

Tuberculosis and Migration: From Global to Local Perspective

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Abstract

Tuberculosis (TB) continues to be a significant global public health issue. It is estimated that around 25% of the world's population is infected with *Mycobacterium tuberculosis*, and TB remains one of the top causes of death worldwide. The World Health Organization's (WHO) latest report indicates that in 2023, there were 10.8 million TB cases and 1.25 million TB-related deaths globally. That year, 8.2 million new TB cases were documented, representing an increase compared with previous years. Population movement is recognized as a significant factor affecting the epidemiology of TB. Migration has increasingly posed a global challenge in social, economic, and public health domains. By the close of 2024, around 118.6 million individuals worldwide had been forcibly displaced due to conflict, violence, persecution, or violations of human rights. Furthermore, the number of people internally displaced by conflict or violence rose by 10% from 2022 to 2023. Ongoing conflicts, economic inequality, and educational opportunities are anticipated to continue to drive migration in the years ahead. WHO underscores the necessity of global cooperation in the screening, diagnosis, treatment, and monitoring of TB among migrants and refugees. Recently, our country has experienced an increase in migration driven by job and educational opportunities. While TB cases have decreased among the native population, there has been an uptick in cases among those born abroad. In light of global patterns and WHO guidelines, it is crucial to reevaluate and enhance our country's TB screening strategies for immigrants within a robust public health framework.

Keywords: Migrant, migration, refugees, tuberculosis

INTRODUCTION

Tuberculosis (TB) is an infectious, able to be prevented and treated, disease caused by the *Mycobacterium tuberculosis* bacillus.¹ Although it most commonly influences the lungs [pulmonary TB (PTB)], it may also affects many organs extrapulmonary TB (EPTB).² TB, which causes morbidity and mortality in millions of people all over the world every year, is the tenth leading reason of death.³

Most people who have TB disease live in 30 countries with a high TB burden. Most TB patients live in 30 countries, that account for 87 percent of the world's population in 2023, with a high TB burden.³ The countries that highest incidence of TB are Pakistan (6.3%), Philippines (6.8%), China (6.8%), Indonesia (10%) and India (26%), and these countries account for 56 percent of the global population (Figure 1).³

According to the World Health Organization (WHO), there were 10.8 million TB patients globally in 2023 and 1.25 million deaths happened that year.³ The number of new TB cases in 2023 was 8.2 million people.³ This number was 7.1 million in 2019, 5.8 million in 2020, 6.4 million in 2021, and 7.5 million in 2022.³ Possible reasons for the increase in 2022 and 2023 include global migration and difficulties accessing healthcare services during the coronavirus disease pandemic.

TB bacilli are transmitted from an infectious person (TB patient) to a healthy person via the airways.⁴ The most infectious patients are those with positive sputum microscopy for acid-resistant bacilli and cavitated pulmonary and laryngeal TB. Smear negative TB patients are less infectious.⁴ The risk of transmission is high for people with close, long-term contact with a patient with TB. These may be family members,

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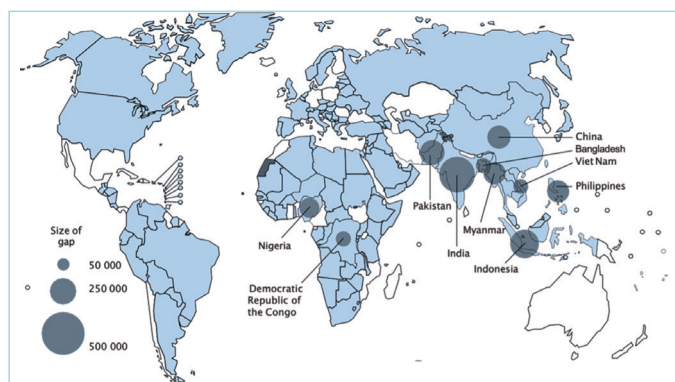


Figure 1. The ten countries with the largest gaps between case notifications of people newly diagnosed with TB and the best estimates of TB incidence, 2023.³

TB: Tuberculosis.

housemates, or work colleagues. Other risk factors for transmission include poorly ventilated environments, crowded environments, not recognising the source case, not being treated or receiving incomplete treatment, increased cough severity of the source case and drug-resistant variant.⁴

