CAD4Kids: Advancing AI-assisted Chest X-Ray Interpretation for Paediatric Tuberculosis

Performance Evaluation Across High Burden Settings

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01

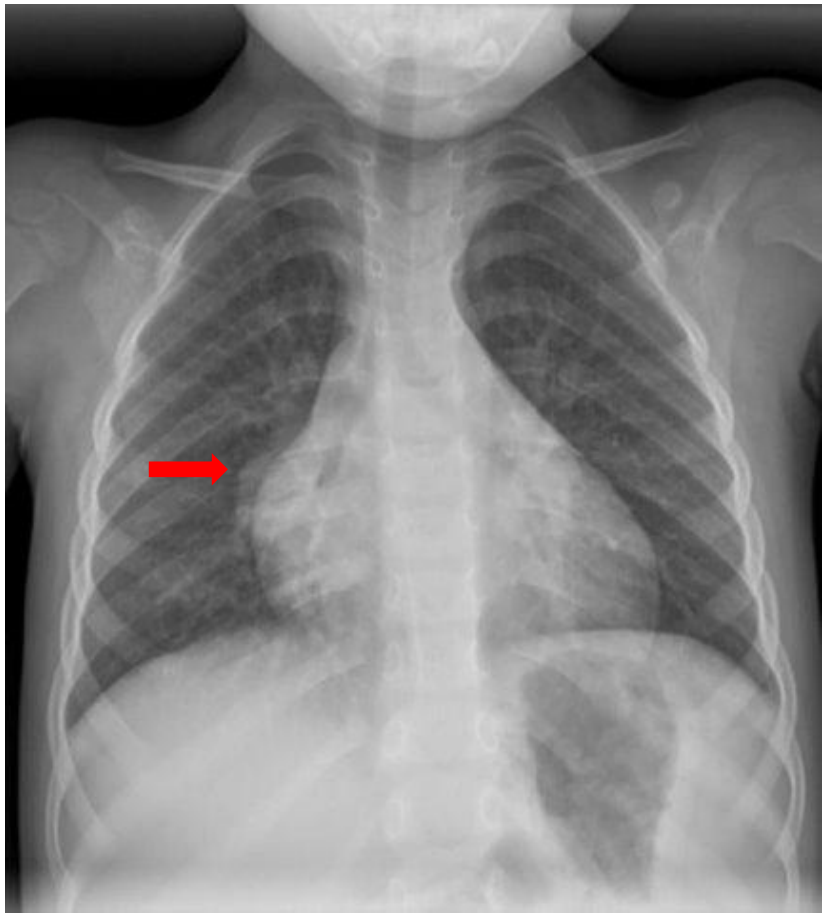
CAD4KIDS

Automatic interpretation of frontal Chest X-rays

The reason behind CAD4Kids

- **Chest X-ray (CXR**) remains a key component of the **TB diagnostic pathway**.
- Reading **CXRs in children** is a complex task due to subtle abnormalities and lower image quality. This requires substantial expertise which is often lacking in high-buren countries.
- Current **CAD** products are mostly focused on adults and are not optimized for the TB in children, especially under 5 years old
- To address these gaps, **CAD4Kids** was developed.

CXR shows enlarged perihilar lymph nodes on the right. Union Atlas.



02

Software Design

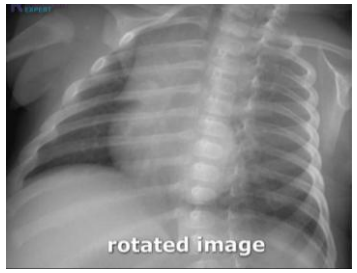
Software Design

- **X-rays** (AP and PA) were collected from over 15 countries from children 0-15. Images came from several continents, settings and patient populations. Data included lower quality x-rays with several types of issues, often seen in practice

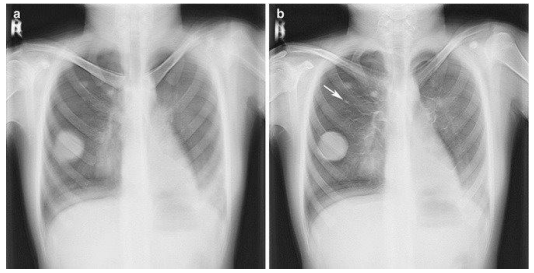
- A **CAD4Kids** module has been developed as a **screening** and **triaging tool for** frontline healthcare workers, assisting with determining normal vs abnormal CXRs.

