Integrated care for tuberculosis (TB) and diabetes mellitus (DM) comorbidity in Asian countries: health system challenges and opportunities
Integrated care for tuberculosis (TB) and diabetes mellitus (DM) comorbidity in Asian countries: health system challenges and opportunities

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Authorship and acknowledgements

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Researchers from the following collaborating institutions contributed significantly to preparing this report and are included as co-authors: National Heart Foundation Hospital & Research Institute, Bangladesh (Professor Sohel Reza Choudhury); Duke Kunshan University, China (Dr Qian Long); Global Institute of Public Health, Kerala, India (Dr Shaffi Fazaludeen Koya and Professor K Rajasekharan Nayar); and University of the Philippines (Ma. Esmeralda Silva, Ma. Socorro Ignacio, Paul Michael Hernandez).

We also want to thank the independent consultants, Dr Monsurul Haque (National Institute of Cardiovascular Disease, Dhaka, Bangladesh), Dr Biraj Karmacharaya (Kathmandu University, Nepal), and Dr Roshan Mahato (Dhulikhel Hospital, Kathmandu, Nepal), for their critical support and consultation in gathering relevant data and preparing this report. We also want to acknowledge the advisory support provided by the team at the National University of Singapore (Helena Legido-Quigley, Pami Shrestha, Chuan De Foo).

Special thanks to the research support staff (Qianmei Du, Leiting Wang and Permata Silitonga of the Global Health Research Center at Duke Kunshan University; Drs Agatha Tyas and Mazidatun Maftukhah of Universitas Indonesia; Mr. Miko Balisi of University of the Philippines; and Drs Renesa Tarannum, Aruna Sarker, Ahmed Khairul Abrar, Shamim Jubayer and Mohammad Abdullah Al Mamun of National Institute of Cardiovascular Disease, Bangladesh) for their support in completing the project activities.

We would also like to convey our sincere acknowledgements to the peer reviewers for providing constructive feedback in finalizing this policy brief and working paper.

We express our sincere appreciation to every person who attended our stakeholders’ meetings and/or participated in the in-depth interviews and focus group discussions and provided valuable insights and information.

The authors acknowledge funding support from the Asia Pacific Observatory on Health Systems and Policies (APO).
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<th>Acronym</th>
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<tr>
<td>APO</td>
<td>Asia Pacific Observatory on Health Systems and Policies</td>
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<td>CDC</td>
<td>Chinese Center for Disease Control and Prevention</td>
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<td>CHW</td>
<td>community health worker</td>
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<td>DALY</td>
<td>disability-adjusted life year</td>
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<td>DM</td>
<td>diabetes mellitus</td>
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<td>DoH</td>
<td>Department of Health</td>
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<td>DOTS</td>
<td>directly observed treatment, short-course</td>
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<td>DPCB</td>
<td>Disease Prevention and Control Bureau</td>
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<td>FBS</td>
<td>fasting blood sugar</td>
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<td>Global Fund</td>
<td>The Global Fund to Fight AIDS, Tuberculosis and Malaria</td>
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<td>HIC</td>
<td>high-income country</td>
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<td>IDI</td>
<td>in-depth interview</td>
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<td>Institutional Review Board</td>
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<td>LMICs</td>
<td>low- and middle-income countries</td>
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<td>MDR</td>
<td>multidrug resistance</td>
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<td>MoH</td>
<td>Ministry of Health</td>
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<td>NCD</td>
<td>noncommunicable disease</td>
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<td>NHM</td>
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<td>NHSS</td>
<td>Nepal Health Sector Strategy</td>
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<td>NPCDCS</td>
<td>National Programme for prevention and control of Cancer, Diabetes, Cardiovascular diseases, and Stroke</td>
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<td>NTCP</td>
<td>National Tobacco Control Programme</td>
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<tr>
<td>NTEP</td>
<td>National TB Elimination Programme</td>
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<td>NTP</td>
<td>National TB Programme (or National TB Control Programme)</td>
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<tr>
<td>PMDT</td>
<td>programmatic management of drug-resistant TB cases</td>
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<td>PPSA</td>
<td>patient provider support agencies</td>
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<td>RBS</td>
<td>random blood sugar</td>
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<td>RNTCP</td>
<td>Revised National Tuberculosis Control Programme</td>
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<td>SES</td>
<td>socioeconomic status</td>
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<td>STEPS</td>
<td>WHO STEPwise Approach to NCD Risk Factor Surveillance</td>
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<td>The Union</td>
<td>International Union Against Tuberculosis and Lung Disease</td>
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<td>TB</td>
<td>tuberculosis</td>
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<td>WDF</td>
<td>World Diabetes Foundation</td>
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<td>WHO</td>
<td>World Health Organization</td>
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Part 1: Policy brief

A. What is the problem?

A1. Why do we need to focus on the integrated care of TB–DM in Asian countries?

The dual burden of tuberculosis (TB) and diabetes mellitus (DM) has become a major global public health concern and a critical public health challenge in low- and middle-income countries (LMICs). Globally, an estimated 10 million new cases, equivalent to 127 cases per 100 000 population, and over 1.5 million deaths occurred due to TB in 2020 [1]. The burden of TB is particularly high in countries of South-East Asia (43%), followed by Africa (25%) and the Western Pacific Region (18%) [1]. Although in recent years, the number of TB cases and deaths has been decreasing in LMICs, TB remains a significant public health burden for many developing countries in Asia. Meanwhile, the burden of noncommunicable diseases (NCDs), including DM, is increasing in both LMICs and high-income countries (HICs). DM was among the top 10 causes of deaths in adults (20–79 years) and, in 2019, it caused an estimated 11.3% of total deaths globally (2). Although a high prevalence of DM can be seen in the Middle East and North Africa (13.9%) and the Western Pacific Region (12.8%) compared to South-East Asia (12.6%) [2], DM poses a significant public health threat to countries in Asia, because these countries are not yet prepared to systematically address the growing burden of DM and other NCDs [3].

The countries studied in this report (Bangladesh, China, India, Indonesia, Nepal and Philippines) face public health challenges due to the emergence of comorbidity of TB with DM [4]. These countries are among the high TB-burden countries in the world, accounting for over 50% of the estimated prevalence of TB worldwide: India (26%), China (8.5%), Indonesia (8.4%), Philippines (6.0%), Bangladesh (3.6%) and Nepal (0.45%) [5].
The prevalence of DM among the adult population (20–79 years) is on the rise in these countries, ranging from 6.2% in Indonesia, to 7.1% in Philippines, 7.2% in Nepal, 9.2% in Bangladesh and China, and 10.4% in India [6].

The high prevalence of TB and DM independently in these countries underscores the potential high prevalence of TB–DM comorbidity. In a 2021 systematic review, the prevalence of TB–DM comorbidity ranged between 11% and 24% in South Asian countries [7]. The growing burden of TB–DM comorbidity in these countries is further compounded by health system-related factors, such as the lack of availability of screening and diagnostic facilities, insufficient supplies of second-line anti-TB drugs, shortages of trained personnel, and lack of facilities designed to prevent transmission of mycobacteria among persons with DM. Patient-related factors include lack of access to care, diagnosis and completion of treatment [4]. Addressing this growing threat of TB–DM comorbidity would require a multifaceted approach and collaboration across government departments, the private sector and professional bodies.

