Review

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Roadmap for ending TB in China by 2035: The challenges and strategies

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SUMMARY Tuberculosis (TB) is one of the top ten causes of death worldwide, taking the lives of over a million people annually. In addition to being a serious health issue, TB is also closely linked to eradicating poverty according to the Sustainable Development Goals (SDGs) of the United Nations (UN). All UN members have committed to ending the TB epidemic by 2030. China has one of the highest TB loads worldwide, ranking third in the world on many TB burden indices. The national strategy for TB control is aimed at creating a collaborative network and integrating TB treatment into the medical system. According to the WHO's global TB report, China is expected to have 748,000 new cases of TB in 2022 and an incidence of 52 cases per 100,000 people. Ending TB remains a huge challenge and requires comprehensive control strategies in China. In this work, we have discussed the challenges of TB prevention and control in China and proposed specific measures to end TB.

Keywords tuberculosis, end TB, challenges, strategies

1. Introduction

More than a million people die from tuberculosis (TB) each year, making it one of the top ten global killers (*1,2*). TB has become the most common infection-related cause of death worldwide and the most common antimicrobial-resistant infection (*3,4*). In addition to being a health issue, the Sustainable Development Goal (SDG) of ending poverty is also directly related to TB. As part of the SDGs, UN member nations have pledged to eradicate the TB epidemic by 2030 (*5,6*). The WHO's "End TB Strategy" outlines benchmarks and goals to be accomplished by 2030 (*7,8*). These milestones and targets include a 90% decrease in TB deaths since 2015 and an 80% decrease in the incidence of the disease.

Recently, the 78th session of the UN General Assembly held its Second High-level Meeting on Tuberculosis earlier at UN Headquarters in New York on the theme of "Advancing science, finance, and innovation, and their benefits, to urgently end the global TB epidemic". Efforts are focused on ensuring equitable access to TB prevention, testing, treatment, and care. The meeting culminated in the adoption by world leaders, heads of government, and high-level representatives, among others, of a political declaration setting ambitious new targets for the next five years to galvanize global efforts and ultimately end TB. The newly adopted political declaration proposes to provide 90% of the population with access to TB prevention and care and to use the rapid test recommended by the WHO as the preferred method of diagnosing TB; in addition, the leaders committed to providing social welfare packages to all people with TB, licensing at least one new TB vaccine, and closing the TB response implementation and research funding gap by 2027.

In China, TB has been classified as a category II notifiable disease since 1996. A comprehensive program for TB control and prevention was started in the 1990s and has been supported by national efforts and prioritization (*9*). Because of this, fatality rates for TB in China decreased by over 80% between 1990 and 2010, while incidence decreased by 3.4% per year (*10*).

Despite these successes, China still has one of the largest global TB burdens, ranking third globally in a variety of TB burden indices (*1,11*).

The national TB control strategy sought to develop a cooperative network and incorporate TB care into the healthcare system. The need to lessen the burden of TB in China was stressed in the national plan Healthy China 2030 in 2016 (*12*). The strategy also included a goal to lower personal health spending to under 25% of overall spending on healthcare by 2030 (*13*).

In the WHO's global TB report, the estimated number of new cases of TB in China was 748,000 in 2022 (780,000 in 2021), ranking third among 30 countries with a high TB burden. The estimated number of TB deaths in China is 30,000 and the TB mortality rate is 2.0 per 100,000 people. There are estimated to be 30,000 patients with multidrug/rifampicin-resistant TB (MDR/RR-TB) (*3*). Ending TB remains a challenge and requires comprehensive control strategies in China.

2. Challenges of TB prevention and control in China

As a result of China's efforts, significant achievements have been made in TB prevention and control, but the country is still facing major challenges (*14-19*). First, socio-economic support is insufficient; TB requires adequate investment to be effectively controlled. For example, patients with TB face a heavy financial burden, and this is especially true for patients with drug-resistant TB. Although China's basic health care coverage is very high, there are still many inadequacies in the current relevant policies for the diagnosis and treatment of patients with TB, including the lack of coordination between health insurance and medical policies, and the fact that social security for TB is still unsound. A suggestion has been made that multi-channel financing should be further promoted and that the level of social security for patients should be upgraded by focusing on their actual needs. Under the Precision Poverty Alleviation Program, financial and charitable funds should be used to provide timely assistance to patients who have lost work and who are impoverished due to illness, and individualized subsidy programs should be formulated for patients with multidrug-resistant/extensively drug-resistant strains based on an understanding of the patients' actual difficulties.

