Stop TB Partnership
GLOBAL DRUG FACILITY

LOOPAMP™ (LAMP) TEST

TECHNICAL INFORMATION NOTE

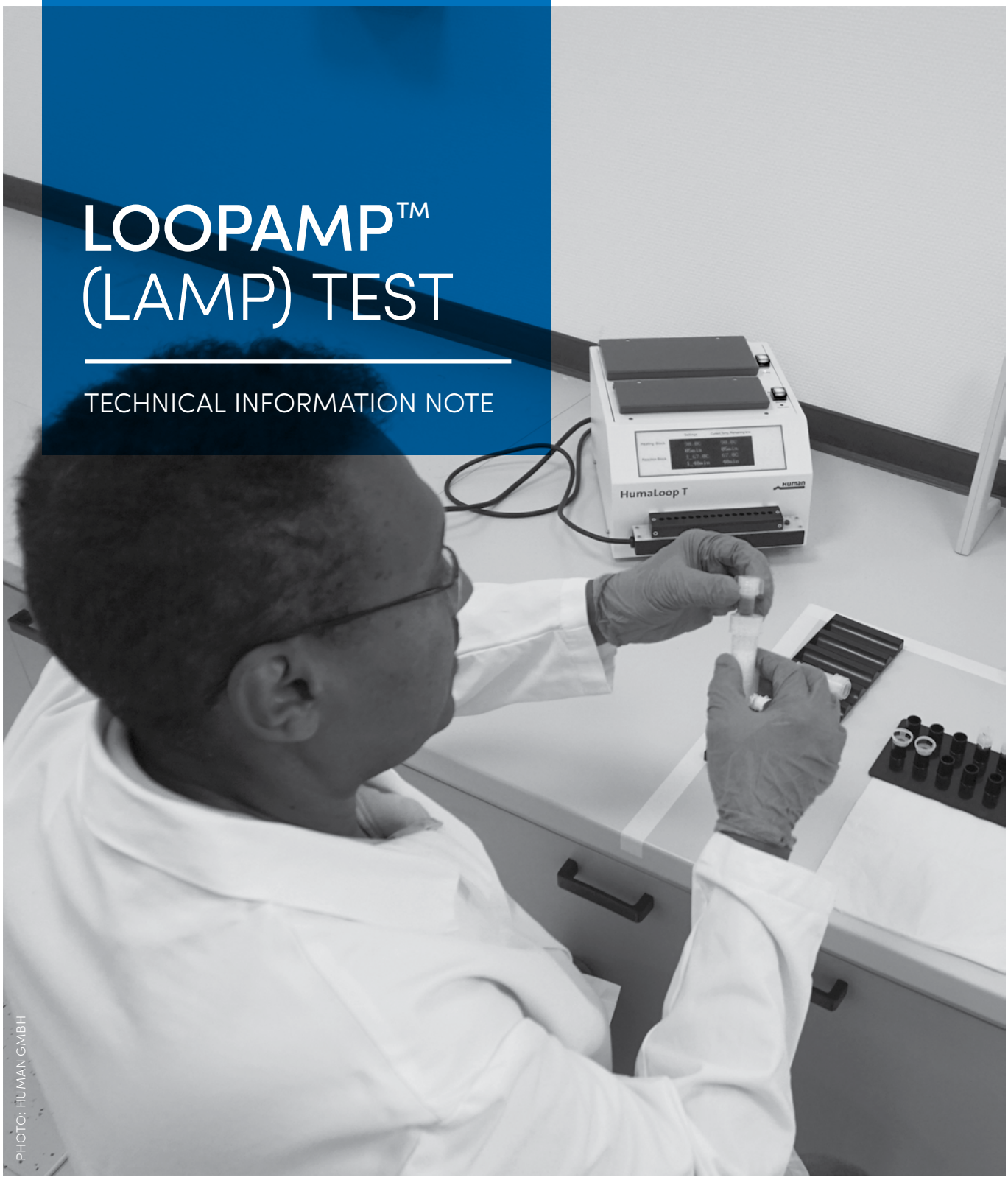

PHOTO: HUMAN GMBH

Ensuring an uninterrupted supply of quality-assured, affordable anti-TB drugs and diagnostics to the world.

