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can end TB**

# Childhood TB diagnosis in the era of stool-based testing:

## The SOS stool method

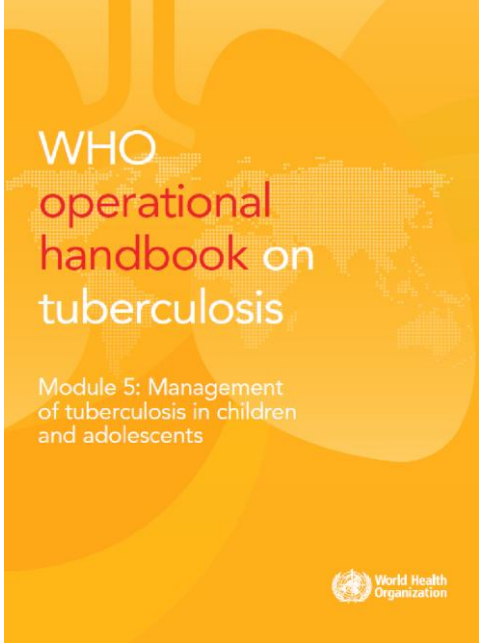
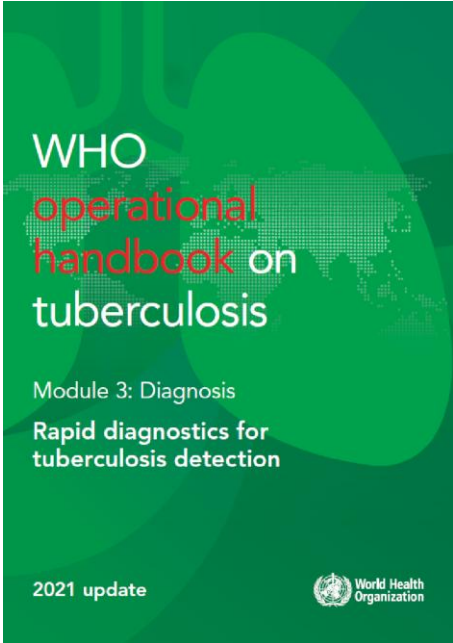
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Mansa Mbenga, Clinician

16 Jan 2025  
SEARO webinar



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# Guidance from WHO on stool-based testing



Available since:

2020, updates 2021/2024

Recommends:

Stool-based testing using Xpert MTB/RIF (2020) & Xpert MTB/RIF Ultra (2022)

2022

- Stool-based testing using Xpert MTB/RIF Ultra
- Clinical algorithm
- Stool processing methods

