



Healthcare worker Perceived Barriers and Facilitators to Implementing a Tuberculosis Preventive Treatment (TPT) program in Dhaka Brac TB Centers

Atqiya Faizah Niki
(24167006), 20th Cohort
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Master of Public Health

Submitted to:

Supervisors:

Dr Ataur Rahman
Director, Centre for Professional Skills Development
rahman.ataur@bracu.ac.bd

Dr Atiya Rahman

Assistant Scientist

Dr Santhia Ireen

Deputy Director, Education and Research
BRAC James P. Grant School of Public Health

Dr Shayla Islam

Associate Director at BRAC Health Program

shayla.i@brac.net

Mentors:

Dr. Ashraful Hossain

Manager, Operations Communicable Disease, BRAC Health Program

BRAC James P. Grant School of Public Health, BRAC University

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B. Abstract

Introduction

Tuberculosis preventive Treatment (TPT) is a crucial step that will prevent the further development of latent tuberculosis infection (LTBI) into active tuberculosis. Yet, it faces numerous constraints when implemented in resource-limited urban environments, e.g., Dhaka, Bangladesh. This research analyzes the barriers and facilitators of TPT uptake at BRAC urban TB centers and provides direction for enhancing program delivery.

Methods

Using an explanatory sequential mixed-methods design, qualitative and quantitative data were collected. In the above procedures, interviews with 17 healthcare providers were also conducted, and 41 Field Organizers (FOs) were polled through a survey. The qualitative data were coded thematically, and quantitative data were summarized using descriptive statistics. The Consolidated Framework for Implementation Research (CFIR) was applied to describe the study's outcome.

Results

Barriers included resource constraints, such as drug shortages, funding gaps, and insufficient human resources. Logistical difficulties, stigmatization, lack of patient information, and inefficiencies in data capture also hampered the provision of TPT. Patient adherence was influenced by beliefs, pill size, side effects, and competing demands, including daily earnings. Factors included a willingness to use BRAC health care providers, adaptable TPT guidelines (e.g., 3HP regimen), suitable staffing, and working in partnership with the National Tuberculosis Program (NTP). Community support and engagement also emerged as critical enablers.

Conclusion

Results underscore the need to take action on funding, staffing, and supply chains to enhance TPT delivery. Improvements to community education, private-sector collaboration, and streamlined documentation and monitoring practices can improve adherence and coverage. These recommendations offer a pathway to enhance TPT programs in settings with limited resources and help set targets to achieve the ambitious goal of TB elimination globally.

1. Introduction

1.1 Problem Statement

To sustain and reduce the transmission of TB in populations, TBI must be identified to break the chain of transmission and treat individuals properly to prevent TB disease from spreading the diseases (Uplekar et al., 2015). There are projections that 1.5 billion people are living with M. tuberculosis infection, which causes TB in humans (Houben & Dodd, 2016). About five to ten percent of people infected with tubercle bacilli may develop active TB at some time in their lifetime; half of these cases would occur within the first two years of the infection (WHO, 2018; Styblo, 1985). As a preventable problem, the WHO introduced the 'End TB Strategy, with its vision for a 50% reduction in TB incidence with those mortality rates and universal adherence to the four A's by 2020 and to minimize avoidable suffering by 2030 (WHO, 2015).

This strategy includes TB Preventive Treatment (TPT), which focuses on the persons in contact with the TB index case to reduce the risk of new disease and/or development of the active disease. Realizing the goals of the 'End TB Strategy' also relies on vigorous implementation of TPT in the setting of TB control. This is because TBI if left untreated with TPT, will mean that Latent infections will continue to fuel the TB burden. TB remains a critical public health problem of significant consequence in Bangladesh, wherein the combined estimate for new TB cases and deaths in 2020 Was 360000 and 44 000 (WHO, 2020). Thus, the national TB incidence rate has been highest, with a prevalence of 221-225 per 100,000 populations since 2001, and the TB case detection and notification rates have been highest since 2000 (National TB Control Program, 2019).

The main activities of the National Tuberculosis Program (NTP) of Bangladesh are case finding and treatment, while resources dedicated to TPT are scarce. Cohort coverage for other high-risk groups has not, however, been scaled up sufficiently, while IPT is provided to children below the age of five years and people living with HIV. NTP currently operates with the leading strategic partner, BRAC, through DOTS in fifty-one districts, realizing 95% treatment success (May & Rhatigan, 2011). However, in recent years, BRAC has started facing some issues with the integration of TPT, such as insufficient resources to recruit and train healthcare workers, low levels of TPT community awareness, and infrastructural constraints for operationalizing the large-scale TPT program. While IPT for young children revealed an excellent response with a 75% completion rate, the overall response rate was just 51%, indicating a high level of dropout rate in utilizing TPT for the high-risk group in the Bangladeshi population (WHO, 2020).

1.2 Gaps in the Literature

During the UN HLM on TB in 2018, leaders of nations pledged to give TPT to 4 million contacts below 5 years and 20 million contacts above five years for the year 2022 (WHO, 2018). However, from 2018 to 2022, a total of 2.2 million (55%) HC under 5 years and 2 million (10%) HC 5 years and older have received TPT (WHO, 2023). According to a published meta-analysis, TPT coverage among HC in LMIC for household contacts lies between 14-100% (Sagili et al., 2022). Though the need to scale up TPT is well recognized, several barriers to its implementation have been documented and include difficulty in identifying the household contacts, inadequate access to TBI tests, poor knowledge of TPT among implementing clinicians and patients, inadequate availability and supply of drugs and low priority given to TPT within TB programs (Chee et al., 2018; Faust et al., 2020; Velayutham et al., 2020)

While the UNHLM has recently committed to TPT to reach 30 million household contacts by 2027, much of the existing research has evaluated patient-level barriers. These barriers include low adherence to treatment due to the long treatment duration and poor awareness, resulting in treatment completion rates as low as 30% to as high as 64% (Stuurman et al., 2016). Research focusing on operational characteristics of TPT, specifically from the healthcare provider's point of view or systematic barriers in urban TB centers, is scarce. Moreover, there is a lack of systematic information about the TPT enrolment, starting, and completion ratios among the household contacts of TB patients in Bangladesh, which is crucial to frame prevention measures.

The effectiveness and sustainability of TPT programs are contingent on the level of community knowledge and the ability of healthcare practitioners (Lönnroth et al., 2013). More studies are required to examine the experience of implementing health initiatives and understand specific barriers and community mobilization methods employed to increase TPT use and compliance. Knowledge of these gaps is crucial for developing TPT programs that are appropriate for implementation in Dhaka's resource-constrained, high-population-density environment.

1.3 Justification of the Study

Tuberculosis Preventive Treatment (TPT) is still, to a great extent, a challenge in programmatic contexts worldwide (Suri et al., 2019). As a result, there is a lack of information on TPT implementation for all HH contacts, although there is some data on children. These studies suggest reasonable readiness levels in the initial care cascade, including screening and diagnosis; however, TPT enrollment and usage by HHCs remain very poor (Otero et al., 2020). IPT studies conducted in India show that the implementation of the above mentioned earlier IPT program was not

effective and required multiple cycles to enhance its coverage and effectiveness (Rekha et al., 2013; Rekha et al., 2009; Pothukuchi et al., 2011; Shivaramakrishna et al., 2014). This pattern is evident in other countries showing global implementation issues (Singh et al., 2017; Makova et al., 2022; Ryckman et al., 2023).

The implementation of IPT for all HHCs since January this year was poised to build on prior implementation experiences. Based on this background, the existing literature on the programmatic management of TPT for HHCs in Bangladesh is minimal. Therefore, It is imperative to fill this gap to identify and eliminate impediments to efficient TPT provision.

This research is, therefore, confined to exploring the experiences of Healthcare Providers directly managing the TPT interventions for high-risk target communities in urban TB facilities in Bangladesh. The implementation of TPT is still in an early phase, and the opportunities that BRAC had to initiate TPT piloting in Dhaka reveal timely findings regarding the prospects, barriers, and facilitators of TPT application. This research study will produce new knowledge to inform interventions for enhancing TPT initiation and completion in urban areas to address the TB challenge.

Selected challenges relate to the type of population density, the availability of resources, and the socio-economic characteristics of urban zones of Bangladesh where AHS will be delivered. Challenges include poor health center access, financial problems, and compliance with treatment schedules, which prevent TPT implementation. Although patient-centered research focuses on issues such as non-adherence and lack of knowledge, it naturally fails to address system and organizational challenges that healthcare providers face: insufficient amount of training, improper infrastructure, and lack of resources (Paltiel et al., 2017).

Hence, unlike previous studies that focused mainly on analyzing the perceived barriers by TPT programs, this study examines barriers and enablers from the more informative viewpoint of healthcare providers to establish broader recommendations that will improve the functional efficiency of TPT programs. These findings will also help achieve Bangladesh's national TB prevention goal, which aligns with WHO's End TB Strategy.

In addition, this research's findings have implications for policy and program-specific planning, prioritization, and funding in low-resource, high-density urban environments. The outcomes will also help to achieve global targets for TB elimination, set for 2030 and beyond, for providing sustainable prevention and control of TB.

2. Research Question

What are healthcare workers' perceived barriers and facilitators to implementing tuberculosis preventive therapy (TPT) in Dhaka BRAC TB Centers, and how prevalent are these perceptions among field organizers?

3. Objectives

3.1 General Objective

This study aims to identify, analyze, and quantify healthcare workers' perceived barriers and facilitators to implementing tuberculosis preventive therapy (TPT) in Dhaka BRAC TB Centers.

3.2 Specific Objectives

1. To explore healthcare workers' perceptions and experiences regarding implementing TPT through qualitative analysis.
2. To assess the prevalence and distribution of identified barriers and facilitators among field organizers using quantitative analysis.
3. To identify systemic and operational challenges affecting the effective delivery of TPT from the healthcare workers' perspectives.
4. To propose actionable recommendations for addressing identified barriers and leveraging facilitators to improve TPT implementation in urban TB settings.

4. Conceptual Framework



Figure 1: Consolidated Framework for Implementation Research (Damschroder et al., 2022)

5. Operational Definitions

Tuberculosis Preventive Treatment (TPT): Users are given a range of drugs to help them avoid contracting tuberculosis at an early age.

Health Care Implementers: This guideline may be used directly by all personnel directly involved in the delivery of TPT, including Community Health Workers, TPT Program managers, and Medical Officers.

Latent Tuberculosis Infection (LTBI): A condition in which an infected person's body has Mycobacterium TB, but this does not result in active infections or symptoms, and the affected individual is not contagious.

Contact Investigation: An orderly set of measures for screening those potentially having undiagnosed TB disease or Latent TB Infection among the TTBs of an index TB patient. CI includes identification, clinical evaluation, and TPT (for those without TB disease).

Household Contact: Any person sharing a house with the index TB patient for any period of time.

