

Point-of-care ultrasound to support the new WHO treatment decision algorithms in the diagnosis of TB in children

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No conflicts of interest to declare



Background

- Almost half of children with TB are never diagnosed, leading to high mortality from TB, particularly in children with other co-morbidities such as severe acute malnutrition (SAM).
- Chest X-ray is a useful tool for TB diagnosis but is not always available.
- Point-of-care Ultrasound (POCUS) has shown value for extrapulmonary TB (EPTB) diagnosis in children living with HIV and with SAM.
- WHO has recommended a new treatment decision algorithm (TDA) for pulmonary TB (PTB) in children <10 years for settings with and without X-ray.
- **We assessed the utility of POCUS for TB diagnosis (PTB or EPTB) in children in a context with high levels of malnutrition, with no access to chest X-ray, and where the new WHO TDA for PTB was used.**



Study design, population and site

How: Diagnostic prospective study

Where: Malakal, South Sudan

Who: Children under 10 years with symptoms of pulmonary TB (cough, fever, weight loss or unusual fatigue)

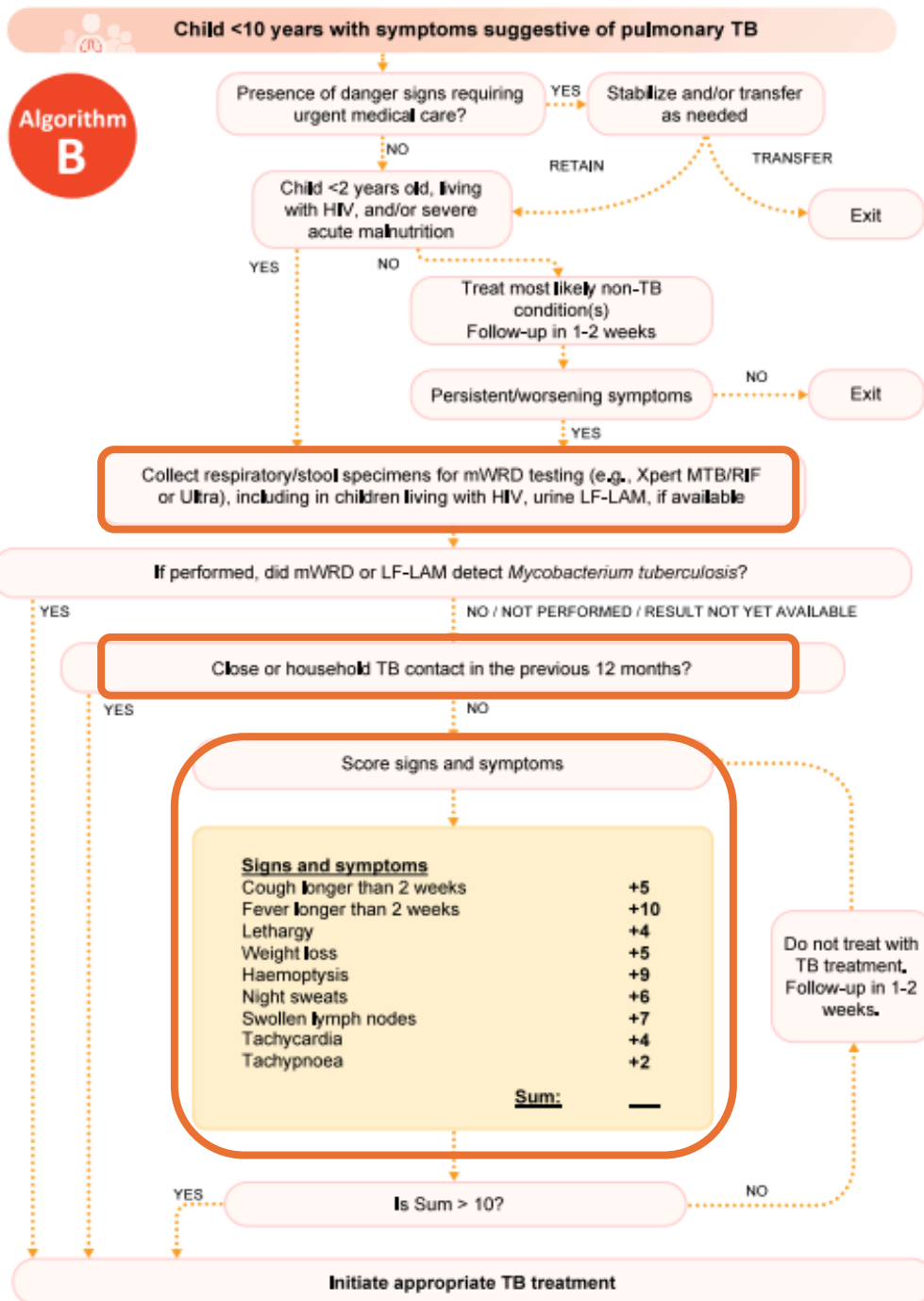


When: January – December 2024



- High prevalence TB and malnutrition
- High population movement, history of conflict
- MoH hospital supported by MSF (pediatric and nutrition services, in- and out-patients departments, no access to X-ray)





WHO Treatment Decision Algorithm B for children with symptoms suggestive of pulmonary TB in contexts without access to chest X-ray

- Laboratory tests: **GeneXpert, TB-LAM**
- History of **contact** with TB
- **Score** based on **signs and symptoms**

