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# Point-of-care ultrasound for tuberculosis in children in Mozambique

**Submission date**
24/06/2025

**Recruitment status**
Recruiting

**Registration date**
05/08/2025

**Overall study status**
Ongoing

**Last Edited**
07/07/2025

**Condition category**
Infections and Infestations

[_] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[_] Results
[_] Individual participant data
[X] Record updated in last year

## Plain English summary of protocol

Background and study aims
Tuberculosis (TB) continues to be one of the main causes of morbidity and mortality, especially among children. Despite significant progress in TB diagnosis, improving childhood TB diagnosis remains a major challenge worldwide. Microbiological confirmation of TB is particularly challenging in children, given the difficulty in obtaining sputum samples and the nature of the disease in children, where there are usually low numbers of bacilli in the sputum. Given the limitations of the currently available sputum-based diagnostic tests, it is necessary to develop new tools for the diagnosis of TB in children. For adults, chest X-ray (CXR) has been deemed a good tool for the screening of active pulmonary TB. Furthermore, artificial intelligence (AI)-assisted interpretation of CXR has shown a very good accuracy in this same group and has recently become a WHO policy recommendation. In children, CXR has been used as well to help clinicians decide whether they need to start treatment in children with presumptive TB and certain CXR findings are incorporated in the TB treatment decision algorithms now endorsed by the WHO. Despite the advances on CXR as a screening and diagnostic tool, the use of CXR is limited by high implementation costs, radiation exposure, and high inter-reader variability, among other factors.

Therefore, this study aims to evaluate point-of-care ultrasound (POCUS), a real-time technique performed by physicians/clinicians rather than specialist sonographers. This has shown promising performance compared to CXR for diagnosing lung pathologies, such as pneumonia and TB, in children and adults. There are studies in South Africa that have shown that up to 1/3 of children with pulmonary TB also have extrapulmonary TB that can be detected with ultrasound, and that it can also be useful for monitoring disease and response to treatment. A recent review suggests that POCUS may be a potentially useful tool for identifying mediastinal lymph nodes, a feature of pediatric TB. Furthermore, this is a non-invasive, non-ionizing and affordable imaging technique for the diagnosis of pediatric TB that can potentially address the challenges of diagnosing childhood TB in high-burden countries, such as Mozambique.

The study's overall objective is to evaluate whether a comprehensive POCUS approach (combining lung, mediastinum and abdomen) can diagnose childhood TB in a rural high TB and HIV burden setting. The secondary objectives include evaluating the capacity of POCUS to monitor TB treatment response compared to existing tools (CXR and clinical assessment);

determining the diagnostic accuracy of POCUS for TB diagnosis using standardized diagnostic categories (NIH criteria confirmed, probable, unlikely TB); comparing the diagnostic accuracy of POCUS versus CXR for TB diagnosis; and evaluating the incremental yield of combined CXR and POCUS assessment.

Who can participate?
Children <15 years with signs or symptoms suggestive of TB from inpatient and outpatient departments at health facilities

What does the study involve?
All eligible children who assented and have parents' consent to participate in the study will undergo a clinical assessment, and sputum samples will be obtained for bacteriological confirmation of TB. A chest X-ray and an ultrasound will also be performed by study physicians who have been previously trained. Follow-up visits will be conducted at baseline and also at 2 and 6 months of follow-up in those initiating TB treatment, in which clinical assessment, Chest X-ray and ultrasound will also be performed to evaluate treatment outcomes.

What are the possible benefits and risks of participating?
Participant benefits:
Participants can anticipate the free use of a simple, safe and non-invasive tool which could identify prior undiagnosed medical problems, quicker referrals for identified problems, and quicker results and feedback than routine.

Community benefits:
The community can expect the availability of a diagnostic tool that was previously not available at the hospital, an opportunity to partake in a potential landmark study that could influence future policy, and training of facility radiographers in lung ultrasound and therefore capacitating the facility.