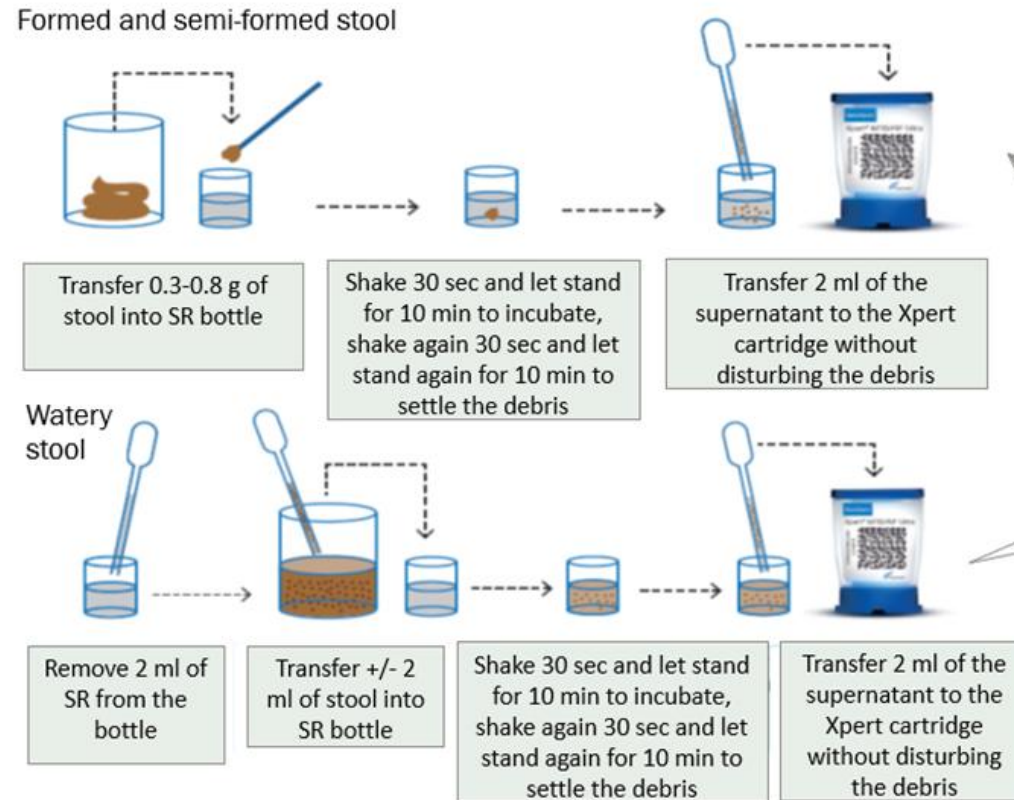
2022

- Stool processing methods
- Practical considerations
- Indicators



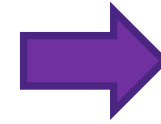
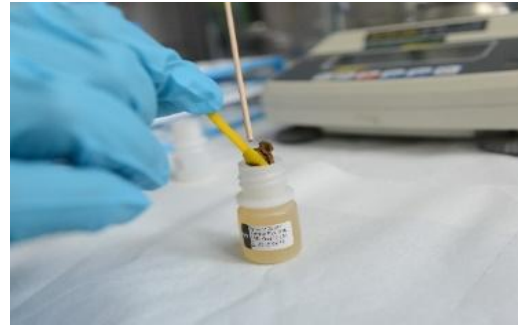
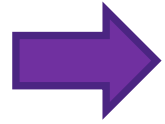
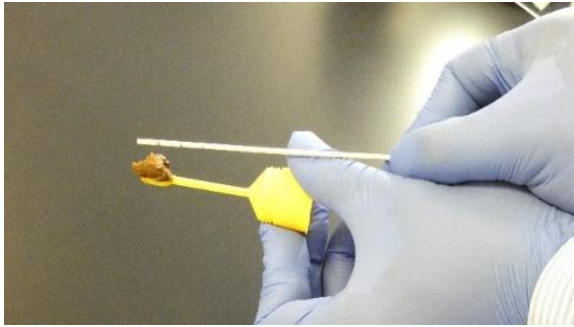
# The simple one step (SOS) stool processing Method

- One of the two methods recommended by WHO
- Similar sensitivity and specificity compared to (complex) method
- No additional supplies required than for sputum Xpert testing
- Easy to implement at low cost at any Xpert site
- Lab personal finds it easy to perform the test
- Minimal training required
- Method is robust, relatively low error invalid rate

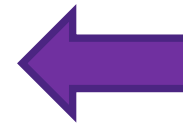
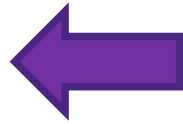


## Sources:

1. Development SOS method: de Haas/Yenew et al. J Clin Microbiol. 2021
2. GLI Practical handbook on stool-based testing, 2022
3. Accuracy of SOS stool: Yenew/de Haas/ et al. Miciobiol Spectrum 2024 (Ethiopia)
4. Head to head comparison SOS stool method: Jasumback 2021
5. Head to head comparison: Louness et al 2024, Lancet Microbe accepted 2024
5. Optimisation of the SOS stool method, Yenew/ de Haas et al. Microbiol. Spectrum, 2023
6. 2023 Systematic review stool-based testing methods: Caratala-Castro et. al Lancet Microbe, 2024