Awareness now exists about the possible consequences of TB–DM comorbidity in almost all Asian countries with a high TB–DM burden. Although the delivery of integrated TB–DM care has been considered to mitigate the growing burden of TB–DM comorbidity, there are still many questions to be addressed. In this policy brief, we present insights gained from literature reviews, available policy and research documents and exploratory studies conducted among relevant stakeholders in the six case study countries.

B. What do we know so far?

B1. The need for TB–DM integrated care is well accepted by multiple stakeholders

While there is no consensus on how TB–DM integrated care can be delivered or integrated within the existing health-care systems, the need to address the growing burden of TB–DM comorbidity is gaining recognition from global public health communities, policy-makers and international agencies. To mitigate the growing threat of TB–DM comorbidity, the World Health Organization (WHO) and the International Union Against Tuberculosis and Lung Disease (The Union) launched a “Collaborative framework for the care and control of tuberculosis and diabetes” in 2011 [8]. The main recommendations include policy strategies for routine
implementation of bidirectional screening of the two diseases and establishment of mechanisms for collaboration between TB and DM control programmes.

To further support integrated care for TB and DM, The Union and the World Diabetes Foundation (WDF) developed technical guidelines on the management of DM–TB in 2019 [9]. With support from international bodies, in the past few years, several case study countries have incorporated targeted policy measures and explored a few programmatic models to address TB–DM comorbidity within their own health-care context.

**B2. A wide range of health systems measures is in place to address TB–DM co-morbidity in these six Asian countries**

We found that the case study countries took different measures to address TB–DM comorbidity within their existing health-care systems. All countries recognized the importance of prevention and management of TB–DM comorbidity in the national policy documents, such as the policy strategies for national TB control programme (NTP) and the national NCD or DM control programme. However, developing policy measures to initiate programmes for bidirectional screening to ensure access to diagnosis and availability of essential TB–DM medications varied across the case study countries. In general, the range of policy measures developed, and the progress made in implementing any measures within the health-care system correlated with the economic development of the country. More developed nations (i.e., China, India) tend to make significant progress towards an integrated TB–DM care than less developed nations, which are still in the very early stages of developing national policies and service provisions for TB–DM comorbidity.

**B3. Challenges to integrated TB–DM care in these six Asian countries**

While countries are at different stages of developing policies and programmes for TB–DM integrated care, difficulties and challenges remain. These challenges vary according to the country, the health system, and the scope of the existing TB and NCD control programmes. The key challenges identified are as follows:

1. Inadequate government and leadership support and inadequate funding to support the development and implementation of TB–DM integrated care
2. Lack of specific guidelines and/or programme implementation plans for screening, testing, diagnosis and treatment of TB–DM comorbidity

3. Inadequate consultation and engagement of broader stakeholders in the process of developing national policies and strategies for TB–DM integrated care

4. Limited effort for provision of bidirectional screening, treatment and follow-up mechanism within the primary health-care system in most of the case study countries, except China and India

5. Insufficient coordination and communication between different stakeholders, including programme managers working in TB and DM programmes, between public and private service providers of TB/DM programmes, and between different sectors of government (i.e. central, provincial and local government)

6. Lack of availability of trained human resources to deliver integrated TB–DM care. Also, capacity-building initiatives are lacking to train health-care workers on the co-management of TB–DM within the TB or DM programmes

7. Limited attention and resources to address geographical barriers to TB–DM service delivery, particularly for those living in rural and remote island areas

8. Poor knowledge about the relationship between TB and DM, and limited awareness about the co-management of TB–DM at the population as well as the health systems level

9. Lack of provision for documenting/recording and reporting of TB–DM comorbidity within the current primary health care systems of most case study countries.
C. Policy options for countries to consider

Considering the available literature as well as the six country case studies, the following policy options have been recommended. However, each recommendation must be considered within the context and health system of the specific country.

1. Design and conduct a contextualized needs assessment for integrated TB–DM care

These case study countries of Asia that are facing an increasing problem of TB–DM comorbidity have taken country-specific initiatives to address the problem. However, substantial differences exist across these countries in terms of situation and factors such as economic development, education, culture, geography, health service delivery, and social and cultural contexts. These countries need to carefully consider these contextual factors while designing and implementing integrated care for people with TB–DM comorbidity.

Addressing these contextual factors would help to reduce inequities in access to health care. Equitable access should also consider the use of disaggregated data to identify vulnerable groups and prioritize health-care delivery programmes. In addition, technological advancement and the related disparities across the geography and population should also be considered to support and standardize the use of health technologies across primary health care systems. Mitigating individual or societal barriers would also accelerate access to health care. Since the governments of these countries are at different stages of designing and implementing TB–DM-related policies, strategies, guidelines, programmes, allocating resources and building the capacity of health-care workers, thoughtful consideration must be given to addressing the relevant contextual factors while developing and strengthening TB–DM integrated care in these countries.

2. Need to strengthen primary health care systems for TB–DM management

Although the case study countries of Asia are willing to establish integrated TB–DM care at the primary care level, there is a need for rigorous evaluation of contextual- and health system-level complexities that will enable or hinder the establishment and/or strengthening of TB–DM care. Establishing periodic and performance-based evaluation systems is a
promising approach that could be explored. In line with the policy priority for TB–DM integrated care, all case study countries should prioritize the development of a clearly outlined service delivery guideline to address the problem of TB–DM comorbidity and its associated risk factors (tobacco use, harmful use of alcohol, physical inactivity and unhealthy diet). Also, a clear treatment protocol for the clinical management of patients with TB–DM at the primary care level would be necessary. To reinforce and strengthen integrated TB–DM care at the primary care level, there is also a need for linking primary health care facilities with the nearest district and tertiary-level hospitals that would provide specialized health-care services. Functional collaborations between these primary care levels and district or tertiary-level health facilities are essential for developing effective TB–DM management plans, screening and diagnosing TB–DM, delivering services, and establishing effective referral and follow-up mechanisms. Horizontal integration of TB–DM services across levels of care would be useful to ensure effective management, avoid complications and improve outcomes. Examples could be followed from the structure of current HIV/TB programme operations in the case study countries. Further, a strong commitment from the primary health care system and its leadership is essential to advocate for an integrated TB–DM programme to combat the growing problem of TB–DM comorbidity in these countries.

