WORLD BANK GROUP

POLICY BRIEF

OPTIMIZING INVESTMENTS IN THE TUBERCULOSIS RESPONSE IN BLANTYRE, LILONGWE, AND MZIMBA DISTRICTS, MALAWI:

RESULTS OF A TB ALLOCATIVE EFFICIENCY STUDY

INTRODUCTION

This brief summarizes the findings of an allocative efficiency analysis using the Optima TB model and highlights opportunities to improve Malawi's TB response. The analysis was a collaboration between the Malawi National Tuberculosis Program, the World Bank and its academic partner the University College London. The study was designed in 2018 and implemented during 2019, well before the COVID-19 pandemic started to impact the Malawi health services.

The study adopted an innovative design by focusing on three typified districts - Blantyre, Lilongwe, and Mzimba - in order to capture the breath of local TB situations relevant for decentralized decision-making. The selected districts represent different TB burdens, HIV prevalence rates and urbanization levels, and are located in the three regions of Malawi – North, Centre and South.

MZIMBA DISTRICT | Population: 0.95 M
Malawi's largest district in area size (10,430 km²), rural and sparsely populated
Intermediate adult HIV prevalence: **7%**
Pulmonary TB notifications (2018): **426**
TB notification rate (2018): **45/100,000**

LILONGWE DISTRICT | Population: 2.7 M
A mixed urban/rural district (6,159 km²), with capital city Lilongwe
Intermediate adult HIV prevalence: **8%**
Pulmonary TB notifications (2018): **1,939**
TB notification rate (2018): **72/100,000**

BLANTYRE DISTRICT | Population: 1.2 M
A small, mostly urban district (2,012 km²), with Malawi's second largest city Blantyre, the commercial and financial centre of the country
High adult HIV prevalence: **16%**
Pulmonary TB notifications (2018): **1,248**
TB notification rate (2018): **101/100,000**

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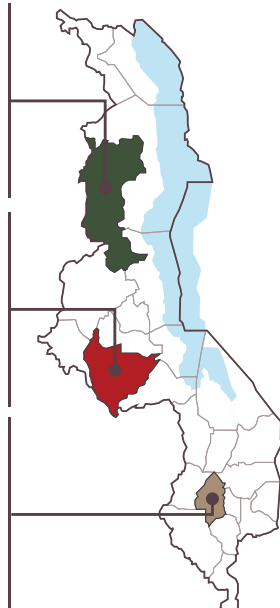
WHY IS ALLOCATIVE EFFICIENCY IN TB IMPORTANT FOR MALAWI?

TIGHT HEALTH RESOURCES – Malawi is a low-income country with one in five residents classified as ultra-poor and half of the population living below the national poverty line. In 2017, domestic general government health expenditure per capita was only US$ 9.89, indicating how scare state resources are to address the health needs of the population. Donor dependency remains high in the health sector with about 52% of health expenditure covered by external sources. Value-for-money considerations have always been important in Malawi's health sector, and they are now heightened by the resource needs to address the coronavirus pandemic.

TB REMAINS A TOP DISEASE – Since 2003, after a peak in the HIV epidemic and the expansion of TB and HIV services, TB incidence has been declining. But the toll is still high. TB was the fourth most important cause of death in 2017, according to Malawi's Global Burden of Disease estimates, after HIV/AIDS, neonatal disorders and lower respiratory infections.[1] Malawi is still classified as a 'high-burden' country for TB. The 2018 global TB report estimates Malawi's TB incidence at 133/100,000 population, TB deaths at 31/100,000 population, and about half of all TB cases are co-infected with HIV.

PERSISTENT GAPS IN THE TB RESPONSE – While the treatment success rate has improved and the HIV and TB programs are much better integrated (>95% HIV testing coverage among TB cases, >95% ART coverage among HIV-positive TB patients), there are key challenges to be addressed. At 68%, the TB case detection rate is sub-optimal, particularly among outpatients, children and household contacts of index TB cases. The implementation of TB infection prevention measures in health facilities and community-based sputum collection points is poor. Also, the diagnosis and management of MDR-TB remains weak.