stoptb.org/gdf

Stop TB Partnership
GLOBAL DRUG FACILITY

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TECHNICAL INFORMATION NOTE
LOOPAMP™ (LAMP) TEST

The Loopamp™ test uses the loop-mediated isothermal amplification (LAMP) technique to accurately detect *Mycobacterium Tuberculosis complex* (MTBC) at peripheral health centers, where smear microscopy is usually performed. The LAMP technology provides better results than microscopy, detecting 15% more patients with pulmonary TB when used for all persons presenting with signs or symptoms of TB. If used as an add-on test after microscopy, the increase in TB cases detected among those with smear-negative results is more than 40%. The test does not require sophisticated instrumentation and has biosafety requirements similar to smear microscopy. The manufacturer is Eiken Chemical Company Ltd. (Tokyo, Japan).

SUPPLY INFORMATION

→ Available in the GDF diagnostics catalog
Distributor: HUMAN Gesellschaft für Biochemica und Diagnostica mbH, Wiesbaden, Germany

HumaLoop T

Loopamp™ PURE DNA Extraction Kit

Loopamp™ MTBC Detection Kit

Pipette-60 Set

For more information or to place an order contact
gdf@stoptb.org

EQUIPMENT, REAGENTS AND CONSUMABLES REQUIRED

ITEM	GDF ITEM NUMBER	GDF ITEM DESCRIPTION	COST
HumaLoop T *MANUFACTURER REF: 961000*	106632	Incubator for sample processing, amplification and visual result reading	€ 2,450*
HuMax ITA *MANUFACTURER REF: 980000*	106663	Benchtop microcentrifuge with preinstalled program for incubation, mixing and centrifugation of Loopamp™ reaction tubes	€ 575
Loopamp™ PURE DNA Extraction Kit *MANUFACTURER REF: 970000*	106635	Supplies for 90 extractions Storage and shipment at 2-30°C Shelf life: up to 640 days (21 months)	€ 298.20 per kit*
Loopamp™ MTBC Detection Kit *MANUFACTURER REF: 972000*	106634	Supplies for 96 tests (2 packages of 48), plus controls Storage and shipment at 2-30°C Shelf life: up to 280 days (11 months)	€ 352.50 per kit*
Pipette-60 Set *MANUFACTURER REF: 971000*	106643	1 pipette, 384 filter tips (4 packages of 96 filter tips)	€ 44.10 per set*

* FIND-negotiated concessional prices offered to the public sector in 145 high burden and developing countries (see https://www.finddx.org/find-negotiated-product-pricing/)

ACCESSORIES REQUIRED

ITEM	GDF ITEM NUMBER	GDF ITEM DESCRIPTION	COST
Sputum containers	106525	80ml each; 1,000 cups per pack	$83.30
Latex gloves	106345, 106346, 106347	Sizes small, medium and large, respectively; 1,000 pieces per pack.	$50.32
Stable chlorine disinfectant	106624	100 tablets; 1 tablet should be dissolved in 1 liter of water	$30.25

ACCESSORIES OFFERED

ITEM	GDF ITEM NUMBER	GDF ITEM DESCRIPTION	COST
Uninterruptable Power Supply (UPS)	106443	700 VA / 500 Watts UPS; alternatively a UPS with similar specifications may be procured locally to allow for direct servicing. The internal battery of the offered model allows for continued power during only brief power outages. In settings with extreme incoming voltage fluctuations, a voltage stabilizer may also need to be procured locally.	US$ 467.03
Auxiliary battery pack	106492	Battery pack for UPS 700VA, to amplify the existing back-up time of the UPS up to 150 minutes. In settings with longer power outages, an auxiliary battery pack is required and may be procured locally.	US$ 393.03

