CAMEROON · COUNTRY EXPERIENCE

Implementation considerations for new TB diagnostic approaches: *Pooling of sputum specimens to increase access to molecular TB testing*

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SCENARIO: From constraint to impact: smarter testing to end TB.

In a TB diagnosis and treatment center in Cameroon, **Dr. Ahmadou** opened his storage cabinet and paused; **only 50 GeneXpert cartridges** remained, while **300 prisoners urgently needed TB testing** following a confirmed case in a prison.

In this high-risk and overcrowded setting, any delay could accelerate transmission. Yet testing each sample individually was simply not feasible. With growing pressure from health authorities, the challenge was clear: **how to ensure rapid diagnosis with such limited resources?**

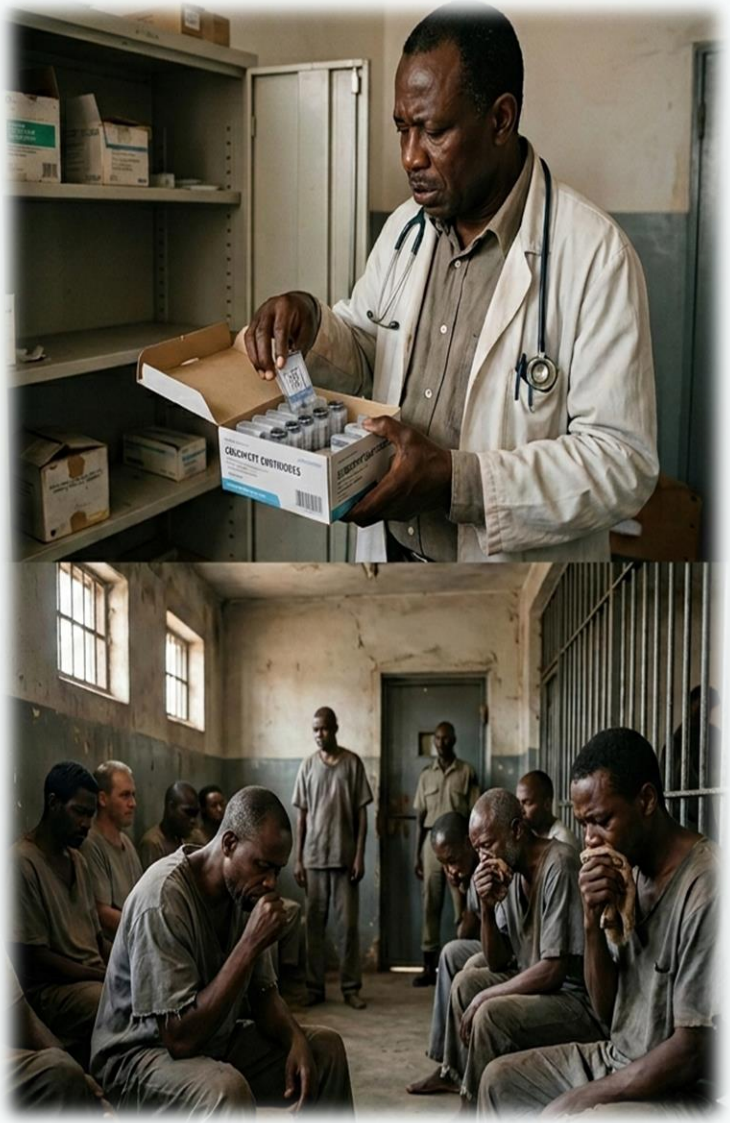
Faced with this constraint, Dr. Ahmadou and his team introduced an innovative solution: **pooling samples**; testing several patients using a single cartridge. This approach enabled them to **screen all prisoners more quickly, reduce costs, and still identify TB cases for immediate treatment**.

What began as a crisis soon became a breakthrough, demonstrating that **simple innovation can transform scarcity into a powerful tool in the fight against tuberculosis**. Encouraged by these results, the pooling strategy was progressively expanded to other laboratories across the country, improving access to TB diagnosis in resource-limited settings.