It is estimated that one quarter of the world's population is infected with TB today.³ Being infected with TB bacilli does not mean being a TB patient, it only means that the body has been exposed to the bacilli.⁵ This is called latent TB infection (LTBI). Over time, latent infection can progress to TB disease, which is the principal clinical problem. The risk of individuals with LTBI developing TB is highest in the first 2 years (roughly 5%) and this risk decreases over time.^{3,5} These individuals have a lifetime risk of developing TB of 5 to 15 percent.⁵

TB is a treatable disease, but treatment may be inadequate due to factors such as prolonged therapy, the need for multiple drugs, and difficulty accessing medication. Drug-resistant TB (DR-TB) may develop over time in people who fail to complete their treatment, and these patients constitute the most costly and deadly group in medical and socioeconomic terms. Strategies and targets to combat TB are reviewed annually by WHO and other international health organisations, and substantial efforts are made in this regard. Although it will take a long time to reach the targets of the end TB (END-TB) strategy conducted by WHO, the 2025 results indicate that TB incidence has been reduced by 50 percent and deaths from TB have been reduced by 75 percent over the last 10 years. However, there are serious challenges to achieving the objective of TB eradication, especially in countries with high TB incidence. The fundamental problem is the cost required for diagnosis and treatment.³

History of the Spread of Tuberculosis

The existence of TB, which is thought to have been present on Earth since the age of the dinosaurs, has also been proven in prehistoric Africa.⁶ The disease of TB in humans started with the domestication of cattle.⁷ Humans who began living with cattle encountered *Mycobacterium bovis*, the "bovine TB bacillus", for the first time through consumption of animal milk and meat and became ill. Over time, this bacillus has acquired genetic changes consistent with the more virulent human strain, *Mycobacterium tuberculosis* *humanus*. As people started to live in communities of more than 25,000 people, the spread of TB became

easier.⁸ Through the intercontinental migrations of humans, the TB bacillus travelled to America through the Bering Strait, which was opened 9000 years ago.⁸ Today, migration remains a major risk factor for the spread of TB worldwide.

What is Migration, Migrant and Refugee?

The movement of a person or people from a country, locality, place of residence, etc., to settle in another is called "migration".⁹ Since the earliest periods of history, people have migrated. Today, factors such as new job opportunities, education, wars, human rights violations, and terrorism cause migration. Currently, 281 million people (3.6%) worldwide are migrants.³ In addition to its economic, social, and psychological effects, migration facilitates the spread of infectious diseases such as TB. This further increases its significance.

Refugees are specified as persons who are outside their country and unable to return because of a well-founded fear of persecution on account of their religion, nationality, race or political opinion.¹⁰ However, migrants are defined as individuals who move to another country to improve their academic, financial or social situations and enhance prospects for themselves.¹¹ TB is an important reason of morbidity and mortality amongst refugees and migrants.¹² By the end of 2024, 118.6 million people globally were forcefully displaced because of conflict, persecution or human rights violations.¹³ In 2023, more than half of all refugees were estimated to have come from just three countries: Ukraine, Afghanistan, and Syria (respectively 5.9, 6.1, and 6.7 million).¹⁴ The total number of refugees all over the world has increased by at least three times in the last decade, with three-quarters living in low- and middle-income countries.¹⁵ Additionally, the number of internally displaced persons as a result of violence or conflict has increased by 10 percent from 2022 to 2023.¹⁵

Overview of Tuberculosis Risk in Migrants and Refugees

Refugees and migrants are the people most at risk of contracting infectious diseases such as TB due to their living conditions.¹⁶ Migrants and refugees are at greater risk of contracting TB than the native population. This is associated with factors such as TB prevalence in their country, migration route, frequency of visiting their home country, living conditions and duration of residence in the host country.^{17,18} The impact of migration on the epidemiology of TB is significant.¹⁹ The arrival of large groups of refugees significantly increases the burden and cost of TB. This also affects TB control efforts in host countries that accept refugees.¹⁸ Because of most migrants come from low-income countries with a high disease burden, this condition reveals serious challenges for global control and elimination of TB.²⁰ In migrants, breakdowns and blocking in access to health services is main risk in terms of spread of TB.³

