Molecular WHO-recommended Rapid Diagnostic Tools to Detect TB and DR-TB

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Presentation Outline

- **WHO endorsed molecular tests for Pulmonary TB & drug susceptibility testing**
- **TB Diagnostic Network and Laboratory Services of NTP**
- **New rapid diagnostic tools for TB**
  - TB LAMP
  - Line Probe Assay
  - Xpert MTB/RIF test
  - Xpert MTB/RIF Ultra
  - Xpert MTB/XDR test
  - Truenat

Significant public health problem of Tuberculosis

A significant public health problem globally and the impact of tuberculosis is also challenging in Myanmar.

(1)The gap between the numbers estimated and notified is large and has worsened during the coronavirus disease (COVID-19) pandemic

(2) . Drug-resistant TB (DR-TB) is another area of concern, particularly multidrug- or rifampicin-resistant TB (MDR/ RR-TB)

Rapid diagnosis of TB is essential for effective management of TB .

Access to fast and accurate detection tests and rapid and accurate drug-susceptibility testing (DST) is needed for all patient.

Efforts are needed to build laboratory capacity (especially DST)

End TB Strategy – calls for the early diagnosis of TB and universal access to DST.

WHO recommends to meet the End TB Strategy

People with signs or symptoms of tuberculosis (TB) receive a molecular WHO-recommended rapid diagnostic (mWRD) test to detect TB;

People with bacteriologically confirmed TB receive a rapid molecular test to detect resistance to at least the first-line drug rifampicin (RIF); and

People with RIF-resistant TB (RR-TB) receive a rapid molecular test to detect resistance to at least fluoroquinolones (FQs; for example, evofloxacin and moxifloxacin)

Importantly, the transition to rapid molecular testing does not eliminate the need for culture and phenotypic DST.

Those tests are still needed for conducting DST for drugs for which an mWRD is not available, conducting DST to guide drug dosing determinations, monitoring the response to TB treatment and investigating discordant results from diagnostic testing or DST.

WHO endorsed molecular tests for Pulmonary TB & drug susceptibility testing

Initial diagnostic tests for diagnosis of TB with & without detection of drug resistance

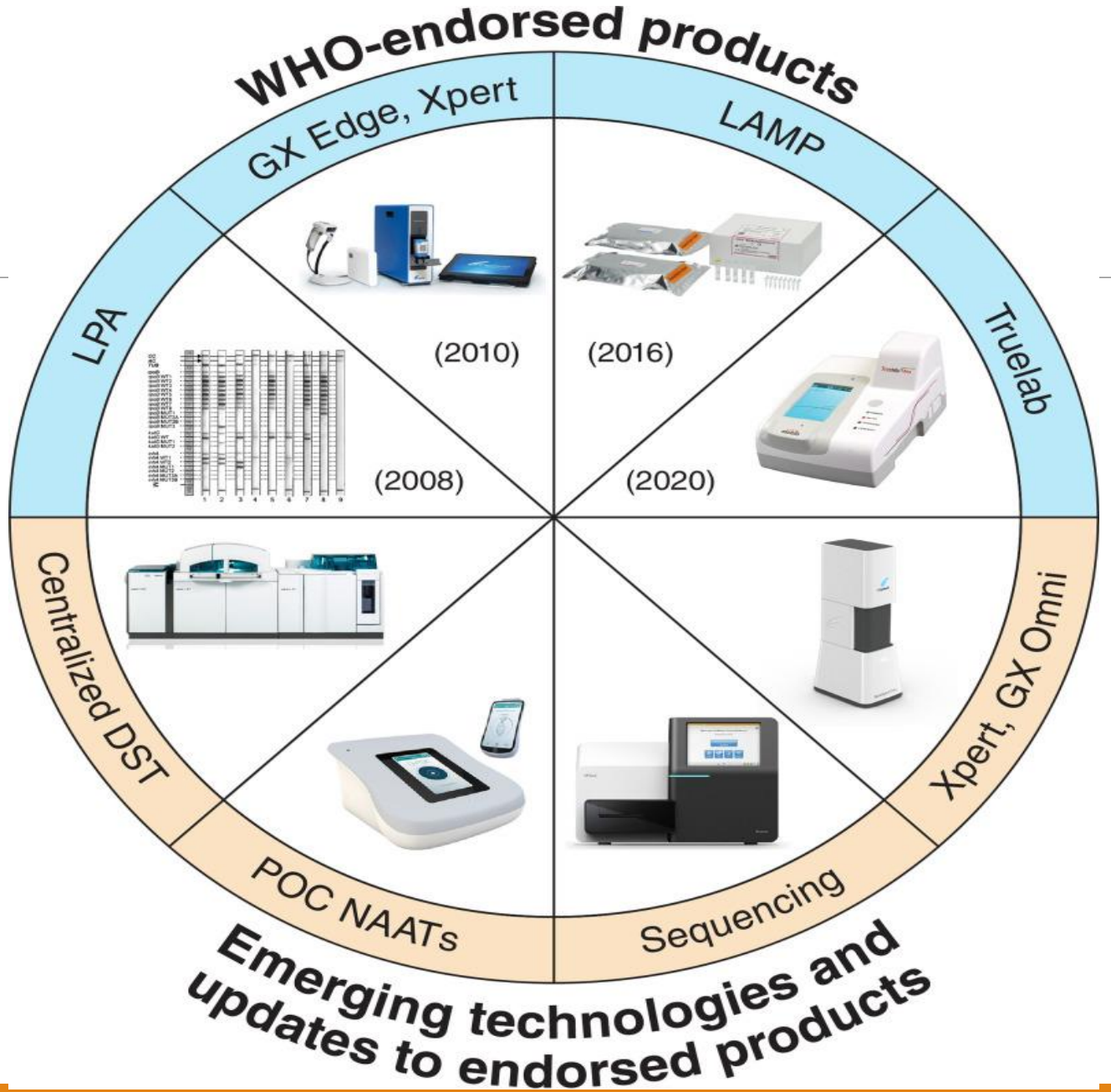
Technology	Year endorsed	Method principle	Intended use	Sensitivity (%)[b]	Specificity (%)[b]	Target setting of use	Turnaround time (h)	Amenable to rapid test-and-treat?	Reference for policy guidance
Xpert MTB/RIF	2010	qPCR	MTB diagnosis and RIF resistance detection	85 (pooled), 96 (RIF resistance)	99 (MTB detection) 98 (RIF resistance)	District or subdistrict laboratory	<2	Yes, especially on Omni platform	WHO 2020 (21), WHO 2016 (84)
Xpert MTB/RIF ultra	2017	qPCR/melting temperature analysis (RIF resistance)	MTB diagnosis and RIF resistance detection	90 (pooled), 94 (RIF resistance)	96 (MTB detection), 98 (RIF resistance)	District or subdistrict laboratory	<2	Yes, especially on Omni platform	WHO 2020 (21)