AMBITIOUS TARGETS TO MEET – The programmatic and contextual challenges like health financing and poverty levels lead to human suffering due to TB. They may also prevent Malawi from reaching the targets the country has committed to attain. The 2035 END-TB targets are to reduce the TB incidence rate by 90% to ≤10 cases per 100,000 population per year, and the number of TB deaths by 95% compared to 2015. The country needs a more effective and efficient TB response that maximizes the response impact, and minimizes costs to TB patients, communities and government.

HOW WAS ALLOCATIVE EFFICIENCY APPROACHED?

The study team developed the main questions for the study to answer. These concerned the epidemic trends of TB in the three districts, including projected TB incidence and deaths to 2035 (assuming stable budget levels, TB program coverage and outcomes). They also included the districts' TB care cascades based on latest available data and estimates. However, the main question was about the impact of resources allocated to TB programs and interventions in the three districts, and whether more TB infections and deaths could be averted through resource shifts. Using the optimization function of the Optima TB model, the optimal allocation of funding for TB prevention, diagnosis and treatment programs was explored, and the likely

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[1]   Institute of Health Metrics and Evaluation https://vizhub.healthdata.org/gbd-compare/

impacts if resources were allocated optimally. There were data limitations mainly due to the analysis being conducted at sub-national level, and some model inputs had to be estimated through apportioning national data to the district level.

## WHAT ARE THE KEY FINDINGS OF THE ANALYSIS?

KEY RESULT 1 – Assuming no changes in TB outcomes and TB program coverage (status quo) and ART coverage reaching 90% by 2030, TB incidence is projected to steadily decrease in the three districts.

In Blantyre District, Optima TB estimated around 2,600 incident pulmonary TB cases in 2017, falling to around 800 cases by 2035. In Lilongwe District, the estimated incident pulmonary TB cases fell from around 3,300 in 2017 to around 790 cases by 2035, and in Mzimba District, from around 890 cases in 2017 to around 200 cases by 2035 (figure 1).

The districts' epidemic trends up to 2017 are mirrored in the national trends, which shows a significant decline in TB incidence from 409/100,000 in 2005 to 131/100,000 in 2017, according to WHO estimates. Similarly, the number of TB-related deaths in Malawi has come down from about 19,000 in 2005 to 5,500 in 2017, based on WHO.

