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Perspective

# Addressing key risk factors hindering tuberculosis control activities in West Africa - progress in meeting the UN sustainable development goals

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ABSTRACT

Tuberculosis (TB) remains a significant public health challenge in West Africa, exacerbated by factors such as HIV, malnutrition, non-communicable diseases, drug-resistant TB, and under-resourced health systems. Addressing these challenges is essential to achieving the World Health Organization's End TB Strategy and Universal Health Coverage goals. This paper explores key strategies for tackling TB and its associated risks in the region. Malnutrition, non-communicable diseases such as hypertension, chronic respiratory diseases, and substance abuse amplify TB burdens. Health system strengthening is pivotal for early TB detection and management. Expanding diagnostic capabilities, particularly through the GeneXpert MTB/RIF assay and Hub-and-Spoke models, alongside workforce development and retention, is crucial. Regional collaborations such as the West African Network of Excellence for Tuberculosis, AIDS, and Malaria (WANETAM) and the Pan-Africa Network for Genomic Surveillance of Poverty-Related Diseases and Emerging Pathogens (PANGenS) demonstrate the importance of collective efforts in research and genomic surveillance. Our article highlights the importance of integrated healthcare approaches, regional partnerships, and community engagement in reducing TB prevalence and improving outcomes. These strategies will not only combat TB but also address its social determinants, advancing health equity in West Africa. By adopting these measures, the region can make significant strides toward UN TB SDG goals.

## Introduction

Tuberculosis (TB) remains a major public health challenge globally, particularly in West Africa, where high rates of poverty, food insecurity, and under-resourced health systems exacerbate its burden [1]. The region faces an alarming dual epidemic of TB and its risk factors, including drug-resistant TB (DR-TB), non-communicable diseases (NCDs), malnutrition, and comorbidities such as TB-HIV co-infections. To achieve the World Health Organization's End TB Strategy and the United Nations' Universal Health Coverage (UHC), it is imperative to strengthen the health systems in West Africa. We highlight key areas requiring intervention, including the management of TB risk factors, health system strengthening, innovative financing, and regional collaboration. By addressing these challenges more holistically, West Africa may be able to move closer to achieving TB elimination targets.

## Epidemiology of tuberculosis in West Africa

West Africa is one of the most TB-burdened sub-regions globally, with Nigeria bearing the heaviest burden [1]. Alone, Nigeria accounts for approximately 4% of the global TB incidence. With a population nearing half a billion, the region includes some of the poorest countries in the world, creating significant barriers to TB control. Among the 16 member states of the Economic Community of West African States (ECOWAS), eight are listed among the 30 poorest globally [2]. Nigeria, Sierra Leone, and Liberia rank among the top 30 high-TB-burden countries worldwide, with Nigeria alone reporting nearly half a million new cases annually [1]. Furthermore, Guinea-Bissau, Guinea, Liberia, and Nigeria are among the 30 countries with the highest TB-HIV coinfection burden, while Nigeria also ranks among the countries with the highest burden of multidrug-resistant TB (MDR-TB) [1].

Despite ongoing efforts, the region lags significantly behind the indicators outlined in the World Health Organization (WHO) End TB Strategy. Between 2015 and 2023, the region achieved only a 16% reduction in TB incidence, markedly lower than the 24% average reduction reported across the WHO African region. As of 2023, no West African country had reached the 50% case-reduction milestone. Progress varied, with Togo, Mauritania, and Cape Verde achieving reductions of 28-42%, while Guinea-Bissau, Liberia, and Nigeria showed no reduction. Guinea

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and Sierra Leone achieved modest reductions of 1.1% and 7.6%, respectively, during this period [1].

Similarly, the sub-region has struggled to reduce TB mortality rates. While 12 out of 16 countries recorded decreases in TB deaths, the overall progress falls short of the End TB Strategy's 2025 milestone of a 75% reduction. Alarmingly, increases in TB mortality were reported in Guinea-Bissau (13%), Liberia (12%), Benin (8%), and Cape Verde (1.8%). The sub-region's average reduction in TB deaths (38%) remains far below the 42% reported for the WHO African region and significantly lags behind global targets [1].