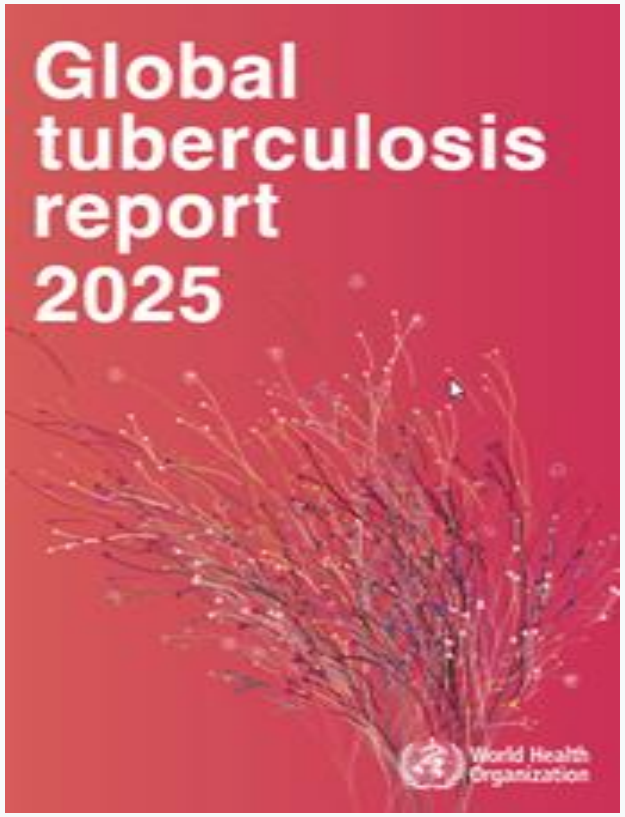
The World Health Organization (WHO) later took interest in this experience as part of its global effort to end tuberculosis. Today, pooling is recognized as a **recommended approach in specific contexts**, helping countries optimize resources while expanding diagnostic coverage.

Now, Cameroon stands ready to share its experience.

Because this story is not just about one laboratory or one prison; it is about how, in the face of limited resources and urgent need, **innovation, teamwork, and determination can help reach more patients, faster and more efficiently**.



Limited access to molecular testing in Cameroon



- **Cartridge cost & shortages**: Each Xpert Ultra cartridge ~$8, limiting test volume.
- GeneXpert **platforms are shared** with HIV viral load and other tests, increasing turnaround time

The result: Lives are lost, and resources being strained

Pooled testing: a proven approach, newly recommended for TB

What is pooling?

A laboratory technique in which sputum from several individuals is combined in equal volume and tested as a single GeneXpert cartridge, instead of testing each specimen separately.

Not a new idea — proven across diseases

- **1943** — First described for syphilis screening (Dorfman)
- **2000s–2010s** — Adopted for HIV and other STI viral load / molecular testing
- **2020** — Used at scale for SARS-CoV-2 PCR testing during COVID-19

WHO 2026 recommendation(Anticipated)

Pooling of sputum specimens is now a recommended diagnostic strategy for the initial detection of TB and rifampicin resistance using LC-NAATs (e.g. Xpert MTB/RIF Ultra).

Why it fits the Cameroon context

- Uses the GeneXpert platforms already deployed nationally; no new infrastructure
- TB positivity in pooled labs ranged 3–15% ; within the efficient range for pooling

Source: WHO, 2016, Implementing innovations for TB diagnostics — Cameroon,; Vuchas et al.

OUR JOURNEY

From crisis response to a national scale-up strategy

Phase 1 · Pilot
2020 – 2022

Born out of necessity

- Launched at 2 reference laboratories during COVID-19-related Xpert cartridge shortages
- Specimens pooled mostly in groups of 3
- Established feasibility and reliability of the approach

10,000+

specimens tested

Phase 2 · National Scale-Up
2023 – present

From crisis tool to routine strategy

- Scaled to 30+ GeneXpert laboratories across 6 of 10 regions, via TB REACH-supported projects
- Network of 183 primary care centres and district hospitals referring specimens for testing
- Pools of 2–8 specimens, sized to each lab's positivity rate and workload