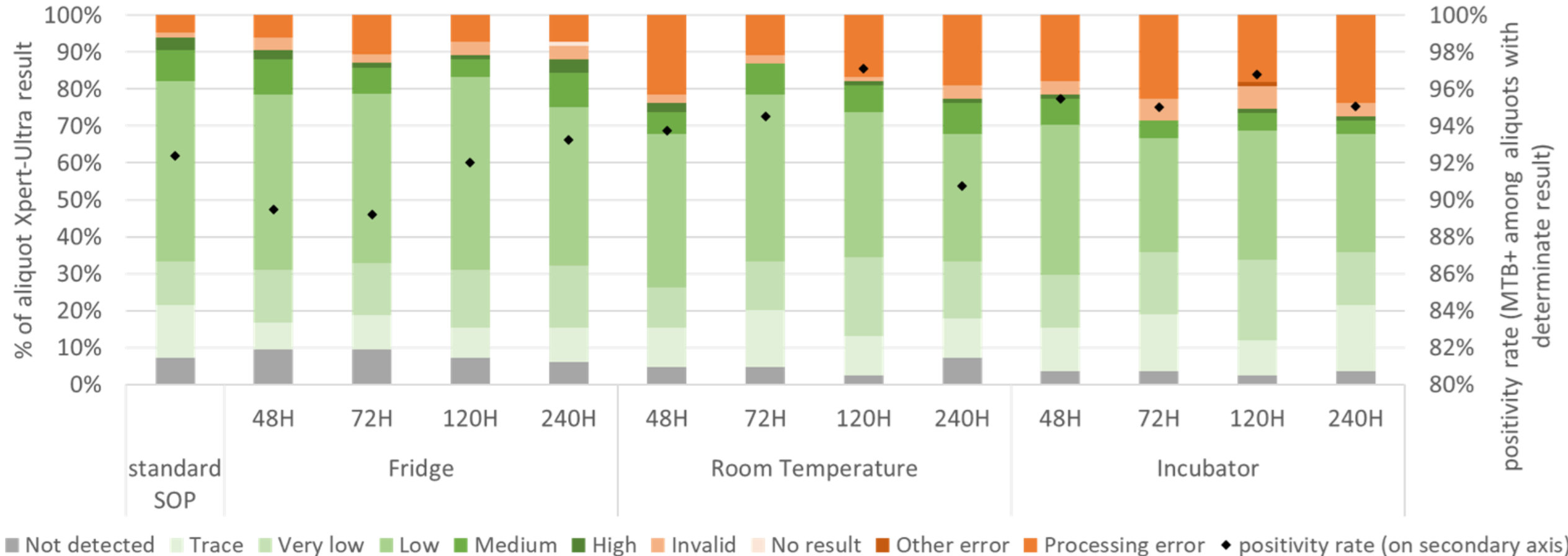


2x 10 min



SOS stool method as simple as sputum processing

# Experiments to evaluate robustness and stool storage conditions –SOS stool method



Stool can be kept at high temperature, but risk of error or invalid results increases, compared to cold chain

Source: de Haas/Yenew et al. PlosOne, 2022, and de Haas/Yenew et al. Microbiol. Spectrum, 2023 (in press)

Results workshop UNION conference 2023, Paris

country	# stool test done	yield stool
Zambia (P)	1233	2.1%
Ukraine (P)	168	10.7%
Malawi (S)	578	6.2%
DRC (S)	793	17.3%
Ethiopia (P)	371	7.2%
Ethiopia	1035	3.4%
Kyrgistan	245	7.9%
Zimbabwe	912	1.4%
Tanzania	696	5.7%
Nigeria (P)	52,835	4.8%
<b>combined</b>	<b>58,866</b>	<b>4.9%</b>

