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WHY TUBERCULOSIS STILL PERSISTS: A NARRATIVE REVIEW OF GAPS IN DETECTION AND PUBLIC AWARENESS

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Abstract

Tuberculosis (TB) remains one of the leading infectious causes of death despite numerous decades of control efforts worldwide and the existence of effective treatments. Limited access to essential diagnostic tools, delayed diagnosis, and the underreporting of a large number of cases remain major obstacle to effective disease control. Misconceptions regarding tuberculosis, Social prejudice, and illiteracy have discouraged individuals from having timely treatments, especially in low- and middle-income, high-burden settings. This review discusses the importance of timely tuberculosis detection, explores the reasons of ongoing delayed diagnosis, underreporting, and social perception of TB. The absence of health education campaigns and lack of culturally tailored communication plans delay engagements at the community level. The emergence of multidrug-resistant tuberculosis (MDR-TB) plays an important role in system failures for timely diagnosis, effective treatments, and post-treatment checkups of patients, exacerbating poverty and other social factors resulting in epidemics. This can be improved by using new strategies that includes introducing better diagnostic technologies, focusing on social and economic factors of disease development, stronger public health training programs, and continued vaccine research and shorter preventive treatment regimens. This review shows that tuberculosis transmission persists because of both biomedical and socio-cultural factors. Curbing it will take more than medical advances alone; it also requires equitable awareness campaigns and shorter preventive treatment regimens.

INTRODUCTION

Tuberculosis (TB), caused by *Mycobacterium tuberculosis*, primarily affects the lungs but can also involve other organs and tissues, a condition known as extra-pulmonary tuberculosis (EPTB) (1). Tuberculosis is used to consider as planets most destructive pathogen until COVID 19. *Mycobacterium tuberculosis* is transmitted from person to person through respiratory air droplets, forms when a sick individual cough, sneezes, or

speaks. Rates of tuberculosis are most likely to be much higher in nations with low incomes, poor living conditions, and high rates of HIV prevalence, common malnutrition, and inadequate tuberculosis control. These conditions present a hostile environment that facilitates the development of the disease, thus becoming an urgent public health issue in such at-risk areas (2, 3).

Tuberculosis (TB) remained a significant global health threat in 2023, with an estimated 10.8 million new cases and 8.2 million newly reported and diagnosed cases, a new record high. Although some of this increase is due to the post-COVID-19 recovery of diagnostic capacity and clearing of residual backlog, it also points to sustained surveillance gaps. The majority of cases were found in the WHO South-East Asia, Africa, and Western Pacific regions, with five Asian nations alone contributing more than half of the worldwide burden. Multidrug- and rifampicin-resistant TB continues to be underdiagnosed and undertreated, even with increases in treatment, and latent TB infection continues to jeopardize future control. Social stigma, economic crisis, and fragile health systems make it more difficult to make progress. New diagnostics, including R&D pipelines, medicines, and vaccines, are encouraging, but commitments still fall short appreciably. These trends explain that, despite being preventable and curable, it remains a major global health challenge because of inadequate case detection, knowledge gaps, and insufficient political and financial support (4, 5).

Mycobacterium tuberculosis has infected approximately 25% of the world's population and a five to ten percent lifetime risk of active disease. Early detection is essential for limiting its spread; however, some of these tests, such as culture, microscopy, molecular tests, and genome sequencing, are still hindered by high costs, resource constraints, and technical demands, resulting in many diagnostic and treatment delays (6). Analogously, as worldwide efforts focus on enhancing drug regimens and prevention measures, delayed diagnosis of TB cases continues to fuel transmission, relapse, and the development of drug resistance (7). Collectively, these challenges indicate that early identification remains one of the largest obstacles to reducing the global burden of Tuberculosis.

This narrative review examines the major gaps in tuberculosis detection, underreporting, public awareness, and stigma that continue to drive TB transmission and hinder global control efforts, and highlights evidence-based strategies to strengthen early diagnosis, surveillance, and public health interventions. Much of the existing research treats diagnostic barriers, stigma, surveillance, and multidrug-resistant tuberculosis as separate problems; few reviews bring them together within a single public health framework. This review addresses that gap, synthesizing recent evidence on these interconnected challenges and the strategies needed to improve TB control.

Literature Search Strategy

This narrative review draws on evidence published between 2018 and 2025 on gaps in tuberculosis detection and public awareness. Literature was identified through PubMed, Google Scholar, and the WHO website, using search terms such as "tuberculosis," "TB diagnosis," "delayed diagnosis," "public awareness," "stigma," "multidrug-resistant tuberculosis," and "TB surveillance." Original research articles, systematic reviews, meta-analyses, and WHO reports published in English were included; studies outside the review's objectives or published in other languages were excluded.