SERVICE AND MAINTENANCE

ITEM	GDF ITEM NUMBER	GDF ITEM DESCRIPTION	COST*
Installation	106637	• On-site inspection according to site preparation check list, and installation of system(s) • Testing incubators and fluorescence module of HumaLoop according to Operation Qualification (OQ) • All equipment and test kits needed for OQ • Issue of Installation and OQ certificates, and start of basic one-year warranty • Travel and accommodation expenses, where applicable, are not included and will be charged separately by HUMAN to the recipient.	€ 1,295
Training	106638	End user training for 2 days, on the following topics: • Introduction to Loopamp™ technology, familiarization with products and procedures, preparation of materials and workspace, performing TB assay, results interpretation & troubleshooting. Includes examination of trainees, with certificate issued upon passing	€ 250

Training (continued)		• The training includes needed training documentation. • Test kits to be used for training purposes are not included in the pricing and should be provided by the trainee or can be ordered via the assigned partner of HUMAN • Travel and accommodation expenses, where applicable, are not included and will be charged separately by HUMAN to the recipient.	
Maintenance	106639	• Annual check of on-site conditions • Extensive cleaning of working area, instrument surface, heating blocks and fluorescence reading unit according to maintenance check list • Inspection and validation of UPS and power connection • Temperature check and verifying the incubation and reaction block are reaching the target temperature according to maintenance check list • Performance of maintenance test kit to ensure the instrument is working properly according to Operation Qualification (OQ) • Needed equipment and test kit to perform the OQ • Issue of OQ certificate • Travel and accommodation expenses, where applicable, are not included and will be charged separately by HUMAN to the recipient.	€ 1,235
Maintenance with warranty extension	106640	All services described under Maintenance above, plus: • Warranty extension for 1 year (on-site) if the maintenance is done before the first warranty period ends and a copy of the filled maintenance check list is returned to HUMAN.	€ 1,675

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FORECASTING AND ORDER PLANNING FOR ROLLING OUT LAMP

ESTIMATING EXPECTED TESTING VOLUMES

- Used as a replacement for smear microscopy to diagnose TB, the average daily number of people with signs or symptoms of TB at planned implementation sites should be used to estimate the expected testing volumes.

DEVICE THROUGHOUT

- Up to 14 patient samples can be run per cycle using the HumaLoop T equipment.
  - → Each cycle also requires a negative and positive control, so maximizing a batch size results in improved cost efficiency.
- Given each cycle takes 1.5 hours, 5 cycles may be run per day in a well-functioning laboratory (up to 70 patient samples per day). In laboratories starting to use the test, 2-3 cycles per day (28-42 patient samples) may be a feasible number as staff build proficiency.

ORDER SIZES

- 1 Extraction Kit (90 extractions) and 1 Detection Kit (96 tests) provide the appropriate number of reagents for testing 84 patient samples, when batch sizes are maximized (6 cycles testing 14 patient samples each)[1].
- The annual number of kits that would be used in 1 year (260 working days) under different scenarios of batch efficiency and cycles per day is provided in Table 1.

[1] Each patient sample requires a test from the Extraction kit and a test from the Detection Kit. Each cycle also requires a positive and a negative control; each positive and negative control uses a test from the Detection kit, and the negative control also requires a test from the Extraction Kit

Table 1. Number of patient samples that would be tested and number of Detection and Extraction Kits that would be used in 1 year (260 working days).

AVERAGE NUMBER OF TESTING CYCLES PER DAY	AVERAGE NUMBER OF PATIENT SAMPLES PER BATCH		
	14 (MAXIMUM EFFICIENCY)	10 (70% EFFICIENCY)	7 (50% EFFICIENCY)
5	18,200 patient samples 217 Kits	*For cost efficiency purposes, the daily number of cycles should be adjusted to increase batch sizes.*	
4	14,560 patient samples 174 Kits		
3	10,920 patient samples 130 Kits		
2	7,280 patient samples 87 Kits	5,200 patient samples 65 Kits	3,640 patient samples 49 Kits
1	3,640 patient samples 44 Kits	2,600 patient samples 33 Kits	1,820 patient samples 25 Kits

SUPPLY PLANNING: SUGGESTED DELIVERY FREQUENCY

- The supply plan must account for the procurement and supplier lead times as well as the time required for country-specific importation processes; in total this may entail 4-6 months.
- For planning of orders and shipments, note the shelf life of the Detection Kit is no more than 11 months at the time of manufacture. Shipments of Detection Kits may therefore be required at least 2-3 times a year in order to avoid the risk of stock-outs.
    - → Given their longer shelf life (up to 21 months), Extraction Kits may be delivered less frequently (e.g., annually).