Tuberculosis Epidemiology in Migrants and Refugees Worldwide

A systematic review published in 2022 summarised the eminence of TB among migrants and refugees.²¹ This review analysed European countries and found that migration from Syria to other countries in 2011 increased TB incidence in both border countries and elsewhere in Europe. Similarly, there were large migrations from African and Asian countries to Europe in those years, and it was stated that these also contributed to the incidence of TB.²¹ Türkiye borders Syria, and it was the largest recipient of migrants during the 2011 Syrian crisis. The rate of imported TB cases in Türkiye increased from 1.3% to 6.8% from 2011

to 2015, reflecting a important increase.²² In Hatay, which borders Syria, the prevalence of TB patients increased from 25.1% to 34.6% between 2010 and 2013.²²

The total number of Syrians in Lebanon is estimated to be higher than 1.5 million, and it represents more than a quarter of the country's population. Unlike other countries, Lebanon has no official refugee camps. That's why refugees are randomly distributed throughout the country.²³ TB incidence in Lebanon declined until 2011. Yet, since the beginning of the Syrian crisis, there has been remarkable rising in TB patients in Lebanon.^{22,24} Before the Syrian crisis, the prevalence of TB cases in Lebanon was 33 percent, but gradually has risen to 53 percent from 2010 to 2015.²²

Another meta-analysis on TB among migrants²¹ indicated that TB patients were aged between 13 and 54 years and that the disease was more prevalent among men than women. Most refugees and migrants with TB are from Asian and African countries. The most frequently reported Asian countries were Vietnam, Thailand, the Philippines, India, Pakistan, and Syria, while the most frequently reported African countries were Somalia and Eritrea.²¹ In the meta-analysis, the incidence and prevalence of TB in migrants and refugees were found to vary across countries. Canada has the lowest TB rate among refugees at 19 per 100,000,²⁵ while the Netherlands has the highest at 754 per 100,000.²⁶ Italy has the highest prevalence in Europe. The prevalence in immigrants is 80 times higher than the estimated prevalence rate in Italy (6.7 per 100,000 population).²¹

In 2020, more than 9,000 foreign-born people in the European Union/European Economic Area (EU/EEA) developed TB.²⁷ The number of Ukrainians developing TB in the EU/EEA rose from 164 in 2020 to 780 in 2022. While 27 of the cases in 2020 were multidrug/rifampin-resistant-TB, this number increased to 194 in 2022.²⁸ This increase indicates significant changes in the epidemiology of TB in the EU/EEA due to migration in recent years.

The most common type of TB among migrants and refugees is PTB. In fact, this group has the highest risk of developing EPTB.²⁹ EPTB is important because diagnosis/treatment delays are significantly greater compared to PTB.²⁹

According to the most recent large meta-analysis, diagnostic delay for TB is greater among migrants than non-migrants. However, the time to initiation of treatment is shorter among migrants than among non-migrants.³⁰⁻³² The main reasons for delayed diagnosis among migrants with TB are distance to health centres, the cost of healthcare services and concerns about stigmatisation.³³ Recent study including only immigrants analysed delays of diagnosis and treatment, and it founds that delays varied according to country of origin and level of education.²⁹ In a meta-analysis including 60,802 migrants with TB and 221,002 non-migrants with TB, negative treatment outcomes such as treatment failure, treatment refusal and loss to follow-up were higher in migrants [odds ratio: 1.76 (95% confidence interval: 1.01-3.03)].³³

Drug-Resistant Tuberculosis and Its Role in Migration

DR-TB refers to a disease that is resistant to one or more drugs used in treatment. It is analysed in 5 categories by WHO; isoniazid resistant TB, RR-TB, multidrug resistant-TB (MDR-TB), rifampicin and fluoroquinolone resistant TB and rifampicin, fluoroquinolone and bedaquiline or linezolid resistant TB (XDR-TB).⁴

The most significant problems with DR-TB are treatment difficulty, increased risk of transmission, and high mortality. While the duration of treatment in classical PTB is 6 months with oral drugs, treatment for DR-TB takes years, and many drugs must be administered intravenously concurrently, thus requiring hospitalisation for months or even years. However, since this is not possible in many countries, these patients remain infectious without receiving treatment. Access to drug resistance testing is unavailable in many settings. Therefore, it is thought that most cases are undetected. Each undetected case continues to transmit the disease and, unfortunately, often results in death. The diagnosis and treatment of DR-TB depends on a lot of factors such as the success of the health system, integrated efforts of governments and international cooperation.