Eligible for TPT: Children of age ≤ 5 years and all first-degree contacts of each newly registered TB patient who are not themselves positive for any active TB. Furthermore, children below five years of age and adults who present positive TBI results with a regular X-ray or where an X-ray is not feasible. It is also open to people living with HIV (PLHIV). TPT options are 3HP (Isoniazid and Rifapentine, given as two tablets once weekly for 12 weeks) or 3HR (Isoniazid and Rifampicin, given daily for 3 months). Note: Rifapentine is contraindicated for children younger than 2 years or pregnant women because the effects of the drug have not been studied in these populations.

Diagnosis and Treatment of TB Patients: TB suspects present with TB clinical symptoms and get evaluated for the disease. After the diagnosis, regardless of the phase in which he or she tests positive, the patient is referred to the first PHI from the testing site for other management measures, such as contact tracing and administration of TPTs.

Contact Tracing Visits and Identification of Household Contacts: As guided by the NTEP, the STS, TB-HV, or other frontline workers from the PHI visit the homes of TB patients with a view of identifying all the contacts and also start their screening. According to the National Tuberculosis Control Programme of Bangladesh, a household contact is "a person who has had close physical contact with the index TB patient for one or more nights during the three months prior to the commencement of his or her chest TB treatment or spent an extended time with the index TB patient during the daytime" (National Tuberculosis Control Programme, Bangladesh, 2021).

Screening of Household Contacts: A primary survey for active TB is performed for household contacts and includes questions about whether household members had any of the following symptoms: current cough, fever, night sweats, sputum production or hemoptysis, weight loss, chest pain, shortness of breath, or fatigue. In children below 5 years of age, some signs are poor feeding, poor weight gain, no desire to eat, and lethargy or reduced playtime (National Tuberculosis Control Programme, Bangladesh, 2021). If such symptoms are present, the person is classified as a presumptive TB case and referred to test for the active form of TB through sputum examination through CBNAAT and Chest X-ray. Household contacts of the index TB cases with a history of clinical smear-positive TB are treated for TB at the PHI.

For contacts within the household less than 5 years and without current signs of active TB, TPT is prescribed for six months. Contacts from the same household with a positive history of prior exposure to TB and are 5 years and above are further subjected to IGRA or TST. If they confirm TBI and have a normal chest X-ray, TPT is commenced for them despite the attendant complications. When a chest X-ray is either not available or is normal, TPT begins only if there are no aggravating features like hepatitis, peripheral neuropathy, or alcohol consumption, irrespective of previous TB status. Also, household contacts can initiate TPT if the IGRA test is unavailable, provided TB disease and its contraindications have been excluded. From the literature and the study, recipients of TPT, which are the household contacts, are given a TPT card, and their progress is checked monthly by the concerned PHC or healthcare through one-way calls or direct home visits during the monthly delivery of TPT.

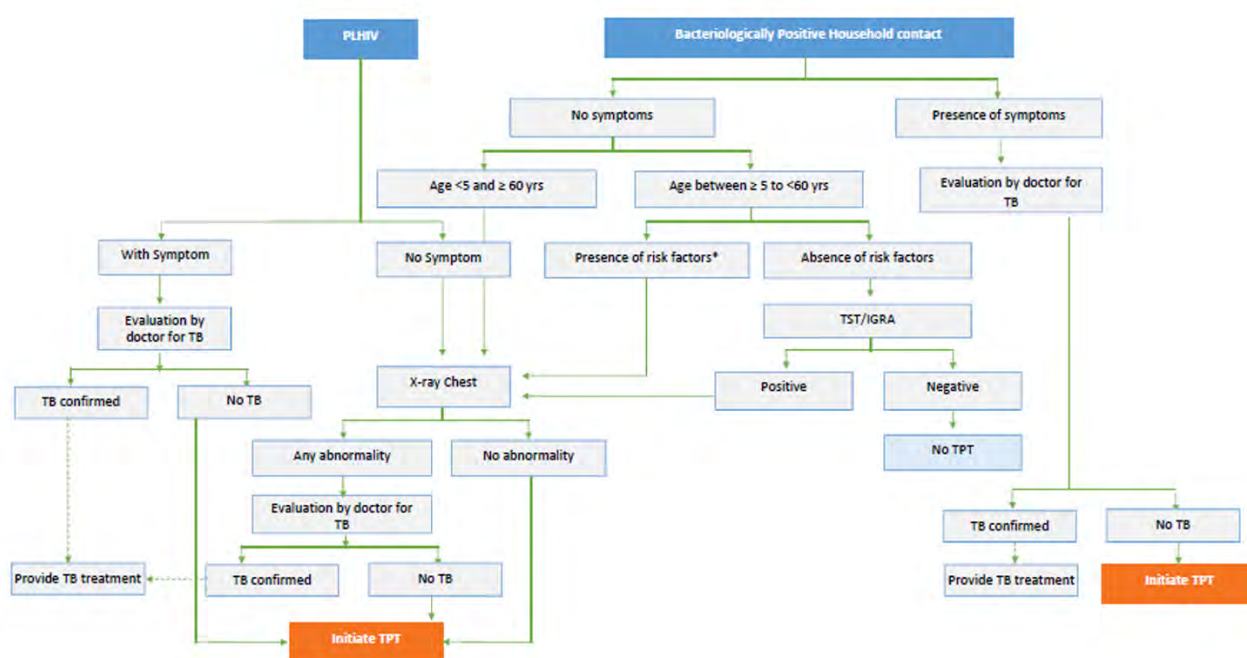


Figure 2: Flow chart showing the assessment for TPT eligibility according to guidelines for Programmatic Management of TB Preventive Treatment in Bangladesh (National Tuberculosis Control Programme, Bangladesh, 2021)

6. Methodology

6.1 Study Design

The current study applies an explanatory sequential qualitative dominant mixed-methods design to determine the factors hindering or enhancing TPT integration in Dhaka BRAC TB Centers (see Figure 02). This research also offered an opportunity to explore, with a measure of depth, the experiences and opinions of healthcare workers regarding TPT implementation and gather the quantitative data necessary to support and amplify the results. In exploratory design, data is initially accumulated and summarized qualitatively, while themes are used to develop a survey to quantitatively investigate the research issue (Creswell & Plano Clark, 2011; Teddlie & Tashakkori, 2008; Nelson et al., 2010). As a result of this design, three stages of analyses are conducted: the methodological triangulation at the end of the first qualitative phase as well as a secondary quantitative phase that follows the initial qualitative exploratory phase, and the integration phase that connects the two strands of data and extend the initial qualitative exploratory findings (Creswell & Plano Clark, 2011). This article presents the last aspect of the integration phase in the study.

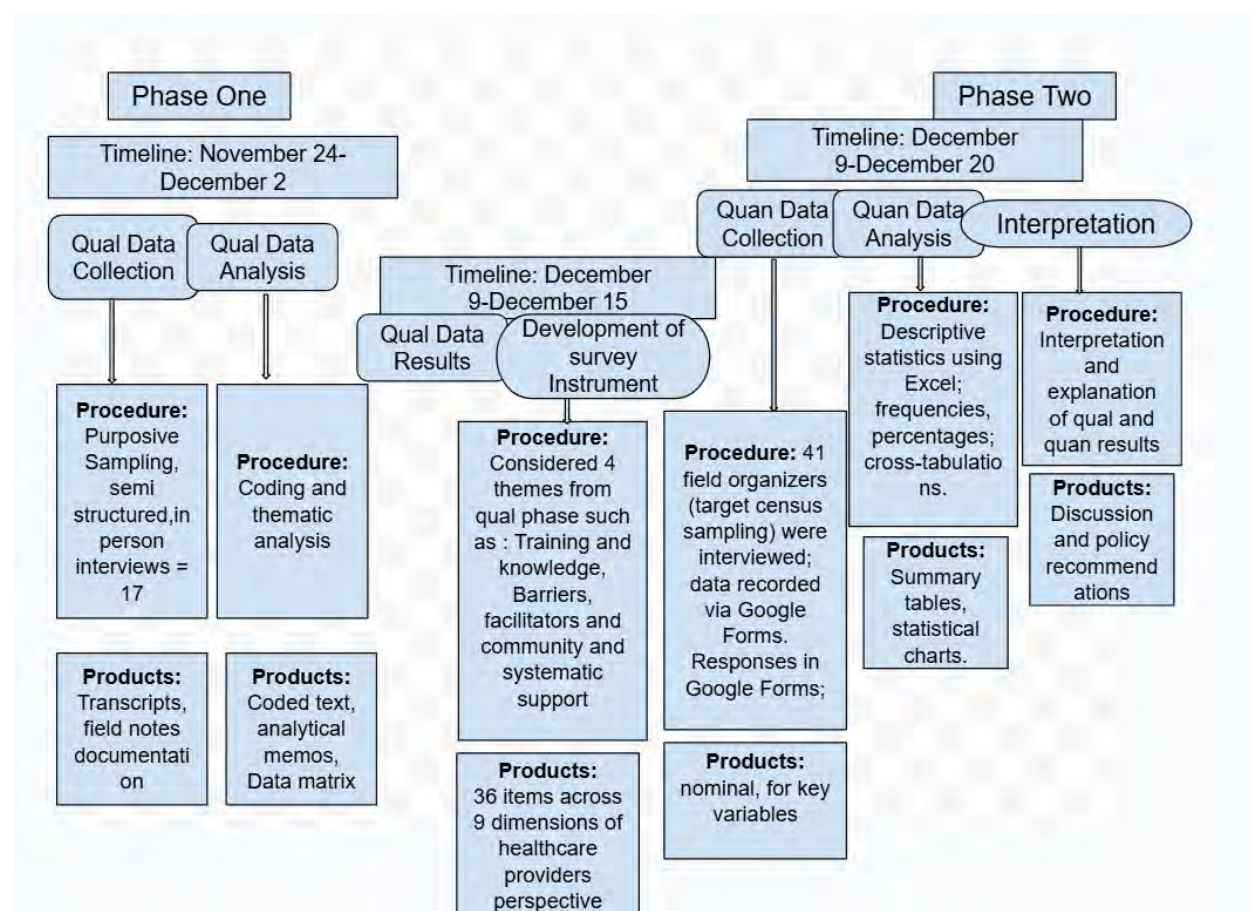


Figure 3: Explanatory sequential mixed methods research design

6.2 Study Settings

6.2.1 General Setting

The study was carried out in Dhaka, the capital of Bangladesh, with an estimated 2023 population of 23 million (World Population Review, 2023). Since the city is the country's major economic center, its population is nearly entirely urban, and it also hosts a large number of people migrating from rural areas. Tuberculosis, or TB, is prevalent in Dhaka, estimated at 221 per 100,000 population in 2022 (BRAC, 2024).