3. **Need to vitalize TB–DM management through strong policy and financial support**

A few case study countries (China, India and Indonesia) in recent years have already initiated TB–DM integrated care within the primary health care system. While these countries would need to revitalize their existing services, others would need to develop TB–DM integrated care with up-to-date service delivery guidelines, assure necessary funding, provide bidirectional screening, and ensure the steady supply of medication, technologies and logistics. These countries also need to develop effective mechanisms, with a focus on electronic data collection and data integration, for documenting TB–DM programmes, reporting, referral and follow up of those with TB–DM. Further, to strengthen and sustain TB–DM integrated care in these countries, there is a need to review and update the overall health systems policy and financing mechanisms, particularly to promote TB–DM integrated care. As the private sector in these case study countries has also been contributing significantly to the delivery of TB- and DM- related services, it is essential to involve them in the planning, establishment and delivery of integrated TB–DM care at the
primary care level. Establishing regulations and programmes to boost the private sector’s role in TB–DM co-management and ensuring effective referral (private–public) mechanisms would facilitate strong public–private partnerships. Further, there is a need for functional collaborations with international agencies and academic institutions to establish and strengthen integrated TB–DM care at the primary care level.

4. Need for public education to increase societal acceptance of TB–DM integrated care

Improving health literacy among the general population, particularly focusing on TB–DM prevention and care, would be useful to gain public support for integrated TB–DM care in these case study countries. Community engagement/participation in any ongoing TB–DM integrated service delivery would ensure ownership and sustainability of the programmes. To increase community awareness of TB–DM service delivery, primary health care centres need to integrate community-based diabetes screening initiatives alongside TB symptom screening activities. Further, to establish and strengthen integrated TB–DM care, it is important to enhance societal acceptance of these programmes, inculcate shared values among community members, and recognize contributions made by the community health workers (CHWs) and other allied health-care providers.

5. Need for multisectoral collaboration to combat TB–DM comorbidity

Multisectoral collaboration is an integral part of health programme planning, implementation and evaluation. It is important that different governmental and nongovernmental sectors have functional collaboration to establish and deliver integrated TB–DM care in these case study countries of Asia. Intersectoral action for health can entail enhanced collaboration among various components of the health system. Agencies such as agriculture, education, social and economic development, and industry and commerce could play critical roles in improving the health behaviours of the general population and those at risk of developing TB only or DM only or both. Further, information and communication technology, which has developed substantially over the past decade, could also play a pivotal role in enhancing access to TB–DM-related health information and available resources as well as in the dissemination of relevant policies and guidelines.
6. **Need for continuous data gathering and operational research**

Investing in research to integrate data from existing sources and conducting research to gather additional data on TB–DM comorbidity would provide guidance for programme planning and improvement. Improving routine data collection and surveillance systems to include TB–DM is important, with a particular focus on data quality, and streamlining systems to relieve some of the burden associated with data collection. Also, collection of disaggregated data by socioeconomic variables should be considered to assess equity. There is also a need to prioritize research activities targeting areas or populations with a high burden of disease. Priority should be given to operational research examining the implementation of integrated management of TB–DM. We also need to understand TB–DM comorbidity as a public health problem. This requires exploring health system-related factors, patient and provider interactions, and socioeconomic factors that play critical roles in the successful management of TB and DM. Health service research and anthropological research employing qualitative and quantitative methods can be helpful in this direction.
Part 2: Working paper

1. Introduction

The dual burden of TB and DM has become a major global public health concern and a critical public health challenge in LMICs [4,10,11]. Worldwide, annually, there are an estimated 9.6 million new patients with active TB [1] and, of them, 1 million have both TB and DM (TB–DM) [12]. The bidirectional associations between TB and DM are well established. In a recent systematic review, the prevalence of TB ranged from 1.7% to 36% in persons with DM, and the prevalence of DM ranged from 1.9% to 35% in patients with TB [13]. Evidence also shows that DM triples the risk of developing TB, and rates of TB are higher in people with DM than in the general population [14,15]. DM is also associated with adverse TB treatment outcomes [15]. With many countries around the world undergoing epidemiological transition, current predictions indicate that the number of people with DM will reach 552 million by the year 2030 [16]. Approximately 80% of these cases will be in LMICs, where TB prevalence is high [8]. If the current DM epidemic continues to increase as predicted, TB incidence is estimated to decrease by less than 10% by 2030 – way lower than the target of 80% proposed by the World Health Organization (WHO) End TB Strategy [17], underscoring an urgent need to strengthen health-care systems to address these two diseases.

1.1 TB–DM comorbidity in Asian countries: a growing public health problem

East, South and South-East Asian countries focused on in this report (Bangladesh, China, India, Indonesia, Nepal and Philippines) face public health challenges due to the emergence of TB–DM comorbidity [4]. These countries are among the high TB-burden countries in the world. At the same time, the prevalence of DM and related mortality is on the rise in these countries. Global estimates show that the prevalence of diabetes among those with TB in countries of the Western Pacific Region is 19.4% and
South-East Asia is 19% [4]. Limited information is available in terms of the prevalence of TB among people with DM in the region; however, a recent study showed that the prevalence of TB among those with DM in countries of Asia was 4.16% [18]. This growing burden of TB–DM comorbidity in countries of South and South-East Asia is further compounded by health system-related and patient-related factors such as lack of policies and strategies, inadequately trained human resources, poor access to TB–DM care, unavailability of screening and diagnostic facilities (i.e. chest X-ray), and poor rates of treatment completion [4]. While all the target countries are facing a challenge from the growing burden of TB–DM comorbidity, each country has its own epidemiological pattern and contextual factors.

Bangladesh is a high-burden country for TB with an incidence of 218 per 100 000 population for all types of TB in 2020 [1]. TB prevalence is higher in urban than rural areas. Multidrug-resistant TB (MDR-TB) is also emerging as a public health challenge. Based on the national TB drug resistance survey in 2010–2011, the prevalence of MDR-TB among new cases was 1.4% and the prevalence of MDR-TB in previously treated cases was 28.5% [19]. At the same time, the prevalence of DM is also on the rise among adults in both urban and rural areas. According to the 2018 national survey [20], 8.4% of the adult Bangladeshi population (18–69 years of age) had a raised blood glucose level, including 3.0% who were on medication for DM. The growing DM epidemic increased the prevalence of TB–DM comorbidity at the population level. Based on several recent studies, the prevalence of DM in TB patients ranged from 8.3% in 2014 [21] to 12.8% in 2016 [22] and 12% in 2020 [23].

China is a high-burden country for both TB and MDR-TB with an estimated 842 000 TB patients (incidence of 59 per 100 000 population) and 16 343 laboratory-confirmed MDR-TB patients in 2020 [1]. On the other hand, the prevalence of DM increased from less than 1% in 1980 [24] to 12.8% in 2018 [25]. The increase in prevalence of DM suggests a potentially alarming rise in the number of TB–DM patients at the population level. The prevalence of DM in TB patients ranged from as low as 1% in 1980 [26] to 7.2% in 2013 [27] to 11.03% in 2020 [28]. Based on a WHO report, the prevalence of TB among patients with DM in China is about 958 per 100 000 population, which is much higher than that in the general population without DM (78 per 100 000) [29].