Access to drug-resistance testing is limited. Despite this, the prevalence of DR-TB is currently estimated at 5.5 percent and is on the rise (Figure 2).³ According to the WHO, only 25% of all DR-TB patients worldwide started treatment in 2023.³ 75% do not have access to testing and treatment. The population that accounts for this large difference lives in Ukraine, Myanmar, Pakistan, China, Indonesia, Philippines, India, Nigeria, Vietnam and South Africa.³ Today, these countries account for the highest number of immigrants to Europe and neighbouring countries. In a meta-analysis conducted in Europe, DR-TB was found to be 3.6 times more common in immigrants than in non-immigrants.³³

In China, Bangladesh and Russia, the rates of multidrug resistance in previously treated TB cases are 26%, 29%, 99%, respectively.³⁴ In Eastern Europe, the rate of multidrug resistance in previously treated TB cases is 69.0% in Belarus, 62.0% in Moldova and Estonia, 56.0% in Ukraine, 49.0% in Lithuania, 30% in Latvia and 23.0% in Bulgaria.^{35,36} Migrants from countries with high rates of DR-TB are increasingly settling in European countries with low TB incidence.

It has been reported that nearly three-quarters of MDR-TB cases detected in EU and EEA member states were identified in migrants.³⁴ In Germany, migrants account for 94% of MDR-TB cases, but only 58.7% of TB cases.³⁴ Worldwide, only half of MDR-TB patients successfully complete treatment, while a quarter disappear without any information on the treatment result.³ Only 26 percent of XDR-TB patients successfully complete treatment, while a quarter drop out of follow-up.³ This difference is greater in countries where drug resistance has a higher prevalence.³ The main factors that compromise adherence to MDR-TB treatment can be listed as multi-drug therapy, long-term treatment, and concerns about social stigma.³⁷⁻³⁹

Some data suggest that MDR-TB treatment success is lower among migrants than among the local population in low-incidence European countries. It is thought that this situation may be related to barriers such as language, health literacy and lack of access to healthcare services.³⁴

Human Immunodeficiency Virus-Tuberculosis Co-Infection and Its Role in Migration

The most common opportunistic disease in individuals with human immunodeficiency virus (HIV) is active TB and HIV is the strongest known risk factor for TB development.⁴⁰ The risk of developing active TB is twenty times higher in HIV-positive individuals with latent TB,⁴⁰ leading to a significant increase in morbidity and mortality in these cases.⁴⁰ Another reason why TB is important in people with HIV is that the drugs used in the treatment of both diseases interact with each other.⁴ The most significant risks for HIV-TB co-infection among