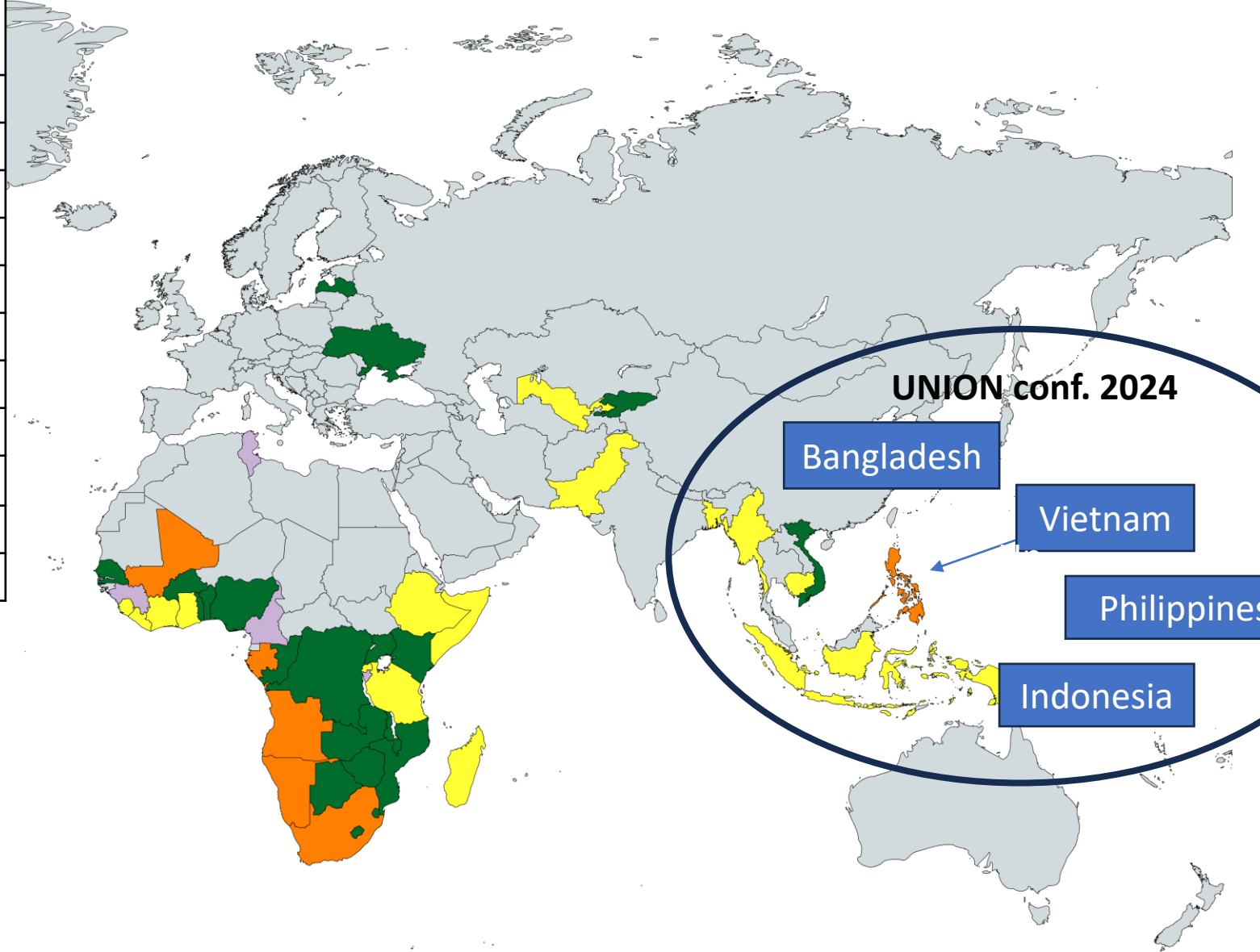
S, submitted; I, in progress, P, published

Stool implementation status

- Routine introduction
- Implementation at selected sites
- planning phase
- interested to start/considering



# Uptake of stool-based testing



Source: Klinkenberg/de Haas et al. accepted EID, 2025: Practical lessons learned from early implementation of stool-based Xpert MTB/Rif testing by National Tuberculosis Programs to diagnose TB in children.