6.2.2 Specific Setting

The BRAC Urban Tuberculosis Centers in Bangladesh, known as Organizational Core Structures of TB within the administration of Dhaka, have important functions in the operation of the National Tuberculosis Control Program. There are 37 BRAC Urban TB Centres in Dhaka where Tuberculosis Preventive Therapy (TPT) is offered, as well as diagnostic and treatment services (BRAC, 2023). TB Center controls tuberculosis units (TUs) that treat around 1000000 people on average. These are subdivided into Designated Microscopy Centres or Directly Observed Treatment and Short-course Centres and run by community health/nodal workers or field organizers.

TPT has been rolled out in all the thirty-seven Urban TB Centers. Among these, 12 are under the PPP project, whereby the TPT staff conducts everyday tasks such as tracing contacts, screening, and routine follow-up. In contrast, other staff administer the dispense of drugs. The last 25 centers use TPT under routine program conditions while the DOTS staff performs all processes. Screening assessment is performed in all 37 Centres through clinical, laboratory, and radiological assessment of the household contacts of Pulmonary TB patients using the "screen and treat" approach.

TPT beneficiaries receive isoniazid for 6 months (6H); however, a shorter regimen of isoniazid and rifapentine for 3 months (3HP) is available in some centers. The TPT staff at the various centers under the PPP project offers first-point screening and identification of TB-like symptoms, counseling for starting treatment regimens, routine counseling, and providing necessary drugs through the linked DOTS centers. In centers, the DOTS handles the application of TPT under routine TB care, such as smear microscopy, screening, and drug administration.

The study was carried out at five purposely chosen BRAC Urban TB Diagnostic Centers in Dhaka; all five employed the 'test and treat' approach using tests and X-rays for TB infection before

starting the TPT. At the centers under the PPP project, the dedicated TPT staff provides initial screening for TB symptoms (cough, fever, night sweats, and weight loss), treatment initiation support, and regular counseling. At the same time, drugs are dispensed through the linked DOTS centers. The study was conducted at five selected BRAC Urban TB Diagnostic Centers in Dhaka; all of them utilized the "test and treat" strategy with test and X-ray for TB infection diagnosis before initiating TPT

6.3 Study Population

For the Qualitative Phase, we interviewed purposively selected 17 healthcare providers until data saturation. No one refused to participate, and no repeat interviews were conducted.

1. **Upper-Level Implementers:** Associate Director of the BRAC Health Program (1), TB Operational Managers (2), Senior Manager (1), Divisional Manager (1), District Managers (2), and Medical Officers (2)
2. **Mid-Level Staff:** Field Organizers (FOs) (5) facilitating community-level TPT activities.
3. **Frontline Workers:** Community Health Workers (CHWs) (2) and Shasthya Shebika (1)

For the Quantitative Phase: The participants included 41 Field Organizers (FOs) directly implementing TPT among the Index Smear Positive TB patients at the selected BRAC Urban TB Centers in Dhaka. These FOs were selected in an intentional manner in order to capture facilitators and barriers of TPT implementation at the level of program operation and execution.

6.4 Sampling Technique

6.4.1 For the Qualitative Phase: The respondents were purposely chosen for the role and the level of engagement in practices supporting TPT. It guaranteed a broad representation of organizational levels and included valuable information on widespread and personal problems.

6.4.2 For the Quantitative Phase: A systematically selected strategy was first proposed to capture all 59 FOs, thereby maximizing generalizability and minimizing sample bias. Nevertheless, because of organizing constraints, time limitations, and the non-recognition of several FOs, the above study embraced only 41 FOs who agreed and could be traced within the achievable time span. Nevertheless, this limitation doesn't harm greatly because the sample data makes up almost 69% of the population and provides results that are really close to those of the general population.

6.5 Tool Development

A quantitative structured questionnaire was used to obtain numerical data from FOs involved in implementing TPT. The questionnaire was hence developed using Google Forms to make it easier

to administer and to make it easier to collate the results. It comprised both closed-ended and multiple-choice questions, focusing on the following key areas:

1. **Demographic Information:** Age, sex, years of service, and level of education.
2. **Program Engagement:** The assignment of tasks, the amount and rate of TPT-related work performed.
3. **Operational Barriers:** Difficulties encountered while implementing TPT may include practicalities in performing the task, patient cooperation, or the availability and use of resources.
4. **Facilitators:** A number of practice enablers contribute to the effective implementation of complex interventions, including training, supervision, and endorsement by the community or other stakeholders.

The study questionnaire was designed based on the study aims and with reference to the Consolidated Framework for Implementation Research (CFIR). This was piloted on the first 10% of the FOs who were not part of the final sample to modify any questions that were unclear, redundant, or invalid. The tool developed for the study was pre-tested, and the feedback gathered from the respondents was used to fine-tune the tool in the next steps. The phrasing of questions evolved, and the number of options was increased where needed so that more extensive feedback could be collected during the study.

6. 6 Data Collection Procedure

6.6.1 Qualitative: Semi-structured interviews were conducted on November 24 and December 2, 2024, with broad, open-ended questions, and participants were requested for audio-recording permission. In the interviews where the respondents did not allow the use of a recorder, field notes were taken as the data collection method. Finally, at the end of the interview, which lasted between 30 – 60 minutes, the interviewee was given the summary of the interview conducted for validation.

•**Key Informant Interviews (KII):** A qualitative study with eight upper-level implementers; to address the research question on the nature and impact of TPT implementation, the CFIR was adapted to determine the domains and constructs to explore during the interview.

•**In-Depth Interviews (IDI):** Conducted with ten mid-level and frontline workers (five FOs and five CHWs) to delve into individual and operational challenges

6.6.2 Quantitative: The survey instrument for the second quantitative phase of the mixed method study was created from the data collected from the qualitative phase. The survey was conducted based on the qualitative themes and the five main CFIR domains. Data collection for the

quantitative phase occurred between December 9 and December 15, 2024, utilizing both face-to-face and phone surveys to maximize participant reach:

- **Face-to-face surveys:** Conducted with 31 FOs during field visits to gather in-depth responses.
- **Telephone Surveys:** Administered to ten more FOs in order to guarantee inclusion and get around logistical obstacles.

The survey instrument based on qualitative exploration was developed with structured questions to quantify the frequency of established barriers and facilitators during the study's first phase.

6.7 Data Analysis Plan

6.7.1 Qualitative Analysis: Narrative responses obtained from KIIs and IDIs were coded for each CFIR construct to establish the barriers and facilitators. Common themes of the implementation were grouped under procedural areas such as "Implementation obviousness," "Physical environment," "Community/political context," "Clients/staff, and "Extent to which implementation was executed." Reporting in this study was done using a Consolidated Criteria for Reporting Qualitative Research checklist for reporting [25]. The audiotaped interviews were then transcribed back verbatim by the researcher as the author of the original transcript. The transcripts were then read from cover to cover before correcting grammatical mistakes and then copied into Dedoose software for analysis. A thematic analysis was utilized by applying an equal measure of deductive and inductive analysis. They were then grouped and coded into subcategories under each domain and put under the theme. An interview was followed by the creation of the codebook with reference to the objectives of the work and the topics investigated. Each transcript was opened using the Dedoose software, and every statement was read carefully and coded into nodes. The coding was done, and there was a bit of shifting of the position of the nodes, leading to other nodes being merged to come up with themes. As coding proceeded, it was found that the initial codebook developed was required to be changed. Major and sub-themes were then noted down, and in the next step, the table of themes was taken to Word to do further analysis of data. Furthermore, each node was exported back into Word for better reading and selection of the most exploitable quotes, which are in the result section of this work. The observations made during data collection were used to guide the quantitative survey design.

6.7.2 Quantitative Analysis: The quantitative data collected in Google Forms were analyzed using descriptive statistical methods. All the data were exported into Stata 17.0 cleaning and

further analysis. Frequencies and percentages were used to analyze demographic data, the type and extent of program engagement, and answers to questions addressing operational challenges and enablers of TPT. Measurement of key variables, including the difficulties experienced during implementation, existing support structures, and enablers noted by Field Organizers (FOs), was done qualitatively using tables and charts to summarize the results. The descriptive analysis made it possible to identify patterns and trends correctly to meet the study objectives.

8. Ethical Considerations

Informed consent was sought to be ethical, and ethical clearance was sought from James P Grant School of Public Health, JPGSPH. The author also sought permission from the BRAC tuberculosis program. Participants were explained the aim of the study, and they were informed that their identity and data would be kept confidential. All identified participants signed informed written consent. Verbal consent was sought from the participants, and all the interviews were also audiotaped. The information gathered from this research excluded the clients' identities and was stored under the JPGSPH institutional data retention.

9. Results

9.1 Socio Demographic Characteristics

A total of 17 healthcare providers were involved in the study, including 9 participants from top-level implementers and the other 8 participants from frontline health workers. There were a total of 41 Field Organizers working at the selected district TB centers, assisting in the implementation and coordination of tuberculosis preventive treatment (TPT) efforts.

Characteristics of participants are displayed in Tables 1 and 2

Characteristics	Frequency
Age group	
21–30	3
31–40	6
41–50	4
>50	4
Gender	

Characteristics	Frequency
Male	7
Female	10
Designation	
Associate Director	1
Operational Manager	2
Senior Manager	1
District Manager	2
Divisional Manager	1
Medical Officer	2
Field Organizers (FO)	4
Community Health Workers (CHWs)	3
<i>Shasthya Shebika</i> (SS)	1

Table 1. Characteristics of healthcare workers interviewed.

Variable	Percentage (%)
Profession of the Respondent	
Field Organiser	100.00
Age Group of Participant	
24-35	50.00
36-45	38.46
>= 46	11.54
Gender of the Respondent	
Female	30.77
Male	69.23
Education Level of the Respondent	
High school graduate	19.23

Variable	Percentage (%)
Bachelor Degree	34.62
Master's degree	46.15
Work Experience of Participant	
0-3 Years	34.62
4-6 Years	15.38
7-9 Years	23.08
Above 9 Years	26.92
Duration of Involvement in TPT	
0-2 Years	23.08
2-4 Years	76.92

Table 2: Characteristics of Direct TPT Implementers FOs

9.2 Facilitators of TPT Implementation

9.2.1 Intervention Characteristics

Patient-Acceptance Regimens

In many of the urban clinics and the rural health center where TPT programs are prescribed, the effectiveness of these programs mainly depends on the freedom of the choice of the drug combinations. *"We offer both weekly and daily regimens, depending on the patient's age and weight,"* explained one healthcare provider (KII7). Some patients prefer weekly regimens, like 3HP, they only have to take the medicine once a week for a week. The patient preferences were mentioned by one provider as; *"Patients like a weekly dose better, I think because it is less frequent,"* (KII7). The result also shows that to some extent, patients are more accepting of the 3HP regimen because of the weekly dosing compared to the 3HR regimen, as supported by 50% of the FOs. It is also evident that in plans to boost the success rates of TPT programs, an option that a patient would prefer is a key factor in increasing the level of patient compliance. About formulation there has been a major advancement of dispersible formulations especially to families with young children. A provider noted, *"Having dispersible formulations for children*

makes it easier to administer TPT" (KII4). It has been especially useful for parents who find this approach easier when trying to get their children to receive the right treatment.