59,164

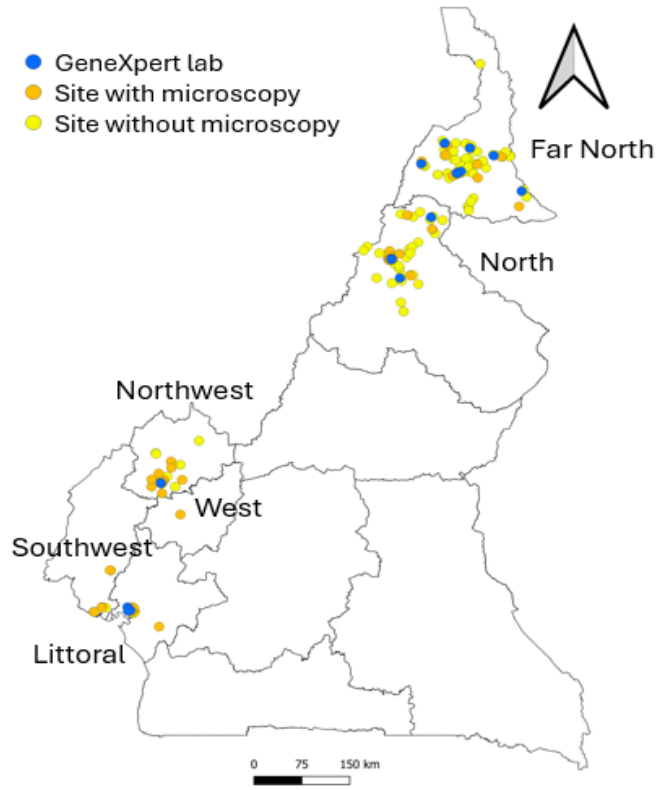
specimens in 14,111 pools (Oct 2023–Mar 2025)

IMPLEMENTATION TAKEAWAY

When implementing pooling , you can start even at a small scale then grow it to a larger national routing scale,

IMPLEMENTATION CONSIDERATION

A national network, not a single-site pilot



Map of Cameroon: GeneXpert laboratories and affiliated referral facilities implementing pooled testing

30+ GeneXpert laboratories implementing pooled testing

6 of 10 Regions of Cameroon covered (North, Northwest, West, Southwest, Centre, Littoral)

183 Primary care centres & district hospitals referring specimens for molecular testing

39,191 Additional people tested with the same cartridge supply (pilot + scale-up)

IMPLEMENTATION TAKEAWAY

When implementing: anchor pooling on the network you already have. Cameroon added no new sites; it layered pooling onto its existing GeneXpert and referral footprint.

Source: Implementing innovations for TB diagnostics — Cameroon, May 2026

OUR PROCEDURE

How pooled testing works, step by step

Implementation consideration

1. Collect

Each person submits one sputum specimen as usual; **no repeat collection.**

2. Pool

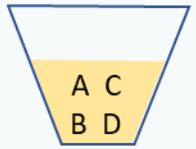
An equal volume from 2–8 specimens is combined into a single pooled sample.

3. Test

The pool is tested with a single Xpert Ultra cartridge.

4. Decide & deconvolute

Negative pool: all results reported negative. Positive pool: each specimen re-tested individually.

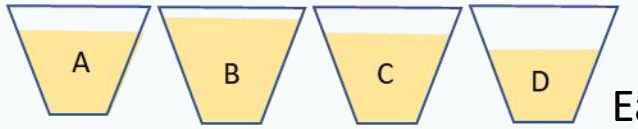


Pool equivalent amount from each of 2-8 specimens and test with a single cartridge

MTB NOT detected

All individual results reported as MTB NOT detected; no further testing

MTB detected



Each specimen re-tested and result reported individually

No extra burden on patients

Pooling happens entirely in the laboratory. The person submits only one sputum specimen, exactly as in routine practice ;there is no repeat collection or added wait for an individual result if the pool is negative.

LAB DECISION: TO POOL OR NOT?

Historical positivity rate

- Guides optimal pool size selection – Pooled testing is efficient for positivity rates of less than ~25%
- When the positivity rate is higher, pooled testing typically does not help to save tests and improve efficiency

Source: Implementing innovations for TB diagnostics — Cameroon, May 2026

IMPLEMENTATION CONSIDERATION

Pool size is a local decision, driven by positivity rate

Lab decision: to pool, and how much?