Figure 1   Modelled pulmonary TB incidence and death rates
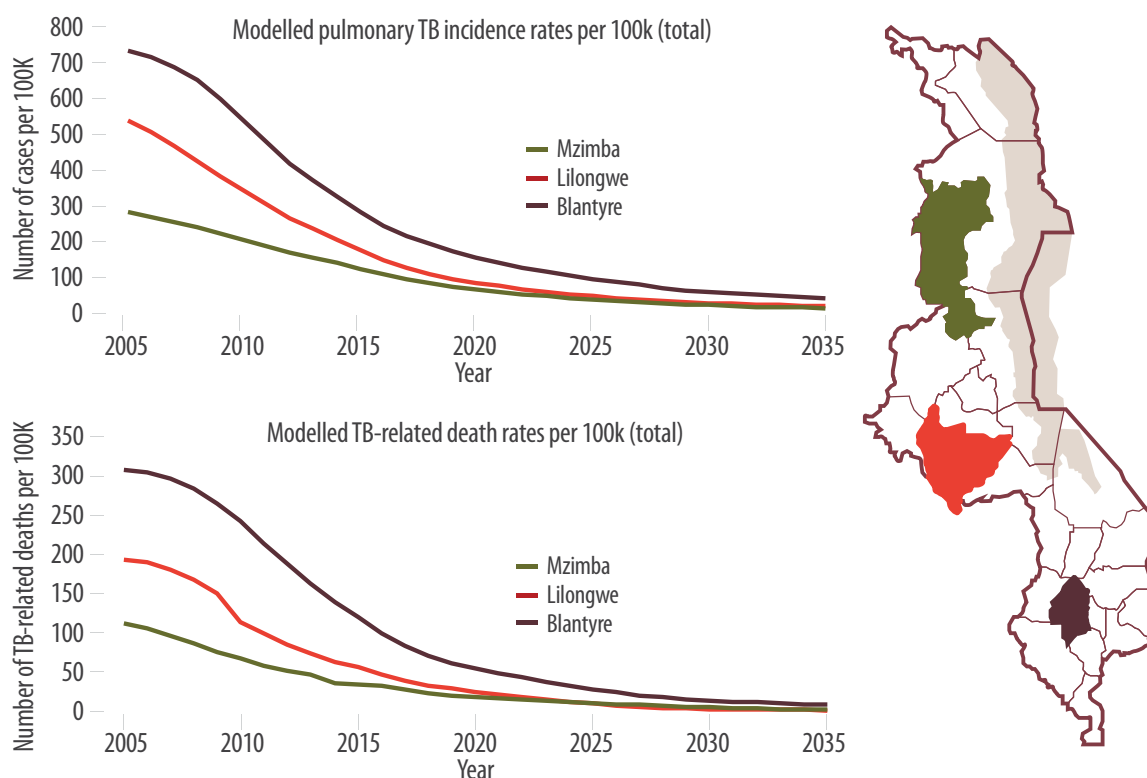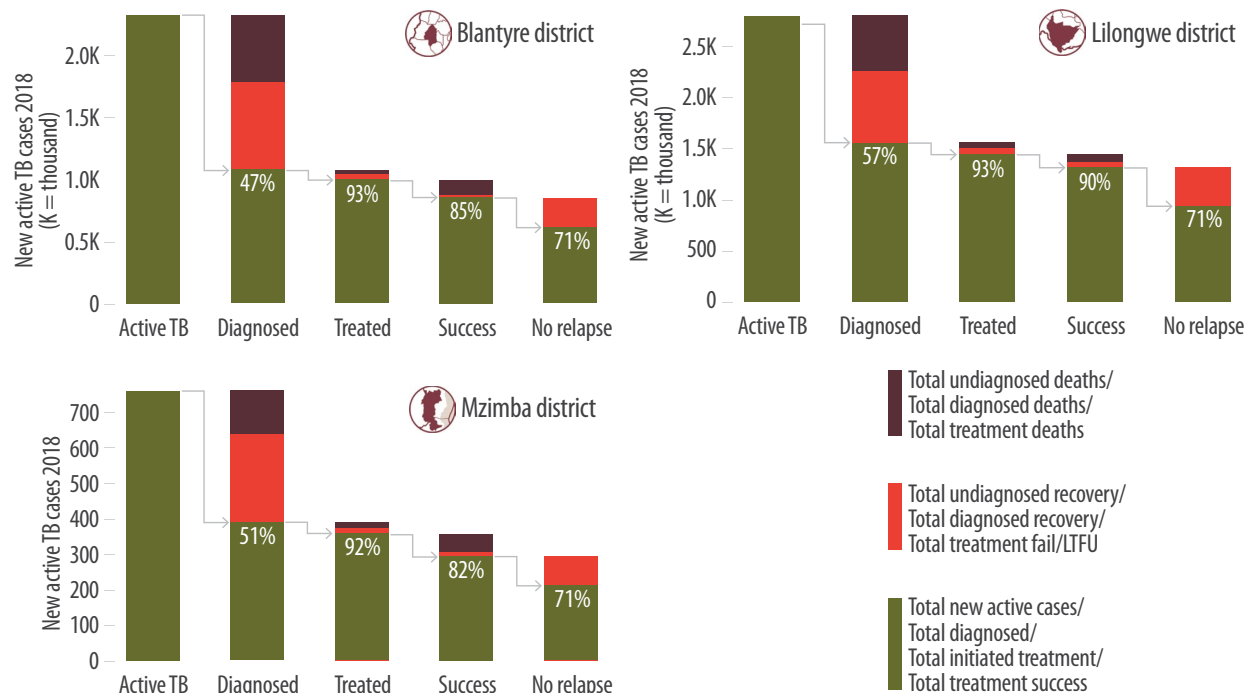

Source: Optima TB model output, World Bank.
Notes: k = thousands; TB = tuberculosis.