Adapting Guidelines for Inclusivity and Continuity

Another contributor to success has been flexibility of TPT guidelines especially in areas of limited resource endowment. Where essential diagnostic commodities like Tuberculin Skin Test (TST) or X-ray machines cannot be procured verbally screening surfaces as an essential control measure. A healthcare worker shared, *"Verbal screening is officially recognized when X-ray or TST facilities are not accessible, which helps maintain program continuity" (KII9).* This adjustment prevents a situation whereby some deserving person will not be attended to by the system due to infrastructures within the system.

Flexibility in implementing guidelines has also given the doctors the strength to take action. *"NTB has issued formal instructions allowing verbal screening by doctors to initiate TPT if required," shared a provider (KII9).* It maintains the program participatory especially in those areas where there is scarcity of sophisticated diagnostic equipment. However, if existing programs are developing various strategies in an attempt to tackle these challenges, the desire for increasing the availability of such tools as the Mantoux Test (MT) remains, too. *"Using the MT test would significantly improve diagnosis if implemented more widely,"* one expert remarked (KII4). Each of the Field Organizers stated that they are unable to use the Interferon-Gamma Release Assay (IGRA)/MT/TST test in order to get infection results in matters of urgency. The desire for increased funding is another factor that strengthens the continuous development of TPT programs and their efficiency and accuracy.

9.2.2 Outer Setting

Community-Centered Approach

In the crowded alley ways of Dhaka main city and outskirts of rural Bangladesh, the BRAC health workers move with a mission. It is a familiar and most of the time, trusted presence for many people. Because these workers have engaged these communities for years, they have developed strong bonds with them. According to one of the workers: *"Our staff have been*

working in these communities for a long time, so they have gained trust.” (KII7). This trust is the foundation upon which they have based their success in the usage of Tuberculosis Preventive Therapy (TPT). When the staff of the BRAC does speak, their words are quite potent. People in a community tend to trust them as friends who genuinely care for their welfare. “When BRAC staff speak, people often believe them because they think, *‘If BRAC’s brother or sister is saying this, it must be for my benefit’*” (KII7). This is owing to the perception created that patient compliance in starting and sustaining treatment is made easier. However, when the doctors that are supposed to perform the TPT lessen the importance of the same, challenges come in. One health worker explained, *“Patients trust BRAC staff when they explain the benefits of TPT, but trust is undermined if doctors dismiss its necessity”* (KII9). This disconnect may result in bewilderment to the patients and consequently, interference with the program. As health workers, the coverage area of BRAC is restricted to the slums and rural regions—other regions that are hardly considered for health interventions. *“Many of our health workers’ outreach is used to in charge the slum and communities”* (KII5). The most important feature of these contexts is the need to establish trust in order to facilitate program implementation and acceptance among the hardest to reach populations.

Supportive Community and Family Members

Every patient being accepting of TPT has a family and community support system that has the potential to dictate success. In the process mothers establish themselves as health promoters in their homes. One health worker observed, *“Mothers in the family are often the most understanding, recognizing the benefits of treatment”* (IDII). They have a crucial function of ensuring compliance because they remind their children, spouses and relatives about the need to keep healthy. However, not all family environments are proof of encouragement. Husbands in particular are often reluctant to take medicine with common complaints being produced that the drugs weaken them for work. *“Men frequently resist, claiming that the medication and its symptoms might weaken them and hinder their work”* (IDII). Such resistance is why leadership must break the mold to incorporate theories, information, and interventions that focus solely on gender interests and facts.

Secondly, the case studies Within family spread out and influence other members to get in the business. *“Family members who witness improvements in patients are more likely to join the treatment program themselves” (ID11)*. If people see one person in their family progressively getting better, this serves as a good reminder for them to join the program and think about getting a preventive measure for themselves.

Support from Government Programs

In this framework of intervention, the good work of BRAC is organized under the umbrella of the National TB Program (NTB). With the cooperation with NTB, BRAC gets the directions and aids for operating TPT programs effectively. A health worker explained, *“Coordination with NTB ensures consistent guidelines and resources for TPT” (KII4)*. This partnership ensures organization wide consistency on how the particular disease is controlled and prevented across the different regions. Such support also facilitates scaling up of TPT initiatives and extend them to cover other areas in the country that may not function optimized. *“Government support is critical for scaling up TPT implementation” (KII4)*. Thus, filling logistical and infrastructural voids by these partnerships benefit programs such as BRAC’s and extend their reach. The socialization also goes beyond just resource provision as prescribed by NTB. As a broad framework, it plays an ongoing role in implementing changes, or solving problems that emerge during implementation. *“While there are challenges, NTB helps us resolve many issues” (KII7)*. This partnership gives assurance that TPT programs can continue to innovate and grow despite the challenges.

Social Support Mechanisms

To most of them, these challenges are as massive as the disease they have to fight; challenges such as, financial and logistical challenges. Being aware of this, both BRAC and its donors have developed essential supporting frameworks to help relieve populations in need. Of these, the most useful has been the transportation aid. *“We provide transportation support for financially vulnerable individuals to access testing or treatment, which enhances the TPT uptake” (KII7)*.

This small but very important intervention guarantee that persons from the most vulnerable groups in the society are able to access health facilities without necessarily being concerned with

the amount of cash they have to part with. With issues to do with finances being tackled by such initiatives, earlier mentioned as one of the greatest hurdles to accessing care, more people can benefit from TPT .

9.2.3 Inner Setting

Dedication and Commitment of Field Staff

While combating this social disease, field organizers (FOs) and community health worker (CHWs) stand as the pillars of the strategy. Such dedicated and unrecognized workers have to strategise effectively within allocated resources to provide counseling to patients suspected to have TB and start them on TPT. As one key informant shared, *“Field organizers go above and beyond to counsel patients and ensure they begin TPT, even amidst resource constraints” (KII9)*. Their continuous contributions are sometimes manifested by home visits, and patients’ follow-ups, in order to ensure that patients remain compliant despite busy schedules. *“Nevertheless, field staff still get time to go to patients’ home to do proper follow-ups as well as keep the program going” (KII9)*. Field staff also increase patient satisfaction with counseling by reaching out to patients in homes, facilities and even the streets in the event of a breakdown. *“I feel it is my major responsibility to counsel the patients regardless of their place of residence, our firm, or streets going round the regions of the slum to get the patients whom I attended in the hospital” (IDI4)*.

Data Collection Improvements

The other key factor influencing implementation of effective TPT involves data collection accordingly. Implementation of new advanced documentation systems is closing previous gaps where patient progress is being ascertained and /or the probability of success being estimated in non-inflated rates. *“The success rate showed last year is 95-100% which was not realistic result for us, thus we inquired and found mismanagement of documentation. After that we conducted training and tried to inform all the healthcare providers about algorithm of documentation; Thus, we are hoping updated documentation systems aim to address previous gaps and provide realistic success rates by 2025” (KII9)*. These improvements focus on the use of preventive measures on a disease that is much cheaper to address in its early stages than when it presents

with fully blown symptoms. “We need to focus on prevention as a cost-effective approach compared to treatment” (KII5).

Effective Use of Resources

Resource optimization emerges as one of the most significant factors in maintaining such programs. Strategic funding guarantees basic functionalities of crucial ingredients that include diagnostics and incorporation of TPT within operations. *“We prioritize our funding carefully to ensure diagnostic capacity and integration of TPT into operations” (KII7)*. It also ensures most vulnerable children are accessed with limited resources while keeping the program integrity high.

9.2.4 Characteristics of Individuals

Staff Resilience

Running through all of these activities is the tenacity of those field staffs who juggle several tasks to keep a program ongoing. *“Staff manage multiple responsibilities effectively to ensure program continuity” (KII9)*. This resilience is supported through mentoring and periodic contact with district and program managers. *“District Managers and Program Managers conduct monthly or quarterly meetings to address gaps in training” (KII9)*. Their effectiveness is boosted more by peer collaboration since senior peers offer their thinking. *“Senior coworkers offer valuable insights into alternative approaches for motivating patients” (IDII)*.

Engagement Through Advocacy

Education/mobilization of the patient and advocacy form great strategies for the enhancement of TPT. Facebook, instagram, twitter and other social utilities are in effect becoming powerful platforms for raising awareness. *“We should utilize platforms like Facebook, Instagram, and Twitter to spread awareness effectively” (KII7)*. The misconceptions over TPT are addressed through advocacy programs to recruit doctors into advocating for the patients. *“Counseling patients and engaging doctors through stronger advocacy programs can help change misconceptions about TPT” (KII9)*. Newspaper headlines, short movies, and segments that can

be aired on television are good examples of the fact that campaign messages effectively create awareness and awareness messages and such a format should be adopted for TPT. *“Public awareness initiatives, such as news headlines, short films, or TV segments about TB, have been effective in the past and should be incorporated for TPT” (KII9).*

Innovative Patient Mobilization

The multiple-wave and mixed-mode administration of TPT programs facilitate novelty mobilization strategies. Several settings such as the workplaces and schools are considered appropriate to engage communities. *“By conducting mobilization activities in workplaces and educational institutions, we can reach them more effectively” (KII7).* Patients are encouraged to follow the treatment when they hear or read testimonies from other patients who have undergone through TPT and have been cured. *“If we use individuals who have successfully completed TPT to share their experiences, it would encourage others to adhere to treatment” (KII7).*

9.3. Barriers

9.3.1 Intervention Characteristics

Complexity of TPT Regimen

One of the largest barriers is the regimen itself, which is usually quite difficult to follow and deal with patients for side effects fear. 92.3 % participants respondent that the main barriers of dropout or adherence TPT is fear of side effects. Patients receiving the treatment also complain of uncomfortable adverse effects like vomiting, itching, and burning sensations among others causing them to stop treatment. According to one of the interviewees, *“Some people receive TPT willingly whether they are healthy or not, but if it causes them vomiting they just stop taking it without our knowledge (KII7).* These side effects sometimes seem exaggerated by the patients, with another healthcare worker observing, *“Many patients mention experiencing side effects but often exaggerate their impact” (KII9).* This highlights to us the need to improve on counseling and to look at how patients perceive the treatment.

The regimen itself, which takes three months, is considered a burden by most patients. One patient voiced, *“The lengthy medication process discourages patients; they feel three months is*

too long” (IDI1). But when one is healthy and strong and taking this medication, the confusion is complete. “*Why should I take the big tablets like TB patients even though I am healthy?*” (IDI5) questioned one patient, highlighting the difficulty of convincing asymptomatic individuals of the treatment's necessity. As it is for others, the size of the tablets is overwhelming. “*They are so big – why are the tablet’s sizes standardised?*” A participant recalled saying: ‘*It looks scary to look at, let alone eating them*’ (IDI4), clearly indicating patients are resistant because of not only the appearance of the medication.