- In this research we validate its performance for detecting **normal vs abnormal findings** in frontal CXRs using retrospective frontal X-rays from three countries

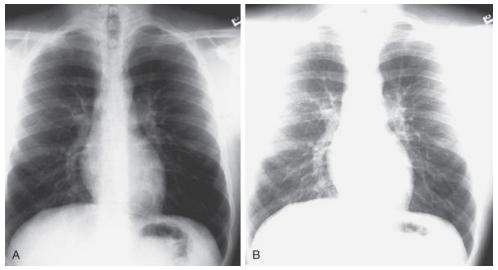
Vertical rotation



Movement artifact

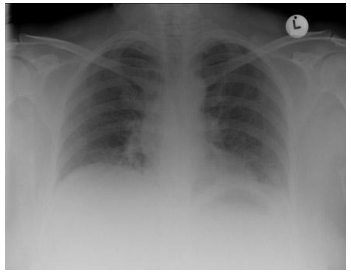


Under/Over penetration



Narrow/wide collimation

Under inspiration



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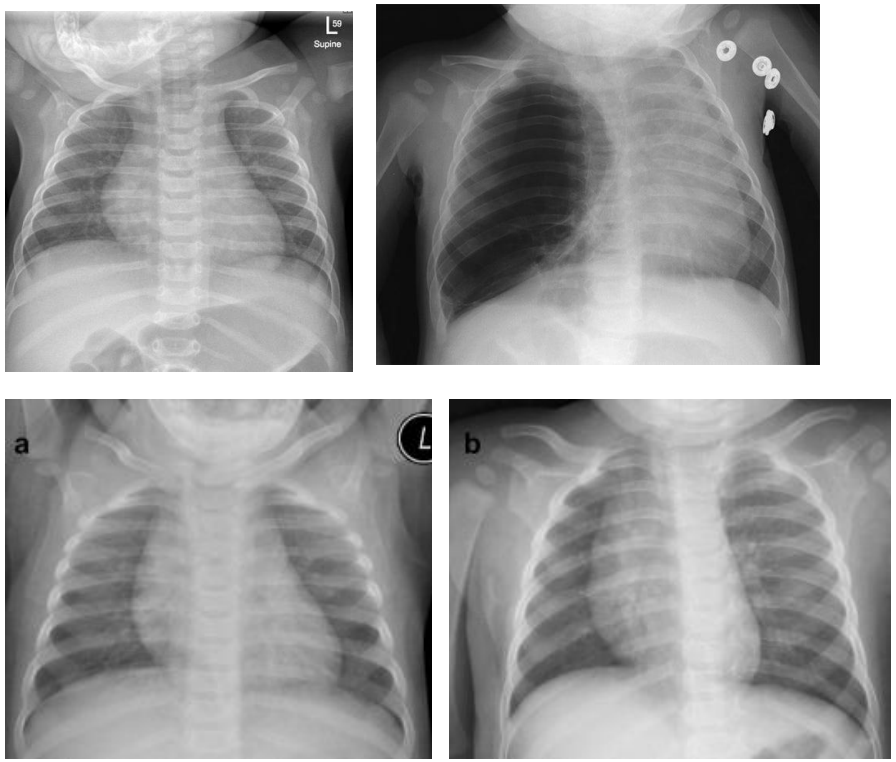
Study Objective & Methods

Dataset Description

- A total of **508 chest X-rays (CXRs)** were collected from **three high TB-burden countries:**
  - Eswatini
  - Mozambique
  - Uganda
- The cohort had a **mean age of 3.3 years**, representing a **very young and challenging population for radiological interpretation**.
- Use of **multi-country data** ensured the evaluation reflected **diverse imaging conditions** and real-world TB program settings.



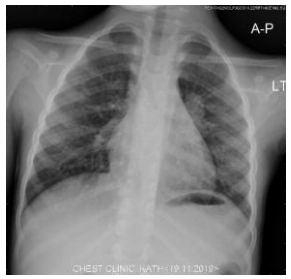
Methods

X-ray interpretation

- All images were **read by a general physicians** for abnormality including specific radiological abnormalities:

Opacity

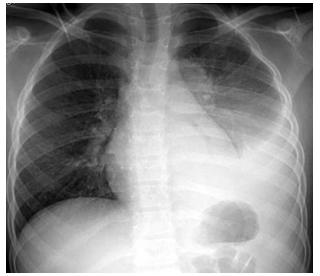
Lymph Node Enlargement



Miliary pattern

Cavity

Pleural Effusion



- Cases in which the physician deemed **uncertain/unclear** were **re-reviewed by an expert radiologist** to ensure a robust **reference standard**.