WHO endorsed molecular tests for Pulmonary TB & drug susceptibility testing

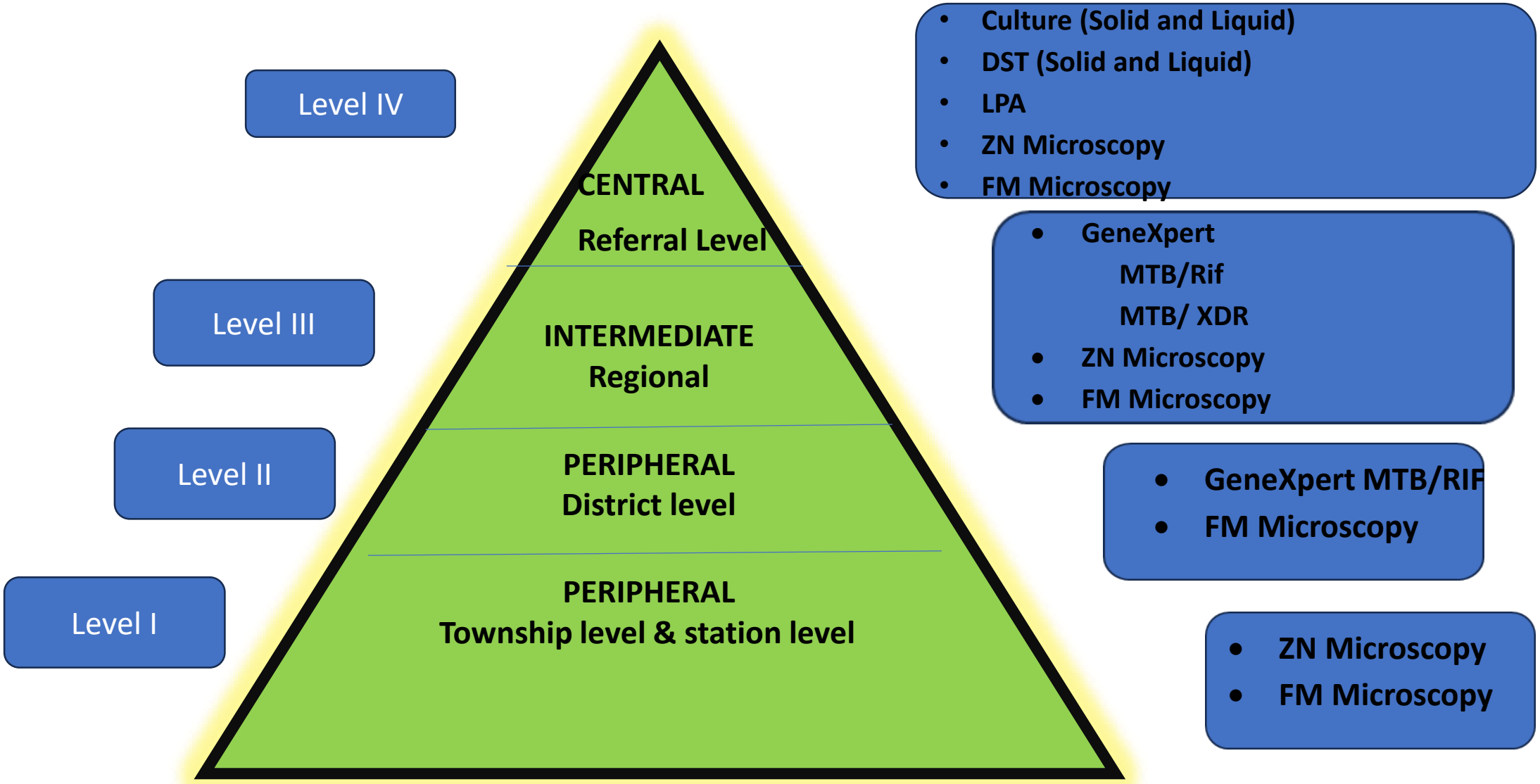
Technology	Year endorsed	Method principle	Intended use	Sensitivity (%)[b]	Specificity (%)[b]	Target setting of use	Turnaround time (h)	Amenable to rapid test-and-treat?	Reference for policy guidance
Loopamp MTBC assay	2016	Loop-mediated isothermal amplification	MTB diagnosis	78 (pooled)	98 (MTB detection)	Peripheral laboratory	<2	Yes	WHO 2016 (16)
Truenat MTB plus	2020	Micro RT-PCR	MTB diagnosis	80 (pooled)	96 (MTB detection)	Peripheral laboratory	<2	Yes, on Truelab platform	WHO 2020 (21)
Truenat MTB-RIF Dx	2020	Micro RT-PCR	Diagnosis of RIF resistance	84 (RIF resistance)	97 (RIF resistance)	Peripheral laboratory	<2	Yes, on Truelab platform	WHO 2020 (21)

WHO endorsed molecular tests for Pulmonary TB & drug susceptibility testing

Follow-on diagnostic tests for detection of drug resistance				
Xpert MTB/XDR	Cepheid, Sunnyvale, USA	Automated NAAT	LC-aNAAT	INH, FQ, ETO, AMK
GenoType MTBDR*plus*	Bruker/Hain Lifescience, Nehren, Germany	Manual reverse hybridization assay	FL-LPA	RIF, INH, ETO
Genoscholar™ NTM + MDRTB Detection Kit	NIPRO Corporation, Osaka, Japan	Manual reverse hybridization assay	FL-LPA	RIF, INH[b]
GenoType MTBDR*s*/	Bruker/Hain Lifescience, Nehren, Germany	Manual reverse hybridization assay	Individual	FQ, AMK
Genoscholar PZA-TB	NIPRO Corporation, Osaka, Japan	Manual reverse hybridization assay	HC-rNAAT	PZA


WHO-endorsed products
GX Edge, Xpert
LAMP
Truelab
Xpert, GX Omni
Sequencing
POC NAATs
Centralized DST
LPA
(2010)
(2016)
(2008)
(2020)
Emerging technologies and updates to endorsed products

Organization of TB Diagnostic Network Of NTP



Laboratory Services for TB

To confirm DS-TB/DR-TB

To monitor treatment progress

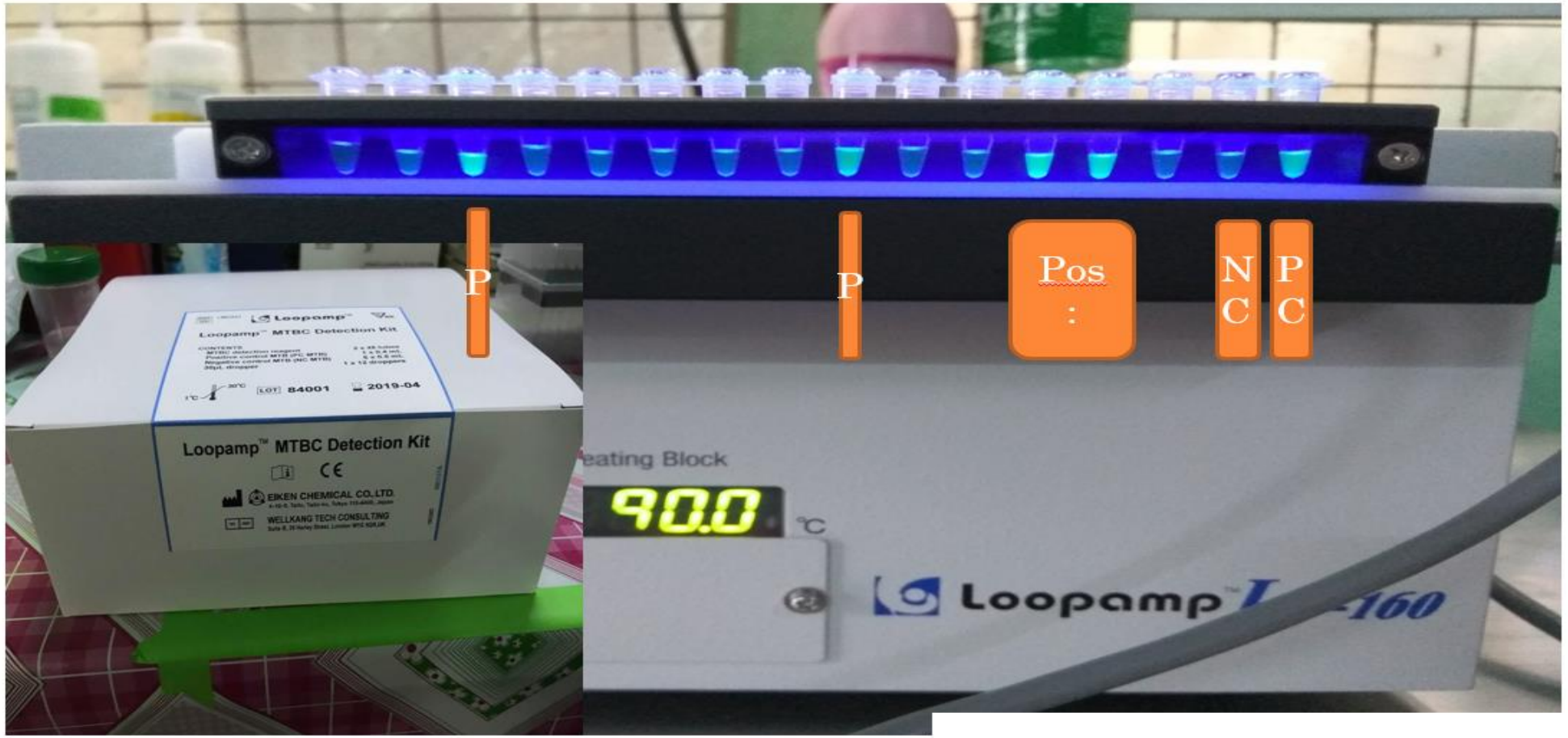
To identify treatment failure

To provide the decision for Cured patient

To provide the decision for Failure patient

Loop mediated isothermal amplification (LAMP)