It is, however, important to note that in addition to the treatment the patient has to go through, many of them go through socioeconomic and lifestyle issues. Many interviewees therefore regard the requirements of the regimen as being incompatible with their manual labor occupations. “*Daily laborers say they cannot manage the regimen alongside their daily work*” (IDI3), explained one healthcare worker. Those in families with several people on TPT also experience the issue of different side effects which complicate the end of the treatment. One is forgetfulness; this is especially the case with the weekly 3HP regimen. As one worker noted, “*Motivating patients to adhere is tough, especially with minor side effects*” (KII3), illustrating the small but persistent barriers that impede adherence.

These challenges are also greatly compounded by emotional and stigma related barriers. The linkage of TPT with active TB, and stigma, makes taking a preventive treatment a challenge. In the same regard, one HCW said, “*The three months of TPT is not easy, for those who do not feel that they are ill ...*” (KIII). This is discomfort for body and mind of taking pills relating to a disease that is still considered taboo in many quarters.

Limited Trust in the Evidence of TPT

And if the process of having to adhere to the treatment regime wasn’t difficult enough, there is then the matter of trust – both Anti’s and the healthcare system’s. However, TPT gives specific instructions on how it can be administered and has numerous advantages, but many physicians are reluctant to go for it. An interview with a doctor summarized the widespread doubting of the efficacy of the drug: “*I will prescribe this to my patients but will not take it myself*” (KII7). This

hesitation can be attributed to a number of factors including inadequate knowledge of TPT protocols.

The same skepticism is seen in patients due to their poor understanding of the disease diagnosis, particularly latent TB and its dangers. *“Patients often say, ‘I am healthy, why should I risk side effects?’” (KII9)*, one healthcare worker pointed out. 84.6% participants pointed out that patients reluctant to visit referral centers to take TPT treatment where same amount of participants blamed non-medicine doctors for not knowing much about TPT. This is in reference to the challenge of getting people with no symptoms to take a pill that they do not consider relevant to them. Another patient had a similar attitude expressing the sentiment: *“Why should I use high antibiotics while I do not have any disease?” (KIII)*.

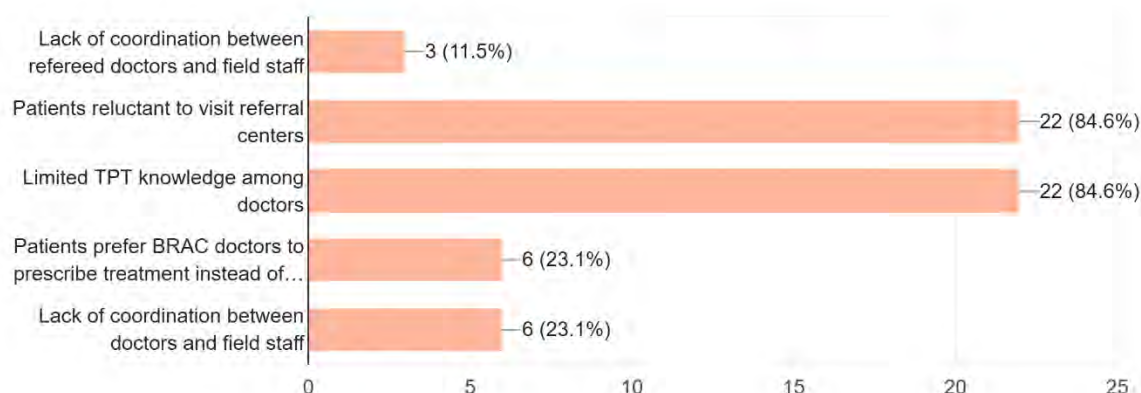


Figure 4: Challenges Face Referring Patients for TPT

Moreover, where tuberculosis is considered as a more severe disease compared to the threats today as COVID-19, the situation is only getting worse. A qualitative study participant argued, *“The disease progression of TB is slower than the inflammatory rate that was seen with COVID-19; hence people are not as worried now” (KII5)*. This perception reduces the level of importance attached to TPT by the healthcare providers and decreases patients’ compliance with the treatment programme.

Even with strong an attempt made by the healthcare workers to talk and counsel the patients, there are questions. Some patients still refuse TPT, saying, *“I am healthy, why should I take*

medicine?” (IDI1). Families also remain unconvinced, as one worker observed: “There is still doubt among some patients and families about whether this treatment is necessary” (IDI3).

When all reasons are explained, patients tend to insist on the inefficiency of the treatment. *“Even after explaining, some people question the effectiveness of the medicine” (IDI3),* shared one healthcare worker, illustrating the persistent skepticism that continues to cloud the adoption of TPT.

9.3.2 Outer Setting

Patient Stigma

Tb related stigma was identified as a patient level factor that hinders both screening for TPT and compliance to the treatment. This is worst felt in involve the social acceptance by the community and as such those with unmarried daughters keep their TB status a secret. One participant noted, *“Families often hide their TB status, especially for unmarried daughters, to avoid judgment in the community or fear of not being able to get married off” (KII1).* This denies them interaction with other people and early treatment as another respondent said, *“Some individuals opt to keep TB secret and ask us not to reveal it to anyone. They expressed concerns such as peoples’ visits to their home would be fewer or they themselves would be treated differently” (KII7).* The fear of being labeled “infectious” further discourages participation in TB programs. One healthcare worker stated, *“There is fear among patients about being labeled as ‘infectious’ in their communities” (IDI6).* This brings stigma on the treatment, where patients have even refused home visits from field officers out of stigma. One respondent averred, *“The FO tells other people that there is a TB patient in the house. In this they instruct me, ‘Sister, please do not send the FO again.’ You come instead” (IDI2).* The issue of stigma also impacts the family welfare where misconception makes some patient conceal his or her status from his or her children. A healthcare worker noted, *“Some patients even hide from their children, fearing their children will detach everything from them once they know that one of their parents is TB positive” (IDI6).*

Perception of TB

Urban populations have misconceptions about TB, perceiving it as a ‘disease of poverty’. A respondent observed, *“Educated individuals (those who go to school/colleges/workplace and*

access to social media) are harder to convince because they question and don't listen to us about why they need to take medication if they don't have TB" (KII7). This is a common belief as one participant put it, "TB is a poor man's disease; we don't need treatment" (IDI1); such rhetoric undermines the importance of preventive treatment among the well-to-do population. "Urban areas are more affected by stigma regarding TPT due to higher literacy levels and questioning the need for TPT" (KII2). A significant 62.5% of Field Organizers reported facing challenges in providing TPT to educated individuals, while 37.5% found it more difficult to administer TPT to those who are uneducated. 73.2% frontline health workers respondent lack of awareness about TPT is the second main barrier where 61.5% participants felt the cultural/ social stigma is the responsible for TPT adherence. Again some patients have religious and cultural barriers that lead to resistance, some patients believe in divine protection and therefore, they do not seek preventive care. One participant shared, "Some people tend to say, 'Allah will not bestow me with such a disease. That's why some patients give their doctors the right prayers, 'I have your prayers; I will not be positive.' (IDI4). There are also other logistic and personal factors that make patients and healthcare organizations resist TPT. According to the patients, they will only be willing to take the medication if they are diagnosed of having TB as admitted by this patient: "I'll start it if I become tested positive" (IDI4). Caregivers too harbor same sentiments about their kids with one of them saying, "My child is very young." This actually raises another question, how can they have so many medicines? (IDI3).

Supply Chain Challenges

Lack of medication availability was established as a major factor that hampers effective implementation of TPT. Long time durations before the stock-in of these products, including the reclaiming drugs like 3HP and 3HR, discouraged both the doctors and patients to persist with treatment. A healthcare worker noted, "Irregular supply of medications like 3HP for adults discourages doctors and patients from continuing treatment" (KII9). These interruptions make people wait for their treatment and also negatively impact their confidence on healthcare institutions.

Availability of the formulations also varied and lack of particular difficult to disperse forms required for children made the problem worse. One participant explained, "Towards the end of last year, there was a shortage of child preventive treatment medications" (KII6). This

inequality was worse among the vulnerable population such as children, thereby complicating the treatment process.

Local variation in proposed medications meant that stock had to be reallocated between branches whenever required. *“We often face stockouts, and in such cases, we try to arrange the medication from nearby branches,” shared a healthcare worker (KII4).* While doing this it reduced some gaps but at the same time augmented the administrative hassles and the delivery of care. Thus, additional problems came from the supply chain side not only limiting medications, but also diagnostics supplies. A community based healthcare worker described, *“He noted that they will often run very low on cartridges and other diagnostic equipment. Every essential medicine generates a particular number, and if the government delays the supply of those medicines, it affects every numeral of the treatment plan.” (KIII1).* These shortages exacerbated problems related to diagnosis and treatment, as well as adding to more extensive difficulties. Especially due to supply shortages, patient care was affected by the limited choice of regimens. One worker noted, *“We often face shortages of 3HR doses; in fact, it stopped supply in my TDC center, leaving us with only the weekly 3HP options” (IDI4).* This limitation precluded personalization in polymorphic patients, and may have undermined results.

Resource Constraints

Lack of resources greatly hampered the ability to properly manage Tuberculosis Preventive Therapy (TPT) programs. Lack of finances and poor patient compliance particularly in organising for transport were cited as major challenges. CHWs solicited money for hiring rickshaw for elderly patients but the basic support system was missing. As one healthcare worker noted, *“Transport costs are a significant challenge for low-income families” (KIII1).* Though x-ray for TB testing was free; however, there was no funding for travel costs in TPT and vulnerable populations were not supported (KII2). Another identified need was nutrition; therefore, nutritional support became one of the priorities. They were told to take something healthy to help withdraw side effects but no help given, thus limited compliance. *“They do not get any nutritional support for TPT patients,” commented a healthcare worker (KII2).* These challenges were exacerbated by lack of funds, particularly in organizations that relied on donor support where funds are stretched and sparingly availed. While in TB testing transportation support for presumptive cases was provided to clients, in TPT it was greatly lacking. *“We must*

prioritize needs carefully due to funding gaps,” explained one respondent (KII7). This was due to the opportunity cost of clinic visits that did not only lock out low income families and owners of small business ventures who relied on daily wages for the treatment. “Low-income families prioritize daily wages over treatment visits,” noted one participant (IDI3). The middle-class patients also did not seek treatment because they considered that they lacked time (IDI1).

Finally, reimbursement gaps and consultation fees posed additional barriers. Travel costs were often only partially covered, frustrating patients. *“They must visit the center twice but are reimbursed only once” (IDI2).* Furthermore, consultation fees added a significant financial burden. One patient shared, *“The doctor’s fee will be around 200-250 BDT. How will I go there? Okay, let me see. I will go to the doctor’s a few days after saving some money” but later they don’t go (IDI6).* These financial hurdles made it even harder for patients to engage with the program.