Statistical Analysis

- **CAD4KIDS performance** was evaluated against the final read (physician or expert radiologist. Performance of the CAD model was assessed by generating an ROC-AUC including sensitivity and specificity at certain thresholds.

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Results

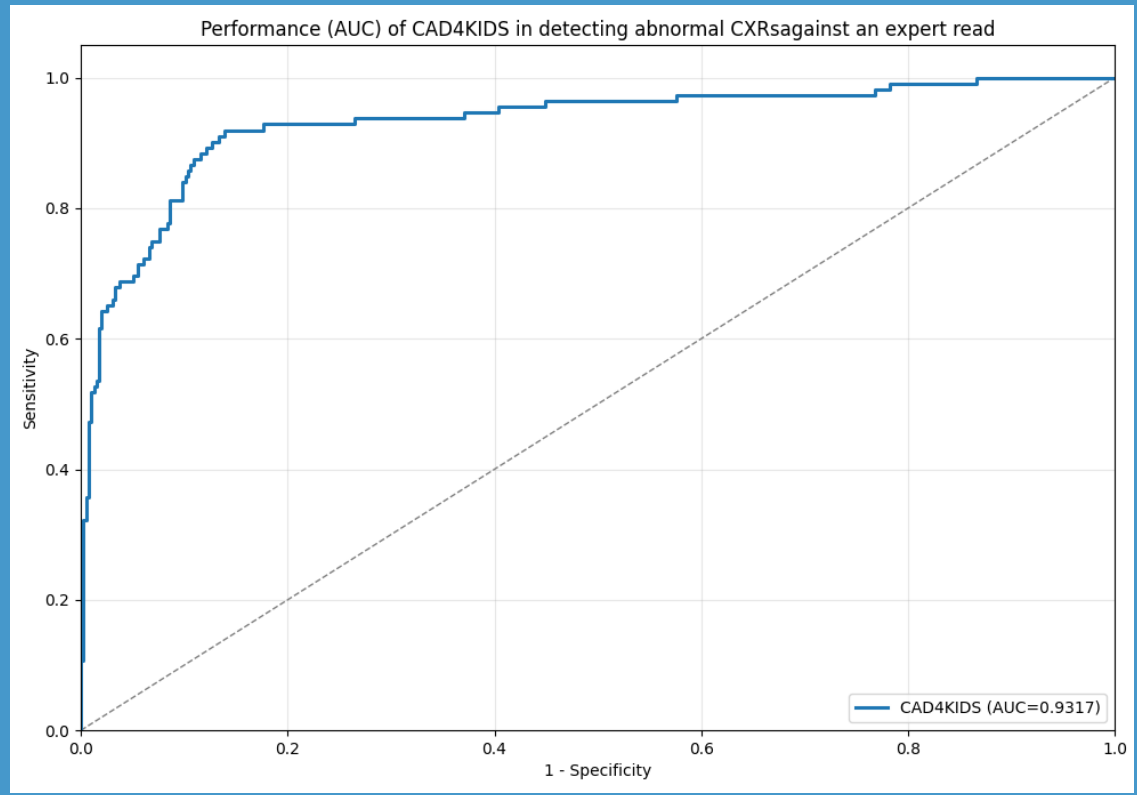
Results

Overall results

- In total, **209/508 CXRs** were **re-reviewed** by the expert radiologist, a total of **102 images classified as abnormal**.
- **CAD4KIDS** achieved an **AUC of 0.93**. At a threshold of **51.7**, performance reached **92% sensitivity** and **86% specificity**.

Specific findings

- **False positives** included **pleural effusion** (n=1) and **lymph node enlargement** (n=1).
- At a lower threshold (**18.4**), **sensitivity increased to 95%**, with **specificity decreasing to 63%.**



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Discussion & Conclusions

Discussion & Conclusions

- **CAD4Kids** showed high **diagnostic performance** for detecting **radiological abnormalities** in **young children** across **multiple settings**.
- Findings support **paediatric CAD** as a **digital decision-support tool** to strengthen TB detection rates, while additional **clinical oversight** remains essential for **complex cases.**
- Careful selection of **thresholds** can prioritize **sensitivity** or **screening efficiency**, may significantly improve the **TB care cascade.**
- In summary, this study shows **CAD** can be a valuable tool in the **paediatric TB diagnostic pathway**, particularly where **CXR interpretation expertise is limited**.

DELFT IMAGING

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