Encouragingly, treatment success rates in the region have shown progress, with an average of 85%, close to the WHO African region's 88%. However, this remains below the End TB Strategy target, underscoring the urgent need for tailored interventions to bridge the gap.

## Challenges hindering tuberculosis control in West Africa

Several interconnected challenges hinder TB control in West Africa, compromising efforts to achieve the End TB goals. Among the most pressing are the increasing prevalence of drug-resistant TB strains, TB-HIV coinfection, and high levels of undernutrition. Limited financial resources, inadequate laboratory capacity, shortages of essential medicines, and insufficient social protection further strain fragile healthcare systems. Compounding these issues are workforce shortages and limited access to healthcare facilities.

The region also faces a unique challenge in the genetic diversity of the *Mycobacterium tuberculosis* complex (MTBC). West Africa harbors all six primary human lineages of MTBC (lineages 1–6), with lineages 5 and 6 (*Mycobacterium africanum)* predominantly restricted to this region [3]. This diversity has implications for TB diagnosis and control. For instance, the MPT64 TB identification test, widely used for TB diagnostics, has shown reduced performance in lineage 6-endemic areas, leading to significant false-negative results [4]. Such diagnostic limitations pose serious challenges to achieving End TB Strategy goals.

Furthermore, some MTBC genotypes, such as lineage 5, are associated with increased transmissibility compared to lineage 6 with increased resistance to isoniazid [5,6]. *Mycobacterium africanum* (Maf), particularly lineage 5, demonstrates distinct disease progression patterns among latently infected individuals compared to other lineages [7]. These unique epidemiological characteristics necessitate context-specific interventions and innovations in diagnostic, treatment, and control strategies for TB in West Africa.

## Key challenges hindering tuberculosis control in West Africa

Efforts to control TB in West Africa are hampered by multiple challenges that require targeted interventions. The most pressing challenges include the emergence of drug-resistant TB, the prevalence of comorbidities such as HIV and diabetes, undernutrition, and inadequate healthcare infrastructure. These factors not only complicate TB management but also impede progress toward achieving the End TB Strategy goals.

### Drug resistance

While TB is treatable and preventable, the emergence and spread of DR strains pose a significant threat to TB control efforts in West Africa. The incidence of DR-TB in West Africa exceeds prior estimations. A study by the West African Network of Excellence for Tuberculosis, AIDS, and Malaria (WANETAM) indicated an MDR-TB prevalence of 6% in new cases and 35% in retreatment cases, which contradicted WHO estimates of 2% and 17% for new cases and retreatment cases respectively [8]. Prevalence among previously treated cases was high in Bamako, Mali (59%) Ibadan (39%), and Lagos (66%), Nigeria. Even among the newly diagnosed cases, they reported 32% of MDR-TB in Lagos, Nigeria. Currently, DR estimates by the WHO put Nigeria as one of the 30 high-burden countries with estimated cases of 9400 MDR/RR in 2023 [1].

The WANETAM project also observed the incidence of pre-extensively DR (pre-XDR) TB in all its eight participating West African countries with Ghana recording the highest rate of 35% among MDR-TB [8]. Furthermore, pre-XDR-TB isolates were circulating among new TB patients in both Ghana and Togo [8].

Extensively DR-TB (XDR-TB) has been detected in at least six countries (Burkina Faso, Ghana, Mali, Niger, Nigeria, and Togo) (Figure 1 Map A). Between 2015 and 2023, all 16 West African countries except for Guinea-Bissau and Liberia had reported at least two cases of pre-XDR/XDR-TB (614 cumulatively) (Figure 1 Map B) highlighting the potential for further development of drug resistance and possible transmission within the region [1]. In 2023 alone, the West Africa region reported 120 laboratory-confirmed pre-XDR/XDR-TB cases [1]. These recorded DR rates in the sub-region are alarming and call for appropriate actions.

