The Union

International Union Against Tuberculosis and Lung Disease

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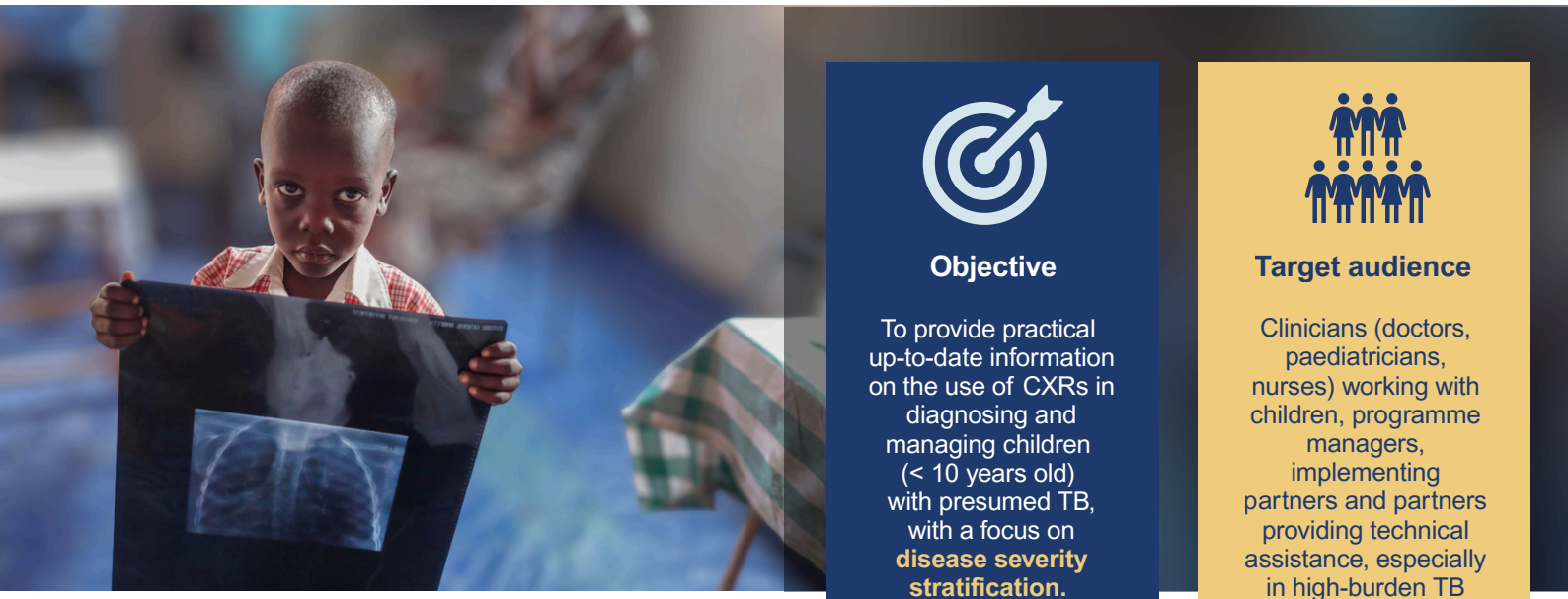
THE ROLE OF CXRs TO DIAGNOSE AND MANAGE CHILDREN WITH PRESUMED TUBERCULOSIS



Objective

To provide practical up-to-date information on the use of CXRs in diagnosing and managing children (< 10 years old) with presumed TB, with a focus on **disease severity stratification.**

Target audience

Clinicians (doctors, paediatricians, nurses) working with children, programme managers, implementing partners and partners providing technical assistance, especially in high-burden TB countries.

INTRODUCTION

Chest X-rays (CXRs) are a crucial tool in the diagnosis and management of childhood TB.

WHEN ARE CXRs USED IN THE CONTEXT OF CHILDHOOD TB:

Screening

To investigate children who are minimally symptomatic or asymptomatic but have recent TB exposure or latent TB infection to exclude active TB disease

Diagnosis

To investigate children with symptoms compatible with TB*, to distinguish between active TB disease and other childhood illnesses

Disease severity stratification

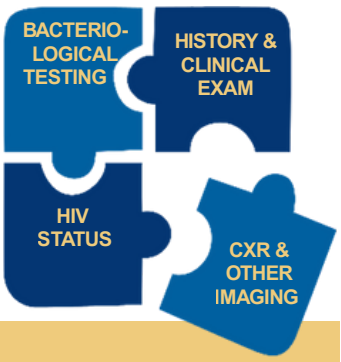
To distinguish between severe and non-severe disease so that the correct treatment regimen duration can be selected.