* Algorithm A for contexts with access to chest X-ray includes a score is based on signs and symptoms & chest X-ray



Procedures

- Medical history & clinical exam
- GeneXpert MTB/RIF in stool and gastric aspirate
- TB-LAM in urine for children with HIV
- POCUS – lung and abdomen (FASH)
- Clinicians treating children were blinded to POCUS results



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Definitions

POCUS positive

lung consolidation > 1cm
pleural effusion
pericardial effusion > 3mm
abdominal lymph nodes > 1cm
splenic or hepatic micro-abscesses
ascites

POCUS highly suggestive of TB

pericardial effusion > 3mm
abdominal lymph nodes > 1cm
splenic micro-abscesses

POCUS "simplified" suggestive of TB

pericardial effusion > 3mm
pleural effusion
splenic micro-abscesses

**TB reference for confirmed TB, unconfirmed TB
and unlikely TB:** as per NIH criteria, CID 2015

Results – Characteristics of the population

	Children N=217	
	n	%
Female	105	48.4
Age, median years [IQR]	1.0	[0.6-1.5]
Hospitalized	203	93.5
High risk of rapid TB disease progression	209	96.3
- Severely malnourished	187	86.2
- Age < 2 years	174	80.2
- Living with HIV	12	5.5
Treatment Decision Algorithm indicative of TB treatment	98	45.2
Started on TB treatment	107	49.3
Duration of POCUS procedure, median minutes [IQR]	18	[15-21]



POCUS findings

	All N=217 n (%)
Lung consolidation	10 (4.6)
Pleural effusion	9 (4.1)
Pericardial effusion	7 (3.2)
Abdominal lymphadenopathy	2 (0.9)
Splenic micro-abscesses	9 (4.1)
Hepatic micro-abscesses	2 (0.9)
Ascites	4 (1.8)

POCUS positive

31 (14.3%)

lung consolidation > 1cm
pleural effusion
pericardial effusion > 3mm
abdominal lymph nodes > 1cm
splenic or hepatic micro-abscesses
ascites