KEY RESULT 2: Diagnosis remains the most significant breakpoint in the TB care cascade in all three districts.

The diagnosis gap meant that approximately half of all new active TB cases received a diagnosis. The Optima TB analysis, using probabilistic estimates of attaining outcomes, suggested that in 2018, only 47% of all new active TB cases in Blantyre District, 58% in Lilongwe District and 51% in Mzimba District completed TB treatment successfully (figure 2).

Figure 2   TB care cascades (2018, all TB cases)

Source: Optima TB model output, World Bank.
Note: The cascade shows the probability of final outcomes from each stage in the cascade. The green color in each column indicates total cases, diagnosed, initiated treatment, and completed treatment. TB = tuberculosis.

KEY RESULT 3: Optimized allocations generally move some funding to TB treatment, and additional cases are found at slightly lower cost through prioritizing higher-yield case finding programs. In an optimized allocation, funding was shifted to systematic screening for healthcare workers and higher levels of TB screening of HIV patients.

On the basis of available data, MDR patients should be split between short course regimens and new drug regimens, with clinical decisions guided by latest evidence on MDR treatment protocols.

In Blantyre District, an estimated USD 1.9 million was spent on TB prevention and care in 2018 (right bar in figure 3). Around 33% of this amount was spent to preventive treatment for PLHIV (USD 0.63 million). In an optimized allocation of resources (left bar), about USD 70,000 would be reallocated from diagnosis to treatment. Less funding would be allocated to house to house screening and mobile vans in urban hotspots.