Second, the current trend of TB prevalence is not well understood, there are significant regional differences in the prevalence of TB, with the western region being far more likely to have TB than the eastern and central regions (*20*). There is a high rate of TB drug resistance; prevalence in rural areas is higher than in urban areas (*10*). China's population often migrates domestically, and preventing and controlling TB is difficult because of the lack of a clear understanding of the migrant population in cities and regions. Screening should be intensified given the mobility of potential TB patient populations.

Third, there is an inaccurate understanding of key intervention points. TB prevention and control consists of three basic components: eliminating the source of infection, cutting off the means of transmission, and protecting susceptible populations. The current key measures to control the TB epidemic should include: inhibiting people with a latent infection from developing active TB, inhibiting the transmission of active TB from patients to the surrounding population, and inhibiting the infection of healthy people.

Fourth, TB prevention and control require an entire chain of services at the national level. The existing TB prevention and control service system, technology, manpower, and resource inputs do not fully meet the needs of the new circumstances, the service system's mechanism of operation is not yet perfect in some areas, and there are insufficient diagnostic and treatment facilities or equipment in designated medical facilities, as well as weak prevention and control forces at the grassroots level. The government is promoting the establishment of a new type of service system with a clear division of labor and coordination among disease prevention and control agencies, designated medical facilities, and primary medical and healthcare facilities, and it is improving the level of medical protection.

Fifth, China's TB control is not effective enough. China has a high number of patients with multidrug-resistant TB (MDR-TB) and a low cure rate of only 41%. In addition, there are difficulties in the clinical diagnosis of TB, with a 30% positive rate for patients with TB and a rate of TB diagnosis of less than 5% in children. There is also a lack of new vaccines and drugs. BCG vaccination, the only method of TB prevention, is ineffective at preventing the disease, and TB chemoprophylaxis is poorly adhered to and difficult to administer.

3. Official commitment and policy

In 2019, the National Health Commission, the National Development and Reform Commission, the Ministry of Education, the Ministry of Science and Technology, the Ministry of Civil Affairs, the Ministry of Finance, the Poverty Alleviation Office of the State Council, the National Health Insurance Bureau, and eight other departments jointly issued the "Plan of Action to Stop Tuberculosis (2019-2022) (*21*). In addition, the China Center for Disease Control and Prevention issued "The Action Plan for TB-Free Communities (2022-2027)" in September 2022, involving government advocacy and educational campaigns to mobilize society as a whole and other measures, to achieve a TB incidence of 50% by 2025 and a 90% reduction by 2027.

Ending TB requires enhancing organizational leadership, promoting the implementation of the main responsibility of local governments, and incorporating

TB prevention and treatment into local economic and social development planning and governmental target management assessment as an important component of supporting livelihoods. Measures need to be formulated and work programs need to be implemented in line with local realities, action goals and tasks need to be cascaded to specific departments, relevant institutional settings need to be created and staffing needs to be provided, and the implementation of various action measures needs to be supervised.

The State Council has also issued a series of "5-year national tuberculosis control programs" (11th, 12th, and 13th) to enhance TB control and prevention nationally and to increase funding for scientific research in terms of diagnostics, digital health, new drugs, new vaccines, and implemental and operational research (*22,23*). As a result, the Chinese Government has been paying close attention to TB control and prevention. Chinese researchers are still looking into the prevalence of TB, the traits of the most common strains (*24,25*), the effectiveness of infection control measures, ways to help vulnerable populations, novel drug therapies, and technology to support community case management using mobile phones and medical monitors. The scientific community is still aware that TB is preventing China from moving forward and achieving its Healthy China 2030 goals.