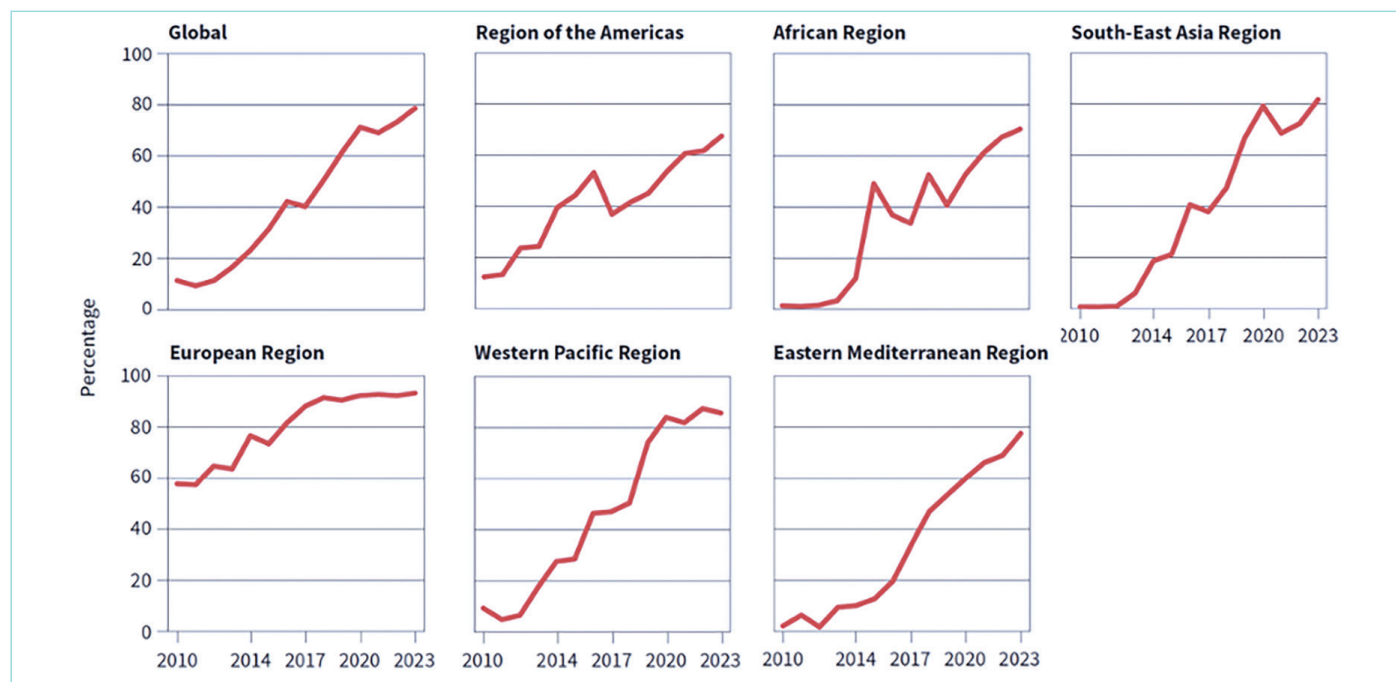


Figure 2. Percentage of people with RR-TB, globally and for WHO regions, 2010-2023.³

RR-TB: Rifampicin-resistant tuberculosis, WHO: World Health Organization.

migrants are poor socio-economic status, poor living conditions and limited access to healthcare services.⁴⁰ Despite this, studies on HIV-TB epidemiology in migrants are insufficient.

The development of antiretroviral treatments over the last few decades has reduced the incidence of HIV-TB co-infection, but the high mortality rate among these individuals remains a significant problem. HIV-TB constitutes 6.3% of all TB cases in 2022.³ Nearly 70% (460,000 cases in total) of HIV-TB cases in 2023 were detected in the African region, especially in Eastern and Southern Africa. In Thailand, it is estimated that unregistered migrants are 3 times more than registered migrants and 30% of TB cases are reported to be HIV-TB.³ Among people with HIV-TB in Portugal, 36.4% are immigrants and 63.6% are natives. Most immigrants (80.3%) came from African countries.⁴⁰

The prevalence of HIV-TB co-infection in Europe increased from 2008 to 2014 [3 in 7 studies from United Kingdom (UK), Spain, France and Portugal, HIV-TB co-infection was higher in immigrants (2.8%) than natives (2.3%)].⁴⁰ In 1994, the prevalence of HIV-TB co-infection among immigrants in Barcelona was 6.5%, rising to 37.1% in 2004, while in the UK it rose from 45% in 2001 to 78% in 2002.⁴⁰ The majority of migrants with HIV-TB in Europe originate from Africa (1-76.6%), Western Europe (3.2%), Eastern Europe (42.8%), South Asia/East Asia/Pacific (36.4%) and Latin America (2-31.7%).⁴⁰

The mortality rate of HIV-TB cases among immigrants has been reported inconsistently. Between 2001 and 2011, it was found that mortality rates among co-infected patients arriving in Germany from Sub-Saharan Africa were higher than those among natives.³ This situation is similar in Spain and Italy.⁴⁰

It is considered that there were 740,000 (95% UI: 550,000-950,000) cases with HIV-TB deaths in 2006 and this number decreased by nearly 78% to 160,000 (95% UI: 130,000-190,000) in 2023.³ The development

of antiretroviral therapies is the main reason for these reductions in incidence and mortality rates.