India has the highest burden of TB in the world with an incidence of 188 per 100 000 population in 2020 [1]. Even with a rapid epidemiological transition in recent years, TB remains in the top five list of causes of
disability-adjusted life years (DALYs) as per the global burden of disease data for 2019 [30]. India is also experiencing an increase in the number of persons with MDR-TB; the number of diagnosed MDR-TB cases increased from less than 30,000 in 2015 to almost 50,000 in 2020 [1]. On the other hand, DM has become a major public health threat in India with an estimated 77 million patients with diabetes and more than 1 million DM-related deaths in 2019 [31]. The prevalence of DM among the adult population is 10.4% [32] with variations across states [33]. The prevalence of diabetes among TB patients in India ranges between 12.39% [34] and 44% [35], with variations across states [35–40].

Indonesia is the third highest TB-burden country after India and China and contributes to 8% of global TB incidence. With an incidence of 301 per 100,000 population in 2020, TB in Indonesia is the fourth leading cause of death whereas among individuals aged 15–49 years, it is the number one cause of death [1]. On the other hand, with a prevalence of 6.2%, about 10.7 million adults (aged 20–79 years) were living with DM in 2017 [32], making DM the third major cause of death in 2020 [41]. However, the prevalence of DM may be higher because the majority of the people with DM remain undiagnosed [32]. The reported proportion of DM in patients with TB in Indonesia ranged between 5.2% and 70.4% [42,43], whereas the reported proportion of TB among DM patients ranged from 1.2% to 27.1% [44,45].

Philippines continues to be a high TB-burden country with an incidence of 539 per 100,000 population in 2020 [1]. At the same time, the prevalence of DM (based on a blood sugar level cut-off of 126 mg/dL) increased from 4.2% in the Seventh National Nutrition and Health Survey (NNHS) in 2009 to 5.4% in the Eighth NNHS in 2013 [46]. Based on data from the International Diabetes Federation (IDF), the overall DM prevalence increased from 3% in 2003 to 9.65% in 2012 [47]. However, the prevalence of DM may be higher because the majority of people with DM remain undiagnosed [48].

In Nepal, TB remains a major public health problem with an incidence of 235 cases per 100,000 population in 2020 [1]. At the same time, the prevalence of DM is also on the rise in Nepal. According to a recent STEPS survey (STEPwise Approach to NCD Risk Factor Surveillance), the proportion of adults with raised blood sugar levels increased from 3.8% in 2013 [49] to 5.8% in 2019 [50]. Although limited studies have been conducted on the epidemiology of TB–DM in Nepal, the available evidence suggests a high prevalence of DM among TB patients, ranging between
6.6% [51] in 2008 and 11.9% in 2019 [52]. The prevalence of TB among patients with DM ranged from 0.1% in 2010 [53] to 8.6% in 2015 [54].

1.2 Health systems responses to address TB–DM comorbidity in the selected six Asian countries

The need for addressing the growing burden of TB–DM comorbidity is gaining recognition from global public health communities, policy-makers and international agencies. Within this context, the literature on TB–DM co-management is evolving as multiple studies are being conducted globally and among Asian countries in the past few years where a few programmatic issues are being discussed for TB–DM management in LMICs. To address the growing threat from the co-epidemic of TB–DM, WHO and The Union launched a “Collaborative framework for care and control of tuberculosis and diabetes” in 2011 [8]. The main recommendations include the implementation of routine bidirectional screening for the two diseases and establishment of mechanisms for collaboration between the TB and DM control programmes. To further support integrated care for TB and DM, The Union and the World Diabetes Foundation (WDF) developed technical guidelines, Management of diabetes mellitus–tuberculosis, in 2019 [9]. It was argued that an integrated service would mitigate policy-level barriers by bringing together programmes that each address a single health problem, and at the operational level by ensuring that scarce resources are used as efficiently as possible [8,9]. However, to date, no standardized systems have been established to ensure provision of integrated public health and primary care services for patients suffering from communicable (i.e., TB) and noncommunicable diseases (NCDs, i.e. DM) in Asian countries. This might be due to the limited knowledge of how care for NCDs (such as DM) can be integrated into well-established communicable disease control (such as TB) services (or vice versa) in ways that are acceptable to both patients and providers and feasible to implement within the current (or reformed) health-care system. While the selected Asian countries have incorporated targeted policy measures to address TB–DM comorbidity within their own context, these countries also need to explore possible mechanisms for an integrated care model for the management and control of TB–DM comorbidity. In section 3 (point #2), we have elaborated the current TB–DM-related programmes and services in each of the case study countries.
2. Methods

2.1 Goals and research questions

The overarching goal of the current study was to examine health system efficiencies in integrated public health and primary care for communicable diseases and NCDs, with TB–DM as an illustration for such integration, in the selected six South and South-East Asian countries. This study aimed to answer the following research questions:

1. What are the current practices for addressing NCDs within communicable disease control programmes (i.e. TB) in the region and in the selected countries?
2. What are the current practices for addressing TB–DM comorbidities by TB and DM control programmes in the selected countries?
3. What are the challenges and opportunities at the individual, health systems and policy levels for the integrated care of TB–DM comorbidities?
4. What is the extent to which geographical locations (rural versus urban), gender (male versus female), socioeconomic status (rich versus poor) or disease condition (i.e. TB) pose a barrier to integrated TB–DM care?

2.2 Research design overview

To achieve the overall objectives of this study, we took a common methodology framework across the six countries. These included: (i) situation analyses through desk/literature review; (ii) qualitative studies (focus groups and/or in-depth interviews, IDI) to collect in-country data; and (iii) stakeholders’ meetings. Details of the methodological approaches are described in section 2.3 below.
As part of our situation analyses, we conducted a systematic review of integrated care for TB and NCDs in LMICs to summarize the scope of TB–NCD care in different regions/countries, and to inform protocol development for the qualitative research in the present study. The systematic review protocol and the findings are reported elsewhere in more detail [55].

We selected six Asian countries – Bangladesh, China, India, Indonesia, Nepal and Philippines – to conduct the study. These six countries are similar in that they are all among the high TB-burden countries in the world and are confronting an increasing burden of DM-related morbidity and mortality. These countries are also at different stages of developing and/or implementing policy initiatives to address TB–DM comorbidities within the health-care system. We believe that the comparison of research findings in the selected six countries may demonstrate common challenges to and opportunities for addressing TB–DM comorbidities in the Asia Pacific region. We standardized project implementation in all the case study countries to ensure compatibility of findings while allowing adjustments based on the local situation and resources available. Table 1 presents a summary of research activities in each country.
Table 1: Summary of research activities in Bangladesh, China, India, Indonesia, Nepal and Philippines