COST PER LAMP TEST

- The cost per patient sample for reagents (extraction and detection tests) and consumables (from the Pipette-60 Set) depends on the batch size of the cycle, given the need for positive and negative controls. The cost per patient sample under different scenarios of batch efficiency is provided in Table 2.

Table 2. Cost per tested patient sample under various scenarios of batch sizes.

NUMBER OF PATIENT SAMPLES IN BATCH	COST PER PATIENT SAMPLE
14 (maximum efficiency)	7.87 Euro
10 (70% efficiency)	8.18 Euro
7 (50% efficiency)	8.64 Euro
1 (no batching)	17.87 Euro

For more information or to place an order contact
gdf@stoptb.org

WHO POLICY RECOMMENDATIONS (AUGUST 2016)

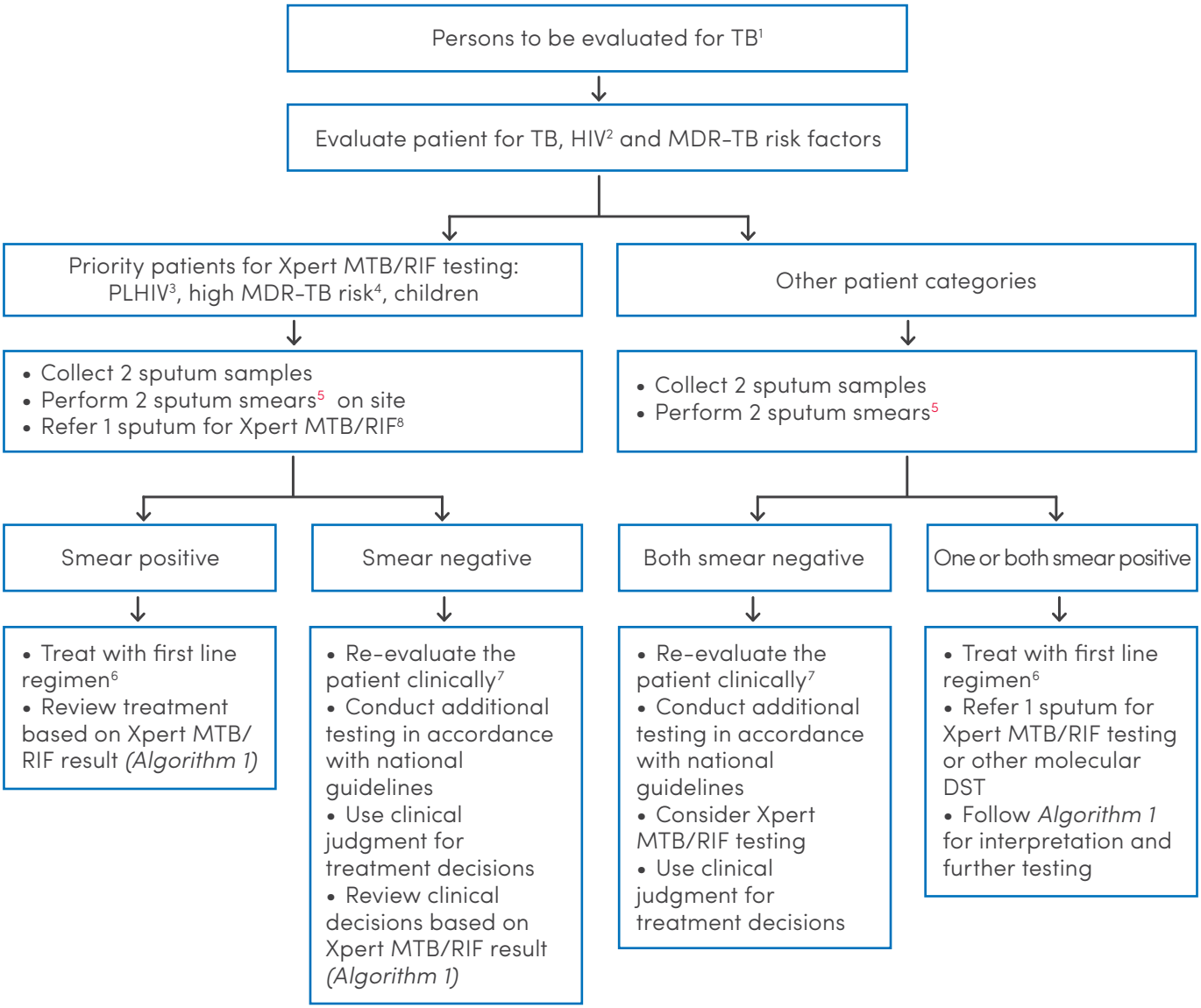
- The WHO Global TB Programme recommends that the LAMP test may be used as a replacement for smear microscopy for the diagnosis of pulmonary TB in adults or children with signs or symptoms of TB. It may also be used as a follow-on test to smear microscopy when further testing of smear-negative specimens is necessary.
- The LAMP test should not replace the use of rapid molecular tests that detect TB and resistance to rifampicin (e.g., Xpert MTB/RIF), especially among populations at risk of multidrug-resistant TB. In settings where the Xpert MTB/RIF test cannot be implemented (e.g., owing to an inadequate electricity supply, or excessive temperatures, humidity, or dust), the LAMP test may be a plausible alternative.
- Due to the limited evidence, it is unclear whether the LAMP test has additional diagnostic value over sputum-smear microscopy for testing persons living with HIV who have signs or symptoms of TB.
- The test should not be used as a replacement for microscopy to monitor patients' response to treatment.