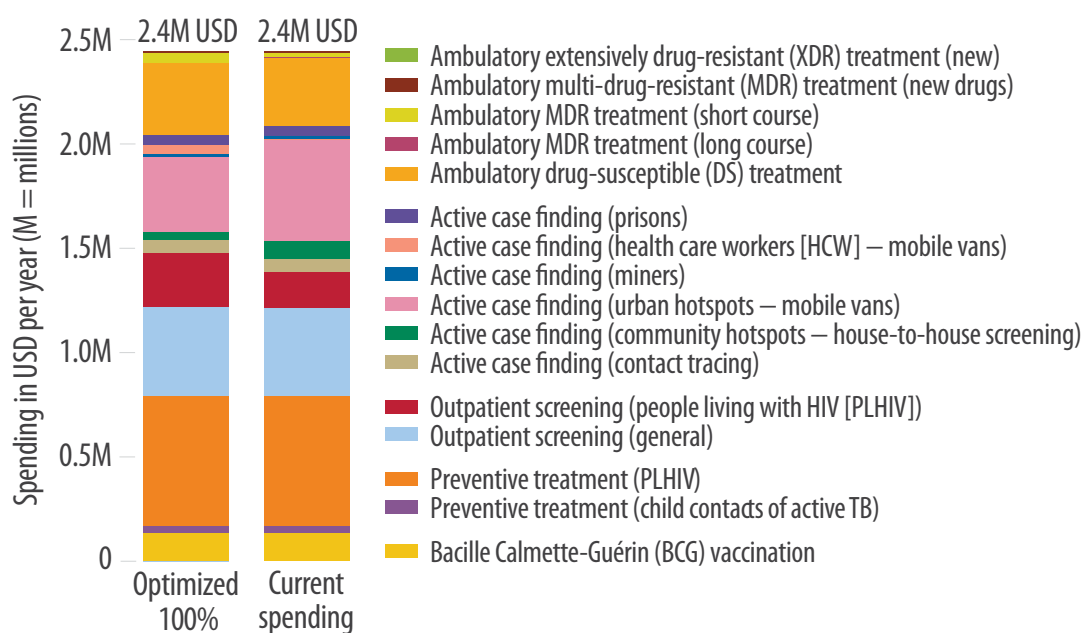Figure 3   Blantyre District: Optimized TB spending (estimated 2018 spending level)
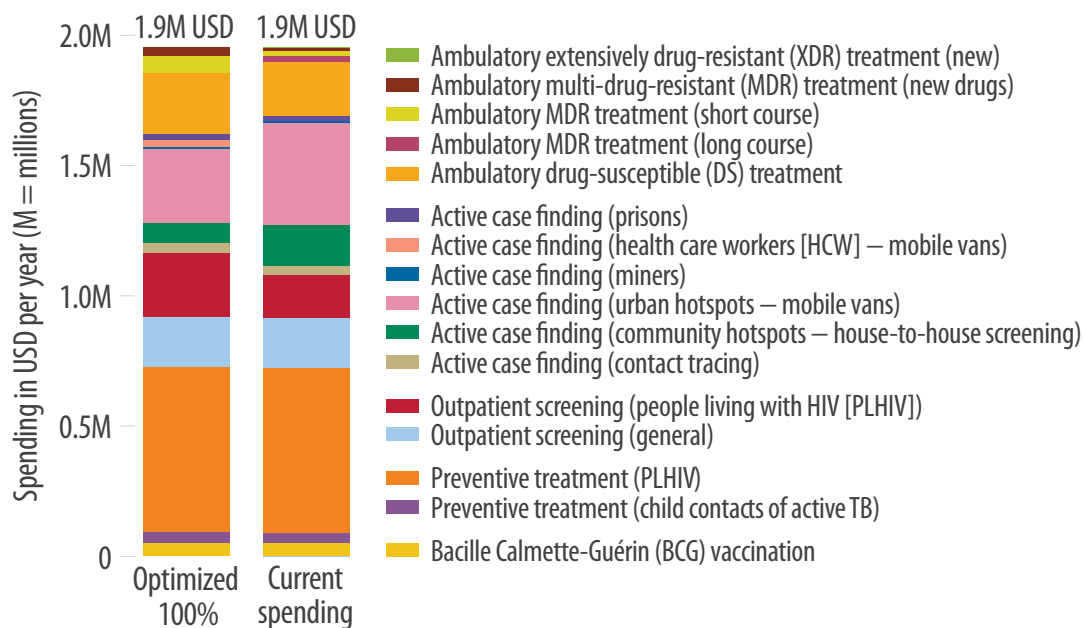
Source: Optima TB model output, World Bank.
Note: USD = U.S. dollar.

In Lilongwe District, an estimated USD 2.4 million was spent on TB prevention and care in 2018 (right bar in figure 4). Around 25% of this amount was spent to preventive treatment for PLHIV, accounting for an estimated USD 0.6 million. In an optimized allocation of resources (left bar), house to house screening in community hotspots would receive reduced funding due to comparatively low yield. Active case finding in urban hotspots would also be reduced due to low estimated yield in Lilongwe, with more funding going to programs targeted to health workers and PLHIV for regular screening.