<table>
<thead>
<tr>
<th>Country</th>
<th>Desk/literature review</th>
<th>Exploratory studies (focus groups, key informant interviews)</th>
<th>Stakeholder meetings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>✔</td>
<td>9 IDIs with policy-makers/key stakeholders; 1 focus group with physician HCWs (n=8), 1 focus group (n=8) with non-physician HCWs</td>
<td>✔</td>
</tr>
<tr>
<td>China</td>
<td>✔</td>
<td>10 IDIs with policy-makers/key stakeholders; 1 focus group (n=4) with HCWs</td>
<td>✔</td>
</tr>
<tr>
<td>India</td>
<td>✔</td>
<td>9 IDIs with policy-makers/key stakeholders; 2 focus groups with HCWs (n=12), 2 focus groups with programme staff (n=12)</td>
<td>✔</td>
</tr>
<tr>
<td>Indonesia</td>
<td>✔</td>
<td>4 IDIs with policy-makers/key stakeholders; 6 IDIs with HCWs</td>
<td>*</td>
</tr>
<tr>
<td>Nepal</td>
<td>✔</td>
<td>6 IDIs with policy-makers/key stakeholders; 12 IDIs with HCWs</td>
<td>✔</td>
</tr>
<tr>
<td>Philippines</td>
<td>✔</td>
<td>4 IDIs with policy-makers/key stakeholders; 2 focus groups (n=10) with HCWs and programme staff</td>
<td>✔</td>
</tr>
</tbody>
</table>

* Our target was to collect minimal data from Indonesia with limited resources, and hence we did not conduct stakeholder meetings.

IDI: in-depth interview; HCW: health-care worker

2.3. Methodological details

The following approaches were taken as a common methodological framework to conduct country-specific studies in the six selected countries.

a. Situation analyses through desk/literature review

Following a common search framework, each country team independently searched and reviewed relevant published articles as well as the grey literature. Articles published during 1990–2020 were searched on the following major online databases: PubMed, Medline, EMBASE, CINAHL.
and Google Scholar. The country team also searched for publications on other relevant local websites, including the local office of WHO, National TB Control Programme, National NCD Control Programme and the Ministry of Health (MoH). Additionally, the country team also hand-searched and reviewed relevant reports, guidelines and policy/strategy documents available locally. The desk review and review of the relevant literature was primarily focused on (i) identifying a full range of approaches to TB, DM and TB–DM comorbidity management, and (ii) evaluation of health systems to identify factors related to the delivery of TB–DM integrated care, including policies and services, organization responsible, sources of funding, human resources involved and challenges.

b. Exploratory studies

To supplement the findings of the review and situation analyses studies, each country conducted exploratory studies, such as IDIs and/or focus groups with a diversified group of participants representing relevant stakeholders involved in TB, DM and/or other communicable disease and NCD services. Participants included health workers (physicians, medical officers, nurses, laboratory technologists, pharmacists, CHWs), policy-makers (officials from the MoH or relevant health departments, programme managers, leaders responsible for TB, DM and NCD services), and representatives of nongovernmental organizations (NGOs, e.g. Diabetes Association, National TB Association). In each country, participants in the exploratory studies ranged in number from 10 to 33. Due to COVID-19-related restrictions, some exploratory studies were conducted virtually by using the Zoom platform. The exploratory study focused on understanding the following aspects: (i) current service provision strategies for TB and DM care independently, and for TB–DM comorbidity; (ii) health systems challenges and opportunities affecting the provision of TB–DM integrated care; (iii) views on rendering integrated services for TB–DM comorbidity; (iv) feasible mechanism within the current health systems that will enable integration or delivery of care for TB–DM comorbidity; and (v) feedback on the training, health workforce and financial needs for TB–DM integrated care. The exploratory studies were conducted by trained graduate-level research personnel under the supervision of the in-country principal investigator. A standardized interview and/or focus group guide was used across the participating countries, while allowing customization in each country based on their local contexts.
c. Stakeholder meetings

Due to the COVID-19 pandemic-related restrictions, stakeholder meetings were conducted in each of the participating countries using the Zoom platform. Besides the in-country research personnel, these meetings were attended by health policy-makers, government officials, NGO representatives, WHO representative, TB/DM programme managers, clinicians from the TB and NCD programmes, and academicians. Participants for the stakeholder meetings were selected purposively based on their current involvement in and responsibilities for the TB control programme, NCD care programme, and research background. The focus of the stakeholder meeting was: (i) to share the initial findings of the situation analyses and exploratory studies; (ii) to gather feedback on the initial findings for further data collection and improvement; and (iii) to discuss the possible mechanisms for integrated TB–DM care within the current health-care delivery systems.

2.4 Conceptual and analytical framework

Based on the comprehensive review of the existing international literature and the approaches being used, particularly in LMICs [56–58], we developed a conceptual framework that could be used in integrating health services for TB–DM prevention and control (Fig. 1). Our conceptual framework focused on multiple dimensions of integration that play complementary roles at the micro level (clinical integration), meso level (professional and organizational integration), and macro level (system integration) to deliver comprehensive services that address the needs of people requiring primary health care services, including TB–DM services [59]. Models of integration between the DM and TB services range from providing referral between services with no shared service provision (least integrated), to providing care for both DM and TB by the same health-care provider (most integrated). We identified five broad categories of integrated TB–DM care, based on how the service user enters the system (Fig. 1), which we have used as the suggested model in this TB–DM study.
To analyse the data obtained from both the situation analyses and qualitative studies conducted in the six selected countries of South and South-East Asia, we used the framework method as recommended by Gale et al. [60], with some modifications. This method is appropriate for synthesizing, comparing and contrasting large-scale textual data across cases using a multidisciplinary research team. The framework approach identifies commonalities and differences in qualitative data before focusing on relationships between different parts of the data, thereby seeking to draw descriptive and/or explanatory conclusions clustered around themes. During the country-level analyses, we followed the four major steps of the framework method: (i) transcription; (ii) familiarization with the interview; (iii) coding; and (iv) developing an analytical framework. Also, WHO’s framework for health systems strengthening, which describes health systems in terms of six building blocks (service delivery, health workforce, information, medical products, vaccines and technologies, financing, and leadership/governance [61]), provided the foundation for the analysis since it is a well-established way to analyse a health system and is useful for identifying health system constraints.
2.5 Ethical considerations

The overall study was approved by the Duke Kunshan University Institutional Review Board (IRB) (Protocol#2020AWL0020). Local IRB approvals were also obtained in each country, as appropriate. Written and/or verbal informed consent forms were obtained from the participants prior to conducting focus groups and/or interviews. Confidentiality of the research data was ensured by the project lead in each of the case study countries.
3. Findings of the study

Major findings from the situation analyses

The key findings obtained from the situation analyses in selected countries are summarized below according to the study objectives. We have presented the countries in alphabetical order throughout the report. The four tables, Table 2 to Table 5, cover the four objectives of the study, respectively.

1. Current practices of addressing noncommunicable diseases within communicable disease (i.e. TB) control programmes

Each country has a measure in place to address the growing problem of NCDs within communicable disease control programmes. These are outlined below according to country and summarized in Table 2.