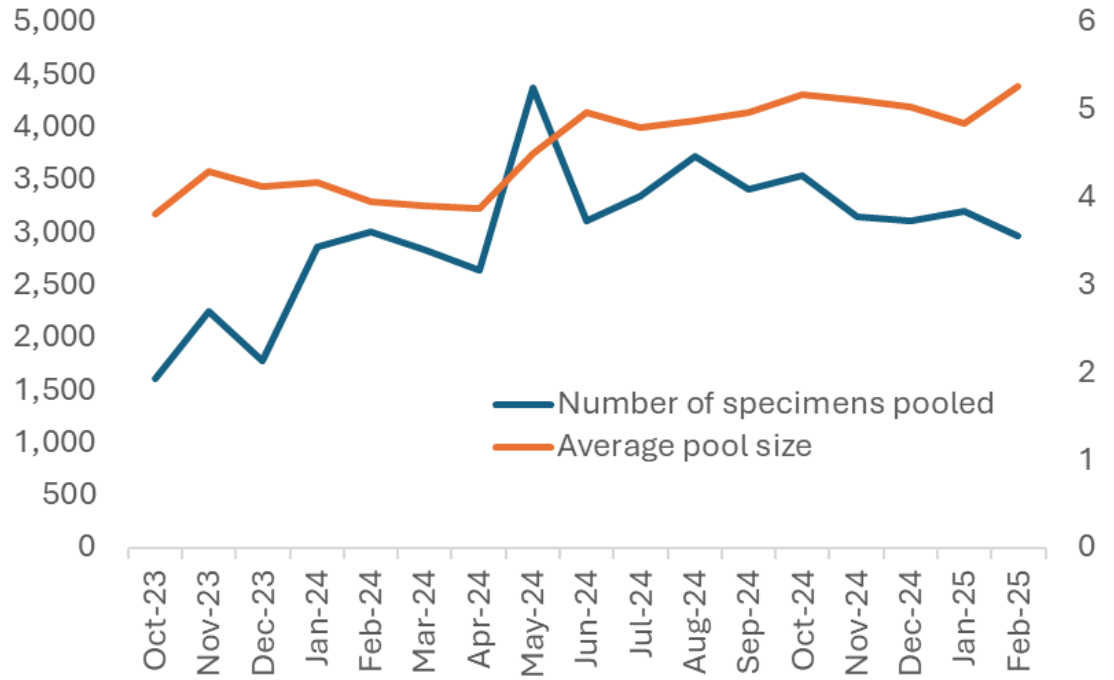
Historical positivity rate
Pooling is efficient when positivity is below ~25%; trained techs select pool size accordingly.

Testing volume & turnaround
Daily specimen load (8–30/lab) and required turnaround time shape the choice of pool size.

Microscopy result, when available
A known-positive smear is tested individually rather than pooled.

WHO 2026 recommends pools up to size 4. Cameroon data show pools of 5–8 are also feasible and efficient at lower positivity rates.

Pool volume and average pool size in routine use



Monthly specimens pooled and average pool size across scale-up laboratories, Oct 2023–Feb 2025

IMPLEMENTATION TAKEAWAY

When implementing: do not fix one national pool size. Give labs a simple range , positivity-based rule of thumb and the autonomy to adjust pool size to their own caseload.

Source: Implementation of pooling to improve Xpert access — Cameroon (Vuchas et al.)

Built on what labs already have; and already know

Minimal extra training needed

Lab personnel already skilled in individual Ultra testing require only a half-day workshop with job aids and videos. Pooling extends an existing workflow ; it is not a new platform.

No new equipment required

Uses the existing GeneXpert instruments, standard sputum collection mugs, and disposable pipettes already in routine use.

Peer network sustains quality

A WhatsApp group for best-practice sharing, monthly virtual review meetings, and remote monitoring of pool efficiency and positivity kept laboratories aligned.

Decision stays with the lab

Trained lab technicians decide whether to pool and at what size, with flexibility based on patient population and daily workload.

IMPLEMENTATION TAKEAWAY

When implementing: budget for people, not platforms. The biggest enabler was training plus a low-cost peer-support channel; not new hardware.