4. Comprehensive strategies and key measures for TB prevention and control

The National Tuberculosis Program (NTP), which serves as the nation's technical leading work group for TB, is dedicated to advancing research on strategies and measures for TB control and prevention, organizing and carrying out action plans, conducting scientific research on applying these techniques, and providing technical guidance, staff training, and quality control for disease control and prevention and public health services across the nation.

TB control requires comprehensive strategies (Figure 1). First, this involves prevention of TB, including BCG vaccination of newborns, infants, and young children, as well as introducing preventive treatment for people with a latent infection and implementing infection control.

Second is controlling the source of infection. Patients with TB are detected through a variety of means, including consultations regarding symptoms, proactive detection in key areas and populations, and health check-ups. Drug-resistant screening should be conducted for all patients pathologically positive for TB. In order to consolidate existing practical techniques, the use of rapid and accurate molecular diagnostic techniques is being promoted. Standardized treatment measures should be promoted based on standardized treatment protocols. Comprehensive health management and care services should be provided to patients.

Third is epidemic monitoring. All medical and healthcare facilities should report patients diagnosed with TB or patients suspected of having TB to the China Disease Prevention and Control Information System. Designated medical facilities for TB and hospitals specializing in TB should register and manage patients

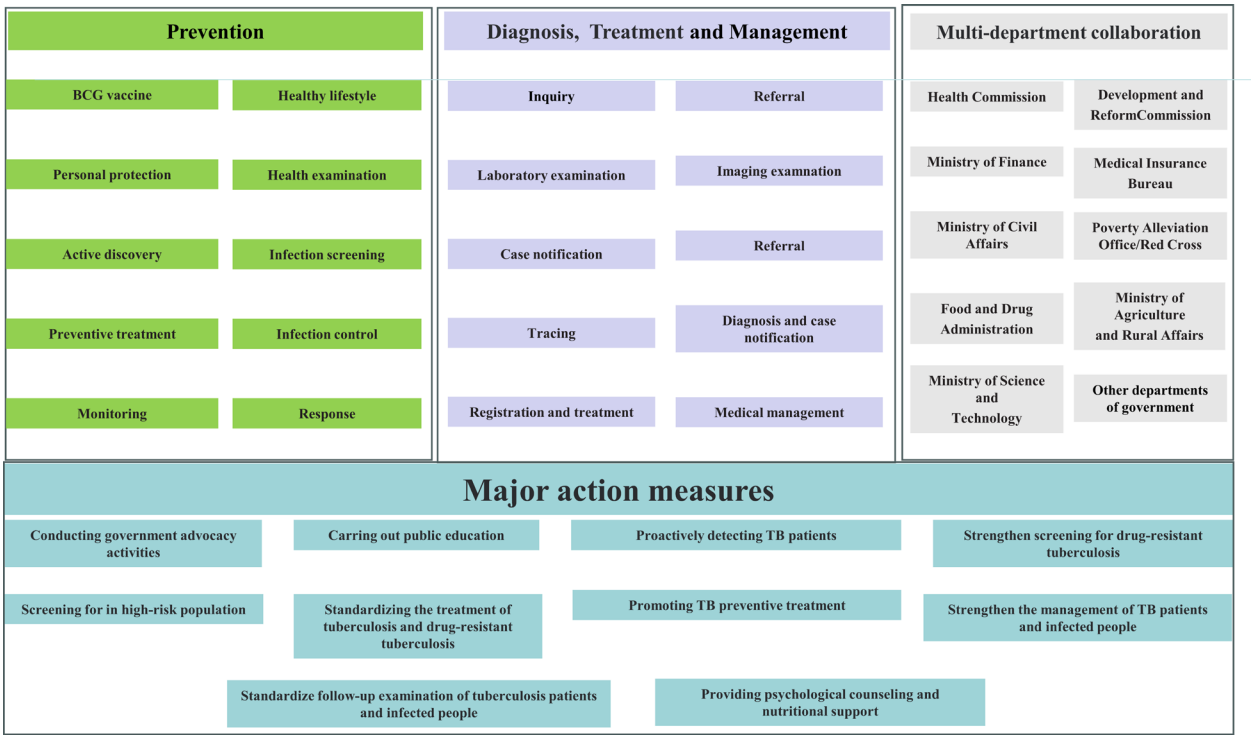

Figure 1. Ending TB strategies and key measures.

diagnosed with active TB, recording information on their diagnosis, treatment, management, and transfer. Disease prevention and control facilities should be responsible for organizing and conducting TB epidemic monitoring and dealing with epidemics.