Figure 4   Lilongwe District: Optimized TB spending (estimated 2018 spending level)
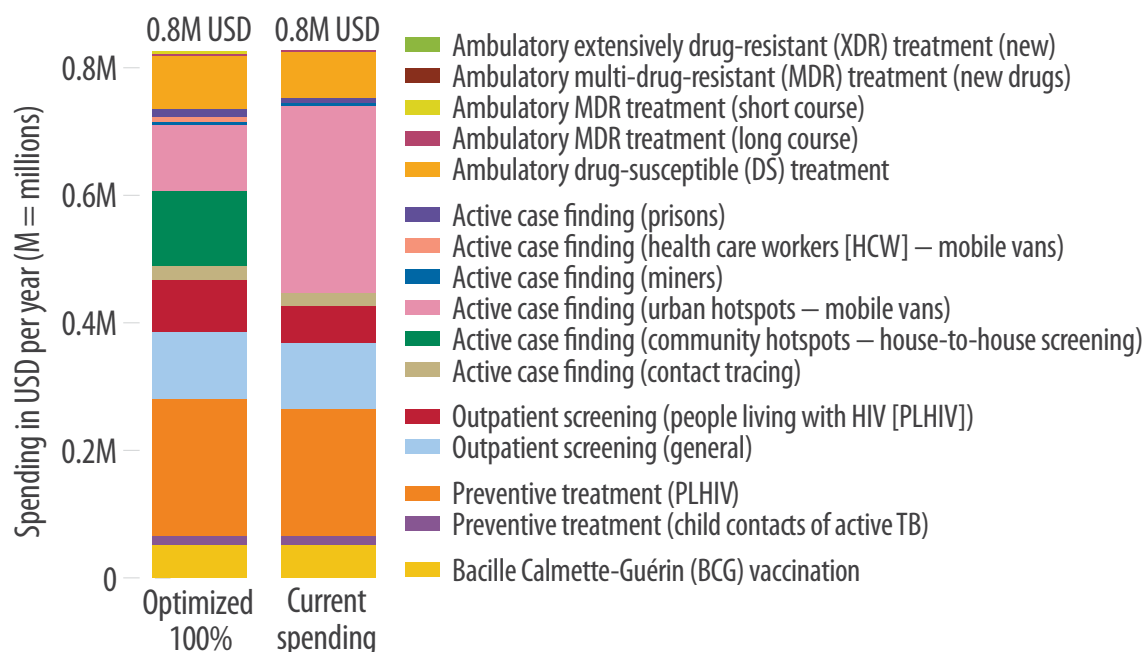

Source: Optima TB model output, World Bank.
Note: USD = U.S. dollar.

In Mzimba District, an estimated USD 0.8 million was spent on TB prevention and care in 2018 (right bar in figure 5). Around 24% of this amount (USD 0.2 million) was spent on preventive treatment for PLHIV. In an optimized allocation of resources (left bar), house to house screening in community hotspots would be introduced. Case finding with mobile vans in urban hotspots would not attract funding due to the high cost and the low expected yield in this district.

Figure 5   Mzimba District: Optimized TB spending (estimated 2018 spending level)

Source: Optima TB model output, World Bank.
Note: USD = U.S. dollar.

KEY RESULT 4: Relative to the current allocation of TB resources in the three districts, an optimized allocation could help to further reduce TB incidence and deaths.

In **Blantyre District** optimal allocation of TB resources could:

▶ Reduce the number of TB-related deaths in 2025 by 12%
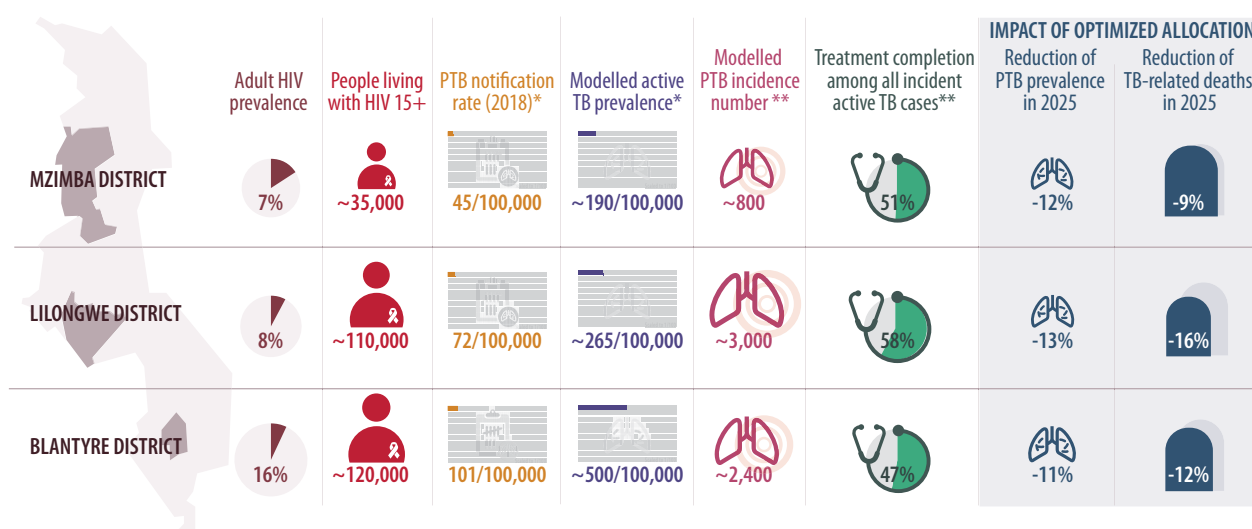
▶ Reduce the prevalence of pulmonary TB in 2025 by 11%