Limited Private Sector Engagement

The lack of participation of the private health care sector in scaling up tuberculosis preventive therapy (TPT) has lots of issues. Private practice doctors appear to have poor knowledge of more recent changes in TPT guidelines; hence, they may not fully implement the program. As one respondent noted, *“General practitioners often lack awareness of the latest guidelines for TPT; the private sector often relies on outdated practices, creating gaps in TPT implementation” (KII4).* This outdated knowledge goes around to make the information wrong hence affecting the patients decision and compliance to treatment.

Another is negative attitude represented by skepticism among private practitioners also hampers TPT efforts. Still, some disregard its usefulness for persons experiencing no symptoms at all. One healthcare worker shared, *“Doctors often dismiss TPT, saying, ‘You’re healthy, you don’t need this,’ undermining the efforts of health workers” (KII7).* This attitude contributes to the patients’ decision not to practice prevention treatment contrary to what beneficial to the health of the society.

Even more, there is poor communication with private sectors through relying on government initiated communication. As one respondent explained, *“A message that we might have to repeat*

multiple times will carry more weight if it comes from the government” (KII9). The results suggested that the physicians rely more on central government guidance compared with the field-based information, increasing the need for a positive government–private sector relationship. One healthcare worker stressed, *“Doctors value government communication more than field-level communication; public-private partnerships need strengthening” (KII5).*

Unavailability of Diagnostic Tools

The lack of diagnostic tools presents a significant obstacle to the implementation of TPT. Tuberculin Skin Test (TST) services are confined to specific areas, such as Rajshahi and Khulna, leaving major urban centers like Dhaka without access. *One participant noted, “TST tests are only piloted in some areas like Rajshahi and Khulna but not implemented in Dhaka urban areas” (KII5).* This uneven distribution leads to regional disparities, limiting the program’s effectiveness. Cost issues further limit access to TST, especially for low-income patients. A healthcare worker remarked, *“TST facilities are limited... they don’t provide the service free of cost, making it inaccessible for many patients” (KII6).* Moreover, the inconvenience and expense of traveling to TST facilities deter many patients from participating. As one respondent pointed out, *“Patients often refuse to travel for TST due to inconvenience and cost” (KII2).* In regions lacking TST, providers must rely on less accurate alternatives, which compromises the detection of latent TB. *“Lack of TST forces us to rely on less precise alternatives like verbal screening” (IDI3),* one participant stated. 65.4% participants do the verbal screening which can lead to wrong treatment. While X-rays are sometimes used as substitutes, they pose challenges, particularly when required for elderly individuals. *“Mandatory x-rays for elderly individuals create additional challenges, especially for reluctant family members” (KII2).* The absence of TST facilities hampers adherence to screening protocols, reducing the program's overall effectiveness. *One healthcare worker explained, “Not all regions have equal access to TST, which limits program reach” (IDI5).* Expanding TST facilities is seen as essential, with a respondent asserting, *“Expanding TST facilities would improve program effectiveness” (IDI2).* Without accessible and reliable diagnostic services, both patients and healthcare providers encounter significant barriers to effective TB screening and treatment.

9.3.3 Inner Setting

Administrative and Workforce Challenges in TPT Implementation

The dual burden of documentation and the heavy workload on field staff poses a significant challenge in effectively implementing Tuberculosis Preventive Therapy (TPT) programs. Field organizers (FOs) and healthcare workers face extensive administrative tasks, including managing manual registers, entering data into electronic systems, and meeting government reporting requirements. One respondent noted, *“Managing registers, entering data into electronic apps, and aligning with government reporting requirements creates a significant burden”* (KII5). 34.6% of the participants felt very difficult to handle TPT documentation while 53.8% participants felt manageable but with difficulty. These redundant processes consume time that could be better spent on patient care, resulting in inefficiencies. Technical issues with the eTB system further complicate the situation. *“The eTB system often has glitches, creating delays in data reporting”* (KIII), and the lack of streamlined tools, such as treatment cards specifically for TPT tracking, adds to the confusion. A healthcare worker commented, *“There isn’t a separate treatment card for patients specifically for TPT tracking... documented in the TPT register instead”* (KII6). The fragmented systems hinder follow-ups and increase the likelihood of errors, as one participant pointed out, *“CI forms add to the workload and often lead to errors. Maintaining separate logs for TB and TPT patients is time-consuming”* (IDII). This administrative burden also results in inflated success rates, as one participant revealed, *“The reported success rates of 95-98% in 2024 are actually based on data collected from 2023; however, in 2023, there were gaps in documentation and reporting”* (KII9). The inability to accurately track long-term outcomes skews success metrics. Burnout among field staff is another critical issue. Some manage populations of up to 100,000, which can be overwhelming. One respondent shared, *“Field organizers are overburdened—they manage everything: documentation, follow-up, data entry, and patient visits”* (KII7). There are no program managers in urban areas where staff report directly to district managers which adds to the strain. *“In rural areas they have program managers to report to district managers but in urban areas there are no program managers which I feel is necessary to enhance the program”* (KII2). Limited resources and understaffing is another pressure. *“With only a few doctors available the workload becomes too much”* (KII4) so staff cannot give enough time to each patient. One FO said *“I am the only one in my center. I plan to cover 20 patients at least for a day. I end up covering a*

maximum of 15 people. What is happening now is that one person is liable for every end of the task” (IDI4). To ease these challenges streamlining documentation and having a unified system is key. One participant said *“If NTB revises its reporting and documentation requirements to simplify or reduce them it would ease this burden on field staff” (KII9).* Frequent transfer of government doctors disrupts the continuity of TPT implementation. New doctors need time to get familiar with TPT guidelines which delays progress. *“Newly transferred doctors need time to get familiar with TPT guidelines which delays progress” (KII4).*

Gender Inequities

53.8% participants think gender inequities also hinders TPT implementation while 46.2% participants denied. Male resistance to treatment especially in male dominated households is a big challenge. *Husbands question the need for TPT, some say “I will take it if I get affected” while others dismiss it entirely “She can go to her father’s house if I have to take this” (IDI2).* Such attitudes discourage women from seeking treatment and creates family conflict especially in lower income households. Stigmatization of women with TB adds to these problems. Husbands may isolate themselves from their wives out of unfounded fears, one participant said *“You have TB. That means I will get affected too so I am separating everything from you” (IDI6).* This stigmatization leads to emotional and physical isolation making it harder for women to adhere to treatment. Cultural norms that put healthcare decision making in the hands of men only exacerbates these barriers, male dominated households resist TPT acceptance. To overcome these barriers gender sensitive interventions are needed to empower women to make informed decisions about their health.

9.3.4 Characteristics of Individuals

Gaps in Training and Supervision: Struggles in TPT Implementation

There is a major limiting factor in the effective implementation of Tuberculosis Preventive Therapy (TPT) programs due to the lack of training and supervision mechanisms. Many newly recruited staff are unprepared to deliver services due to insufficient foundational training. A community health worker (CHW) shared, *“Some staff who joined recently haven’t received any specific training on TPT” (KII6),* revealing how this lack of preparation leaves them ill-equipped to engage patients effectively. *Even long-serving staff are stuck with outdated knowledge, as one*

worker recalled, “We haven’t had training since 2004. Although I still use what I learned before, things have become more advanced, and we require updated training for the new techniques” (IDI2) . Training on TPT is usually crammed into an overall tuberculosis (TB) session, with limited opportunities for detailed chat. One respondent lamented, “There’s no exclusive training on TPT; it’s integrated into general TB training” (KII5), a rushed approach that limits the time needed for patient counseling and engagement. Weak supervision further weakens adherence to TPT guidelines, with inconsistent oversight making it difficult to hold field staff accountable. The strain on resources, due to the inability to deliver timely training to all, worsens the problem. A participant summarized the problem as, “You cannot train all three thousand personnel all at once; training is ongoing and only covers new or refresher requirements” (KII7).

Variable	Percentage (%)
Respondent received TB training	
No	7.69
Yes	92.31
Work experience of participant	
1-8 months ago	30.77
9-24 months ago	38.46
More than 25 months ago	30.77
Respondent received TPT training	
No	46.15
Yes	53.85
Last TPT training received	
1-8 months ago	26.67
9-24 months ago	73.33
Refresher training on TPT	
No refresher training	100.00

Table 3: Inadequate Training among Field Organizers about TPT

The majority of respondents (92.31%) received TB training, but fewer (53.85%) had training specific to TPT, with most TPT training occurring 9-24 months ago (73.33%). Notably, no respondents received refresher training on TPT (100%). These findings highlight gaps in specialized TPT training and the need for regular refresher sessions to ensure healthcare

providers remain updated and well-equipped for effective TPT implementation. Moreover, 32% of the FO was felt the need for additional training while dealing with the TPT cases.

Low Patient Motivation: A Struggle for Adherence

Low patient motivation is a significant barrier to the successful treatment of TPT. A lot of patients discontinue treatment, after half way, due to attributed mild to moderate side effects or just feeling better. *One respondent shared, "Patients often stop midway, saying, 'I feel fine; I don't need this' (KII3). The anxiety of being asked to go back to restart treatment makes the situation worse. Patients are sometimes reluctant to tell that they have stopped taking TPT because of fear that it will be recommenced to treatment" (KII7).* Such behavior contributes to the risk of drug-resistant TB. A healthcare worker warned, "If we dispense medication, we try to finish the three-month course of medicine but if the patient stops taking medication after 1 month or half way through of course, it increases the chances of drug resistance" (KII6).

Further, intensive counseling and post-care are crucial for the resolution of this problem. Consistent with one of the respondents stated, *"You must have strong follow-up and containing counseling for motivating sufferers to finish the course" (KII1).* Successful teamwork between healthcare and medical professionals is also an important factor to increase adherence. *It is the duty of our staff to counsel with people effectively, it is the responsibility of the doctors to tell patients why it is necessary to take TPT" (KII9).*

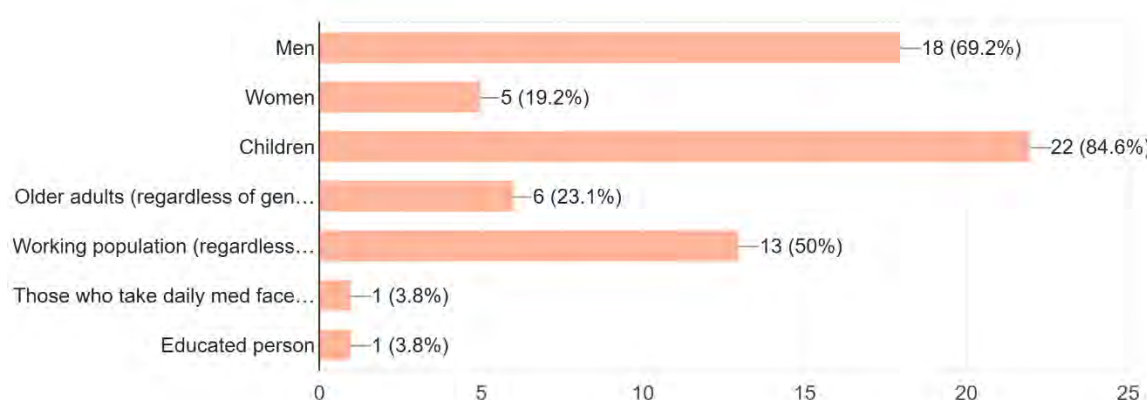


Figure 5: Population based Challenges to Provide TPT Treatment

The bar chart shows the representation of various groups in a survey on whom it's difficult to implement TPT, with children having the highest participation (84.6%), followed by men (69.2%) and the working population (50%). Older adults (23.1%) and women (19.2%) have moderate representation, while those taking daily medication and educated individuals are minimally represented, both at 3.8%. This suggests a strong focus on children and men to counsel more, with significantly lower engagement from another group.