Broader population benefit:
The broader population can expect potentially improved screening of TB suspects, the possibility of reduced missed cases, and improved progress towards the goal of ending TB infections.

No risks for participants are anticipated. However, lung ultrasound, although non-invasive, will require exposure of the upper body. This exposure may make participants uncomfortable. Blood collection through venipuncture can cause mild pain and may result in prolonged bleeding at the injection site. Also, collection of respiratory samples through spontaneous or sputum induction and gastric aspirates may cause certain discomfort and HIV testing may cause mild discomfort and learning about HIV status may cause distress.

Where is the study run from?
Manhiça Health Research Centre, Mozambique

When is the study starting and how long is it expected to run for?
March 2025 to March 2027

Who is funding the study?
National Institute for Health and Care Research (NIHR), UK

Who is the main contact?
Dr Sozinho Acacio (in-country Principal Investigator), sozinho.acacio@manhica.net

Dr Maria Ruperez (overall coordinator), maria.ruperez@lshtm.ac.uk
Prof Helen Ayles (overall Principal Investigator), helen@zambart.org.zm

### Study website
https://www.lshtm.ac.uk/research/centres-projects-groups/pocus4tb#welcome

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## Additional identifiers

### EudraCT/CTIS number
Nil known

### IRAS number

### ClinicalTrials.gov number
Nil known

### Secondary identifying numbers
NIHR156579

## Study information

### Scientific Title
Point-of-care ultrasound for tuberculosis in children in mozambique: preliminary phase

### Acronym
POCUS4TB project_Mozambique

### Study objectives
Given the limitations of currently available diagnostic tests for tuberculosis (TB) in children and the consequently unacceptable numbers of children with TB who have not been diagnosed, tools are urgently needed. Point-of-care ultrasound (POCUS) is an affordable, safe and portable imaging tool that has shown promising performance compared to chest radiography for

diagnosing lung pathologies. Some studies have also shown that it has the potential to detect extrapulmonary TB and lymph nodes in children with TB (which are key features of pediatric TB) and that it can also be useful for monitoring disease and response to treatment

This study will evaluate if a comprehensive point-of-care ultrasound approach (combining lung, mediastinum and abdomen) can diagnose childhood TB in a rural high TB and HIV burden setting.

## Ethics approval required
Ethics approval required

## Ethics approval(s)
1. Approved 03/07/2025, London School of Hygiene and Tropical Medicine Research Ethics Committee (Keppel st, London, WC1E 7HT, United Kingdom; +44 (0)20 7636 8636; maria.ruperez@lshtm.ac.uk), ref: 32041

2. Not yet submitted, National Bioethics Committee (CNBS) from Mozambique (Ministério da Saúde, Av. Eduardo Modlane n° 1008,, Maputo, 264, Mozambique; +258 82 406 6350; cnbsmocambique@gmail.com), ref: -

## Study design
Prospective cohort study

## Primary study design
Observational

## Secondary study design
Cohort study

## Study setting(s)
Hospital

## Study type(s)
Diagnostic, Screening

## Participant information sheet
Not available in web format, please use contact details to request participation sheet

## Health condition(s) or problem(s) studied
Tuberculosis

## Interventions
The study will enrol children <15 years with signs or symptoms suggestive of TB attending health facilities. Those meeting the inclusion criteria and consenting will be enrolled. Clinical assessment, clinical history, and physical examination (including anthropometric measures such as height, weight, and MUAC) will be performed. Respiratory samples (spontaneous or sputum induction) and gastric aspirates will be collected for GeneXpert and culture testing, along with stool samples. All participants will undergo a Point-Of-Care UltraSound (POCUS) examination and a Chest X-Ray (CXR). Children will be tested for HIV if they have an unknown HIV status. For children living with HIV, a urinary LAM, CD4 and viral load will also be performed.