Fourth is health promotion. Relevant social departments, enterprises and institutions, social groups, and influential people should be mobilized to participate in the prevention and treatment of TB and create good conditions for TB prevention and control. This should be led by the government, with the cooperation of multiple organizations and the participation of society as a whole. Various ways and means of communication should be used to conduct various forms of TB health education for the public and key target groups and places.

The following measures could be taken (Figure 1), including government advocacy, conducting public information and education, proactively identifying patients with TB, enhancing screening for drug-resistant TB, carrying out testing for TB infection in high-risk groups, standardizing the treatment of TB and drug-resistant TB, promoting preventive treatment of TB, enhancing the management of patients with TB and infected people, standardizing the follow-up examinations of patients with TB and infected people, and providing psychological counseling and nutritional support. In the following sections, we will discuss these measures in detail.

5. Scientific innovation is the key to ending TB

Scientific research should be enhanced to address the scientific and technological weaknesses in TB prevention and treatment (*26-28*), to promote the close integration of basic and applied research, and to accelerate the transformation of scientific and technological achievements.

5.1. TB diagnosis

Patients infected with MTB exhibit host immune responses to mycobacterial antigens in the absence of any TB symptoms. There has been much debate on the true latency and level of metabolic activity in TB-associated states. Rather than being two different disease states, latent TB infections (LTBI) and active TB are on a continuum.

Co-infection with HIV/TB continues to be a serious global public health concern. An estimated 10.4 million new cases of TB were reported in 2015, 1.2 million of which involved people who also had HIV. Patients with HIV most frequently get MTB, an opportunistic infection that puts co-infected individuals at a high risk of dying. Co-infected individuals must be diagnosed as soon as feasible due to the high mortality rate of TB-HIV co-infection; early detection of both HIV and TB is essential to saving lives (*29*).

Resistance to the antibiotics INH and RIF in patients with TB is known as MDR-TB. Resistance to at least four first- and second-line antibiotics for TB is known as extensive drug-resistant TB (XDR-TB). Data indicate that 3.3% of MDR-TB cases are among newly treated TB cases, 20% are among previously treated TB cases, and 5% of TB cases are estimated to have MDR-TB. Moreover, 9.5% of patients with MDR-TB are thought to have XDR-TB. Phenotypic drug susceptibility tests continue to be the gold standard for diagnosing MDR- and XDR-TB, despite their acknowledged limitations.

One notable feature of pediatric populations is the difficulty in diagnosing TB. Children have limited bacillary loads, so conventional bacteriological methods frequently fall short and result in misdiagnoses or confusion with other pediatric conditions. The incidence and mortality rate from TB among young people has increased due in part to this diagnostic deficit. Because of this, the World Health Organization advocated for the integration of state-of-the-art molecular diagnostic techniques beginning in 2021 (Table 1). These are intended to either replace or supplement current techniques, increasing the sensitivity and specificity of TB diagnosis in both adults and children (*30*).

5.2. TB vaccine

Currently, Bacillus Calmette-Guérin (BCG) is the only vaccine available for preventing TB. However, BCG displays only moderate effectiveness, and especially in adults. For almost a century, efforts have been made to create potent TB vaccines.

The development of new TB vaccines that are safer and more effective has been accelerated by scientific advancements in our understanding of the immune system, proteomics, and the genetics of MTB. Three elements should be included in an optimal TB vaccination strategy: preventing latent infection from reactivating, preventing primary infection and illness after exposure, and providing immunotherapeutic adjuvant therapy in addition to standard TB treatment to promote patient recovery. The inactivated, live attenuated, recombinant BCG, subunit, viral vector, and DNA vaccines are among the new TB vaccines that are presently undergoing clinical trials (*31*) (Table 2).