It is important to note that the detection and reporting of XDR-TB cases depends on the availability of diagnostic facilities and surveillance systems. Some countries may have undetected or unreported cases due to limited resources. Continuous monitoring and strengthening of diagnostic capacities are essential for effective TB control in the region.

### Comorbidities

Comorbid conditions such as HIV, diabetes mellitus (DM), and undernutrition significantly impact TB progression, treatment, and outcomes in West Africa. Addressing these comorbidities is essential to developing integrated strategies for TB management.

#### *Tuberculosis-HIV coinfection*

HIV/AIDS remains the most significant TB comorbidity in West Africa, where TB is the leading cause of death among people living with HIV (PLHIV) [1]. The prevalence of TB-HIV coinfection in the region ranges from 15-21%, reflecting the high HIV burden in countries such as Côte d'Ivoire and Liberia [9]. PLHIV are 15–22 times more likely to develop TB than individuals without HIV [9].

To mitigate the impact of TB-HIV coinfection, West African countries have implemented integrated TB-HIV services, including

1. **Co-located clinics**: Establishing clinics that provide simultaneous diagnosis and treatment for TB and HIV.
2. **Intensified case finding**: Systematically screening PLHIV for TB and vice versa.
3. **Preventive therapy**: Scaling up isoniazid preventive therapy (IPT) to reduce the risk of active TB among PLHIV.
4. **Antiretroviral therapy**: Expanding antiretroviral therapy (ART) access for PLHIV diagnosed with TB.

Despite these efforts, challenges persist, including limited ART access in rural areas, poor treatment adherence, and drug-drug interactions between ART and TB medications such as rifampicin [10]. Strengthening community-based programs, ensuring early ART initiation, and scaling up HIV testing among TB patients are critical for improving outcomes.

#### *Diabetes mellitus*

Diabetes is a growing TB comorbidity in West Africa, driven by urbanization, sedentary lifestyles, and increasing obesity. Within the limited studies conducted, TB-DM prevalence in West Africa is estimated as 2.4%, with higher rates in countries such as Ghana (9.4% among TB patients) [11,12]. Diabetes impairs the immune response, increasing susceptibility to TB, delaying sputum conversion, and complicating treatment.

