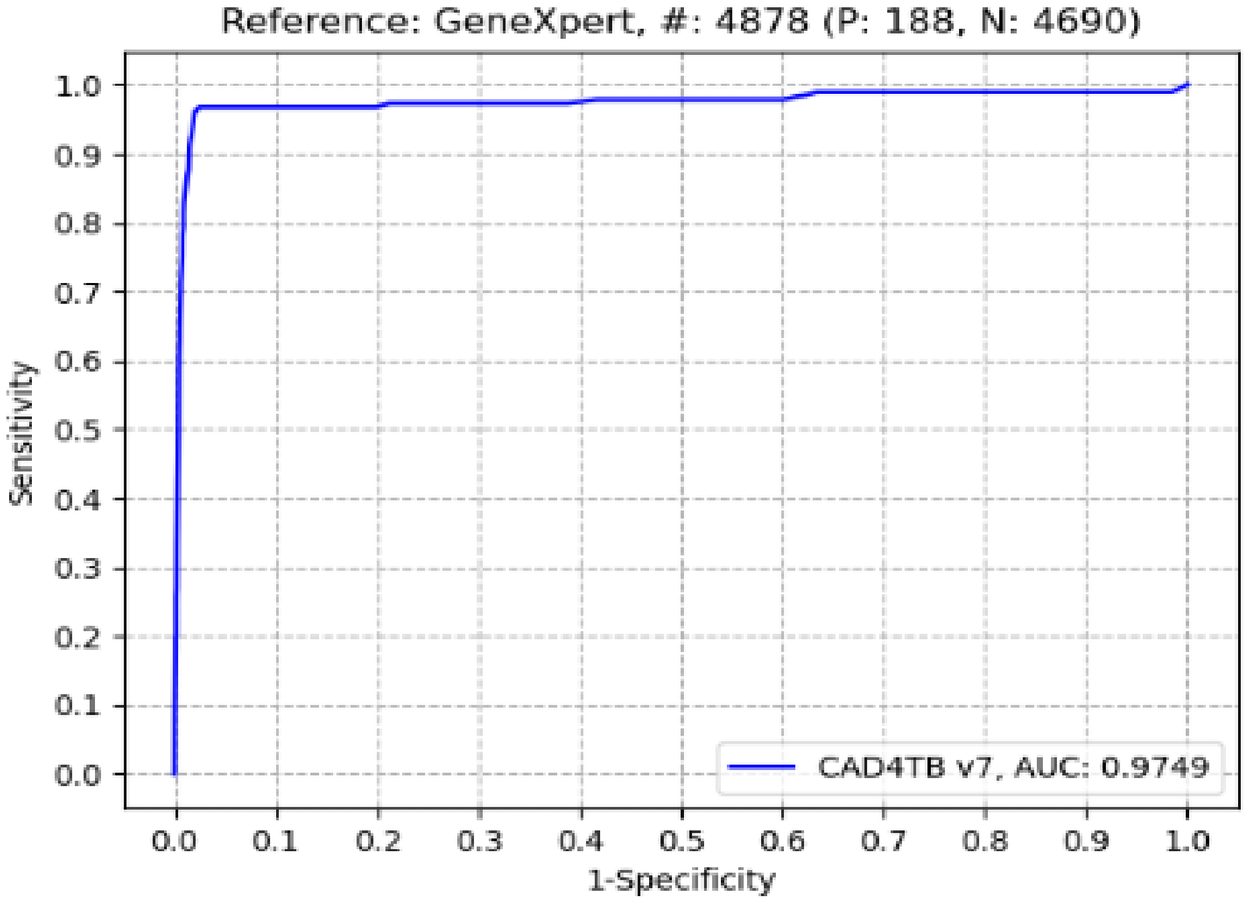


METHODS

- A retrospective cross-sectional study was conducted in the West Nile region of Uganda among individuals screened for tuberculosis (TB) using computer aided digital x-ray between 2021 and 2024.
- A total of 6,000 records were included, with 188 GeneXpert-confirmed TB-positive and 4,690 TB-negative. CXRs were analyzed using CAD4TB version 7. 1,122 were NA for GeneXpert and thus were excluded from the analysis.
- Receiver Operating Characteristic (ROC) analysis assessed diagnostic performance including sensitivity, specificity, referral burden, number needed to test (NNT), and positivity yield at thresholds 30% (CAST+), 45%, and 50% (national).