Tuberculosis Epidemiology in Turkish Republic of Northern Cyprus and the Impact of Migrants

In recent years, there has been a decrease in the number of TB patients in our country. According to official data, the number of cases decreased from 70 in 1989 to 32 in 2013, 35 in 2014, 39 in 2015, 20 in 2016, 29 in 2017 and 22 in 2018.⁴¹ Although the total number of TB cases has decreased, the vast majority occur among migrants. Eleven of the 22 cases reported in 2018 were migrants. The majority of these individuals were from the former Soviet Union, Asia, and Africa. In 2023, a total of 61 people were newly diagnosed with TB in the Turkish Republic of Northern Cyprus (TRNC). While only 3 of these patients were TRNC citizens, the remaining 58 patients were primarily from countries of the former Soviet Union, Asia, Africa, and the Republic of Türkiye. Twenty of the cases were female, and 41 were male. The majority of migrant TB cases (54, 88.5%) were PTB. In addition, bone TB was diagnosed in 3 cases, lymph node involvement in 1 case, and ocular TB in 1 case. These data indicate that the epidemiology of TB in the country is increasingly associated with migrant populations, and that extrapulmonary forms are included in the diagnostic spectrum.

In 2024, a total of 45 TB cases were recorded, of which only 2 were TRNC citizens. According to the available data for 2025, only 1 of the 2 cases detected so far has TRNC citizenship. These findings indicate that the majority of TB cases diagnosed in recent years occurred among migrants, with a marked downward trend in the number of local cases. This demonstrates the impact of migration on the epidemiology of TB. In addition, it highlights the need for a screening and control strategy that accounts for global migration.

Migration-Related Tuberculosis Screening Strategies

Current practices in the United States and Europe

Regular migrants from regions where TB is endemic have a similar risk of contracting TB as in their home countries, but it is generally higher than in the country where they will settle.⁴² For this reason, countries with low incidence rates require pre-migration screening, particularly for migrants arriving from high-incidence regions.⁴² The aim is to identify TB patients and migrants who are at high-risk of developing TB after migration.⁴²

Although TB screening strategies in migrants vary between countries and regions, WHO recommends systematic screening of migrants for active disease by chest x-ray (CXR) and tuberculin skin test (TST) or interferon- γ release test (IGRA) for latent TB infection (LTBI) in migrants from countries with high TB burden.^{3,42} The European Centre for Disease Prevention and Control (ECDC) recommends screening all migrants from high-incidence countries using CXR, TST or IGRA.^{3,42} The ERS report states that all migrants with a TB prevalence of more than 100 per 100,000 in the country of origin should be screened for active TB and LTBI on entry into the EU/EEA and the UK.³³

If an immigrant at risk of TB has not been screened for TB, it is recommended that TB or latent infection screening should be performed within the first 2 years after entering the country.³³ It is even advocated that migrants who are excluded from active TB should be given short-term preventive treatment regardless of LTBI status.³³ TB- screening strategies for migrants in various countries are summarised in Table 1.

Current practices in Turkish Republic of Northern Cyprus

In the TRNC, the TB Dispensary has been conducting regular TST for certain groups, especially primary-school students in grades 1 and 5, since 1976. Additionally, individuals are screened with the TST during military recruitment. Until 2023, migrants in the country who held a work permit were also screened for TB using the TST. However, since the second half of 2023, a screening method based on C-reactive protein (CRP) level has been adopted instead of the TST to screen migrants. Under this new practice, individuals with CRP levels above the normal reference range are further evaluated by CXR for PTB. In our country, people diagnosed with TB, especially those with highly infectious PTB,

are hospitalised and monitored to ensure isolation and treatment effectiveness. Following confirmation of the diagnosis, molecular genetic tests to detect rifampicin resistance are ordered for all patients. In our country, TB treatment is provided free of charge in line with public health policies, and the medicines are supplied by the Ministry of Health.