WHAT WE ACHIEVED

Pooled testing reaches more people, faster and at lower cost

65%
cartridge cost saved vs. individual testing

$2.81
per result, vs. $7.97 for individual testing

23.8 min
instrument time per result, vs. 66 min individually

+38,326
additional people tested with the same cartridge supply

Metric	Pool size 2	Pool size 4	All pools
Avg. time / specimen, pooled (min)	45.4	26.0	23.8
Avg. time / specimen, individual (min)	66.6	66.2	66.2
Instrument time saved	32%	61%	64%
Cost per result, pooled	$5.29	$3.06	$2.81
Cartridge cost saved	34%	62%	65%

n = 59,164 specimens in 14,111 pools (sizes 2–8), 16 GeneXpert laboratories, October 2023 – March 2025

IMPLEMENTATION TAKEAWAY

When implementing: lead your business case with cost and time. A ~65% cut in cartridge spend and ~64% less instrument time is what frees capacity to test more people, faster.

WEIGHING THE TRADE-OFF

IMPLEMENTATION CONSIDERATION

Pooling preserves accuracy, with a small, known trade-off

The dilution effect

Combining specimens dilutes the *M. tuberculosis DNA* from any single positive sample within the pool, which can modestly reduce analytical sensitivity compared with individual testing.

Who do we miss?

Compared with individual Ultra testing, pooled testing predominantly missed specimens with very low and trace bacillary loads; the cases closest to the assay's detection limit.

Pooled vs. individual Ultra, against culture reference

Metric	Individual	Pooled
Sensitivity	91%	**89%**
Specificity	98.8%	99.1%
Positive % agreement (pooled vs. individual)	—	**99.4%**

An acceptable trade-off for the gain in access

A 2-point drop in sensitivity (91% to 89%) is the cost of detecting tens of thousands of additional people who would otherwise not have been tested at all.

IMPLEMENTATION TAKEAWAY

When implementing: pair pool-size guidance with explicit messaging to clinicians that a small, quantified sensitivity trade-off is being accepted in exchange for far greater population coverage.

IMPLEMENTATION CONSIDERATION

KNOWING THE LIMITS

Pooling is not universal; context determines feasibility

Benefit depends on TB positivity rate

- Optimal savings (pools of 3-4): positivity below ~5.7%
- Diminishing returns as positivity approaches ~25%
- Ineffective above ~25%; re-testing negates the savings

Operational & policy challenges encountered

- Sustaining consistent technical quality and supervision across 30+ sites requires ongoing training investment
- Formal integration into national TB diagnostic algorithms and NTP policy endorsement can be a lengthy process

A bridge, not a competitor, to new technologies

- Pooled testing requires **no new capital investment** and works on infrastructure already in place today
- As non-sputum, point-of-care NAATs (NPOC-NAAT) roll out, pooling remains a **complementary, low-cost option for high-volume centralized labs**
- Sustainability depends on **continued positivity-based pool-size guidance**, refresher training, and routine data review

IMPLEMENTATION TAKEAWAY

When implementing: know your ceiling. Pre-screen with prevalence data, secure NTP endorsement early, and treat pooling as a bridge alongside; not a replacement for; emerging point-of-care tools.

RECOMMENDATIONS

What other national programmes can take from Cameroon's experience

Start with your prevalence data

Map laboratory-level TB positivity first; it determines optimal pool size and expected savings before any rollout.

Begin with pools of 3-4

Aligned with the WHO 2026 recommendation; larger pools (5-8) can follow once feasibility is confirmed locally.

Invest in light-touch training & peer support

Workshops plus a peer messaging network for troubleshooting sustains quality without new staffing.

Pursue policy endorsement early

Engage the NTP from the pilot stage to shorten the path to national guideline integration.

Monitor accuracy, not just efficiency

Track sensitivity and specificity alongside cost and time savings to keep the access-vs-accuracy trade-off transparent.

Position pooling as complementary

Plan pooling alongside, not instead of, emerging NPOC-NAAT and other new diagnostic tools.

Presenter: Valerie Flore Donkeng Donfack, PhD — Centre Pasteur du Cameroun (TB-NRL), Yaounde

Thank you

Questions & discussion

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