In **Lilongwe District** it could:

▶ Reduce the number of TB-related deaths in 2025 by 16%

▶ Reduce the prevalence of pulmonary TB in 2025 by 13%

In **Mzimba District** it could:

▶ Reduce the number of TB-related deaths in 2025 by 9%

▶ Reduce the prevalence of pulmonary TB in 2025 by 12%

Figure 6   Summary of key findings across the three district

	Adult HIV prevalence	People living with HIV 15+	PTB notification rate (2018)*	Modelled active TB prevalence*	Modelled PTB incidence number **	Treatment completion among all incident active TB cases**	**IMPACT OF OPTIMIZED ALLOCATION** Reduction of PTB prevalence in 2025	Reduction of TB-related deaths in 2025
MZIMBA DISTRICT	7%	~35,000	45/100,000	~190/100,000	~800	51%	-12%	-9%
LILONGWE DISTRICT	8%	~110,000	72/100,000	~265/100,000	~3,000	58%	-13%	-16%
BLANTYRE DISTRICT	16%	~120,000	101/100,000	~500/100,000	~2,400	47%	-11%	-12%

Source: Derived from Optima TB model output, World Bank.
Note: * = rate per 100,000; ** = 2018

RECOMMENDATIONS

Based on the findings and insights from this analysis, the following recommendations can be made:

1. Strengthen contact-tracing of notified cases

▶ Contact tracing should be done at scale, with high coverage and intensity, as it is a primary strategy to find additional cases early.

▶ Better data on contact tracing activities should be collected. This would also shed light on reasons for the low yield (0.48% reported yield in Malawi), and highlight areas where contact tracing has been more successful. For example, linkage to care, sample transportation or coverage of diagnostic testing may be better in certain areas. It is important to note that the declining trend of Malawi's TB epidemic, and some characteristics of rural settings contribute to low yields.[2] Furthermore, household contacts are often smear-negative culture-positive, so sensitive diagnostic tests are better suited to identify TB in contacts.

▶ Contact tracing should be seen as an investment: Often new TB cases come from places where TB occurred before, so making a constructive rapport with the traced contacts is an investment for future prevention/care seeking by individuals with known TB risk.

2. Ensure regular TB screening for healthcare workers as per the infection prevention and control policy

▶ A regular screening program for all health care workers should be ensured - a recent survey among 592 Malawi health workers showed that only 2.4% had been screened for TB in the previous year.[3]

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2   Little, K.M et al. Yield of household contact tracing for tuberculosis in rural South Africa. BMC Infect Dis 18, 299 (2018).

3   Flick RJ et al. (2017) Assessing infection control practices to protect health care workers and patients in Malawi from nosocomial transmission of Mycobacterium tuberculosis. PLoS ONE 12(12): e0189140.

▶ Healthcare workers are at higher risk of TB and are relatively easy to find, and in the Malawi health system, screening them regularly is part of infection prevention and control in health care settings.[4]

3. Improve case finding through better use of molecular tests

▶ Although all cases in Malawi have access to bacteriological testing, expanding the use of rapid testing methods such as GeneXpert would reduce the number of false negatives and false positives, hence enhance case identification in the context of a declining epidemic.