Follow-up visits at 2 and 6 months after enrolment will be conducted. Clinical information and anthropometric measurements will be collected at each visit, and, if the participant is still symptomatic, microbiological TB testing (Gene Xpert and culture) will be repeated. At each follow-up visit, POCUS and CXR evaluation will be conducted in all participants who had initiated treatment. For those who started TB treatment later than baseline, an end-of-treatment visit will be performed.

### Intervention Type
Other

### Primary outcome measure
Diagnostic performance of ultrasound for detecting tuberculosis is measured in terms of sensitivity, specificity, positive predictive value, and negative predictive value, by comparing interpretations of ultrasound images by two independent readers to chest X-ray findings (used as the gold standard) at baseline and 2 and 6 months follow-up

### Secondary outcome measures
Diagnostic performance of ultrasound for detecting tuberculosis is measured in terms of sensitivity, specificity, positive predictive value, and negative predictive value, by comparing interpretations of ultrasound images by two independent external readers to the NIH classification of intrathoracic childhood TB as the reference standard at baseline and 2 and 6 months follow-up

### Overall study start date
01/03/2025

### Completion date
01/03/2027

## Eligibility

### Key inclusion criteria
Children <15 years of age presenting at health facilities with either:
1. Chronic, well-defined symptoms:
1.1. Persistent cough: more than 2 weeks
1.2. Weight loss/failure to thrive
1.3. Persistent unexplained fever: for >1 week and > 38°C
1.4. Persistent, unexplained lethargy or reduced playfulness
1.5. Infants 0 – 60 days:
1.5.1. Neonatal pneumonia
1.5.2. Unexplained hepatosplenomegaly
1.5.3. Sepsis-like illness
or
2. Any duration of cough/wheeze/acute pneumonia plus any of the following:
2.1. Chest X-ray compatible with TB as interpreted by the treating physician
2.2. A history of contact with a TB patient in the last two years

### Participant type(s)
Population

### Age group
Child

### Lower age limit
0 Years

### Upper age limit
15 Years

### Sex
Both

### Target number of participants
250

### Key exclusion criteria
Participants will be excluded if:
1. History of TB treatment in the last year
2. Parents refused to provide consent for study participation or HIV testing when the status is unknown
3. Severe illness resulting in an unstable condition

### Date of first enrolment
01/08/2025

### Date of final enrolment
01/03/2027

## Locations

### Countries of recruitment
Mozambique

### Study participating centre
**Manhiça Health Research Centre**
Rua 12
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## Sponsor information

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London School of Hygiene & Tropical Medicine

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University/education

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https://ror.org/00a0jsq62

## Funder(s)

### Funder type
Government

### Funder Name
National Institute for Health and Care Research

### Alternative Name(s)
National Institute for Health Research, NIHR Research, NIHRresearch, NIHR - National Institute for Health Research, NIHR (The National Institute for Health and Care Research), NIHR

### Funding Body Type
Government organisation

### Funding Body Subtype
National government

### Location
United Kingdom

## Results and Publications

### Publication and dissemination plan
Planned publication in a peer-reviewed journal

### Intention to publish date

01/03/2027

## Individual participant data (IPD) sharing plan

The datasets generated during and/or analysed during the current study will be stored in a publicly available repository

• The name and email address of the investigator/body who should be contacted for access to the datasets: Dr Sozinho Acacio (sozinho.acacio@manhica.net), Dr Maria Ruperez (maria.ruperez@lshtm.ac.uk), and Prof Helen Ayles (Helen@zambart.org.zm)
• The type of data that will be shared: The anonymised dataset required to reproduce the main outcomes of the study
• Timing for availability: Once the main outcomes of the study are published data set will be publicly available as it will be uploaded to an open-access repository
• Whether consent from participants was required and obtained: Yes, this is included in the participant's informed consent
• Any ethical or legal restrictions: No
• Any additional comments: Ultrasound images/videos will not be made available

## IPD sharing plan summary

Stored in publicly available repository, Available on request