POCUS highly suggestive of TB

17 (7.8%)

pericardial effusion > 3mm
abdominal lymph nodes > 1cm
splenic micro-abscesses

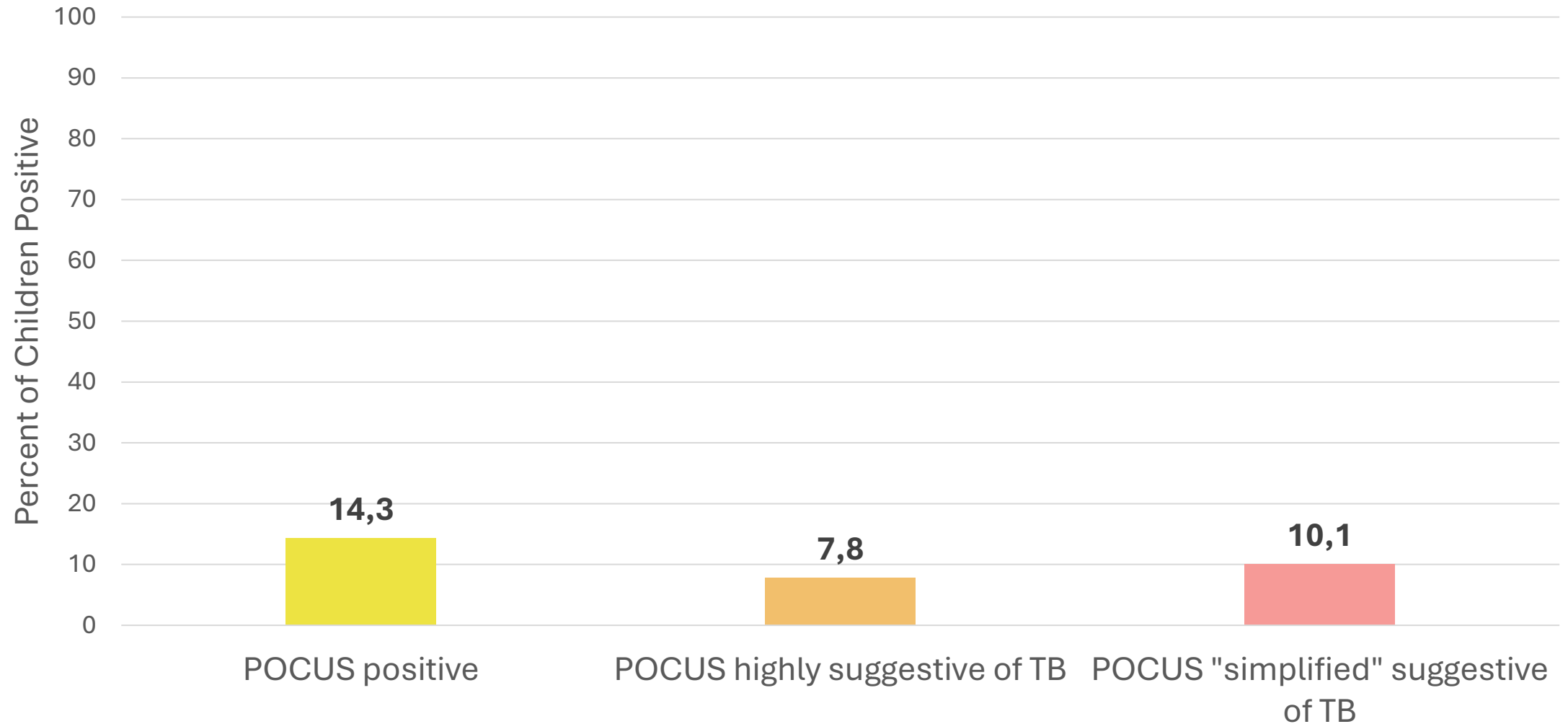
POCUS "simplified" suggestive of TB

22 (10.1%)