World Health Organization strategies in migration-associated tuberculosis

In 2014, the WHO launched the END-TB strategy. Its goal is to end the global TB epidemic by 2030 (Figure 3). At the 2023 United Nations meeting, a political declaration was issued, and heads of state made the following commitments:

- To provide TB prevention and treatment to 90% of those in need.
- To ensure that all TB patients undergo the WHO-recommended rapid diagnostic test.
- To ensure that all TB patients are afforded with a health and social support package.
- To ensure the development and use of at least one new, safe and effective TB vaccine.
- To provide the necessary funding for TB research until 2027.

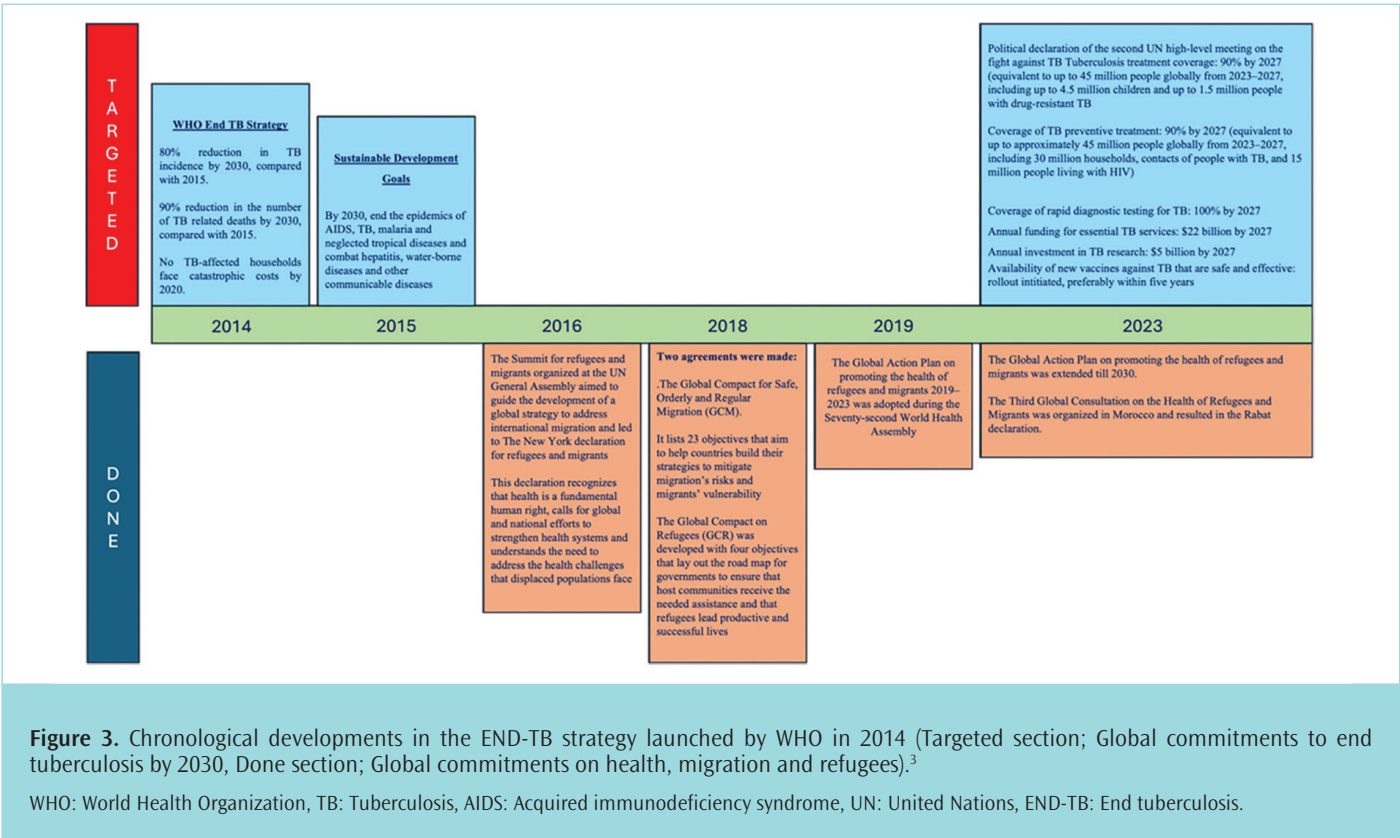
Implementation requirements in the Turkish Republic of Northern Cyprus