- Rapid testing to detect MTBC directly from direct sputum
- Use as a rapid alternative tool to sputum smear microscopy



WHO Recommendation

TB-LAMP may be used as a replacement test for sputum-smear microscopy for diagnosing pulmonary TB in adults with signs and symptoms consistent with TB.

(Conditional recommendation, very low-quality evidence)

TB-LAMP may be used as a follow-on test to smear microscopy in adults with signs and symptoms consistent with pulmonary TB, especially when further testing of sputum smear-negative specimens is necessary.

(Conditional recommendation, very low-quality evidence)

Cont:

Can apply to setting where conventional sputum smear microscopy can be performed

Easy to read as providing a visual display

Can read with naked eye under UV light

Require minimum laboratory infrastructure & few biosafety requirements

TB-LAMP should not replace the use of Xpert MTB/RIF assay especially among population at risk of MDR-TB

Additional diagnostic value in HIV patients with presumptive TB symptoms over smear microscopy is unclear due to limited evidence

Advantages

Simple operation

More sensitive and specific than smear microscopy

(156 CFU/ml of sputum)

All-in-one for 3 steps of molecular diagnostics (DNA Extraction, Amplification & Detection)

More affordable than other PCR machines

Can test 14 samples per run

Rapid detection

(The whole test process takes 1- 1.5 hours)

Maintenance-free with a robust design

Why is molecular DST (Genotypic DST) important?

Rapid and accurate.

Can be done in presence of contaminants

May provide information on virulence.

May provide information on level of resistance.

May help to identify molecular pathways to develop new drugs.

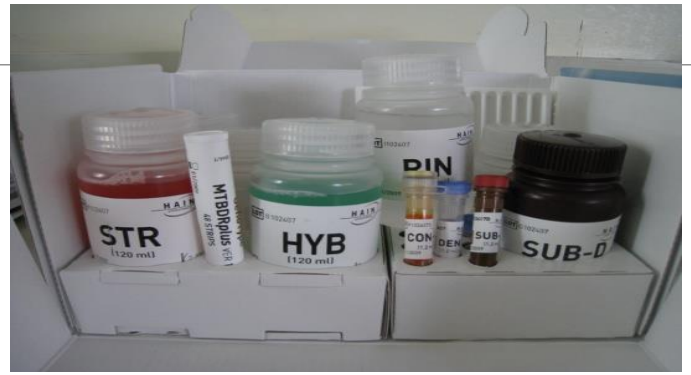
Less biohazard involved

Line Probe Assay

First Line LPA Kit

For Detection of MTBC & MDR-TB

GenoType® MTB DR plus kit (1st line LPA kit)



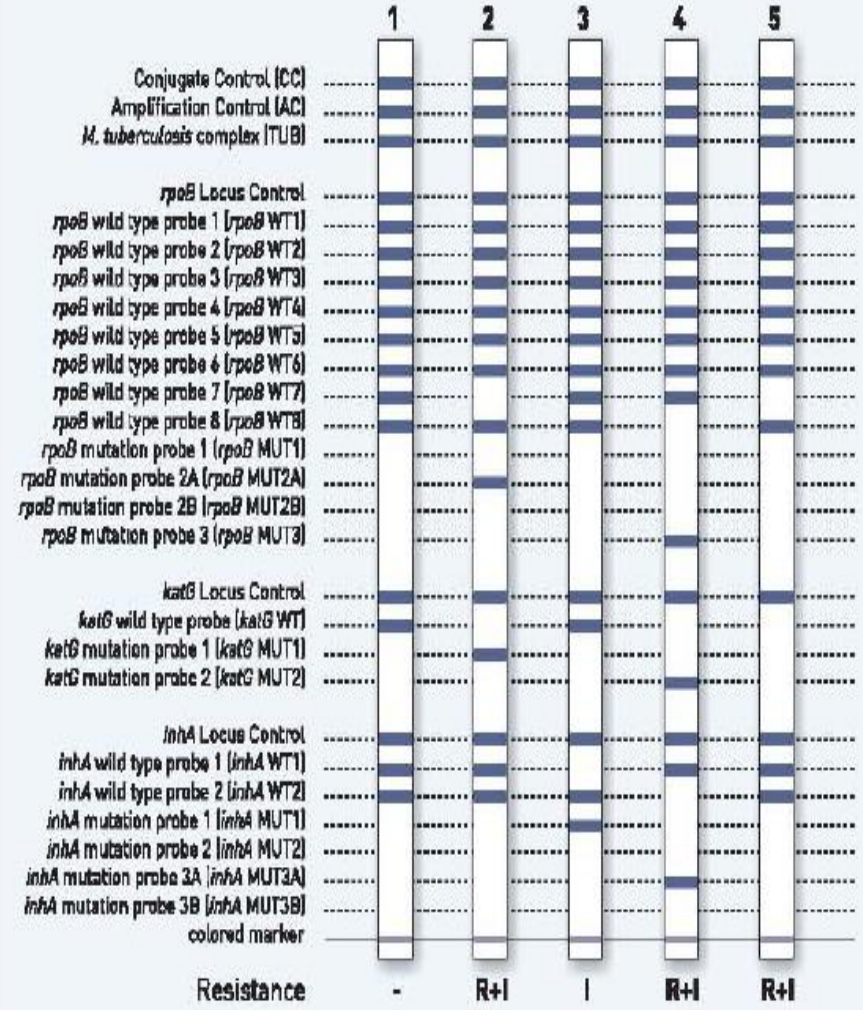
GT-Blot® 20

Automation of Hybridization reaction

TwinCubator®

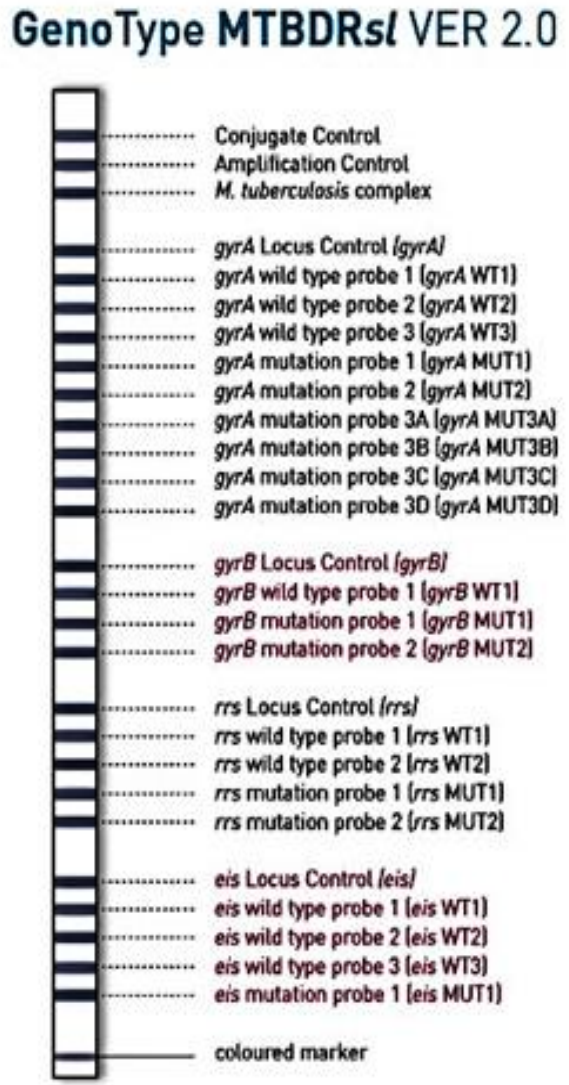
Manual of Hybridization reaction

First Line LPA kit
GenoType® MTB DR plus kit



- Endorsed by WHO in 2008 & has been used since 2010
- Identify MTBC & MDR-TB
- Can detect rpoB gene mutation for rifampicin resistance
- Can detect katG gene & inhA gene mutation for isoniazid resistance
- Formely used for Dx of MDR-TB but now for confirmation of discrepancies in Xpert MTB/RIF test.