# Stool-based testing to detect TB successful

- SOS method easy to perform, can be done at every Xpert-site and beyond
- Sensitivity (79%) with high specificity (99%) against Xpert respiratory sample
- Can be used as rule in test for treatment initiation at lower healthcare level
- Increased access to bacteriological confirmation incl. resistance pattern
- Clinicians and care givers are generally happy with this non-invasive test
- Stool-based testing works also for adults who can not produce sputum
- Its not a stand-alone tool - should be part of a comprehensive package

Sources (not limited to):

1. Guideline management childhood TB & adolescent, module5, 2022
2. Systematic review stool processing methods, Carratala-Casto Lancet Microbe, 2024
3. *Increased access Ethiopia: Babo et.al Trop Med Inf Disease, 2023*
4. *Increased access Nigeria: Nwokoye et al. Trop Med Inf Disease,2024*
5. *Increased access Zambia: Mwanza et al., IJTLD, 2024*
6. *Increases access Ukraine: Diuzheva et al. Trop Med Inf Disease,2024*
7. Accuracy of SOS stool: Yenew/de Haas/ et al. Miciobiol Spectrum 2024 (Ethiopia)
8. Decentralisation study TBspeed: Wobudeya et al. ClinicalMedicine 2024
9. *Stool TB testing for children & PLHIV Vietnam: de Haas et al., IJTLD, 2022,*
10. *Stool TB testing for Adults China: Xia Yu et al. Microbiol Spectrum 2023*
11. *Scoring diagram to screen children for TB, TBspeed: Chabala et al., clinical medicine 2024*

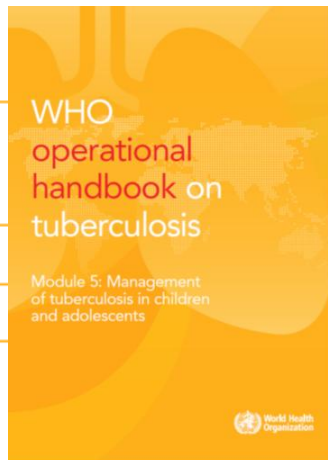


# Diagnostic assays recommended for stool testing

- Currently only Xpert MTB/RIF and Xpert MTB/RIF Ultra are recommended for stool-based testing by WHO
- Uptake of Truenat is rapidly increasing in countries
- Need for rapid drug resistance test (e.g Xpert XDR and tNGS) when stool is tested RIF resistant

**Can stool be tested on Truenat MTB plus and Xpert MTB/XDR?**

Test	Acceptable specimen types	Rifampicin resistance detection
Xpert MTB/RIF	Sputum Gastric fluid Nasopharyngeal aspirate <b>Stool</b> Cerebrospinal fluid (CSF) Lymph node aspirate or biopsy Pleural fluid Peritoneal fluid Pericardial fluid Synovial fluid Urine Blood <sup>a</sup>	Yes
Xpert Ultra	Sputum Gastric fluid Nasopharyngeal aspirate <b>Stool</b> CSF Lymph node aspirate or biopsy	Yes
Truenat MTB and MTB Plus (Molbio Diagnostics, Goa, India)	Sputum	Yes
TB-LAMP	Sputum	No
LF-LAM	Urine <sup>b</sup>	No