Treatment response monitoring

To evaluate radiological response to TB treatment in children, particularly in those with suboptimal clinical response and/or underlying co-morbidities.

WHY ARE CXRs USEFUL TO DIAGNOSE AND MANAGE CHILDHOOD TB?

- There is no diagnostic test for childhood TB with perfect performance.
- TB symptoms in children are non-specific and overlap with other common childhood illnesses.
- Collecting respiratory samples for bacteriological testing is not always feasible in all settings, and current bacteriological tests have lower sensitivity in children than in adults.
- CXRs remain the most widely available and accessible chest imaging tool.
- CXR evaluation is included in the WHO's Treatment Decision Algorithms for paediatric TB.
- Diagnosing childhood TB requires putting multiple pieces of information together, and CXR is an important piece of this diagnostic puzzle.



***Symptoms compatible with TB**

- Cough > 2 weeks
- Fever > 2 weeks
- Weight loss or no weight gain
- Lethargy/less playful

WHAT CXR FEATURES ARE SPECIFIC TO TB?

In a child presenting with symptoms compatible with TB, the following CXR features are very specific to childhood TB:

- Enlarged intra-thoracic lymph nodes (hilar, paratracheal, subcarinal)
- Ghon focus or complex
- Airway compression or deviation
- Miliary pattern
- Cavitation
- Pleural or pericardial effusions

Features that are commonly seen in childhood TB but are less specific and also seen in children with other common childhood illnesses such as pneumonia:

- Consolidation
- Collapse/atelectasis

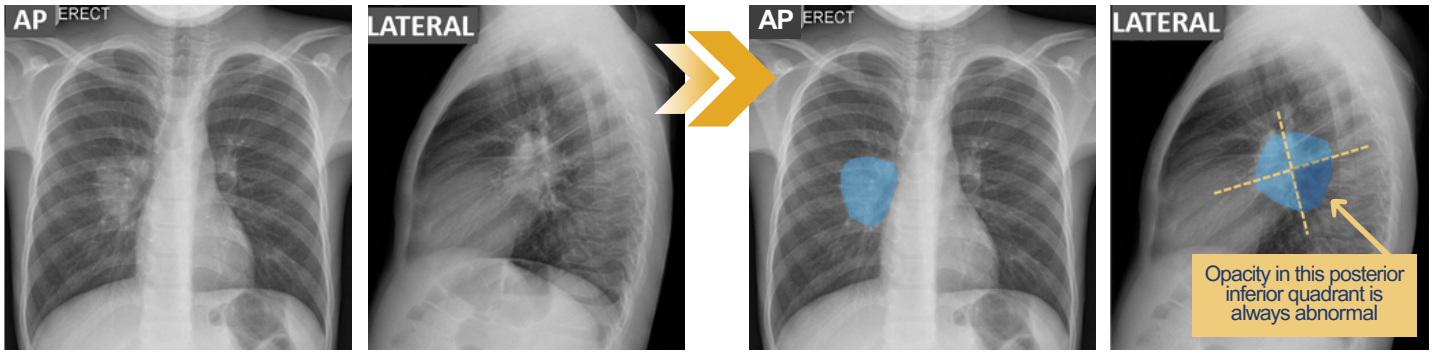
CHEST EXAMINATION IN CHILDREN WITH TB

CLINICAL TIPS

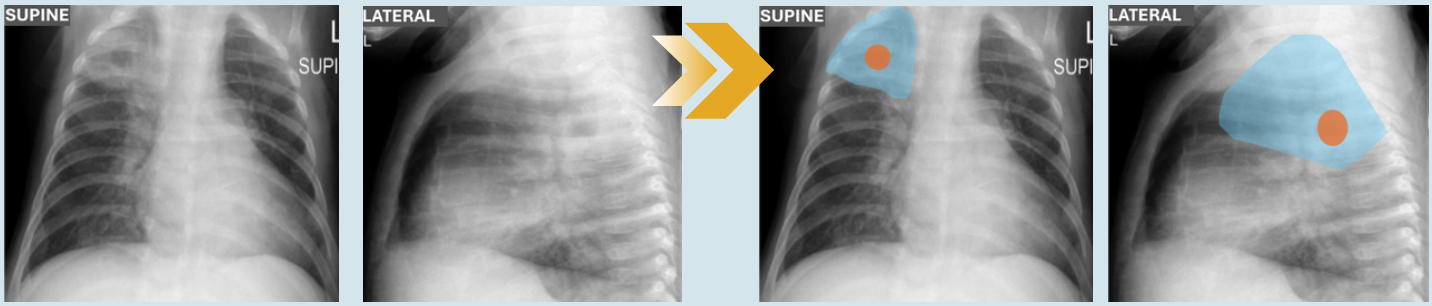
- Chest examination in children with TB is often normal.
- Unusual but important examination findings to remember include:
  - Unilateral wheeze
  - Decreased air entry on one side
  - Wheeze not responding to bronchodilators

HILAR LYMPHADENOPATHY

Enlargement of intra-thoracic lymph nodes is the radiological hallmark of paediatric pulmonary TB.

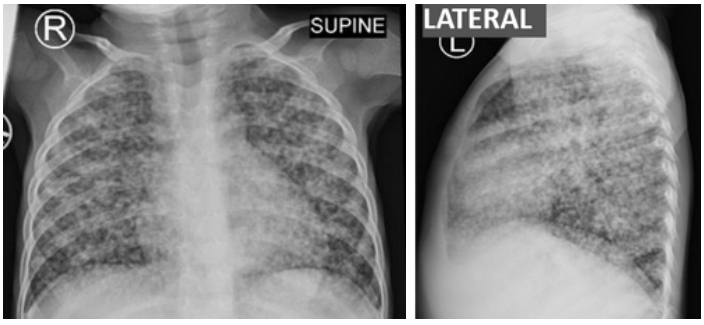


CAVITARY DISEASE



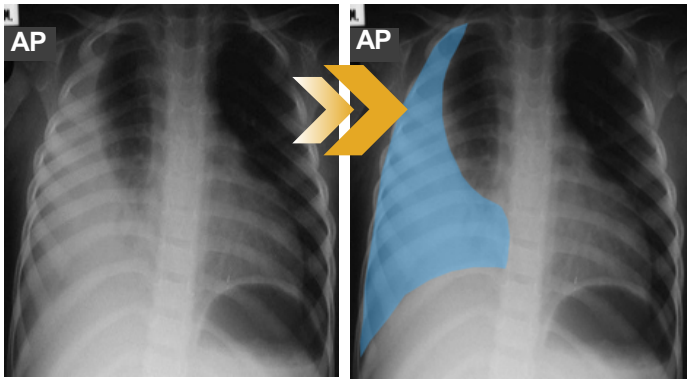
This CXR shows consolidation of the right upper lobe with breakdown and cavity formation (a cavitating primary/Ghon focus).

MILIARY PATTERN



- Note the evenly distributed small, millet-sized (< 2 mm), round nodules - often best observed on the lateral CXR in the lower lobes (posterior to the heart).
- This miliary pattern indicates disseminated disease - start treatment and look for TB elsewhere.

PLEURAL EFFUSION



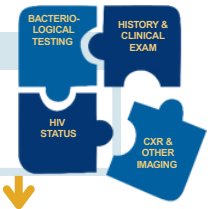
- This type of simple pleural effusion is more commonly seen in older children and adolescents.

HOW TO ASSESS RADIOLOGICAL SEVERITY?

Is the technical quality of the CXR acceptable?