Second Line LPA kit
GenoType® MTB DRsl kit



Recommended by WHO in May 2016

Identify MTBC

Can detect gyrA & gyrB gene mutation for fluoroquinolone resistance

Can detect rrs gene mutation for aminoglycoside and cyclic peptide resistance

For exclusion of Pre- XDR and XDR-TB

Limitations of LPA

Can detect the mutations that are most frequently identified in resistant strains

May miss rounding 20% of potential resistance INH, FQ & SLI.

Resistance cannot be completely excluded even in the presence of all wild type probes

Less efficient than conventional DST in hetero-resistance

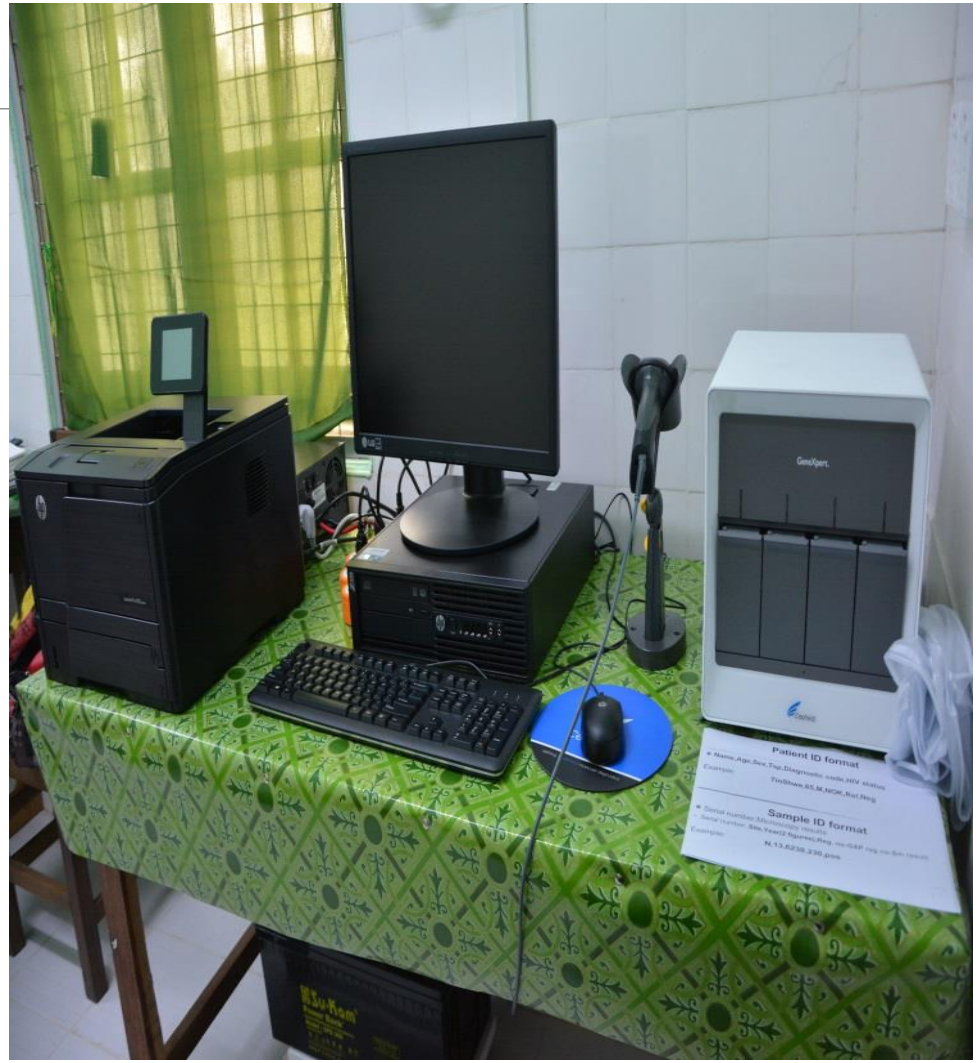
Xpert MTB/RIF test

Rapid and simultaneous detection of TB & rifampicin resistance

Semi-quantitative nested real-time PCR

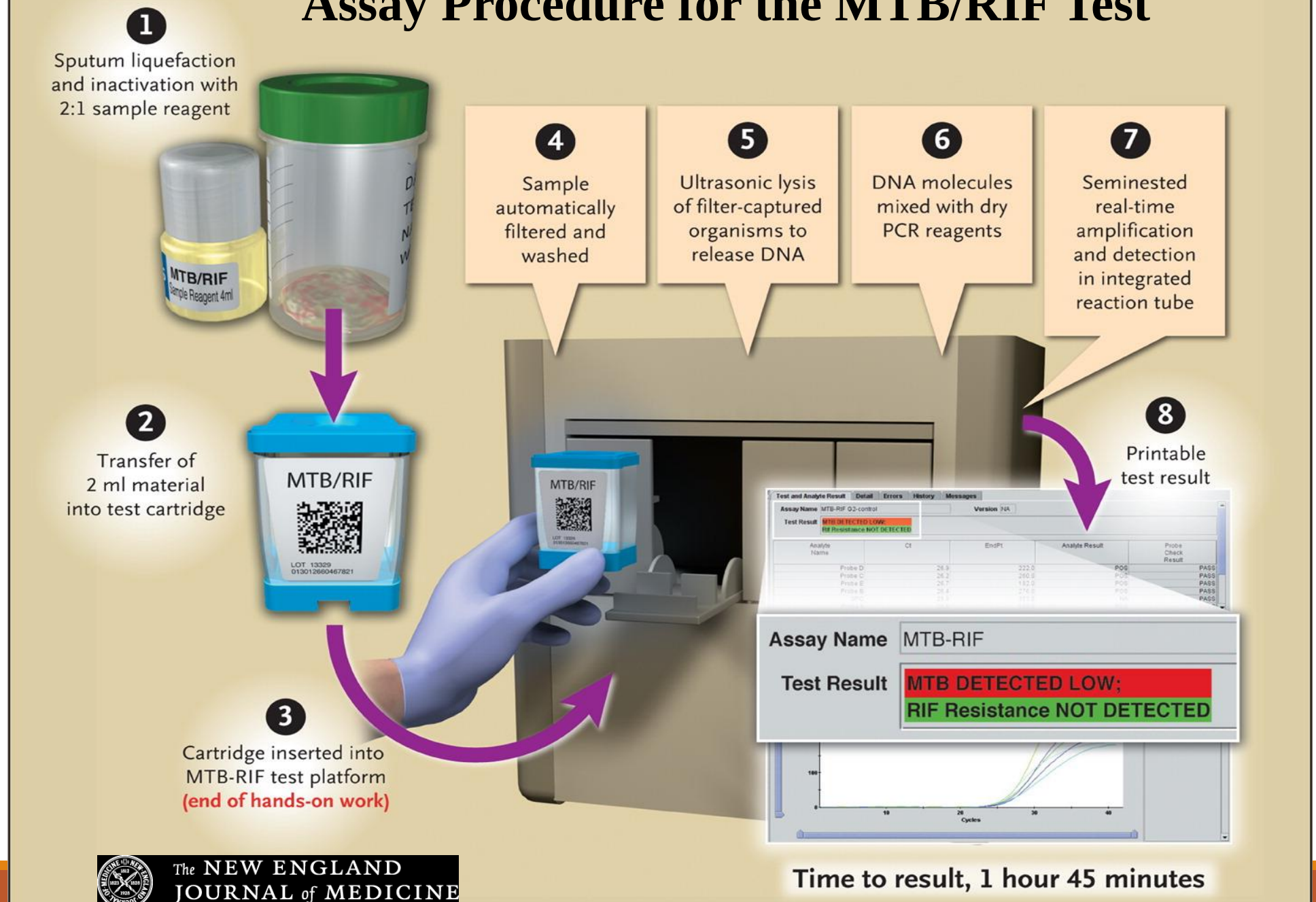
Can use both smear positive & negative samples