Review structure

This review covers five areas: gaps in tuberculosis detection, underreporting of TB cases, public awareness challenges, multidrug-resistant tuberculosis, and strategies for strengthening TB control going forward. Together, these sections map the major barriers to achieving the WHO End TB Strategy.

Gaps in detection of TB:

Delayed Diagnosis

Regardless of having a lot of TB diagnostic tools and technology, the delayed diagnosis of TB is

still considered a problem. Negative sputum smear, extra-pulmonary tuberculosis, HIV co-infections, living in the countryside, impoverished environment, lack of education, and ignominy all contribute to the delayed or missed detection of TB. Another downfall in late detection is that patients with initial TB symptoms are sent to low-level healthcare units or to traditional healers who don't have much experience, where they get non-specific treatments, resulting in a second delay before getting specific treatment. This cycle shows how social and health system flaws prolong a detection gap in TB (8).

It takes a lot of effort for the timely identification of tuberculosis, as it is clinically similar to many other lung diseases, such as pneumonia. A prospective study was conducted in Kosovska Mitrovica at the Department of Pulmonology in Clinical Hospital Center, which enlisted 70 pulmonary TB patients and 75 patients with pneumonia in order to compare the two diseases and check for similarities between them. The study stated that pulmonary TB is mostly found in young men between 30-39 years old, especially from rural or lower middle education, whereas pneumonia was more common in older-aged women. The symptoms of both diseases were very similar, including chest pain, cough, and high fever. Even the Radiological results were so confusing to differentiate between the two diseases. This showed that it is so confusing and overlapping symptoms make it difficult to identify TB correctly (9).

Another study conducted from 2008 to 2017 in the National Tuberculosis Surveillance System, a retrospective cohort analysis on pulmonary TB patients, reported delays in diagnosis. The average patient delay was around 37 days, and the total delay increased to 62 days, with over 80% of cases taking more than a month to be diagnosed correctly. Interestingly, the delays increased throughout the study, with patient delay lengthening from 33 days to 44 days and total delay from 59 days to 70 days. Unemployment, alcohol addiction, and high TB incidence countries were highly linked with longer patient delays. Characteristics such as older age, being female, and having comorbidities resulted in delays in healthcare. These results show that both the responsiveness of the health system and social determinants play important roles in the identification of TB, and detailed analyses are required to lower the delay between the onset of symptoms and the diagnosis (10).

Limited Access to Diagnostic Tools

There have been prodigious advances in TB diagnosis techniques for identification, but still a lot of patients go undiagnosed or wait for ages before proper diagnosis. Ten high-burden countries, most of which still use primarily smear microscopy, a technology that has been around for over one a century and has poor sensitivity, account for about 77% of the diagnostic gap. While brand new technologies like rapid molecular tests (like CBNAAT, line probe assays, and LAMP) and liquid culture techniques have notable enhanced precision and lower the time need to complete the process, the requirement for specialized setup, costs frequently hinder their application, and their unavailability in resource-scarce environments. Therefore, access to quality and timely diagnostics continues to be one of the largest hurdles to TB elimination, especially among populations at risk for drug-resistant TB or co-infections such as HIV (11).

A systematic review and meta-analysis from high TB-burden countries documented high patient presentation delays, health system responsiveness delays, and treatment initiation delays. The study results showed the pooled median patient delay in low- and lower-middle-income countries (LIC/LMIC) was 28 days, whereas in upper-middle-income countries it was only 10 days; health system delays were as long as 14 days in LIC/LMIC versus in upper-middle-income countries it was merely four days. Late treatment still shows a major hindrance to timely care. Diagnostic and treatment delays have shown that this is due to inadequate access to diagnostic technology, equipment, and stockpiles, particularly in resource-poor settings with antiquated methods, under-capacity lab facilities, and bureaucracy that impeded the serendipitous identification of cases. These delays have also

added to patient-level barriers such as lack of basic TB knowledge, stigma, rurality, and poor living standards, which added to the overall delays in patients accessing diagnostic techniques in a timely manner. Altogether, these results have showed that late diagnosis and inadequate availability of diagnostic techniques results in enable TB transmission and render elimination in high-burden settings (12).