RESOURCES AVAILABLE: CURRENT NORMATIVE AND PRACTICAL GUIDANCE

- 2016 WHO Global TB Programme Guidelines on the use of the LAMP test for the diagnosis of pulmonary TB
- 2017 GLI Model TB Diagnostic Algorithms: Includes the LAMP test as a possible replacement test for smear microscopy in Algorithm #2
- 2016 GLI Information Note: Practical considerations on implementation of LAMP
- 2018 HumaLoop T – training video: Visual explanation of the LAMP test workflow

POSITIONING OF THE LAMP ASSAY (TB-LAMP) IN ALGORITHM 2 OF THE GLI MODEL TB DIAGNOSTIC ALGORITHMS.

Algorithm 2 is an interim algorithm moving towards universal access, with rapid testing for priority populations. It is suitable when Xpert MTB/RIF testing cannot be accessed on-site or through a reliable referral system with short turnaround time.



[1] Persons being evaluated for TB include all persons with signs or symptoms suggestive of TB or persons with a chest X-ray with abnormalities suggestive with TB. This algorithm may also be used for persons being evaluated for extrapulmonary TB. See footnotes to Algorithm 1.
[2] For persons being evaluated for TB who are HIV positive and have CD4 counts ≤100 cells/µl or are seriously ill, see Algorithm 4.
[3] PLHIV include persons who are HIV positive or whose HIV status is unknown, but who present with strong clinical evidence of HIV infection in settings where there is a high prevalence of HIV or among members of a risk group for HIV. For all people with unknown HIV status, HIV testing should be performed according to national guidelines.
[4] Patients at high risk for MDR-TB include previously treated patients including those who had been lost to follow-up, relapsed, and failed a treatment regimen; non-converters (smear positive at end of the intensive phase of treatment); MDR-TB contacts; and any other MDR-TB risk groups identified in the country.
[5] **TB-LAMP may be used as a replacement test for sputum smear microscopy.**
[6] Patients should be initiated on a regimen with first-line TB drugs according to national guidelines unless the patient is at very high risk of having MDR-TB. In that case, treat according to national guidelines while awaiting the Xpert MTB/RIF result.
[7] Further investigations for TB may include chest X-ray, additional clinical assessments, clinical response following treatment with broad-spectrum antimicrobial agents, or culture if available.
[8] A third sample should be collected if neither of the original two samples collected has sufficient volume for both microscopy and Xpert MTB/RIF testing, or according to national guidelines.

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