Shows rifampicin resistance within 2 hours



GeneXpert 4 modules machine

Assay Procedure for the MTB/RIF Test



The NEW ENGLAND JOURNAL of MEDICINE

Recommendation

WHO recommends the use of a molecular WRD (Xpert MTB/RIF, Xpert MTB/RIF Ultra, Truenat MTB, Truenat MTB Plus, Truenat MTB-RIF Dx or TB-LAMP) as the initial diagnostic test, rather than microscopy or culture, for all individuals with signs and symptoms of TB.

In adults and children with signs and symptoms of extrapulmonary TB, Xpert MTB/RIF may be used in lymph node aspirate, lymph node biopsy, pleural fluid, peritoneal fluid, pericardial fluid, synovial fluid or urine specimens as the initial diagnostic test for the corresponding form of extrapulmonary TB rather than smear microscopy/culture

Xpert MTB/RIF & Ultra Assays as the initial test to diagnose pulmonary TB and RR in children

Xpert MTB/RIF and Xpert Ultra should be used as an initial diagnostic test for TB & RR detection in sputum, gastric aspirate, nasopharyngeal aspirate and stool rather than smear microscopy, culture & phenotypic DST

Xpert MTB/RIF and Xpert Ultra assays as the initial test to diagnose extrapulmonary TB & RR

In adults and children with signs & symptoms of:

TB meningitis Xpert MTB/RIF or Xpert Ultra should be used in **cerebrospinal fluid (CSF)** as an initial diagnostic test for TB meningitis rather than smear microscopy/culture

EP TB Xpert MTB/RIF may be used in lymph node aspirate, lymph node biopsy, pleural fluid, peritoneal fluid, pericardial fluid, synovial fluid or urine specimens as the initial diagnostic test rather than smear microscopy/culture

Xpert MTB/RIF may be used in blood as an initial diagnostic test for disseminated TB

(conditional recommendation, very low-quality evidence)

Updates of **Xpert MTB/RIF**

Not repeating the MTB detected Rifampicin resistant cases in **New patients** except MTB detected Rifampicin resistant (very low) patients

Then send the sputum to NTRL for 1st line- LPA for confirmation of Rifampicin resistant in order to avoid false Rif resistant

Current Testing Criteria for Xpert MTB/RIF Test

- CXR abnormalities

- All pulmonary TB cases (New/Retreatment)
- Sputum smear positive at the end of intensive phase (Non- converter)
- TB patients with Diabetes Mellitus (TB/DM)
- Presumptive TB cases (PLHIV/ Contacts with MDR-TB patients)
- Other cases to be considered individually by MDR-TB expert group

Remark:

Extra-pulmonary specimen - CSF

- Gastric aspirate
- Lymph node aspirate
- **Stool for children**

Xpert MTB/XDR Testing

Xpert MTB/XDR test

WHO recommends to use in end of 2020 and launched in NTP in September 2021

Simultaneous detection of MTB Complex and mutations associated with INH, ETH, FQ & SLID resistance

Results in < 90 minutes

Aids in diagnosis of Pre-XDR TB

Accurate and fast test result for DR-TB management

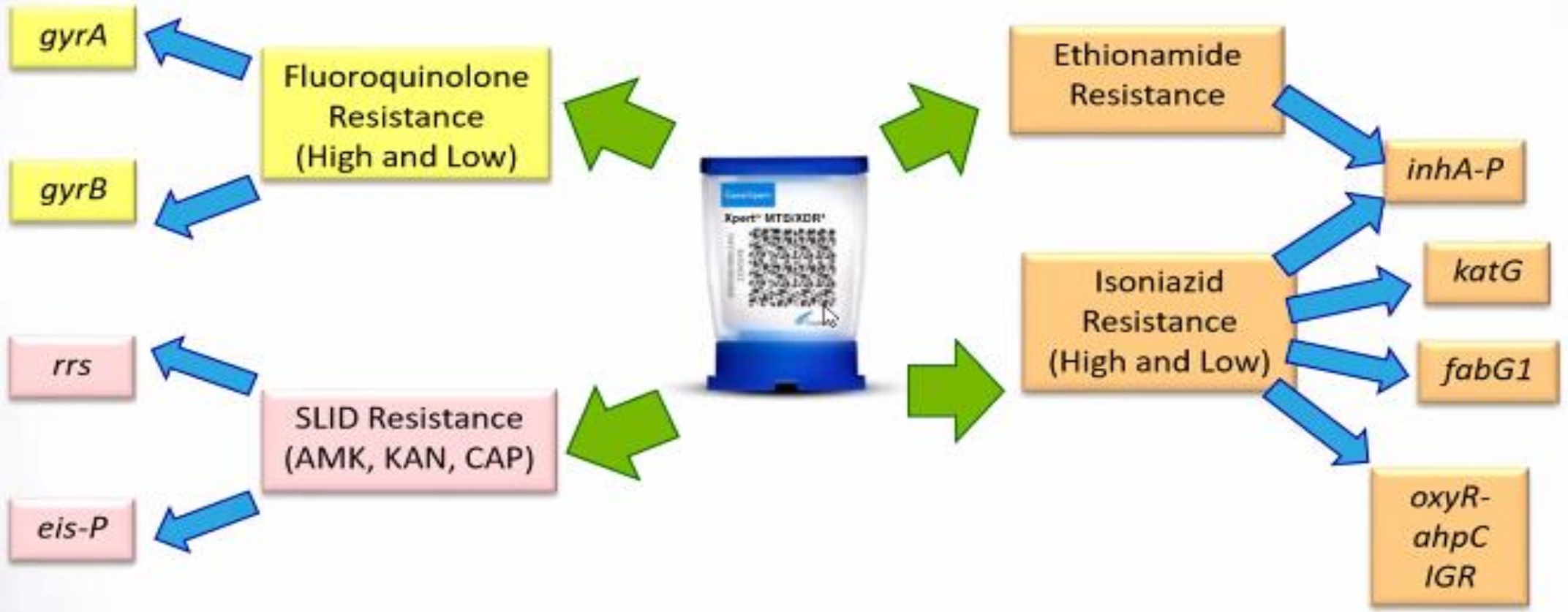
Intended Use

The Xpert® MTB/XDR* assay, is a nested real-time polymerase chain reaction (PCR) in vitro test for the detection of extensively drug resistant (XDR) MTB complex DNA in unprocessed sputum samples or concentrated sediments prepared from sputum.

In specimens where MTB is detected, the Xpert MTB/XDR Assay can also detect isoniazid (INH); ethionamide (ETH); fluoroquinolone (FLQ); and second line injectable drug (SLID) associated mutations.

The Xpert MTB/XDR Assay is intended for use as a reflex test for a specimen that is determined to be MTB positive. This test is intended as an aid in the diagnosis of XDR tuberculosis (TB) when used in conjunction with clinical and other laboratory findings.