▶ The evidence on GenXpert benefits is well documented[5], however, local monitoring of its use is going to be very important in any roll-out, given the multi-test platform options, and diversity of rural/urban settings. The effectiveness, cost, and operational aspects of universal GeneXpert use in TB suspects could be investigated through implementation science research for decision support.

▶ The Malawi NTP could consider piloting universal GeneXpert testing in certain populations to assess the impact on active case finding and notifications. Priority areas could be prisons; screening all PLHIV with sputum collection regardless of symptoms in pilot sites; collecting sputum from all health care workers.

▶ Other initiatives such as the use of cough monitors in outpatient departments may also contribute to increased notification rates.

4. Finetune active case finding programs

▶ One of the differences in funding allocations between districts is the amount of funding allocated to different case finding approaches. The reported yield of active TB diagnoses per case screened in urban hotspots varies significantly between Blantyre (1.51%), Lilongwe (1.11%) and Mzimba (0.3%). As a result, and given the relatively high cost of using mobile vans, funding for this program could be reduced in the districts to enable funding of programs targeting key populations.

▶ Improved data on the yield and cost of different active case finding programmes at the district-level should be collected and continuously monitored to inform future policy decisions

5. Prioritize the use of local evidence on MDR treatment to inform future recommendations

▶ Outcomes from the Malawi cohorts on new MDR drug regimens were not available at the time of analysis. These data should be closely monitored to inform future policy on the treatment of DR-TB, however, this analysis

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4   Ministry of Health, Malawi National TB Control Programme. Guidelines for Infection Prevention and Control for Tuberculosis. Lilongwe: 2009.

5   See https://www.who.int/publications/i/item/who-consolidated-guidelines-on-tuberculosis-module-3-diagnosis---rapid-diagnostics-for-tuberculosis-detection

supports the provision of a mix of MDR short course regimens and new drug regimens.

▶ The most cost-effective way to reduce the prevalence of MDR-TB is to ensure that patients adhere to successful DS-TB treatment, avoiding escalation to DR-TB.

6. Continue to expand ART coverage and ART adherence support

▶ The progress in ART scale-up in recent years has likely played a key role in the contraction of Malawi's TB epidemic. Increasing ART coverage has a significant impact on TB incidence amongst PLHIV and continued expansion of ART care will help reduce the number of new active TB infections.

▶ The TB incidence rate remains several times higher in PLHIV. TB must therefore be considered across the entire cascade of HIV care: HIV diagnosis must be paired with TB testing, HIV treatment with TB preventive therapy, PLHIV monitoring and ARV refill contacts with regular TB screening using an algorithm with high sensitivity.

▶ There must be an enhanced focus on PLHIV with low CD4 or poor ART adherence as they are at high risk for developing active TB; Retention and adherence support of ART clients must be ensured in order to reduce TB incidence and death in this patient group.

7. Maximize the collection and use of TB routine data to inform programming and policies

▶ The quality and availability of cost and coverage data in Malawi, particularly at district-level provided a challenge for this analysis and results in uncertainty in model parameters.

▶ TB notifications should be reported by HIV status and resistance type.

▶ Key data sources include tracking of TB-specific expenditures, reporting of how TB cases are identified (by intervention modality) and keeping better records of often fragmented implementation of activities.

▶ Monitoring and evaluation systems should be streamlined, and spending and coverage data should be collected for all TB programs (NTP led and non-NTP led).

8. Additional funding would further prevent TB-related deaths

▶ Although there is substantial uncertainty in the underlying district-level TB burden, Malawi has made important progress towards eliminating TB in each district. More funding for the TB program would reduce active TB prevalence more quickly and prevent TB-related deaths.

9. Any future TB modelling analyses at sub-national level should evaluate data

availability and data quality during the scoping process.

▶ This will help to maximize the learning from sub-national analyses especially on how the local situation differs from the national one, and what setting-specific solutions need to be prioritized in TB resource allocation and programming.

▶ Local engagement from districts is critical to the success of the analyses and application of results.

More detail is available in the full technical report on: https://openknowledge.worldbank.org/.

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