Research on novel TB vaccines has advanced, but several obstacles still need to be overcome. These include the low sustainability of clinical trials for the TB vaccine, challenges in selecting epitopes for antigens, the exclusion of pregnant women from current trials, disagreements over how to evaluate the endpoints of these trials, and a lack of appropriate animal models for testing TB vaccines, particularly epitope-based vaccines. That said, the use of new technologies has given TB vaccine research new directions. Examples of these include the use of deep learning and mRNA vaccines.

Table 1. Novel techniques for tuberculosis diagnosis. Data obtained from the World Health Organization's consolidated guidelines (*30*)

Diagnostic method	Detects	Use	Patient type	Technique
Xpert MTB/RIF	MTB and RIF resistance	Pulmonary TB, extra-pulmonary TB, HIV co-infection	Adults and children	PCR
Xpert MTB/RIF Ultra	MTB, minimize false RIF resistance results	TB meningitis, pulmonary TB, extra-pulmonary TB	Adults and children	PCR
Truenat MTB, MTB Plus, and MTB RIF Dx tests	Semi-quantitative detection of MTB complex, RIF resistance	Pulmonary TB, HIV co-infection	Adults	PCR
TB-mediated isothermal DNA amplification (LAMP)	MTB	Pulmonary TB	Adults	PCR
Loop-LAMP	RIF, INH, and ETO associated mutations	Pulmonary TB, extra-pulmonary TB	Adults	PCR
Lipoarabinomannan (LAM) determination by lateral flow immunochromatography	Mycobacterial LAM antigen in urine	Pulmonary TB, extra-pulmonary TB, HIV co-infection	Adults and children	Immunochromatography

Table 2. List of the candidate vaccines in clinical stages

Phase I	Phase IIa	Phase IIb	Phase III
AdHu5Ag85A	D93+GLA-SE (QTP101)	RUTI	MIP
GX-70	ACE/BC02	DAR-901	SRL172
TB/FLU-01L	ChAdOx1.85A	H56:IC31	MTBVAC
TB/FLU-04L		H4:IC31 (AERAS-404)	VPM1002
		MVA85A	M72/AS01E
		BCG (Revaccination)	GamTBvac

The creation of new TB vaccines is a public health initiative that advances human welfare, notwithstanding the many obstacles the field of TB vaccine development faces, such as financial, legal, and societal limitations. In this endeavor, governments and international organizations ought to offer strong backing and actively encourage international cooperation and exchange.

5.3. Anti-TB drugs

The discovery of drugs aimed at TB declined after the surge in the development of antibiotics. However, the WHO declared TB to be a global crisis in the 1990s due to the rise in TB cases and the development of drug resistance.

To address the urgent need to create new medications and enhance TB treatments, representatives from a variety of sectors, including academia, pharmaceutical companies, and public-private partnerships, gathered in South Africa in 2000. With seventeen drugs in various stages of clinical development and six in preclinical stages, great progress has been made after two decades of intense efforts. About 10 of these that are in the clinical stage might have novel mechanisms of action. The remaining seven contenders are enhanced iterations of previously established anti-TB (*32*). However, only 10 of the 17 candidates that are currently in the clinical stage have been tested for their capacity to eradicate intracellular MTB (Table 3), with encouraging results indicating that they may be used to treat LTBI.

Research must continue to overcome the obstacles that are in the way. The ramifications of the developments can revolutionize medicine and open the door to the possibility of worldwide TB control and even eradication.

6. Roadmap for ending the TB epidemic in China

The expected TB incidence in China is 33/100,000 in 2025, 13/100,000 in 2030, and 7/100,000 in 2035 based on the aggressive goals of the End TB strategy and the baseline incidence in 2015 (65/100,000 people) (*33*). The End TB targets are ambitious. To achieve the End TB targets at the national level, key points include the following actions (Figure 2).