The Xpert® MTB/XDR* Assay Resistance Detection



*CE-IVD. In Vitro Diagnostic Medical Device. May not be available in all countries. Not available in the United States

Cepheid.

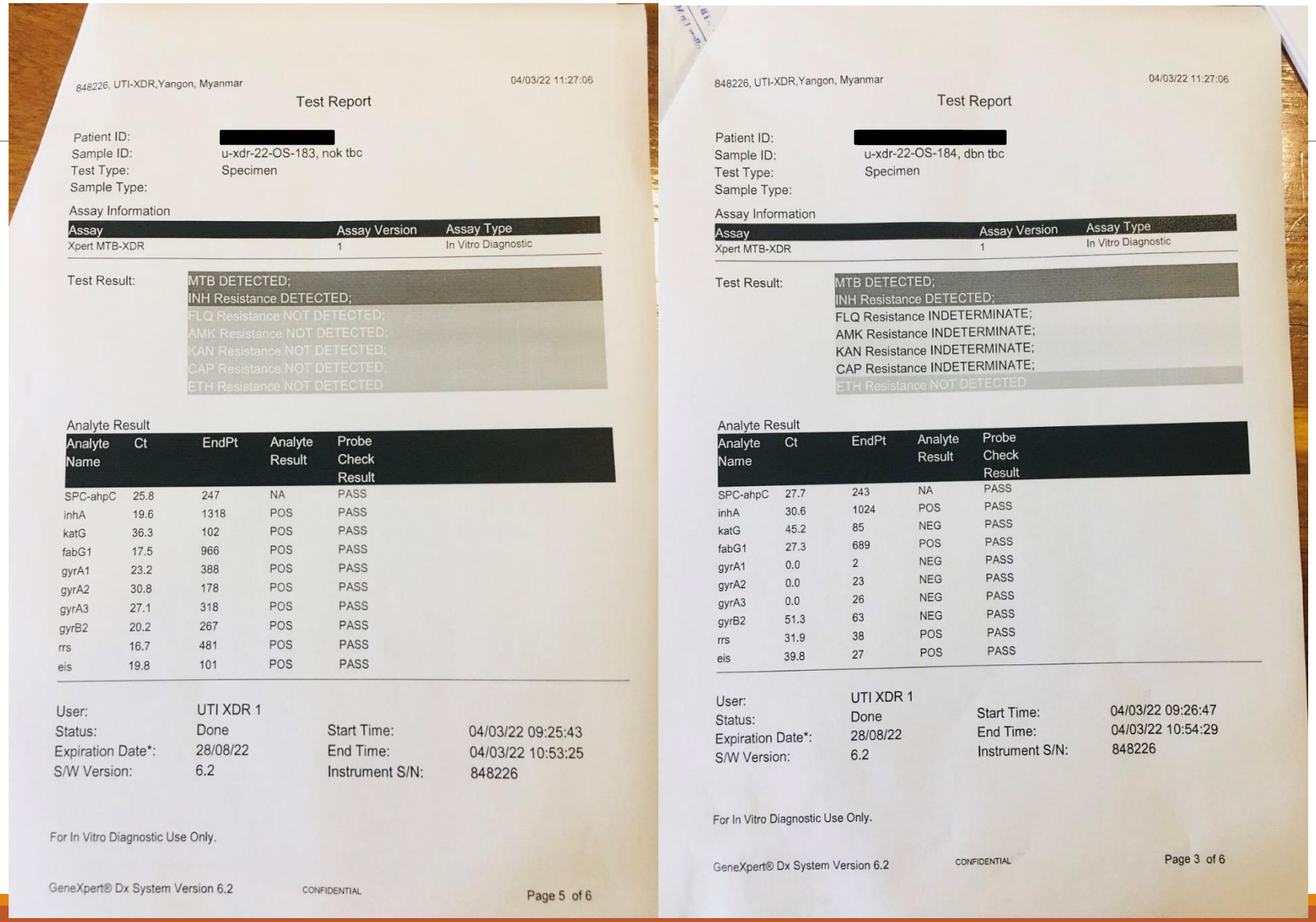
Gene Targets and Mutations for Xpert® MTB XDR* Assay

Gene	Detection
inhA- Promotor	Specifically detect high and low level resistance to Isoniazid (INH)
katG	
fabG1	
oxyR-ahpC Inter Genetic Region	
gyrA	Specifically detect low-R & high-R associated mutations for Fluoroquinolones (FLQ)
gyrB	
rrs	Differentiate between cross-resistance and individual resistance for Second line Injectable drugs (SLID)
eis-Promotor	

*CE-IVD. In Vitro Diagnostic Medical Device. May not be available in all countries. Not available in the United States

Cepheid.

Xpert MTB/XDR Results



848226, UTI-XDR,Yangon, Myanmar 04/03/22 11:27:06

Test Report

Patient ID: [redacted]
Sample ID: u-xdr-22-OS-183, nok tbc
Test Type: Specimen
Sample Type:

Assay Information

Assay	Assay Version	Assay Type
Xpert MTB-XDR	1	In Vitro Diagnostic

Test Result:
MTB DETECTED;
INH Resistance DETECTED;
FLQ Resistance NOT DETECTED;
AMK Resistance NOT DETECTED;
KAN Resistance NOT DETECTED;
CAP Resistance NOT DETECTED;
ETH Resistance NOT DETECTED

Analyte Result

Analyte Name	Ct	EndPt	Analyte Result	Probe Check Result
SPC-ahpC	25.8	247	NA	PASS
inhA	19.6	1318	POS	PASS
katG	36.3	102	POS	PASS
fabG1	17.5	966	POS	PASS
gyrA1	23.2	388	POS	PASS
gyrA2	30.8	178	POS	PASS
gyrA3	27.1	318	POS	PASS
gyrB2	20.2	267	POS	PASS
rrs	16.7	481	POS	PASS
eis	19.8	101	POS	PASS

User: UTI XDR 1
Status: Done
Expiration Date*: 28/08/22
S/W Version: 6.2
Start Time: 04/03/22 09:25:43
End Time: 04/03/22 10:53:25
Instrument S/N: 848226

For In Vitro Diagnostic Use Only.

GeneXpert® Dx System Version 6.2 CONFIDENTIAL Page 5 of 6

848226, UTI-XDR,Yangon, Myanmar 04/03/22 11:27:06

Test Report

Patient ID: [redacted]
Sample ID: u-xdr-22-OS-184, dbn tbc
Test Type: Specimen
Sample Type:

Assay Information

Assay	Assay Version	Assay Type
Xpert MTB-XDR	1	In Vitro Diagnostic

Test Result:
MTB DETECTED;
INH Resistance DETECTED;
FLQ Resistance INDETERMINATE;
AMK Resistance INDETERMINATE;
KAN Resistance INDETERMINATE;
CAP Resistance INDETERMINATE;
ETH Resistance NOT DETECTED

Analyte Result

Analyte Name	Ct	EndPt	Analyte Result	Probe Check Result
SPC-ahpC	27.7	243	NA	PASS
inhA	30.6	1024	POS	PASS
katG	45.2	85	NEG	PASS
fabG1	27.3	689	POS	PASS
gyrA1	0.0	2	NEG	PASS
gyrA2	0.0	23	NEG	PASS
gyrA3	0.0	26	NEG	PASS
gyrB2	51.3	63	NEG	PASS
rrs	31.9	38	POS	PASS
eis	39.8	27	POS	PASS

User: UTI XDR 1
Status: Done
Expiration Date*: 28/08/22
S/W Version: 6.2
Start Time: 04/03/22 09:26:47
End Time: 04/03/22 10:54:29
Instrument S/N: 848226

For In Vitro Diagnostic Use Only.