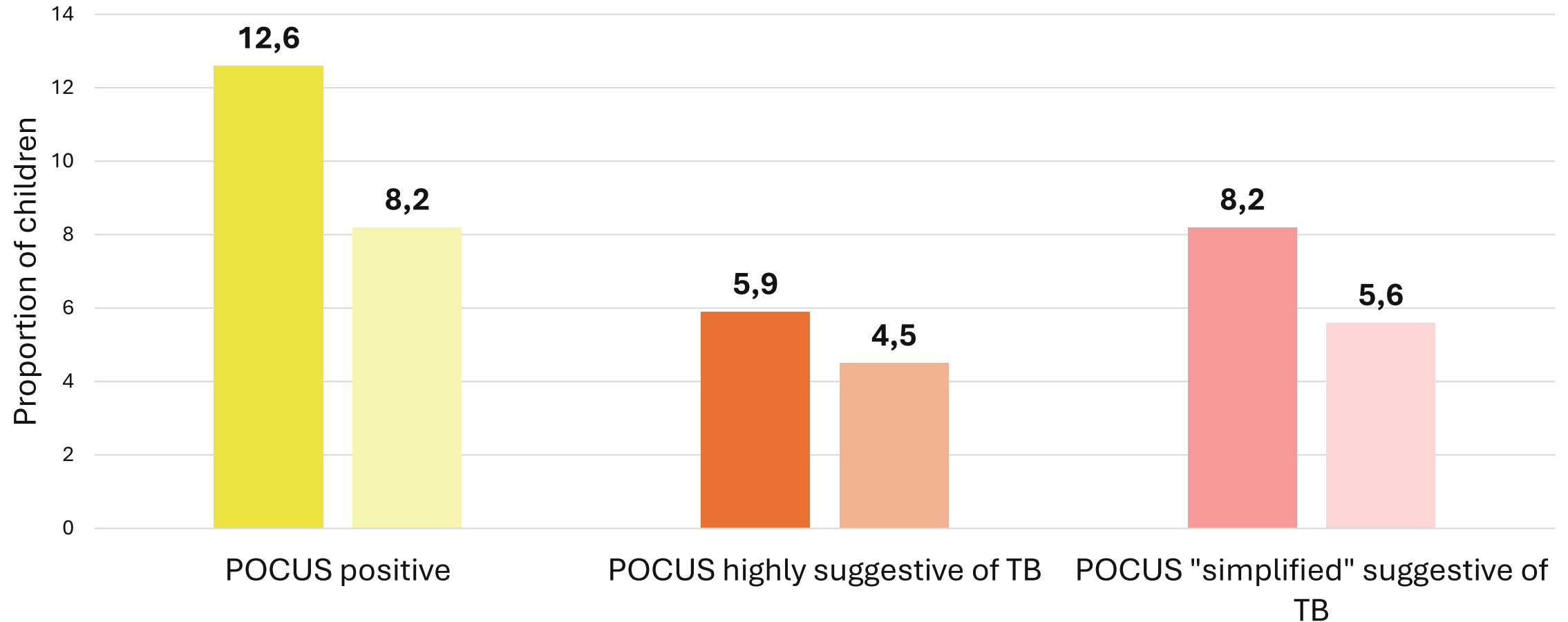
pericardial effusion > 3mm
pleural effusion
splenic micro-abscesses



POCUS findings by TB status (N=217)