Bangladesh. The National Tuberculosis Control Programme (NTP), started in 1965, is the main governing body for controlling TB in Bangladesh. The overall vision of the NTP has been to eliminate TB as a public health problem in the country. Since then, the NTP has gone through a series of important policy changes and reforms. Such policies, strategies and activities of the NTP have been formulated in accordance with the National Health and Population Plans and Health, Nutrition & Population Sector programmes. Under the NTP, TB diagnostic and treatment services are available free of cost for all people in the country. Since 1993, the NTP has made remarkable progress in implementing the directly observed treatment, short-course (DOTS) programme throughout the country. The NTP in Bangladesh incorporated the “Stop TB strategy”, an approach recommended by WHO to reduce the burden of TB, in line with global targets and the Millennium Development Goals set for 2015 [62]. The NTP in Bangladesh is responsible for overall policy development, programme
planning and management, coordination of relevant activities and implementation of TB services.

To address the growing problem of NCDs, including DM, in the country, the Government of Bangladesh has developed a range of policies and strategies. From the policy perspective, the “National Strategic Plan for Surveillance and Prevention of Non-Communicable Diseases in Bangladesh” in 2007 is the first official document to recognize the importance of NCD prevention and control in Bangladesh [63]. Following this, the National Health Policy 2011 [64] outlined approaches to integrating services for the prevention and management of NCDs, including DM, at all levels of health-care facilities in Bangladesh. Ongoing NCD-related programmes also prioritize promotion of healthy behaviour, increasing awareness, and health promotion and counselling services. Diabetes has been recognized as an important NCD and provisions have been made to strengthen and orient the health system to address the prevention and control of NCDs through people-centered primary health care and universal health coverage in the Fourth 5-year Health, Nutrition and Population sector Strategic Investment Plan (HNPSIP). Moreover, in recent years, piloting of the WHO-recommended Package of Essential Noncommunicable (PEN) disease interventions has been conducted in some districts/subdistrict levels. Halting the growth of DM has been identified as one of the key priority areas in the Multisectoral Action Plan 2018–2025 for the prevention and control of NCDs in Bangladesh [65]. Further, considering the increasing problem of NCDs in Bangladesh, the Government of Bangladesh in recent years has established NCD corners at the subdistrict level, whose main function is to plan and deliver NCD-related services at the primary health care level [66].
Table 2. Current policies and practices for addressing communicable diseases and noncommunicable diseases in selected Asian countries (Bangladesh, China, India, Indonesia, Nepal, Philippines)

<table>
<thead>
<tr>
<th>Themes/subthemes</th>
<th>Policy focuses and key information</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Communicable diseases (i.e., TB)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Policies and strategies</td>
<td>• Policies and strategies that support delivery of services to prevent and control communicable diseases (i.e., TB)</td>
<td>All countries – adequate*</td>
</tr>
<tr>
<td>TB services</td>
<td>• Existence of services related to communicable disease prevention and control (i.e., TB)</td>
<td>All countries – adequate*</td>
</tr>
<tr>
<td>Human resources for TB</td>
<td>• Availability of trained human resources to deliver TB prevention and control services</td>
<td>All countries – adequate*</td>
</tr>
<tr>
<td>Documenting/recording and reporting of TB services</td>
<td>• Recording, reporting and monitoring of TB prevention and control services</td>
<td>All countries – adequate*</td>
</tr>
<tr>
<td>Referral mechanism</td>
<td>• Existence of an established referral mechanism for TB prevention and control services</td>
<td>All countries – adequate*</td>
</tr>
<tr>
<td><strong>Noncommunicable diseases (i.e., DM)</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| Policies and strategies | • Policies and strategies that support the delivery of services related to the prevention and management of noncommunicable diseases (NCDs) | China, India, Philippines – adequate*  
Bangladesh, Indonesia, Nepal – evolving# |
| DM services | • Existence of services related to prevention and control of common NCDs (i.e., DM) | China, India, Philippines – adequate*  
Bangladesh, Indonesia, Nepal – evolving# |
| Human resources for DM | • Availability of trained human resources to deliver services for major NCDs, including DM prevention and control | China, India – adequate*  
Bangladesh, Philippines – evolving# |
China. The National Health Commission (NHC) of China, formerly the MoH, oversees the national programme for TB prevention and control in China. China made dramatic progress in reducing the overall burden of major communicable diseases (such as smallpox, TB) between 1975 and 1995 [67]. To continue the government’s efforts at TB control, in 1991, China initiated the DOTS programme, which was expanded to cover 100% of the population in 2005. The DOTS programme, led by the Chinese Center for Disease Control and Prevention (China CDC), helped to reduce TB prevalence by almost 50% from 1990 to 2010 [68,69]. However, the challenges of TB control in China continue to include an increase in the number of MDR-TB patients and other patient and health system-level factors [70]. Since 2009, to strengthen China’s TB control efforts, the NHC partnered with the Gates Foundation and developed the “China National Health Commission and Gates Foundation TB Prevention and Control Project” (China–Gates TB project), which was carried out in three phases, from 2009 to 2019 [71]. The China–Gates TB project introduced new policies, tools and service delivery approaches to improve the diagnosis and treatment of TB and MDR-TB. To continue the TB control effort, the NHC issued decrees and guidelines in 2013 and 2016, respectively, to adopt an integrated TB control model: TB-designated hospital in charge of TB diagnosis and treatment; primary health facilities in charge of case management; and CDC in charge of TB surveillance, monitoring and supervision of anti-TB activities [72].
NCDs have become the leading cause of death and disability in China [73], accounting for 85.3% of deaths in urban and 79.5% deaths in rural areas. To address the growing burden of NCDs in the Chinese population, the relevant government bodies (i.e., the National People’s Congress of China, the State Council and the ministries) have formulated a series of laws, regulations and policy documents during the past two decades [74]. In line with these policy initiatives, the government also took several national- and local-level initiatives, such as (i) the Equalization of Basic Public Health Services (EBPHS) policy, 2009 [75], (ii) China’s chronic disease prevention and control workplan (2012–2015) [76], (iii) Healthy China 2030, issued in October 2016, and (iv) medium- and long-term plan for the prevention and treatment of chronic diseases in China (2017–2025), issued on 22 January 2017 [77,78]. These policies and initiatives have been revised time to time [74]. All these newly developed policy strategies opened up the opportunity for integrated care for TB–DM; however, the overall mechanism for such integrated care is not clearly stipulated.