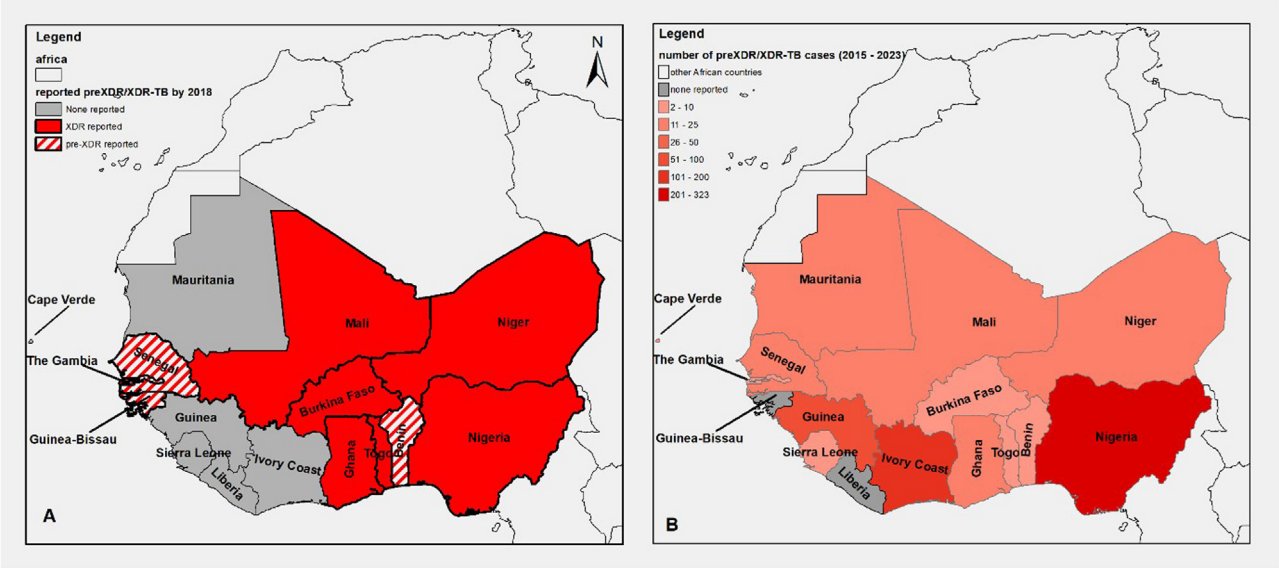


**Figure 1.** Reported pre-XDR/XDR-TB cases by 2018 (a) and between 2013 and 2023 (b) figures from World Health Organization TB Report 2024. pre-XDR/XDR-TB, pre-extensively drug resistant/extensively drug-resistant tuberculosis.

Efforts to address TB-DM include: Integrating diabetes screening into TB programs and vice versa; training healthcare workers to manage co-infected patients; and conducting educational campaigns to raise awareness of the TB-DM link. However, late diagnosis, lack of routine screening, and drug-drug interactions remain significant barriers. To overcome these challenges, the region must strengthen patient education, improve access to affordable joint management models, and develop robust screening protocols. There is also the need for a multisectoral approach involving enhanced diagnostic capacity, integrated service delivery, and community engagement.

*Malnutrition*

Malnutrition, a risk factor for TB, is characterized by deficiencies in essential nutrients, weakens the immune system, and increases susceptibility to TB [13]. Protein-energy malnutrition impairs immune functions like cytokine production and phagocytosis which are key in TB pathogenesis. Malnourished individuals with TB often face poor treatment outcomes, delayed recovery, higher relapse rates, and increased mortality [14]. Chronic malnutrition is widespread in West Africa, particularly in countries like Niger and Burkina Faso [15].

Improving the nutritional needs of patients with TB is crucial to scaling up nutritional assessment and supplementation in TB programs, addressing food insecurity through community-level interventions, and conducting micronutrient supplementation trials specific to the region. Notable strides made to tackle malnutrition in the sub-region include (i) providing nutritional supplements to patients with TB, especially in low-income and food-insecure communities, (ii) community-based programs linking TB care with broader nutrition programs to address underlying food insecurity, and (iii) tracking the nutritional status of patients with TB to guide treatment adjustments through enhanced monitoring and evaluation initiatives.

*Other non-communicable diseases*

NCDs, such as chronic respiratory conditions, hypertension, and substance abuse (including alcohol use disorders), exacerbate TB outcomes.

Hypertension can impair immune function, increasing susceptibility to TB infection and complicating recovery. A study in Nigeria reported that approximately 20% of TB patients had hypertension, with higher rates among older adults and urban residents [16].

Routine blood pressure monitoring should be incorporated into TB care settings to enable early detection and management of hypertension. Additionally, standardized treatment protocols addressing both conditions must be developed to ensure compatibility between anti-TB and antihypertensive therapies. Training healthcare workers to manage these comorbidities effectively and investing in community-based awareness campaigns are equally crucial.

Substance abuse, including alcohol, tobacco, and recreational drugs leads to immunosuppression and socio-behavioral factors such as delayed diagnosis and poor treatment adherence and outcomes. Mitigating these challenges requires counseling, and psychosocial support, to improve treatment adherence and outcomes [17].

Chronic respiratory diseases, including chronic obstructive pulmonary disease and silicosis, are linked to increased TB risk. Damaged lung tissue provides an ideal environment for TB bacteria to thrive, hence reducing occupational exposure to dust and promoting smoking cessation are critical in TB control.