The delayed diagnosis of tuberculosis (TB) is not just a problem for patients and health systems. However, it also focuses on how important it is to have timely diagnostic assistance that is available and accessible. According to the Global Tuberculosis Report in 2018 represented that 30 percent of TB patients are never diagnosed; they remain untreated for a long time, which shows a weakness in the diagnostic system. Studies from India and other nations with both the burden and high prevalence of TB mirror that gaps in the diagnostic process are connected to the availability of quality diagnostic tests, increased likelihood of certain individuals being "missed," absence of care-seeking behavior to locate diagnostic facilities, and failure in diagnosis even at the level of the health center. Access to services alone is insufficient; we need diagnostic capacity, utilization, and quality as well. With no dependable, prompt diagnostic services, patients are left untreated. This results in reported cases that support transmission while weakening efforts to end TB (13).

The diagnostic shortfall for tuberculosis is even greater among children than among adults, with the overwhelming majority of cases either going undetected or diagnosed too late. While there are now new diagnostics and strategies that have been in development during the last few years, access to these diagnostics and strategies is still much too low in the overwhelming majority of high-burden countries. Children specifically pose additional diagnostic challenges because of Paucibacillary disease and the lack of quality specimens. National TB programs must then modify existing strategies and create new interventions to enhance access to child-friendly diagnostics and reinforce detection efforts to eventually bridge the treatment coverage gap in this vulnerable group (14).

Underreporting of Cases

The issue of underreporting Tuberculosis cases remains a significant issue for providing appropriate estimations of disease burden and evaluating control measure. A study conducted in Eastern China, that have third largest TB epidemic, showed that more than a quarter of the TB cases recorded in hospital reports were never submitted to the national reporting system. The underreporting was attributed to a variety of reasons, including unskilled and overstressed health workers, lacking supervision and accountability, and disconnected health information management systems. Moreover, the underreporting highlighted above was even in a relatively developed province, indicating that the extent of case underreporting could be worse in resource-poor settings. These surveillance gaps hamper country and global TB control efforts by hiding the magnitude of the epidemic and delaying timely interventions (15).

Tuberculosis in children is usually an overlooked part of the overall epidemic; this can be mainly because of diagnostic challenges and poor reporting patterns. A cross-sectional study was conducted involving 12 districts from Pakistan that brought this fact to light. Among the 7,125 children suspected of having presumptive TB who sought care from private health care providers (HCP), 5,258 were diagnosed with TB. However, only 4% of these children were reported to the National Tuberculosis Program. This childhood TB inventory study is the first to reveal a significant underreporting of 78% of cases in children across the country. Participants in the study indicated that pediatricians and general practitioners require additional support and accountability for reporting cases. In conclusion, underreporting of TB cases is not just an issue of systems but also at the coordination level; this is present among healthcare professionals and the national surveillance system, resulting in potentially obscuring the true extent of TB in vulnerable groups such as peads (16).

The Underreporting of tuberculosis cases from across all age groups, such as adolescents and children, is a situation that goes beyond national boundaries and is known to be a problem worldwide. A systematic review of literature was undertaken with the aim of examining the large and highly variable differences within tuberculosis notification systems for adolescent and child cases across Low- and Middle-Income Countries (LMICs). Causes to this issue are poor surveillance systems, challenges in making a diagnosis, and inadequate coordination between national programs and health care providers. Interventions have managed to address some of these deficiencies in reporting, yet they are still fragmented and limited. The review highlighted the strong need for stronger global surveillance systems, in addition to targeted interventions, to guarantee that children and adolescents are being diagnosed correctly, reported, and given appropriate TB care timely manner (17).

Underreporting of TB cases continues to be a major impediment to control activities, particularly where the private sector dominates. A scoping review of 36 studies concluded that underreporting is shaped by patient factors (e.g., male, child, or older), health worker issues (unqualified or overburdened staff, unawareness, inadequate incentives), and health system deficiencies (weak supervision, complicated health information systems, and absence of accountability). These factors combined stifle proper notification and surveillance of TB cases in private health facilities (18). Analogously, a recent Indian comprehensive review, framed by the onion model, identified that both patient- and provider-related determinants explain the recurrence of "missing cases." Patient-related determinants were migration, illiteracy, alcoholism, stigma, unwillingness to reveal previous treatment, and lack of good record-keeping, whereas provider-related determinants were poor communication, sampling mistakes, drug unavailability, misclassification, poor diagnostic capability, and notification problems like Ni-KSHAY reporting gaps. The research established that factors related to providers have a predominant role in maintaining India's missing TB burden, emphasizing the necessity of enhanced provider training, enhanced diagnostic facilities, and a tighter notification system (19). As shown in Table 1 the key gaps in TB detection.