The PPD test used in TB screening in the TRNC is both a diagnostic tool with proven efficacy and a tool recommended by the WHO.³ However, as of 2023, screening practices based on CRP levels have replaced the PPD test. Since CRP is not a specific marker for TB and reflects general inflammatory responses, this approach poses a risk of both false positivity and delay in diagnosis.⁴³ This practice poses significant threats to public health and may lead to a weakening of epidemiological control. Experts consider the return to the TST-based screening method with high scientific accuracy, the strengthening of the infrastructure for the diagnosis-treatment process, and the establishment of a holistic national TB control programme as public health priorities. In this framework, migrants applying for work or residence permits, military

Table 1. Countries' TB screening strategies for migrants

Country	Population	Timing	Participation	Method
France	Children from countries with TB incidence >40 per 100 000 up to the age of 18 years Adults aged 18-40 years who live with children and come from countries with an incidence >100 per 100 000	On arrival or shortly after arrival	Voluntary	IGRA/TST
Italy	From countries with TB incidence >100 per 100,000	On arrival or shortly after arrival	Voluntary	IGRA/TST
Norway	From countries with TB incidence >200 per 100,000, Afghanistan and Eritrea, under the age of 35 years	On arrival or shortly after arrival	Mandatory	IGRA
Sweden	From countries with TB incidence >100 per 100,000 or with an exposure risk factor	On arrival or shortly after arrival	Voluntary	IGRA/TST
UK	Migrants aged 16-35 years who have been in the UK for up to 5 years and have lived for >6 months in high-incidence countries (≥ 150 per 100,000) or sub-Saharan Africa	Pre-entry	Voluntary	IGRA
Canada	All migrants	Pre-entry	Mandatory	Chest X-ray/IGRA or TST
US	Migrants aged ≥ 2 years, from countries with TB incidence ≥ 20 per 100,000	Pre-entry	Mandatory	Chest X-ray/IGRA
TRNC	Migrants aged >15 years, from countries with TB incidence <20 per 100,000	Pre-entry	Mandatory	Chest X-ray

TB: Tuberculosis, IGRA: Interferon-gamma release assay, TST: Tuberculin skin test, UK: United Kingdom, US: United States, TRNC: Turkish Republic of Northern Cyprus.



personnel, and student groups should be screened using TST for early detection of TB or LTBI; if the test is positive or there is clinical suspicion, they should be further evaluated by chest radiography for diagnostic confirmation.

CONCLUSION

This review has revealed significant differences between migrants and non-migrants in terms of TB prevalence, treatment and follow-up processes. Migrants seek treatment later, have a higher incidence of EPTB, and experience poorer treatment outcomes. The prevalence of MDR/RR-TB and TB/HIV is higher among migrants; however, it varies between countries. The general approach in countries with low TB incidence is to screen migrants for TB/LTBI, to provide a minimum TB care package for drug-sensitive and MDR/RR-TB, and to develop LTBI preventive treatment strategies for migrants with HIV co-infection. To improve TBTB outcomes among migrants, it is necessary to develop and implement care strategies tailored to this population, enhance the cultural competence of healthcare providers, and establish advanced support systems.

MAIN POINTS

- Global migration is reshaping tuberculosis (TB) epidemiology.
- Barriers to healthcare contribute to delayed TB diagnosis in migrant populations.
- Evidence-based TB screening improves early detection in high-risk populations.

- Current TB screening practices in the Turkish Republic of Northern Cyprus warrant an evidence-based revision.
- Equitable, non-stigmatising TB policies are essential for effective TB control.

Footnotes

Authorship Contributions

Concept: A.B., Design: A.B., F.C., Literature Search: A.B., F.C., Writing: A.B., F.C.

DISCLOSURES

Conflict of Interest: One author of this article, Ayşe Baha, is a member of the Editorial Board of the Cyprus Journal of Medical Sciences. However, she did not involved in any stage of the editorial decision of the manuscript. The editors who evaluated this manuscript are from different institutions. The other author declared no conflict of interest.

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