## High pool of latent TB infection in West Africa

One of the major hindrances to the achievement of the End TB goals is the reservoir of latent TB infection (LTBI) [18]. The epidemiology of LTBI in West Africa reflects the region's high-TB-burden, driven by other factors such as HIV, diabetes, and even *Mycobacterium tuberculosis* lineage diversity. LTBI rates from different studies depending on the population range from 19.5% to 22.8% [19] (Figure 2). The highest prevalence was reported in Guinea-Bissau (26.7%), Guinea (26.1%), and Niger (25.5%), while the lowest was reported in Cape Verde (14.3%), The Gambia (18.7%), and Mauritania (19.6%) [19]. A study from Burkina Faso among three high-risk groups, namely household contacts of TB index cases, healthcare workers, and slaughterhouse workers, reported a higher prevalence of LTBI of 67.3% and 84.2% based on QuantiFERON®-TB Gold Plus (QFT-Plus) and tuberculin skin test (TST) results, respectively [20]. In another study in The Gambia assessing LTBI in the household contacts of newly diagnosed TB cases, 57.1% and 58.8% were positive for enzyme-linked immunosorbent spot (ELISPOT) assay and QuantiFERON-TB Gold in-tube (QFT-GIT) respectively [21].

A major risk factor for LTBI in West Africa is HIV. The dual epidemic of TB and HIV is a major driver of both active and latent TB cases in the region. People living with HIV are more likely to progress from latent to active TB. In a study conducted in Nigeria, the prevalence of LTBI

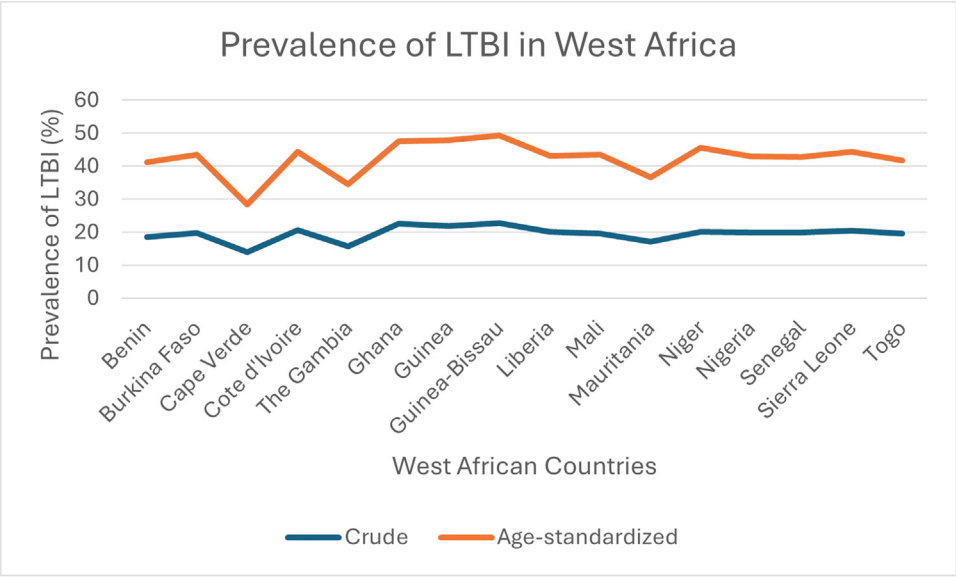


**Figure 2.** The prevalence rate of LTBI in West African countries using data from Ding *et al.* [19].
LTBI, latent tuberculosis infection.

among people living with HIV was reported to be 22.5% compared to the 10.0% recorded among healthy controls [22]. Thus, there is a need to implement active diagnosis and treatment of high-risk group populations.

### Zoonotic tuberculosis

Zoonotic tuberculosis, primarily caused by *Mycobacterium bovis*, is a significant public health challenge at the animal-human interface in West Africa. While *Mycobacterium tuberculosis* is responsible for most human TB cases, zoonotic TB highlights the interconnectedness of human, animal, and environmental health. It is particularly prevalent in regions with high livestock populations, unpasteurized milk consumption, and close human-animal interactions [23]. The prevalence of zoonotic TB in cattle across West Africa ranges from 1.3% to 15%, with hotspots in Nigeria, Ghana, and Mali [24,25]. Despite its significance, zoonotic TB remains underreported in West Africa due to diagnostic challenges and inadequate surveillance systems.