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Testing Criteria for Xpert MTB/XDR

All confirmed MDRTB/RR patients

Patients who showed no improvement clinically or bacteriologically by month 4, bacteriological/radiological deterioration during MDRTB treatment

Culture reversion after culture conversion to negative

Relapse of MDR TB treatment

A patient whose treatment was interrupted for two consecutive months or more /Lost to follow up

Patients with suspected mono-INH resistant while on first line anti-TB treatment

Close contacts of INH resistant TB

People who have indeterminate Xpert/MTB XDR results or MTB not detected by 1st time testing of Xpert MTB/XDR

Other cases to be considered individually by MDR-TB expert group

Xpert MTB/RIF Ultra Assay

Sensitivity of Xpert MTB/RIF is suboptimal particularly with smear-negative and HIV associated tuberculosis.

Xpert MTB/RIF Ultra assay has been developed as the next-generation assay to overcome these limitations

Sensitivity of Xpert MTB/RIF Ultra assay is 5% higher than Xpert MTB/RIF assay and the specificity is 3.2% lower.

LoD - 16 CFU/ml

The “Trace” category identify the paucibacillary samples which were MTB positive but can’t tell the RIF resistance condition

Peculiar points of Xpert ultra

The Xpert MTB/RIF Ultra assay (hereafter called Xpert Ultra) uses the same GeneXpert platform as the Xpert MTB/RIF test, and was developed to improve the sensitivity and reliability of detection of MTBC and RIF resistance.

To address sensitivity, Xpert Ultra uses two multicopy amplification targets (IS6110 and IS1081) and a larger PCR chamber; thus, Xpert Ultra has a lower LoD(limit of detection) than Xpert MTB/RIF (16 colony forming units [cfu]/mL and 131 cfu/mL, respectively).

At very low bacterial loads, Xpert Ultra can give a “trace” result, which is not based on amplification of the rpoB target and therefore does not give results for RIF susceptibility or resistance.

An additional improvement in the Xpert Ultra is that the analysis is based on melting temperature (Tm), which allows for better differentiation of resistance-conferring mutations.

	MTB/RIF	MTB/RIF Ultra
Diagnosis	MTB complex	MTB complex
Resistance	Detects rifampicin resistance as a surrogate for MDR-TB	Detects rifampicin resistance as a surrogate for MDR-TB
Amplification for TB detection	Single target: rpoB core region	Multi-copy target: RpoB core region Insertion elements: IS6110 + IS1081
Resistance detection	Real-time PCR 5 probes bind to RpoB gene	Melting curve 4 probes bind to RpoB gene
Sputum input	2ml	2ml
PCR reaction	25ul	50ul
Assay TAT	112min	65-87min
Limit of detection	131cfu/ml	16cfu/ml
Cost	9.98USD	9.98USD

Short pieces of DNA, occurs multiple times in genome, conserved in MTBC

Results for Rifampicin

Rif susceptible = all four RpoB probes have identifiable melt temperatures in wild type (normal) profile

Rif resistance = all four RpoB probes have identifiable melt temperatures and at least one is a mutant profile

Semi-Quant category	Xpert MTB/RIF	Xpert Ultra
High, Med, low	Rif resistance detected /not detected	Rif resistance detected / not detected/ indeterminate
Very low	Rif resistance detected/ not detected /indeterminate	Rif resistance detected/ not detected/ indeterminate
MTB trace detected		Rif indeterminate

New category: MTB trace

Trace = Improved sensitivity = Lowest bacillary burden detected

ongoing active paucibacillary tuberculosis ?

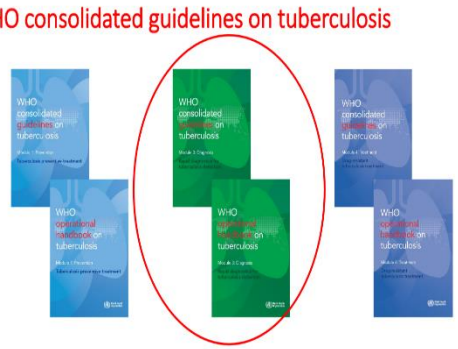
detection of dead bacilli from previous infections ?

Considerations for interpretation of trace results:

In HIV-positives, children and EPTB = TB positive

If in a patient with no-risk of HIV or previous history of TB, treatment should be considered depend on other parameters

WHO Recommendation for Xpert MTB/RIF Ultra (2020)



In adults with signs and symptoms of pulmonary TB without a prior history of TB or with a remote history of TB treatment (>5 years since end of treatment), Xpert Ultra should be used as the initial diagnostic test for TB and for detection of RIF resistance rather than smear microscopy or culture and phenotypic DST. (strong recommendation, high certainty of evidence for test accuracy)

In adults with signs and symptoms of pulmonary TB and a prior history of TB with an end of treatment within the past 5 years, Xpert Ultra may be used as the initial diagnostic test for TB and for detection of RIF resistance rather than smear microscopy or culture and phenotypic DST. (conditional recommendation, low certainty of evidence for test accuracy)

In children with signs and symptoms of pulmonary TB, Xpert Ultra should be used as the initial diagnostic test for TB rather than smear microscopy or culture in sputum or nasopharyngeal aspirates. (strong recommendation, low certainty of evidence for test accuracy)

WHO Recommendation for Xpert MTB/RIF Ultra

In adults and children with signs and symptoms of extrapulmonary TB, Xpert Ultra should be used for detection of RIF resistance rather than culture and phenotypic DST. (strong recommendation, low certainty of evidence for test accuracy)

In adults and children with signs and symptoms of TB meningitis, Xpert Ultra should be used in CSF as an initial diagnostic test for TB meningitis rather than smear microscopy or culture (strong recommendation, low certainty of evidence for test accuracy)

In adults and children with signs and symptoms of extrapulmonary TB, Xpert Ultra may be used in lymph node aspirate and lymph node biopsy as the initial diagnostic test for the detection of lymph node TB, rather than smear microscopy or culture (conditional recommendation, low certainty of evidence)

WHO Recommendation for Xpert MTB/RIF Ultra

Xpert Ultra trace results complicate decision-making

Laboratory and clinical management of trace results was rarely straightforward. If repeat tests are conducted after trace, cause confusion if the second test has a different result (e.g. is negative)

Xpert Ultra repeated testing in adults and children with signs and symptoms of pulmonary TB

In adults with signs and symptoms of pulmonary TB who have an Xpert Ultra trace positive result on the initial test, repeated testing with Ultra may not be used. (conditional recommendation, very low certainty of evidence for test accuracy).