- No → **Unreadable**
- Yes → **Is the CXR abnormal?**
  - No → **Normal**
  - Yes → **Does the CXR show features that are very specific to TB?**
    - Yes → **Abnormal features specific to TB** → **TB likely**
    - No → **Abnormal features NOT specific to TB**

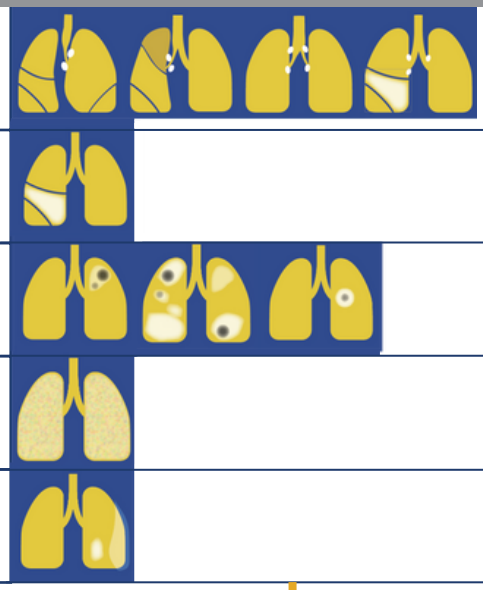
Review all the other pieces of the diagnostic puzzle



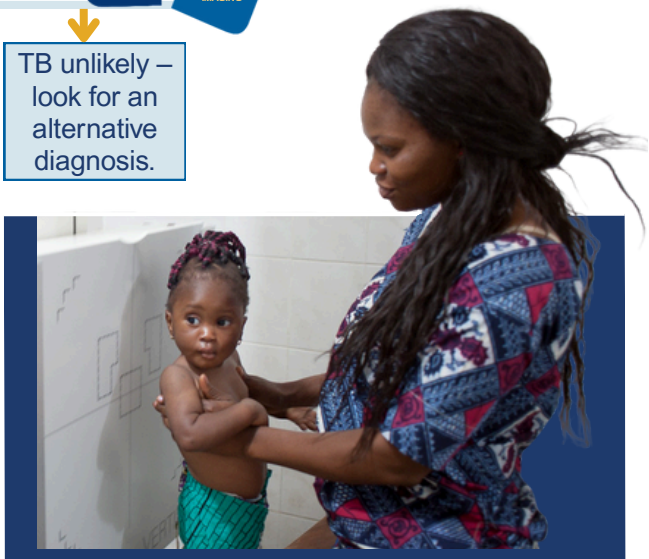
→ **TB unlikely – look for an alternative diagnosis.**

Assess radiological severity – are there any of the following?

- Significant airway compression or deviation
- Consolidation ≥ 1 full lobe
- Cavities
- Miliary infiltrates
- Complicated pleural effusion



- Yes → **Radiologically severe**
  Child ***not*** eligible for the shorter 4-month TB treatment regimen.
- No → **Radiologically non-severe**
  Child ***may be*** eligible for the shorter 4-month TB treatment regimen.



COMPUTER AIDED DETECTION

- Computer aided detection (CAD) software products provide automated CXR interpretation and generate probability scores (usually from 0-100) of TB disease.
- Currently, the WHO only recommends the use of these products for TB screening and triage in people >15 years and not in children.

LIMITATIONS OF CXR

- Interpretation can vary by reader, and can be difficult for inexperienced readers.
- TB findings are non-specific and overlap with other illnesses like pneumonia.
- Imaging alone does not confirm TB and must be considered in the context of clinical features and risk factors.

TO CONCLUDE

- CXRs are an important tool for diagnosing TB in children, and for determining disease severity.
- Combining CXR interpretation with good clinical evaluation and results from TB bacteriological tests helps to put the diagnostic puzzle together and decide whether to treat a child for TB or not, and which regimen duration to choose.

WANT TO LEARN MORE? *Click on the links below*

- Sign up for a free online course on the Interpretation of CXRs in children with presumptive TB
- The Union's Guide to chest X-ray interpretation[1]
- The Union's Diagnostic CXR Atlas for Tuberculosis in Children – image library.

[1] Palmer M, Seddon JA, Goussard P, Schaaf HS. Diagnostic CXR atlas for tuberculosis in children: A guide to chest X-ray interpretation, Second edition. Paris, France: International Union Against Tuberculosis and Lung Disease (The Union); 2022.
WHO consolidated guidelines on tuberculosis. Module 5: management of tuberculosis in children and adolescents. Geneva: World Health Organization; 2022.

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