India. In India, public health is considered a “state subject” under the federal system where state governments are responsible for the provision of public health services, both for communicable diseases and NCDs. However, the national government formulates broader policies and programmes related to disease prevention and control [79]. India initiated a TB control programme as early as 1962, which was initially focused on detecting TB cases to provide effective treatment through the establishment of district TB centres and strengthening state TB training and demonstration centres [80]. The programme, then known as National Tuberculosis Programme (NTP) used X-ray as the primary diagnostic tool and administered short-course chemotherapy. The NTP helped to reduce the TB mortality rate to 53/100 000 population in 1993 from 80/100 000 in 1970. Since then, India has been putting in efforts to continuously formulate policies, develop strategies and implement TB prevention and control programmes nationwide. India initiated a programme called the Revised National TB Control Programme (RNTCP) that was initially piloted in a few districts followed by large-scale implementation by 1997–1998 [81]. The RNTCP has achieved and sustained case detection rates of over 70% and treatment success rates of over 85% nationally since 2007 [81]. The most recent policies are the 2012–2017 National Strategic Plan for Tuberculosis Control [82] and the 2017–2025 National Strategic Plan for Tuberculosis Elimination [83]. Following various international guidelines and standards for TB care (i.e. the WHO Guideline for treatment of TB, 2010), India also developed a guideline, namely, Standards for TB care
in India in 2014. In 2019, India released the National Framework for a gender-responsive approach to TB in India [84]; and developed a handbook to facilitate the involvement of elected representatives in TB prevention and control programmes [85]. Since 2006–2007, the RNTCP had also initiated services to address TB/HIV coinfection and drug-resistant TB. Since 2014, policy strategies to address TB and other NCDs (i.e. DM) have also been developed, the most significant being the National Framework for Joint TB–Diabetes Collaborative Activities (2017) collectively developed by the RNTCP and the National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases and Stroke (NPCDCS). The national programme was renamed as National TB Elimination Programme (NTEP) in 2020 with an aim to eliminate TB by 2025.

**Indonesia.** The Directorate General of Prevention and Disease Control (DG PDC) at the MoH is the governing body for delivering TB-related services in the country. Since the implementation of the national TB prevention and control programme in Indonesia in 1984 [86], the government has developed scores of policies to promote the TB control programme nationwide. To further expand the TB control programme, in 1995, the government introduced the DOTS programme as recommended by WHO [87]. In recent years, some key policies and strategies for the prevention and control of TB have been introduced, including “TB Control Regulation, 2016” [88]; “Hospital and Facility Healthcare for Tuberculosis Drug Resistant Act, 2017” to address the increasing burden of MDR-TB [89]; “Patient Charter for Tuberculosis Care, 2019 (adopted by the Alliance of TB Organizations), which clearly states the rights and obligations of TB patients [90]. In 2020, there was also an Agreement to Draft a Presidential Law for TB prevention and control in Indonesia.

Similarly, the Directorate of Non-Communicable Disease, MoH is the regulatory body for NCDs in Indonesia. Diabetes prevention- and management-related services are delivered through the chronic disease management programmes with a family approach at the public healthcare centres and primary health care (puskesmas) levels. These health facilities also provide referral services to secondary- or tertiary-level public or private sector hospitals when needed [91]. Further, basic services focused on diabetes self-management such as health education, counselling and monthly blood glucose monitoring services are also being provided by community-level primary health care centres [92]. Since 2010, the Indonesian government has initiated a chronic disease management programme (Programme Pengendalian Penyakit Kronis-Polanis) targeted
at patients with DM and hypertension, under the Civil Service Health Insurance Scheme. The programme aims to prevent severe complications in patients with chronic diseases and delivers multifaceted interventions involving both pharmacological and non-pharmacological strategies [93]. Following the WHO guidelines, the MoH has adapted parts of the PEN interventions into its public health services at the primary care level since 2011 [94]; however, the effectiveness and impact of these PEN interventions is not yet known [94].

Nepal. Since the Government of Nepal had started the TB control programme in 1931, the NTP under the MoH has acted as the main governing body for TB control in Nepal. Since then, the government has made several policy initiatives to accelerate the programme and the NTP was integrated within the general primary health care system. With support from WHO, the NTP introduced the DOTS programme in 1996, which has been highly successful in terms of TB case detection, diagnosis and treatment. Under the DOTS programme, regardless of the level of health facility, screening, diagnosis, treatment and/or follow-up services are available at the majority of health facilities in Nepal [95]. To ensure continuous TB control efforts, the government has developed several other policy guidelines for TB prevention and control in Nepal, including the recent National TB management guidelines in 2019 [96].

The NCD response in Nepal is led by the Department of Health Services (DoHS), MoH, Nepal. The NCD prevention and control department within the DoHS, in collaboration with other relevant departments and units, is responsible for formulating and implementing NCD-related programmes in the country. In the past decade, a range of relevant policies and strategies for the prevention and control of NCDs have been developed and executed. Some key policies and strategies include (i) the Nepal Health Sector Programme Implementation Plan-1 (2004–2009) [97], (ii) the Government’s National Health Policy 2014 [98], (iii) Nepal Health Sector Programme Implementation Plan-2 (2010–2015) [99], (iv) the Multisectoral Action Plan for the Prevention and Control of Non-communicable Diseases 2014–2020 [100], and (v) the National Health Policy 2019 [101]. These policies have emphasized the strengthening of health systems to address the growing problem of NCDs, including DM. The basic health services package of the Nepal Health Sector Strategy (NHSS) III 2015–2020 [102] incorporates diabetes screening, counselling and laboratory services at all levels of health-care facilities. Also, in line with the NCD Multi-sectoral Action Plan, the Government of Nepal has introduced the WHO PEN in 2016 to promote the early
detection and management of essential NCDs at primary health care-level health facilities. The phase-wise implementation of WHO PEN package interventions is currently ongoing in selected districts of Nepal. The key elements of NCD prevention and control as well as the co-management of NCDs and infectious diseases (i.e. TB) are highlighted in the NHSS III, 2015–2020 and in the National Health Policy 2019.

Philippines. In Philippines, the NTP is under the Infectious Diseases for Prevention and Control Division (IDPCD) of the Department of Health’s Disease Prevention and Control Bureau (DPCB). Since its inception in 1978, the NTP, which works closely with different government offices and private organizations, has made significant advances in improving the quality and extent of its TB control efforts. Over the years, the NTP has implemented different initiatives such as Public–Private mix DOTS, Enhanced Hospital TB-DOTS, Programmatic Management of Drug-Resistant TB (PMDT), TB–HIV collaborative activities, TB in jails/prisons, TB-DOTS certification and accreditation, expansion of TB laboratory services, and community TB care [103]. Within the current national health plan, the long-term goal (by 2035) of the NTP is to reduce the TB burden by decreasing TB mortality and TB incidence by 95% and 90%, respectively.

On the other hand, the response to NCDs comes under the Lifestyle-Related Diseases Division of the Department of Health (DoH) within the umbrella of the DPCB. The major programmes are clustered under the National Policy on Strengthening the Prevention and Control of Chronic Lifestyle Related Non-Communicable Diseases by virtue of the DoH Administrative Order-2011-0003 [104]. According to the Order, the DoH takes the lead in tackling lifestyle-related NCDs and takes steps to ensure that preventive programmes are developed and implemented. However, there is currently no centrally organized system or framework in place to provide health promotion programmes on the scale needed to have a meaningful effect on NCD-related health risk reduction within the communicable diseases programme. The sole integrated programme being implemented in Philippines is the HIV–TB Integrated Programme, which was initiated in 2012 with support from WHO. Some health systems-level factors have been identified as barriers to integration of the HIV–TB programme; these could provide insights for the inclusion of NCDs (i.e. DM) within major communicable disease programmes (i.e. TB). These barriers are: lack of coordination between the TB and HIV programmes, lack of skilled human resources for health, strict requirement for patient privacy and confidentiality, and weak mechanism for programme supervision [105].
2. Current practices of addressing TB–DM comorbidities in TB and DM control programmes

Our findings show that the study countries address TB–DM comorbidities within the existing TB and DM programmes up to a certain extent in different ways. These are outlined below according to the countries and the key aspects are summarized in Table 3.