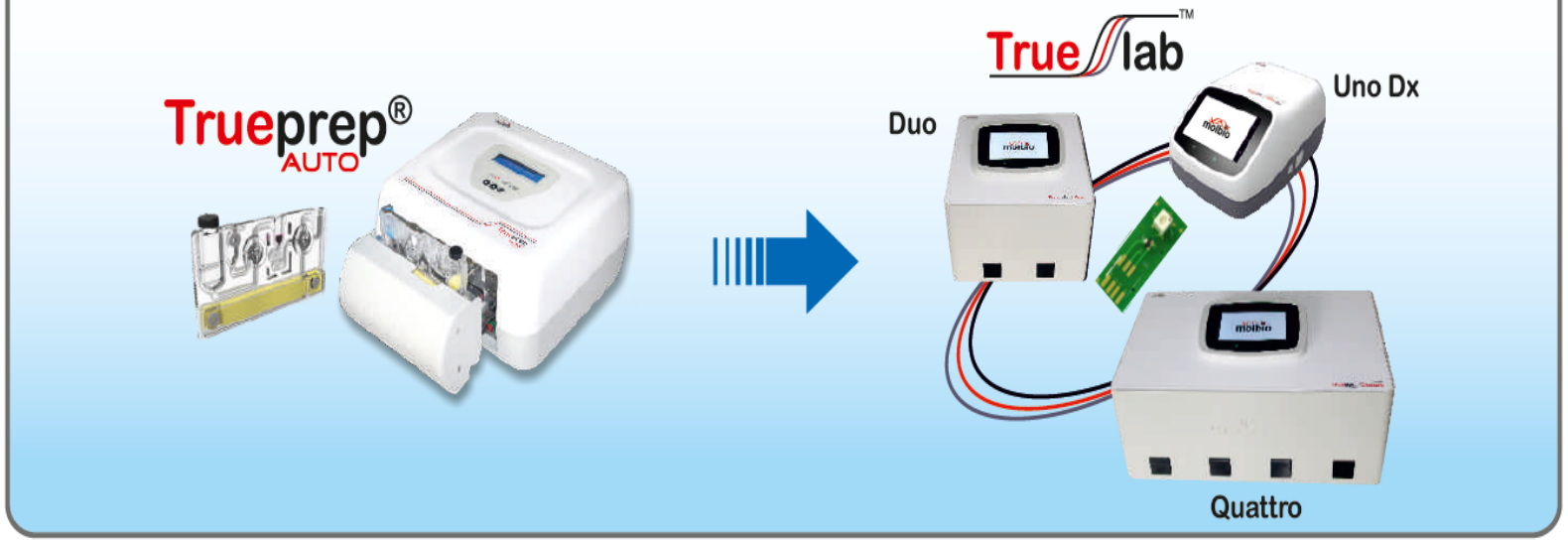
In children with signs and symptoms of pulmonary TB in settings with a pretest probability of less than 5% and an Xpert Ultra negative result on the initial test, repeated testing with Xpert Ultra in sputum or nasopharyngeal aspirate specimens may not be used. (conditional recommendation, very low certainty of evidence for test accuracy)

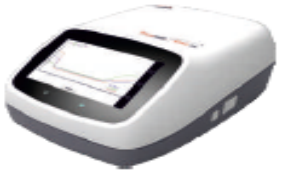
In children with signs and symptoms of pulmonary TB in settings with a pretest probability of 5% or more and an Xpert Ultra negative result on the first initial test, a repeat of one Xpert Ultra test (for a total of two tests) in sputum and nasopharyngeal aspirate specimens may be used. (conditional recommendation, very low certainty of evidence for test accuracy)

True lab™

• Real Time Quantitative micro PCR System •

Sample to Results in less than 1 Hour!





Truelab™ Uno Dx Real Time Quantitative micro PCR Analyzer
Fully automatic Real Time Quantitative micro PCR Analyzer, Three wavelength system, performs between 10-12 tests in 8 hours. Controls amplification, detection and reporting of results.

Truelab™ Duo Real Time Quantitative micro PCR Analyzer
Fully automatic Real Time Quantitative micro PCR Analyzer, Two channel-Three wavelength system, performs 20-24 tests in 8 hours.

Truelab™ Quattro Real Time Quantitative micro PCR Analyzer
Fully automatic Real Time Quantitative micro PCR Analyzer, Four channel-Three wavelength system, performs 40-48 tests in 8 hours.

Trueprep® AUTO Universal Cartridge based Sample Prep Device
The fully automatic sample prep device works in tandem with **Trueprep® AUTO** Cartridge and **Trueprep® AUTO** Reagent kit for extraction and purification of nucleic acids from clinical specimen.

Truelab™ micro PCR printer
Bluetooth printer, prints wirelessly the results of the PCR tests performed by the **Truelab™ UnoDx/Duo/Quattro Real Time Quantitative micro PCR Analyzer**

Truepet® SPA Fixed volume (6µl) Precision micropipette
Precalibrated Single Push Auto ejector fixed volume (6µl) micropipette that ensures accurate pipetting of elute.

ANY WHERE, ANY TIME, REAL TIME PCR

Truenat

The system works on disease specific **Truenat**™ microchips for conducting a real time PCR.

The chips require only 6 µl of purified nucleic acid sample for the reaction.

The chips run on the fully automatic **Truelab**™ **Uno Dx** real time micro PCR analyzer and quantitative results are available in about 35-40 minutes.

The sample preparation (extraction and purification) is done on a fully automated, cartridge based **Trueprep AUTO** sample prep device.

The process is simple and user friendly and takes about 20 minutes.

Truenat

The Truenat MTB chip amplifies a portion of the ribonucleoside-diphosphate reductase gene, nrdB,

(LOD) of **about 100 (CFU)/ml sputum sample**.

The procedure included two steps:

first- sputum samples were processed for separation of DNA by using True prep device.

Second-Presence of MTB was detected by Truelab™ Real Time micro PCR Analyzer.

All the MTB positive samples were tested for the presence of Rifampicin resistance by using another specialized chip.

The salient features of the Truelab™ system are,

Rapid – sample to result in approximately one hour. While processing multiple samples, sample extraction and PCR can be done in parallel to increase throughput.

Simple – Fully automated. Tests can be performed by a minimally trained technician.

User friendly – **Truenat™** chips are stable at ambient temperature (upto 30°C for two years and upto 40°C for 6 months) and are ready to use.

Portable – The instruments are light weight and mains/re-chargeable battery operated and can be carried in the field case provided.

Reliable – Quantitative Real Time PCR chemistry using proven primers and probes.

Accurate –Extensively validated.

Robust – All system components designed for rugged conditions.

Data transfer capability – Results can be automatically/ manually transported to a printer or any remote device/server via GPRS/Wifi/ Bluetooth.

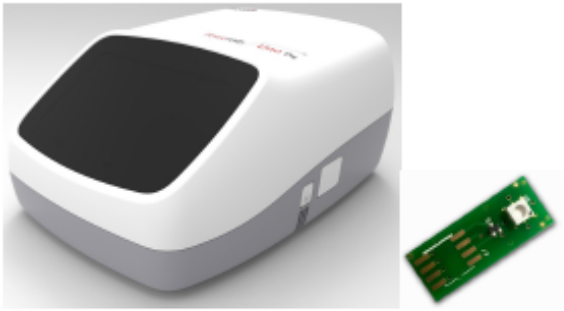
Memory – Upto 20,000 results can be stored on board.

Affordable – Designed to meet the needs of developing countries. Single testing capability.

WHO recommends using Truenat MTB, MTB Plus and MTB-RIF Dx tests

In adults and children with signs and symptoms of pulmonary TB, the Truenat MTB or MTB Plus may be used as an initial diagnostic test for TB rather than smear microscopy or culture.

In adults and children with signs and symptoms of pulmonary TB and a Truenat MTB or MTB Plus positive result, Truenat MTB-RIF Dx may be used as an initial test for RIF resistance rather than culture and phenotypic DST.

Technology	 Other WHO endorsed Platform	 TrueLab™/ TrueNat™ MTB TruePrep™ for DNA/ RNA extraction
WHO Endorsed	Yes	Yes
Cartridge or chip based	Cartridge	Chip
Sample prep	Fully automated	Fully Automated
Assay	Fully automated	Fully automated
Detection	TB + RIF	TB, TB RIF
Other diseases detected by platform at present	MRSA, C Diff, etc	Hep B, Malaria, Dengue, Chikungunya, Typhoid, H1N1, etc
Type of PCR	Nested real-time PCR	Quantitative Real-time PCR
Touchscreen for readout	No	Yes
Internal memory	No. Results stored on laptop.	Yes. Internal memory for 20000 test results
Automated disease surveillance	No	Data can be transported (in encrypted form) to a central/ remote server via in built GSM/Wi-Fi/Blue Tooth
Throughput (8 hour work day)	4 – 5 tests (1 cartridge) 8 – 10 tests (2 cartridge)	10 -12 tests (Truelab Uno) 20 - 24 tests (Truelab Duo)

Gold standard for TB diagnosis

Although culture is still the gold standard for TB diagnosis, with the increasing efficiency of molecular techniques used in the molecular diagnosis of TB, there has been a revolution in the early detection of MTB.

Culture remains the gold standard for laboratory confirmation of TB disease, and growing bacteria are required to perform **drug-susceptibility testing and genotyping**.


Thank You!