# Stool-based testing on Truenat and Xpert-XDR

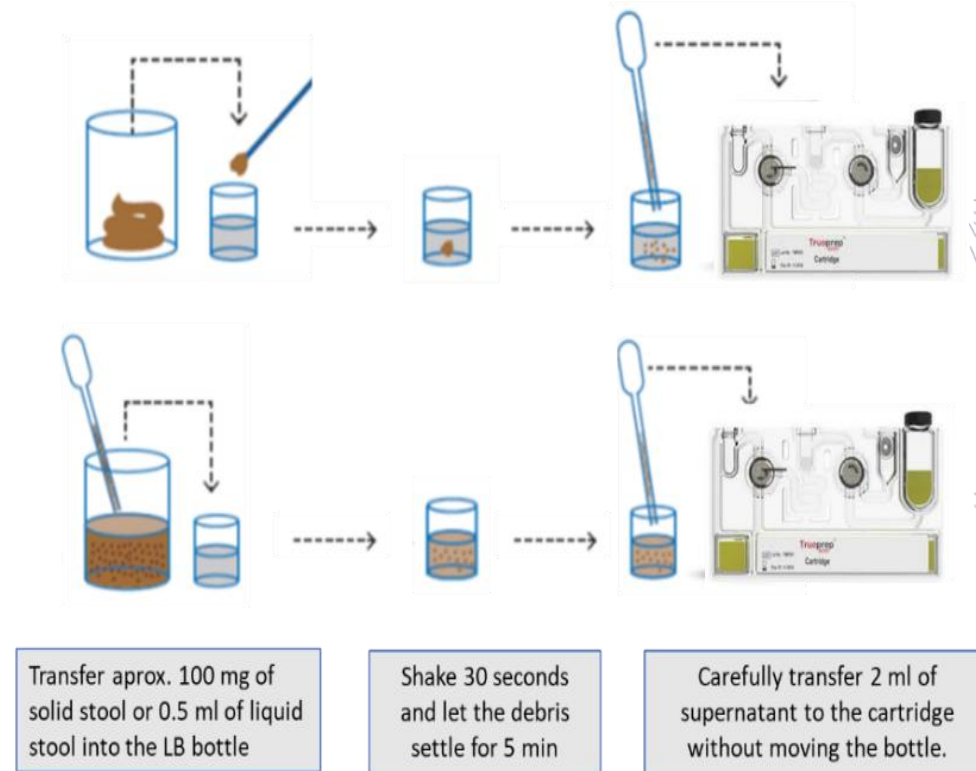
## *Development of SOS method for Truenat and Xpert XDR*

**Phase 1.** SNRL Uganda & KNCV developed the protocol

- Experiments stool spiked with MTB
- Validation routine stool samples (n=60)

**Phase 2.** IHVN Nigeria tested the proposed protocol in routine setting (n=500 children)

## Protocol for stool on Truenat



## THE BRISTOL STOOL CHART

TYPE 1		Separate hard lumps, like nuts (hard to pass)
TYPE 2		Sausage-shaped but lumpy
TYPE 3		Like a sausage but with cracks on its surface
TYPE 4		Like a sausage or snake, smooth and soft
TYPE 5		Soft blobs with clear cut edges (passed easily)
TYPE 6		Fluffy pieces with ragged edges, mushy stool
TYPE 7		Watery, no solid pieces. Entirely liquid

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**Conclusion:** Stool testing on Truenat MTB plus and Xpert MTB/XDR works well using similar simple one step (SOS) method

*Manuscripts in preparation*

# Resources available to countries

- ✓ **Standardized training package** developed including competency assessment lab staff
- ✓ Orientation for clinicians, data collection forms for programmatic implementation, and flyer stool collection, available upon request
- ✓ **Master trainers** trained to train other countries, like staff from SNRL Uganda, SNRL Benin and other senior consultants
- ✓ **Community of Practice (CoP)** active on stool-based testing (led by USAID) to discuss childhood TB diagnosis in the era of stool-based testing and other topics



SOP, and video on stool processing method available in multiple languages  
[www.kncvtbc.org/en/sos-stoolbox](http://www.kncvtbc.org/en/sos-stoolbox)



Master trainers training



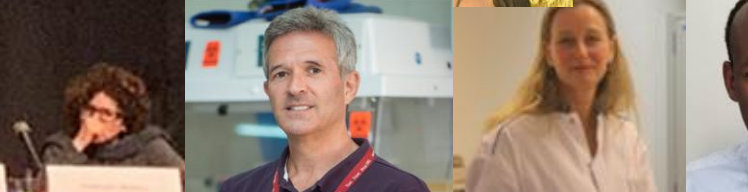
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## TAKE HOME MESSAGES

- Guidance from WHO and GII on childhood TB and stool-based testing is available
- Resources on training, SOPs and data capture form and tools are available
- Stool testing feasible at all Xpert (and Truenat) testing sites
- Lab staff finds SOS stool method as easy as sputum Xpert testing
- Stool is generally well accepted as a diagnostic sample by clinical staff
- More children recorded in the lab registers and TB detected now access is easier
- **Stool also benefits adults (PLHIV, very ill hospitalized)**
- **Awareness raising with clinicians of value of stool as sample is important!**
- **Methods for on-the-spot stool collection might further increase access (stool swabs)**



# Acknowledgements





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Thank you for your attention  
Questions ?