Table 1: Key Gaps in TB Detection and their Consequences

Gap in detection	Description	Consequence
Delayed Diagnosis	Patients may experience considerable delays in getting diagnosed because of nonspecific symptoms, stigma, or lack of easy access to testing.	Boosted community transmission; deterioration of disease outcomes.
Limited Access to Diagnostic Tools	More sophisticated tools, such as Gene-Xpert/NAATs, are not readily available in rural or resource-poor environments.	Missed or delayed detection of drug-resistant TB and TB cases.
Underreporting of Cases	Most of the cases go undiagnosed or unreported, especially from private sectors and informal caregivers.	Inaccurate estimates of burden; poor resource allocation; concealed epidemics.

Table 2: Public Awareness Challenges and Impact on TB control

Challenge	Description	Impact on TB control
Misconceptions about TB	Considering TB a non-curable disease of past caused by poverty or curses.	Delayed healing, myths, stigma
Social Stigma	Patients don't get checked and hide due to fear and shame	Underreporting, Treatment delays
Inadequate Health Education Campaigns	Poor outreach, minimal utilization of local media/folk arts	

Public Awareness Challenges

Misconceptions about TB

Though knowledge of tuberculosis (TB) is almost universal, myths are the biggest obstacle to proper control. In Ethiopia, 95.5% of the respondents in a countrywide KAP survey knew about TB, but only a quarter recognized that its origin is bacteria, with most believing it was due to cold air, hard labor, or spirits (20). Likewise, in students, a review of research identified substantial knowledge gaps in TB symptoms, risk factors, and transmission, as well as myths and stigma. Most of the students see TB as a "disease of the past" and not a contemporary threat, diluting public health messages (21). Both groups describe how entrenched misconceptions develop stigma, slow health-seeking behavior, and undermine TB prevention programs. Focused education campaigns, integration of TB awareness into curricula, and use of digital platforms desperately seek to dispel misconceptions and reform TB control. The same challenges have been observed in all parts of the world, including industrialized countries, where media including TV news - though they are sources of health information - typically report on politicized or biased issues, which contribute to myths and reduce public health awareness (22).

Tuberculosis (TB) is known as a global public health issue; it mainly affects the lungs, although TB can infect nearly all body tissues and organs. It is a completely curable and treatable illness, but it is still often called the "disease of the poor," which creates a false impression that it only attacks poor people in developing countries (as discussed in Table 2). Another commonly misinterpreted fact about TB is that it is the "second great imitator," since it can present with many infectious and non-infectious diseases. These misconceptions lead to delays in seeking care, diagnosis, and treatment, ultimately deteriorating the outcomes of disease (23).

Social Stigma

Social stigma has been the most enduring challenge to successful tuberculosis (TB) care, determining how patients are viewed and handled by their communities. It was shown through a systematic review of 15 studies that stigma has been a persistent challenge in the monitoring and treatment of patients with tuberculosis. The review noted that a high degree of negative stigma is usually experienced by most patients, leading to social withdrawal and increased reluctance to follow therapy. Societies usually reported discriminatory practices, including not letting TB patients play with their children, eat or drink with them, or even stay near them. This not only stigmatizes the patients but also inhibits successful disease control. The research emphasized that strategies aimed at reducing stigma should prioritize the active engagement of both patients and health workers, tackling stigma at both individual and structural levels in order to achieve improved treatment outcomes and acceptability in the community (24).

A systematic review that assessed interventions for TB-related stigma emphasized the need to

address this as a barrier to meeting the WHO End TB Strategy. The review identified 11 studies from 1999 to 2022, with all but one of these interventions focusing on education and psychosocial support for individuals with TB, healthcare workers, and the general public. Findings indicated that these interventions lowered stigma, especially among health workers and populations, but methodological constraints limited their cumulative impact. Most studies did not use validated stigma measurement instruments, and no psychosocial interventions had stigma reduction as an explicit primary goal. Notwithstanding these limitations, the review laid out a conceptual framework linking populations targeted, interventions implemented, and their impacts, thus providing good guidance on how to devise more effective stigma-reduction interventions (25).

Stigma lies in the linking of TB with poverty, bad hygiene, and fear of contracting the disease, resulting in discrimination and exclusion of patients. Psychosocial effects include shame, concealment, loss of status, and denial of illness, which indirectly affects treatment adherence and health-seeking. This continuous stigma further erodes TB control in the world by discouraging individuals from presenting early for care and treatment (23). One of the largest barriers to control of TB is social stigma in the form of internalized shame, fear of revelation, and discrimination. A mixed-method study noted that more than half of TB patients reported self-stigma, and many avoided talking about their illness because they anticipated discrimination. Enacted stigma through disrespect by health workers was also noted. Women patients were particularly vulnerable, and myths in the general public, such as identifying TB with poverty or infectivity, added to the issue further. The findings suggest the necessity of awareness initiatives and education of healthcare professionals to address stigma at both the clinical and community levels (26).