9.3.5 Process

Ineffective Follow-Up: A Cycle of Missed Connections

Ineffective follow-up mechanisms further undermine TPT implementation. Field organizers (FOs) do sometimes make phone calls, but it is not in keeping with the formal program guidelines. While all of the participants agreed that all of them do the follow up through home visits, but 73.1% also agreed that they do both home visit and phone calls *"When we don't get the working person at home while visiting for the follow-up, to be honest, due to overload we could not visit again, thus we call them"* (IDI 4). In addition, because of the time constraint and the FOs tendency not to count the contents of the tablets during follow-up visits, overreporting and overestimation of success rates can occur. Unfortunately, only 3% of them talked about pill count while doing follow up. This has a bearing to the precision of adherence tracking and program changes.

Despite the home visits' greater effectiveness, they are difficult to carry out on a routine basis, owing to the presence of competing demands and patient's time availability. *While doing the follow up for TPT patients, if I get call for TB suspected patients I need to rush there and priorities the TB patients "* (IDI3). *Patients are also prone to miss follow-up appointments because their work schedules do not allow them to see us during our visit times"* (IDI6). FOs, however, are further disadvantaged in the cities in which patients are frequently moving between the different sites of care making it more difficult to keep track of them. *Field workers are in the awkward position of trying to maintain contact with patients as they get moved around frequently from one institution to another"* (KIII).

Patients' behavior, too, complicates follow-up efforts. Usually treatment is stopped, as soon as they get better, because they believe that they are no longer in need of treatment. A respondent

commented, *"We make every effort to schedule an appropriate time with patients, and knock before entering, however, patients are rarely available. They have stopped coughing and they consider, after two months of treatment, that they no longer need to attend follow-up visits"* (IDI3). Alternatively, such as a daily Directly Observed Treatment (DOT) plan, can circumvent the adherence issues, but requires a high amount of resources. *A daily DOT system, however, will be able to tackle the problem in a broader sense, needs a substantial effort in terms of investment and resources,"* (KII7).

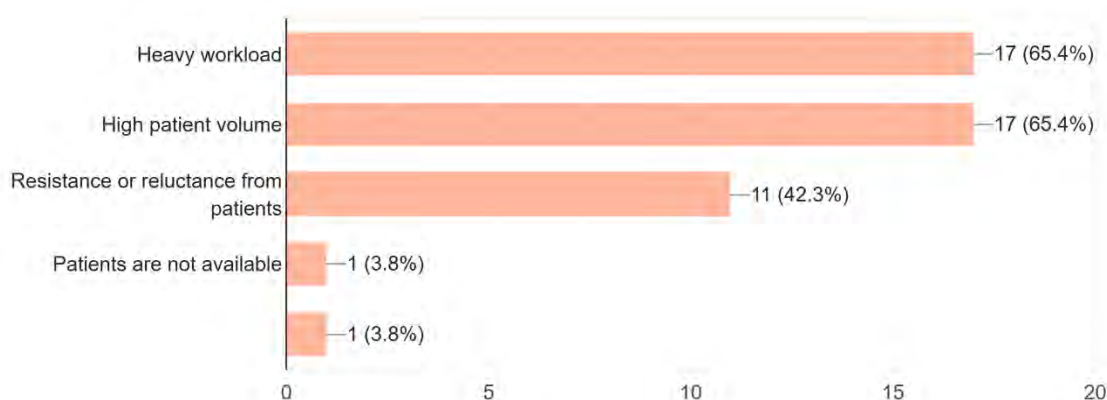


Figure 6: Challenges Face in Tracking and Monitoring Patients for TPT adherence?

Limited Community Engagement: Untapped Resources for TPT Advocacy

The underutilization of community influencers, such as political leaders and teachers, limits the promotion of TPT. A participant stated, *"Political, teacher, and community officials should all be worked on more appropriately with an advocacy blitz to support TPT,"* (KII7). Outreach also occurs in workplaces and in educational settings, where they are both underutilized. Empowering community health workers (CHWs) could also enhance advocacy. The job will be in the hands of the shasthya-shebika (SS) and CHWs just, if they are included in the start-of-management" (IDI6).

Counseling Weaknesses: A Barrier to Patient Engagement

Poor counselling skills also causes poor patient attendance and poor adherence. Due to their busy workload, staff rarely have enough time and energy to perform counseling work effectively. According to an interviewee, *"Counseling is effective, it requires time and tolerance and staff do*

not have time and tolerance to do so because of workload" (KII3). Furthermore, communication errors, such as the improper use of terms like "healthy person", undermine the counseling procedure. "Patients also seem to have a hard time understanding the role that preventive care plays and thus the importance of educational materials is not negligible" IDI8. This lack of easily understood communication and support in fact also impairs patient preference for TPT.

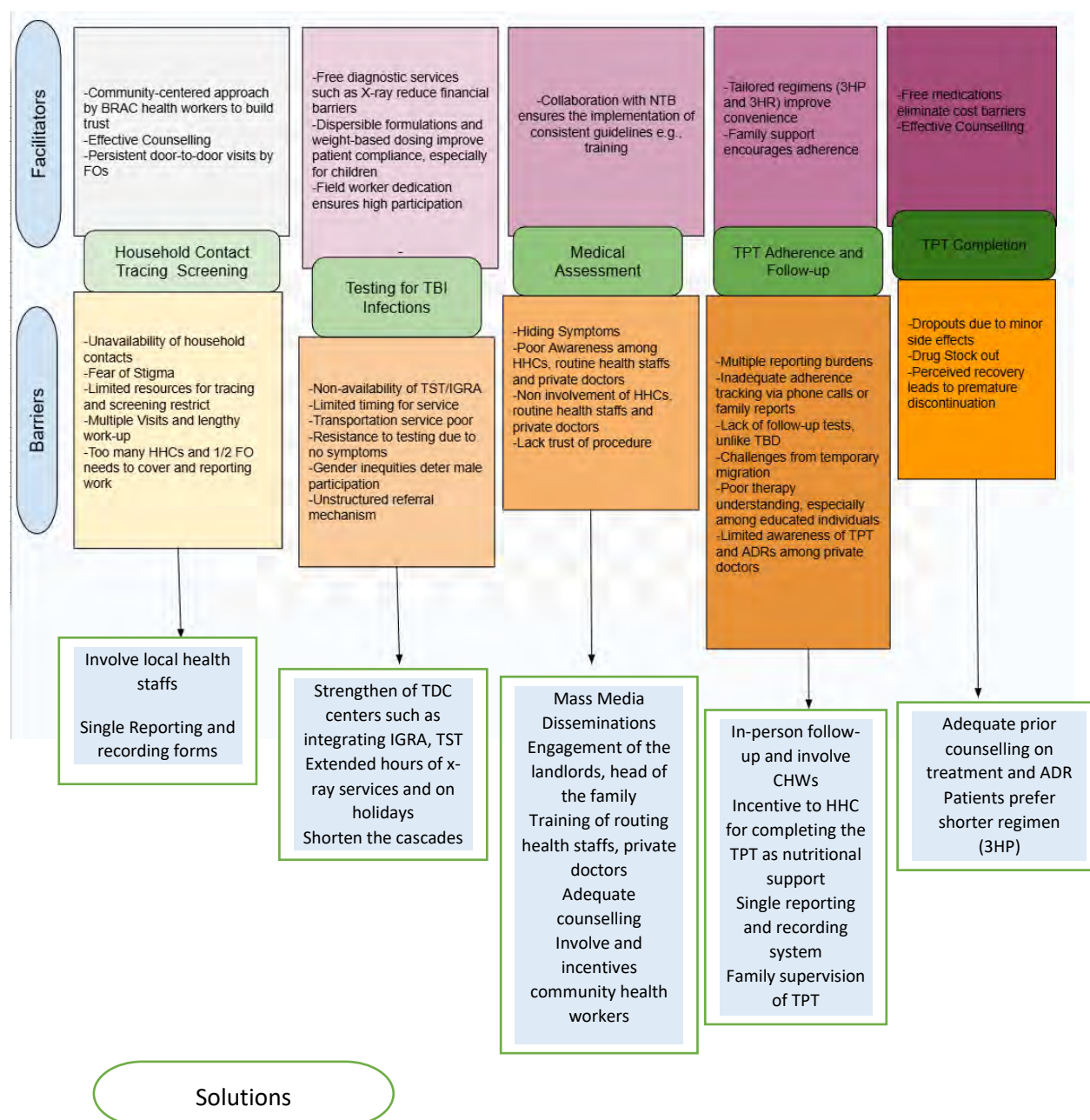


Figure 7: Barriers, Facilitators and possible solutions for implementation of TPT among household contacts

11. Discussion

This study, the first in Bangladesh to use the Consolidated Framework for Implementation Research (CFIR) to examine the factors that facilitate and hinder the implementation of tuberculosis preventive therapy (TPT) at urban BRAC TB facilities in Dhaka, produced several important results.

The following was an essential observation of facilitators in removing some of the barriers in the delivery of TPT. Others were the trusted client status of the community with BRAC healthcare workers, acceptable TPT guidelines, social support, availability of staff, and liaison with the NTP authors. These elements played a role in moderating risk and positively promoting TPT implementation. However, several factors that may inhibit the implementation of citizen participation were revealed. First, supply issues were a common problem that impacted health systems as there were challenges in procurement and use of materials and administrative burden of two different documentations that made the work of the health care providers more cumbersome and affected continuity of care. Second, patient-level factors consisting of stigmatization, perceived no need for preventive therapy, side effects, big size of pills, misconceptions, and misinformation concerning the benefits and duration of the TPT were key barriers towards the initiation and compliance to the TPT. Third, lack of awareness among healthcare providers, inadequate monitoring that included phone call follow-up, lack of standardization of training, and the stated hesitancy to prescribe TPT all limited the program's efficiency. Fourth, most dropouts were witnessed in resource constraints, including the absence of testing services and healthcare workers being overwhelmed. Fifth, public-private partnerships (PPPs) are limited in their ability to uptake the TPT. Last of all, the facilitators to manage specific barriers included the trust of the community in the BRAC healthcare worker, the flexibility of the TPT guideline, Social support, and support from the National Tuberculosis Program. The present analysis offers the following implications for improving understanding the TPT environment in resource-poor urban contexts.