Society as a whole needs to be mobilized and the public awareness of TB needs to be increased. Government advocacy is needed to actively promote the implementation of the government's main responsibility by local government departments, to clarify departmental responsibilities, enhance multisectoral cooperation, and include TB prevention and treatment as an important component of people's livelihoods in economic and social development planning and the government's target

Table 3. Drugs in phase II and phase III trials that have intracellular activity against MTB

Drug	Clinical stage	Activity	*Ref.*
OPC-167832	Phase II	Compared to RIF, its intracellular activity against the H37Rv strain was 0.0048 μg/mL, whereas it was 0.0027 μg/mL for the Kurono strain.	(*35*)
Sutezolid	Phase II	With an intracellular minimum inhibitory concentration (MIC) of 0.05 μg/mL, it has a safer profile than linezolid and also shows a strong cumulative impact.	(*36*)
BTZ-043	Phase II	At doses between 1 and 30 ng/mL, it has demonstrated effectiveness against MTB MDR and XDR strains. It specifically accumulates in foamy macrophages and penetrates necrotic nuclei with ease.	(*37*)
Delpazolid	Phase II	It shows up as intracellular activity in macrophages produced from bone marrow. Its anti-MTB activity is comparable to that of linezolid at 1 ng, but it is more effective at 1 μg.	(*38*)
Telacebec	Phase II	The antimycobacterial action of Telacebec is not affected by the stage of mycobacterial replication. With a MIC50 of 0.28 nM, it demonstrated notable intramacrophagic antibacterial action against MTB H37Rv.	(*39*)
SQ109	Phase II	MTB colony-forming units were drastically reduced to fewer than 10,000 in investigations using peritoneal macrophages infected with MTB H37Rv when SQ109 was administered at a dosage of 0.39 μg/mL for 24 hours.	(*40*)
Delamanid	Phase III	It demonstrated efficacy against intracellular mycobacteria at a dose of 0.1 μg/mL after 4 hours in experiments using THP-1 cells, making it 30 times more effective than RIF for treating LTBI.	(*41*)
Pretomanid	Phase III	After exposing MTB-infected THP-1 macrophages to pretomanid for 4 hours, LTBI was successfully eliminated at levels comparable to those of INH.	(*42*)
Bedaquiline	Phase III	It exhibits a remarkable capacity to eradicate IR, XDR, MDR, and MTB TB. It also has activity against LTBI because of its quick sterilizing action.	(*43*)