Inadequate Health Education Campaigns

There are so many awareness campaigns actively working, but still, incomplete knowledge of health education remains a barrier to adequate TB control. A study has reported that most of the students have poor knowledge about symptoms of TB, risk factors, and how it spreads, with misconceptions and stigma still dominant even among educated segments (21). Loopholes break public health programs because students are a key group we can reach to change future health techniques and policies. Traditional health campaigns often do not work well in tribal and rural communities when trying to communicate with individuals. Research shows that methods adapted to local cultures, like using traditional media such as Nautanki, have been very successful in raising awareness about TB. However, these methods are not used enough. (27). To view past research is to realize that there is an overall inadequacy of the current health education campaigns, which are required to be aimed at evidence-based knowledge dissemination and also at culturally suitable communication strategies.

Emergence of multidrug-resistant TB (MDR-TB)

The emergence of multidrug-resistant tuberculosis (MDR-TB) is inherently linked to sustained lacunae in detection and treatment cascades. The drug-resistant TB (DR-TB) cascade loses patients at each step, from the detection of new cases to successful treatment or survival without disease. Such gaps are most considerable in weak health systems with inadequate financing and endemic poverty, all of which restrict access to early diagnosis and high-quality treatment. Thus, differences in access to treatment for DR-TB continue to be a significant cause of the global burden of MDR-TB, as the foundation of the necessity for strengthening detection systems and ensuring equal access to treatment (28).

Tuberculosis is a classic illustration of a social disease that calls for multidimensional interventions aside from biomedical treatment. Studies demonstrate that social determinants of health play a major role in the development and continuation of MDR-TB. A scoping review identified strong correlations of MDR-TB with multidimensional poverty, such as low income,

malnutrition, limited education, and poor social support, which serve both as causes and results of the disease. Additional determinants such as overcrowded housing, poor living environments, smoking, cultural factors (race, ethnicity, and gender), as well as comorbidities, further increase vulnerability. Since the epidemiology and care of MDR-TB are deeply influenced by socioeconomic disparities, effective control requires not only novel diagnostic techniques and treatments but also sustained social, environmental, and economic actions (29).

Pathways to Improvement

The 2019 Lancet Commission on Tuberculosis described a vision for a TB-free world through scientifically grounded strategic investments in science, prevention, and accountability. Substantial progress has been made since then, with better treatment outcomes for drug-resistant TB and encouraging progress in short-course preventive regimens and late-stage candidates for vaccines. Global progress in the fight against tuberculosis (TB) has been hindered by the COVID-19 pandemic. Although some African countries have achieved significant reductions in TB deaths, more than 7 million people have lost their lives to the disease in the five years since the 2018 UN High-Level Meeting. Such deaths emphasize the need to step up the roll-out of evidence-based approaches and to fully implement the Commission's proposals to enhance detection, prevention, and care (30).

Tuberculosis prevention is one of the most neglected parts, yet it is an essential need for controlling and preventing any epidemics. Existing data on TB shows that it does not shift from infection to disease; instead, it progresses gradually, which requires early detection and targeted prevention. The development of new tools and techniques for testing latent TB infections, TB prevention regimens, and advances in vaccine development are all helping in TB infection control and improvements. We need a multi-strategy approach that involves biomedical advances and social factors to promote equal access of TB detection and prevention to everyone. It is important to focus on these efforts to meet WHO End TB Strategy objectives and reduce TB incidence worldwide (31).

Conclusion

Tuberculosis (TB) remains a major global threat despite the availability of effective treatment strategies exist, because these tools are often not accessible to vulnerable people. This review, we have discussed the gaps in the detection: the poor reporting system, delayed diagnosis, and low public awareness regarding TB that leads to deeply rooted social stigma. Two misconceptions do particular damage: that TB is a disease of the past, and that it only affects the poor. Both discourage people from seeking care early. The rise of multidrug-resistant TB and the poor treatment outcomes seen in many settings trace back to weak adherence, thin patient counseling, and health systems that aren't equipped to support patients through long treatment courses. Newer researches and techniques, provided briefer preventive treatment, and developed vaccines for last stage patients can shift this picture, but only if they're funded and distributed equitably. Public awareness campaigns, community engagement, and health policy all have a role to play in getting patients diagnosed earlier and keeping them on treatment. Closing the gaps in detection and awareness is where progress against TB will actually be made, particularly for the populations currently left out of that progress.

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