In this study, facilitators were involved in overcoming the barriers preventing TPT delivery. Relationship building also emerged strongly as one of the enablers, given that patients trusted the healthcare workers from BRAC to deliver their word. This correlates with a study from Nigeria and a systematic review indicating that community trust enhances the quality of existing basic

amenities, enhancing the acceptability of services and health-seeking behavior hence enhancing the sustainability of the TB program and reciprocally populations' health (Uga Soro et al., 2017; Khan et al., 2021). Other measures in TPT included reverting to verbal symptom screening in practice to increase coverage; this aligns with WHO's suggestion for innovation towards practice (WHO, 2020). Family support, encouragement, and peer support also urged patients to come for TPT and adhere to it. Furthermore, effective personnel recruitment in charge of contact tracing, screening, increasing adherence levels, follow-up, and program delivery (Makova et al., 2022). Working with other facilities through commercialization enhanced the program through the NTP, offering policy coherence, technical assistance, and resource development, boosting the program's credibility and functionality (Houben & Dodd, 2016). These facilitators call for adequate utilization of community trust and institutional relationships for positive TPT delivery. This study also found several barriers to accessing medicines and quality health care: the transportation methods for delivering certain drugs and the two documentary forms that overloaded the functioning healthcare workers and caused interruptions in the continuity of care. Inefficiencies result from multiple systems, leading to working extended hours on ISM instead of patient care, hence working against program implementation. As with other primary studies evaluating TPT in the Eastern Cape, participants in this study pointed to the lack of standard-cum-uniform guidelines for TPT as one hindering factor that is essential to program development (Van de Water et al., 2020, 2021; Black et al., 2018). This reassures that good, thorough, and easy documentation systems are critical since the often-used phrase dictum is 'what is not measured is not done' (UNAIDS, 2023). In addition, supply and demand fluctuations, procurement issues, and low national program TPT priorities continued to be issues. Drug availability remains a problem globally and so Southern Asian nations (Singh et al., 2017; Makova et al., 2022; Ryckman et al., 2023). Transitioning from IPT to TPT requires additional funding because increasing the scale incurs significant escalating costs (Campbell & Menzies, 2022). Instead, governments and global health organizations should ensure TPT sourcing of funds, obtaining long-term and additional financial pledges to maintain and increase such programs through diversified financing mechanisms, including PPFs, and reallocating some funds from the other aspects of the battle against TB (Stop TB Partnership, 2021; WHO, 2021). The findings of this study highlighted the patient-level factors as one of the main challenges affecting the uptake of Tuberculosis Preventive Treatment (TPT) and its continuity, which

include fear of stigma, perceived no need for the preventive treatment, and side effects. Social stigma related to TB is still a substantial barrier to patients' willingness to come for treatment or to continue with their treatment as prescribed (Ahmed et al., 2017). TPT was new for beneficiaries, especially males who perceived risks when not sick; this was evident amongst private providers' reluctance to begin with TPT, as highlighted elsewhere (elsewhere) by Singh et al. (2017). Satisfying these concerns requires proper counseling and public enlightenment (Campaign & Menzies, 2022). Also, it can influence the patients' knowledge by using appropriate and accurate information to dispel myths. (Gaikwad et al., 2018 Alhadad et al., 2023). As with the organizational factors supported by policy, generating valid data as a result of research to emphasize the advantages of TPT and responding to doubts relating to the length of required treatment, daily intake, and side effects, mainly due to the use of the new three-drug regimen, 3HP can also be instrumental in increasing compliance (Makova et al., 2023).

Another important research finding was that poor knowledge among healthcare providers and inefficiency in monitoring TPT delivery, including scarce phone follow-up, presented significant difficulties. Other prior research that was conducted in central India (Singh et al., 2017), Ethiopia (Makova et al., 2022), Zimbabwe (Fentahun et al., 2020), and South Africa (van Wyk et al., 2011) also found a lack of knowledge as a hindrance. There was evidence within this study that providers were unwilling to prescribe TPT due to doubt over patient considerations and potential complications. Peculiarities of this kind have also been reported in other investigations; lower rates of TPT prescription were associated with insufficient training and low confidence levels in its use (Ahmed et al., 2021). Described health training programs, including TPT topics in nursing and medical curricula, and ongoing clinician education that briefs current and emerging treatment standards and patient care approaches are vital to surmounting such knowledge deficits (WHO, 2018). South Africa has also observed a lack of knowledge as a barrier (Singh et al., 2017; Makova et al., 2022; Fentahun et al., 2020; van Wyk et al., 2011). Furthermore, the lack of effective recall systems and phone call follow-ups hampered patients' compliance to take medications, and this was supported by Stojanovic et al. (2020). The principles of task shifting can also be important in enhancing monitors, such as CHWs, which can take up follow-up and patient counsel with increasing incentives rather than loading Fos. Besides, this approach also saves resources while improving patient satisfaction, treatment compliance, and overall

healthcare delivery, especially in high patient turnover practice environments through healthcare task-shifting (Rao, Nyirenda, & Chirwa, 2013).

Furthermore, high turn down was noted in TPT implementation at the step that addressed resource limitations such as test services and health care workers' congestion. The same has been revealed in low-resource settings whereby due to the lack of diagnostic tools for the LTBI, like IGRA testing, most of the patients in the care continuum are retained (Alsdurf et al., 2016).

According to research conducted on TB as well as primary care, self-management by nurses and non-physician clinicians is commendable in terms of clinical protocols, and they are capable of providing good quality treatment in low-resource environments (O'Brien et al., 2014; UNAIDS, 2023; WHO, 2018; Rosenberg, 2022; Rao et al., 2013). Cascade analyses have elaborated that algorithms for clinicians for high-risk individuals have witnessed challenges to be quantified in this environment, which participants perceived as barriers. Although the TPT plan is part of the PIP, which is annually developed as a Program Implementation Plan, it is suggested that a separate budget be allocated for use effectively to successfully implement the TPT plan (Alvi et al., 2024). Nevertheless, cascade diagrams are currently employed in TB care but not as frequently in preventive therapy, perhaps because of poor reporting systems (Pai & Temesgen, 2018; Kruk et al., 2018; Alsdurf et al., 2016; Cazabon et al., 2017). To rebuild and reimagine comprehensive TB interventions, moving the focus from the treatment-oriented model into the realm of prevention and point-of-care algorithms and documentation systems is necessary.

Last, there was constrained Private provider engagement in the TPT program. TPT was also a focal point, and although the private provider initially harbored distrust of it, there was reluctance to begin treatment. However, in general, the collaboration with an NGO became successful for the district and proved that PPP could improve TPT to some extent, especially in the early steps. As in other states, the PPM and Patient-Provider Support Agency (PPSA) models could be used to build on the enhanced private participation, particularly for the 'Test and Treat' scale-up (CTD, 2023). It is crucial to organize and involve the private sector in TPT service delivery and its planning, communication, and research (Matteelli et al., 2023). Alleviating private practitioners' resistance to recommend TPT due to Isoniazid resistance and skepticism is a significant achievement (Matteelli et al., 2023).

Therefore, our study gives valuable recommendations for solving problems with the application of TPT and presents possible solutions. First, the three challenges that result from drug shortage

include inadequate funding, which could be made more stable through adequate funding and centralization of drug procurement. It is required to set a local budget for purchase. Second, regarding the scarcity of human resources, this work underscores the significance of recruiting and retaining highly committed TPT staff. Mentorship, performance appraisals, encouragement and follow-up supervision, home visits, and community health promotion by TB advocates can do this. Third, the contact tracing and screening process should be efficient to ensure that all the members of households are tested and included in the TPT. However, forming the exclusive TPT workforce can take time; in the meantime, the government may partner with private entities to implement the centers. Improving treatment adherence can be encouraged by providing a brief duration of a drug regime like the 3HP. Finally, more research is needed to define TPT's effectiveness in calming the doubts and concerns of private providers and the community.

11.1 Strengths and Limitations of the Study

A few strengths of the current study add benefits to this work. First, the analysis of both qualitative and quantitative data answers the research question on barriers and facilitators of TPT implementation. Interviews with field organizers were conducted alongside surveys conducted among healthcare workers to ensure the results were validated. Second, it examined a diverse level of healthcare providers, enabling frontline healthcare practitioners to understand the delivery of TPT in urban contexts. The study setting in the DHAKA urban context of BANGLADESH provides important information on TPT use in such congested, developing-status urban environments. Last, using the Consolidated Framework for Implementation Research (CFIR) provided an efficient framework to categorize the findings and understand the systematic, provider, and patient barriers to TPT efficacy.

Nevertheless, the study has the following limitations: First, the sampling did not achieve a complete census due to time and resource constraints, which raised the risk of selection bias. As observed in the discussed study, more than half of the Field Organizers were engaged; however, some individuals were not included, and therefore, the results cannot be generalized to all the participants. Second, by comparing the results obtained using self-administered questionnaires, one can identify recall bias or social desirability bias, mainly about compliance with TPT guidelines. Despite this, these biases were minimized through structured surveys and triangulation with qualitative data sources. Third, the study was carried out in an urban setting, and as a result, the resources available and the type of health facilities differ from those in rural

areas. However, the results may not present some of the issues related to TPT implementation in the context of rural and/or geographically dispersed staff and settings, which calls for comparing urban and rural settings in future studies. Last but not least, no quantitative data on TPT adherence or reported patient dropouts was obtained in the study, which threatened the ability to consider the overall impact of barriers or facilitators on the effective delivery of the care cascade. Future research utilizing these measures would provide a more beneficial picture of the TPT program.

12. Conclusions

This paper assesses the status of TPT extended in the early phase in selected district TB centers in Delhi. The Technology Enhanced Parenteral Training (TPT) program was also significant, with better organizational setups and increased patient awareness. However, several issues hindered the optimal implementation of the program. Principal constraints discovered included the availability of drugs, limited financial resources, scarcity of human capital, and refusal by ‘well-off’ practitioners and other private providers. In contrast, relational antecedents like committed staff, NGO collaborations, and short regimens like 3HP were seen as favorable. Community participation and acceptance can only be enhanced through awareness creation, engagement, and education. Operations can be efficient by recruiting competent and trained staff, having one skilled human resource, and supervising the staff in charge of programs. Increasing funding, improved partnerships with the private sector, better drug stock out, and logistics are among the activities that enhance better program coverage. They will, therefore, help to increase health and functioning in a population or groups and familial units affected with tuberculosis and reduce the incidence of TB universally. Suppose the above-mentioned challenges are tackled, and the identified enablers are promoted. In that case, the tuberculosis patient treatment (TPT) program in the Dhaka urban setting will be enhanced by improving the local population’s health and the worldwide effort against tuberculosis.

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