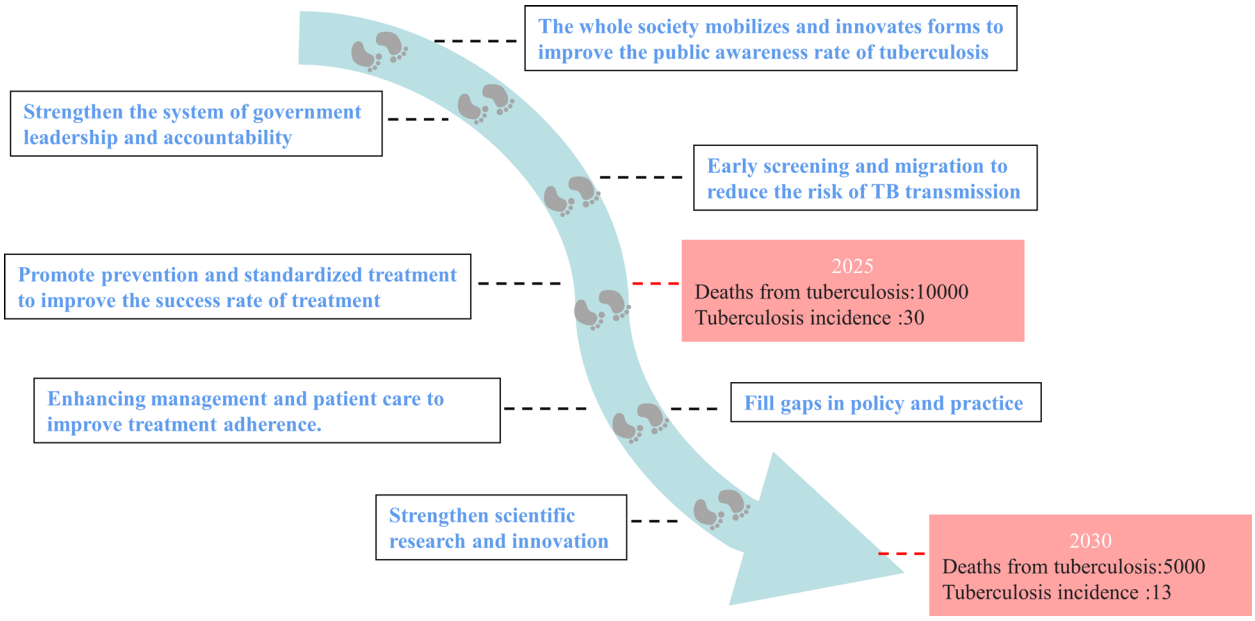

Figure 2. Roadmap for ending TB in China.

management assessment. Multifaceted financing has been provided to provide the necessary working funds, develop and implement TB medical insurance policies, reduce the economic burden on patients with TB, and ensure the smooth operation of TB-free communities. To implement educational campaigns, TB prevention and treatment professional organizations, medical facilities, educational institutions, social groups, scientific and technological associations, and volunteers need to capitalize on "3.24 World Tuberculosis Prevention and Control Day," "World Health Day," and other public awareness efforts and conduct a variety of publicity campaigns with the help of traditional media and new media. With the help of traditional media and new media, various forms of public education on TB prevention and treatment, which are popular among the people, need

to be conducted to raise the public's awareness of and concern for TB, create an awareness of being the first person responsible for public health, and create favorable conditions for society as a whole to participate in the prevention and control of TB.

The system of government leadership and accountability needs to be enhanced. To accomplish the intended objectives within set periods and designated resources, eliminating TB in children and adolescents will require high-level political will, strong leadership, and accountability. Assuring linkages and accountability for essential services (such as maternal and newborn health, HIV, and nutrition), and positioning institutions and actors within or outside the health sector to effectively use resources and sustain efforts to end TB are all important practical steps that leadership should be cognizant of. One key action utilizing the Child and Adolescent Tuberculosis Assessment and Benchmarking Tool, including operational measures, to increase institutional capacity at the national and sub-national levels to organize, direct, and implement TB control programs for children and adolescents. Another key action is enhancing focal points and broadening the Child and Adolescent Tuberculosis Working Group in national TB control programs to include important stakeholders (such as pediatric associations, neonatal and child health departments, and immunization programs). To offer a framework for coordinating the efforts of many partners, strategic planning needs to occur at the national level. Social support needs to be provided to vulnerable families, TB-related services for children and adolescents (including diagnostic services) need to be free of charge, and strategic planning needs to have clear targets, timelines, and dedicated budgets that cover the specific needs of children and adolescents for TB prevention, care, and treatment. In addition, holding health professionals, national plans, policymakers, and leaders accountable for commitments will increase participation by civil society.

Early screening needs to be conducted and target populations need to be monitored to reduce the risk of TB transmission. This includes active detection of patients with TB, active screening, early detection of patients with TB and potential sources of infection, use of innovative tools and technologies such as "Internet^{+} TB prevention and treatment," big data, artificial intelligence, and digital health according to the local situation, and active detection of TB in key populations (close contacts of patients with active TB, the elderly, diabetics, *etc*.), in key places (schools, densely populated places, *etc*.), at key times (starting a job, enrollment in schools, *etc*.). Other efforts include enhancing screening for drug-resistant TB, screening all patients pathologically positive for TB for drug resistance as early as possible, using new laboratory diagnostic techniques such as molecular biology, improving the ability to diagnose drug-resistant TB, shortening the time for drug-resistant diagnosis, maximizing the identification of patients with drug-resistant TB who can be given standardized treatment and management, and taking necessary infection control measures. Monitoring of target populations includes testing for TB infection in high-risk groups, testing for TB infection in people who have close contact with patients with active TB, people infected with HIV, patients with AIDS, people receiving tumor necrosis factor therapy, long-term dialysis therapy, people preparing for organ or bone marrow transplants, patients with silicosis, and people who have been using glucocorticosteroids or other immune-suppressing drugs for a prolonged period.