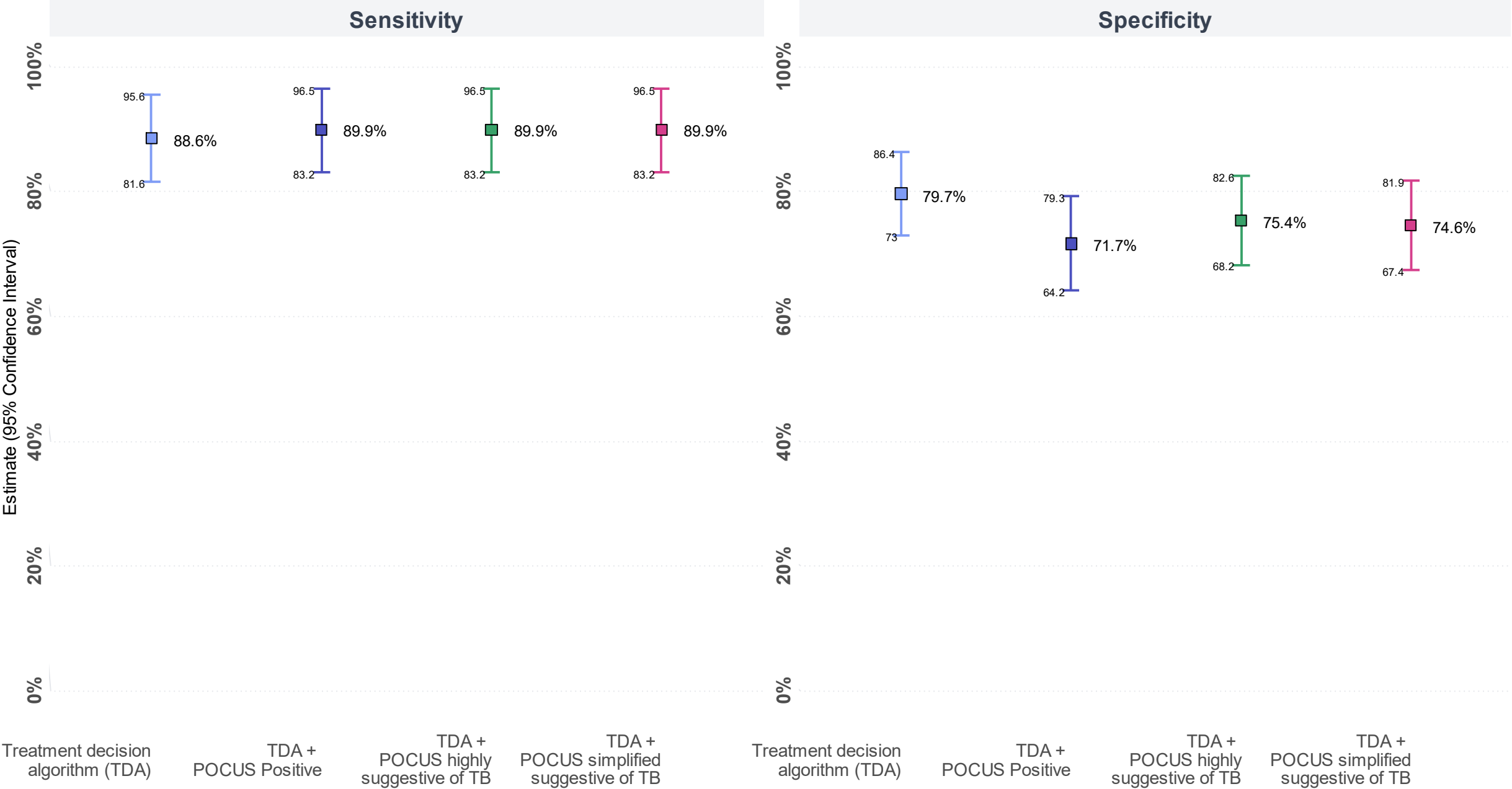
Added diagnostic value of POCUS in children with TDA not indicative of TB treatment (N=119) and not started on TB treatment (N=110)



Accuracy of POCUS



Accuracy of Treatment Decision Algorithm and POCUS



Conclusions and future directions

- POCUS detected a small proportion of children with TB that were missed, in a context with high levels of malnutrition, with no access to chest X-ray, and where the new WHO TDA for PTB was used.
- Using POCUS findings highly suggestive of EPTB (pericardial effusion, splenic abscesses and abdominal lymph nodes) would not imply a high risk of overtreatment.
- A simplified EPTB POCUS exam assessing pleural and pericardial effusion and splenic abscesses identified a similar number of children with TB compared to the full exam and would be faster and easier to teach and implement.
- Larger studies are needed to determine the value of POCUS and the proposed “simplified” POCUS exam to diagnose TB in children in contexts with no access to chest X-ray, and particularly in children with SAM and HIV.



Many thanks to our study participants,
research team, and partners



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