Human cases of zoonotic TB often present diagnostic challenges owing to the limitations in distinguishing *M. bovis* from *M. tuberculosis* using routine diagnostic tools and the emergence of novel zoonotic mycobacterial strains [26]. Unlike *M. tuberculosis*, most strains of *M. bovis* are inherently resistant to pyrazinamide, complicating standard TB treatment regimens [27].

Recognizing the transboundary nature of livestock trade, West African countries are collaborating to standardize TB control measures for animals moving across borders [28]. Strengthened diagnostic systems, surveillance, and environmental measures like safe carcass disposal are also critical.

## Concluding remarks

The health systems in West Africa are faced with many challenges, including underfunding, lack of skilled staff, and a need to improve health service delivery. To achieve the End TB strategic goal and the UN's Universal Health Coverage (UHC), the health system in West Africa should be structurally and functionally resilient to address the challenges associated with the control of TB. Key activities should include:

### Strengthening the laboratory system to be sensitive to detect not only cases but resistance as well

Considering the epidemiology of TB in the sub-region, the Xpert MTB/RIF assay and other rapid tools such as line probe assay, and digital X-rays should strategically be implemented across all levels. Local health authorities should map facilities with the capacity for drug resistance testing to health facilities without the capacity in a Hubs-Spokes system. Sputum samples of presumed TB cases as well as suspected DR-TB cases from health facilities without the needed capacity (spokes) will then be transported using courier services to the Hubs within short intervals. Other systems of health service delivery can be explored in the sub-region based on available resources.

### Human capacity building

There is a need to train more health workers at every level of the health system through continuous training on TB. This should also include trans-disciplinary capacity development where health workers are trained to work in multi-sectoral teams to shift the workload from tertiary to primary health care. Beyond increasing the health workforce, there is an urgent call for strategies to retain the TB health workers in the sub-region. Due to the high brain drain of health workers from Africa, especially in West Africa [29], there is a need to devise strategies such as (i) Providing competitive compensation through attractive pay packages and bonuses; (ii) Showing recognition by giving awards for exceptional services; (iii) Promote continuous learning by demonstrating a clear employee development plan and (iv) Improve engagement by conducting periodic open fora for staff to share their views.

### Regional collaborations and research to combat tuberculosis and tuberculosis risk factors

There is a growing demand for cross-border initiatives through strengthening regional collaboration to address DR-TB, LTBI, TB-HIV co-infections, and other comorbidities in border areas. To address these challenges, West African countries are working to strengthen their health systems and improve TB diagnosis and treatment. Two regional TB consortia already exist that aim to build capacity in genomics for tackling and managing TB: (i) The West African Network of Excellence for Tuberculosis, AIDS and Malaria (WANETAM) was established to build capacity in TB diagnostics across partnering laboratories and (ii) The Pan-Africa Network for Genomic Surveillance of Poverty-Related Disease and Emerging Pathogens (PANGenS) with its main aim to increase Africa's capacity in genomic epidemiology and to conduct genomic epidemiology of drug-resistant tuberculosis and malaria across 12 African countries.

Innovative financing for tuberculosis programs

Innovative health financing in West Africa is important to achieving the End TB strategic goals through the prioritization of TB by governments of the West African sub-region. Although Ghana has the highest Average Health Priorities of 8.4%, it even falls below the cut-off of 15% [30]. This is a wake-up call to policymakers to increase the budget for health programs. This challenge calls for increased investments in integrated healthcare systems that can simultaneously address TB, diabetes, HIV, malnutrition, and hypertension among other diseases.

It is essential to establish innovative financing strategies such as community-based programs for early detection and management of comorbidities and promote public awareness campaigns to educate communities about the risks of TB and associated conditions as well as treatment adherence. Assessment of community needs through co-creation with communities is one of the first key steps. Suggestion and implementation of possible health strategies with stakeholders for consideration by the community.

## Declarations of competing interest

The authors have no competing interests to declare.

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## Author contributions

All authors contributed to the conceptualization, writing and review of the article.

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