Prevention and standardized treatment need to be promoted to improve the success rate of treatment. This involves standardizing the treatment of TB and drug-resistant TB, in accordance with the requirements of the Technical Guidelines for the Prevention and Treatment of Tuberculosis in China, giving standardized treatment to patients with confirmed TB and drug-resistant TB; standardizing the isolation and treatment of patients with TB who are in the infectious stage; and actively promoting the use of new medicines and regimens to shorten the course of treatment and improve its efficacy. Other efforts are promoting preventive treatment for TB, increasing public education and mobilization efforts, raising awareness of preventive treatment among newly identified people with latent TB, actively providing preventive treatment for newly identified people with latent TB who do not have active TB and determining the contraindications for preventive treatment, and increasing acceptance of and adherence to preventive treatment for TB.

Management and patient care need to be enhanced to improve treatment adherence. To enhance the management of patients with TB and infected people, primary healthcare facilities, through models such as family doctor contracting services, need to tailor their services to local conditions and individual needs and use a combination of conventional and digital health technologies to provide patients with TB and those receiving preventive treatment with comprehensive care. Follow-up examinations for patients with TB and infected people need to be standardized. In accordance with the requirements of China's Technical Guidelines for Tuberculosis Prevention and Treatment, regular follow-up reviews are conducted for patients with TB to promptly identify adverse reactions, deal with them appropriately, and follow up on the effectiveness of treatment. For people with a latent infection receiving preventive treatment, medical examinations such as liver and kidney function tests are conducted monthly during the treatment period, and chest imaging is performed once a year after the completion of treatment. For other people with a latent infection, medical follow-ups are conducted at the end of the

third, sixth, twelfth and twenty-fourth months after screening for infection. Psychological counseling and nutritional support need to be provided. These efforts assess the nutritional needs of patients with TB, provide nutritional counseling and dietary guidance, and offer individualized nutritional support services to enhance immunity. In addition, regular activities need to be conducted through psychological support groups such as psychosocial counselors, volunteers, nurses, community doctors, social workers, and recovered patients to increase patients' confidence in treatment, channel patients' stress in their lives, and promote recovery.

Gaps in policy and practice need to be filled by policymakers, managers of pertinent local and national programs, and collaborators in implementation. To end TB and bridge the gap between policy and practice, both new and existing tools need to be capitalized upon. To that end national programs must implement the following measures. Health professionals should be trained in the diagnosis and treatment of children and adolescents with TB infections and/or suffering from TB, with an emphasis on TB prevention. Capacity-building tools regarding TB in children and adolescents should be widely disseminating and their usage increased. Supportive supervision and mentoring should be developed at all levels. Successful pilot projects should be replicated as part of routine TB and child health programs. Implementation of the TB prevention guidelines should be enhanced. The ability of child health workers to collect specimens and use available diagnostic tools (*e.g.*, digital chest radiographs and GeneXpert MTB/RIF) should be enhanced. Locally created promotional materials should be distributed to raise awareness of health workers and the public.

Research and innovation need to be enhanced. Research in TB-related science and technology needs to be promoted. Policymakers, academics, donors, implementing partners, and the corporate sector must ensure ongoing investment in research and create legal and legislative conditions that are amenable to research as well as the quick translation and implementation of research findings. To improve TB prevention, diagnosis, and treatment particularly in children and adolescents (*34*), close attention needs to be paid to the following priority areas; the creation of an effective, long-lasting TB vaccine; and the creation of precise, non-sputum-based point-of-care TB illness and infection diagnostic tests. TB prevention and treatment programs for children should be made shorter, safer, and more appropriate. Drug-resistant and susceptible TB should also be treated. Personnel should be aware of the factors that influence the development of TB as well as the main obstacles that teenagers confront while trying to access TB diagnostic and treatment services. Methods of delivering services for TB prevention, exposure, diagnosis, and treatment need to be studied.

With increased support from the government and society, the pace of eliminating TB in China will accelerate, and the expectation is that TB will be truly eliminated.

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