RESULTS

The figure below shows the ROC curve showing the diagnostic performance of CAD4TB v7 against GeneXpert results



- The area under the curve (AUC = 0.9749) indicates excellent discriminative ability to distinguish TB-positive from TB-negative cases, confirming high accuracy of the CAD4TB algorithm for TB screening in the study population.
- Threshold 45% achieved **96.81%** sensitivity (95% CI: 93.1-98.9%) and **94.22%** specificity (95% CI: 93.5-94.9%), detecting **182** of **188** TB cases with **453** referrals (NNT=2, yield=40%).

RESULTS (cont'…)

Threshold	Sensitivity (%)	Specificity (%)	# confirmed TB	# Referred for test	NNT	Positivity yield
0	100	0	188	4878	26	4%
5	98.94	12.07	186	4310	23	4%
10	98.94	30.26	186	3457	19	5%
15	97.87	42.49	184	2881	16	6%
20	97.87	50.23	184	2518	14	7%
25	97.87	58.46	184	2132	12	9%
30	97.34	70.3	183	1576	9	12%
35	96.81	80.28	182	1107	6	16%
40	96.81	86.18	182	830	5	22%
45	96.81	94.22	182	453	2	40%
50	96.28	98.02	181	274	2	66%
55	84.57	98.96	159	208	1	76%
60	75	99.23	141	177	1	80%
65	63.3	99.51	119	142	1	84%
70	48.94	99.64	92	109	1	84%
75	28.72	99.81	54	63	1	86%
80	24.47	99.85	46	53	1	87%
85	19.68	99.89	37	42	1	88%
90	13.83	99.94	26	29	1	90%
95	6.91	99.98	13	14	1	93%
100	0	100	0	0	0	0

- Uganda's threshold 50 yielded **96.28**% sensitivity (95% CI: 92.5-98.6%) and **98.02%** specificity (95% CI: 97.6-98.4%), identifying **181** cases with 274 referrals (NNT=2, yield=66%). The sensitivity gain at 45 (+0.53%, p=0.045) detected one additional case, with a specificity trade-off (-3.8%, p<0.001).
- Compared to CAST+'s 30 (**97.34**% sensitivity, **70.3%** specificity, **1,576** referrals, 12% yield), threshold 45 reduced referrals by 71% (1,123 fewer, p<0.001) while maintaining near-identical detection (p=0.32).

CONCLUSIONS

- CAD4TB v7 demonstrated diagnostic accuracy exceeding WHO's target performance for TB screening tools.
- While Uganda's current threshold of 50% maintains high specificity and efficiency, a locally optimized score of 45% offered a modest gain in sensitivity with manageable referral increases.
- These findings support the integration of CAD4TB into national screening programs with context-specific threshold adjustments to maximize case detection while preserving operational efficiency.

STUDY IMPLICATIONS

The study provides evidence for revising Uganda's current national CAD4TB threshold (50%) to locally validated cutoff (like 45%) to capture additional TB cases without overwhelming diagnostic services.

Adopting an optimized threshold reduces unnecessary referrals compared to lower cutoffs (e.g., 30%), improving cost-effectiveness and laboratory workload balance.

Continuous monitoring across regions and risk groups (e.g., PLHIV, miners, refugees) will help refine thresholds for equitable, data-driven TB detection.

Limitations: This retrospective study relied on existing program data, which may have introduced selection bias and limited control over image quality and participant characteristics.

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THANK YOU

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