**Bangladesh.** The health system of Bangladesh is still in its initial stage of policy development and service delivery for TB–DM integrated care. To date, TB and DM services in Bangladesh are provided by two separate vertical programmes within the current health-care system. Upon realizing the impact of TB–DM on health systems [21–23,106–111], and to mitigate comorbid conditions due to TB–DM, the Government of Bangladesh developed a policy guideline, “Bangladesh National Guideline on the Management of Tuberculosis and Diabetes Mellitus comorbidity” in 2016 [112], which recommends: (i) screening for TB among patients with DM; (ii) screening for DM in patients with TB; and (iii) treatment and follow up of TB–DM comorbidity. The guideline described the screening procedures (i.e. sputum for acid-fast bacilli [AFB], Gene X-pert) for patients with suspected DM, and recommended the use of an oral glucose tolerance test (OGTT) for screening of DM among TB cases, but for easy assessment, random plasma glucose could also be used. Further, the guidelines also described the types of medications to be used for patients with TB–DM. However, in a recent call, the NTP has started to enhance coordination and collaboration among diverse stakeholders, including the private sector, hospitals and health facilities, medical colleges, nursing homes, village doctors, pharmacies and drug sellers [113] to improve service delivery for TB–DM comorbidity. In addition, the Multi-sectoral Action Plan for the Prevention and Control of Non-Communicable Diseases (2018–2025) [65] has emphasized the importance of screening for TB as a NCD risk factor to achieve universal health coverage. While all these initiatives are encouraging to prevent and control TB–DM, the lack of a national policy framework for integrated care results in these initiatives having little impact on addressing TB–DM comorbidity in the country.

**China.** Within the current health-care system in China, TB and DM programmes are managed independently. However, since 2009, China has introduced the provision of a national basic public health service (NBPHS) programme, and highlighted the case management of hypertension and DM. The government expanded the package of services over the years.
Since 2016, it includes TB case management in its service package. In the NBPHS project, it was suggested that primary health-care providers should be responsible for screening of TB during the quarterly follow up of patients with DM [114]. Since then, China has announced several policy documents to emphasize the active implementation of screening of and education on TB among the high-risk population, including those with DM. In 2011, with support from WHO and The Union, China piloted the implementation of bidirectional screening programmes for TB–DM in a few selected regions [68] and showed the feasibility and usefulness of the bidirectional screening programme. Since then, China has continued to incorporate the management of TB–DM comorbidity within national policy documents. The importance of TB–DM co-management was emphasized in the 13th Five-Year National Tuberculosis Control Plan issued by the State Council in 2017 [115] and further reiterated in the Action Plan to Stop Tuberculosis (2019–2022) in 2019 [116]. These two plans emphasized the screening of TB among key population groups, including patients with DM. Two other national initiatives, the Central Government’s mid- and long-term plan for the prevention and treatment of chronic diseases (2017–2025) [78] and the Healthy China 2030 Plan [117], also emphasized the importance of TB–DM co-management. The health services for both TB and DM are covered through the NBPHS programme under the package of essential public health services [118]. Despite the existence of these national initiatives as well as the increasing interest among relevant government authorities, specific national regulation and guidance for the management of patients with TB–DM comorbidity in China is not yet in place.
Table 3. Current policies and practices of addressing TB and DM comorbid conditions in selected Asian countries (Bangladesh, China, India, Indonesia, Nepal, Philippines)

<table>
<thead>
<tr>
<th>Themes/subthemes</th>
<th>Policy focus and key information</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policies and strategies</td>
<td>• Stated in the policies and strategies about the importance of prevention and management of comorbid conditions such as TB–DM</td>
<td>All countries – adequate*</td>
</tr>
<tr>
<td></td>
<td>• Developed guidelines and standard operating procedure (SOP) for the prevention and management of comorbid conditions such as TB–DM</td>
<td>Bangladesh, China, India, Indonesia, Nepal, Philippines – evolving#</td>
</tr>
<tr>
<td>TB–DM services</td>
<td>• Existence of services related to prevention and management of comorbid conditions (e.g., TB–DM)</td>
<td>China, India, Philippines – evolving# Bangladesh, Indonesia, Nepal – challenging$</td>
</tr>
<tr>
<td></td>
<td>• Provision of bidirectional testing for DM and TB and vice versa</td>
<td>India – evolving# Bangladesh, China, Indonesia, Nepal, Philippines – challenging$</td>
</tr>
<tr>
<td></td>
<td>• Availability of testing and diagnosis of TB–DM at the primary health care level</td>
<td>China, India – evolving# Bangladesh, Indonesia, Nepal, Philippines – challenging$</td>
</tr>
<tr>
<td></td>
<td>• Availability of essential TB and DM medication free of cost</td>
<td>All countries – evolving#</td>
</tr>
<tr>
<td></td>
<td>• Adequate logistical support and medical supplies for the prevention and management of TB–DM comorbid conditions</td>
<td>India – evolving# Bangladesh, China, Indonesia, Nepal, Philippines – challenging$</td>
</tr>
<tr>
<td>Human resources for TB–DM</td>
<td>• Provision of designated human resources to provide services specific to TB–DM comorbidity</td>
<td>China, India, Philippines – evolving# Bangladesh, Indonesia, Nepal – challenging$</td>
</tr>
<tr>
<td></td>
<td>• Availability of trained human resources to deliver services related to TB–DM prevention and management</td>
<td>China, India, Philippines – evolving# Bangladesh, Indonesia, Nepal – challenging$</td>
</tr>
</tbody>
</table>
India. In India, the management of TB–DM comorbidity is incorporated within its well-established TB and NCD control programmes. To strengthen the earlier TB control strategies, India developed the National Strategic Plan for Tuberculosis Control (2012–2017) [82] and the National Strategic Plan for Tuberculosis Elimination 2017–2025) [83]. Since 2015, after a national stakeholder meeting, India has introduced a national policy and guidelines for mandatory screening of people with TB for DM and vice versa. In 2017, the Government of India developed a collaborative framework for the TB and NCD programmes in the country [119]. The overall goal of this framework was to reduce morbidity and mortality through prevention and bidirectional screening of TB–DM for early detection and treatment. It aimed (i) to improve the diagnosis and management of TB among patients with DM through intensified detection of active TB disease among DM patients, (ii) to ensure that TB infection control measures in health-care settings where DM is managed are in place, and (iii) to ensure the provision of TB treatment and management among patients with DM. While the impact of this framework could be significant in the co-management of TB–DM in India, overall implementation strategies would still need to be strengthened. There are also good approaches for data sharing across TB and NCD settings in India. For example, the TB treatment card under the

Note: Adequate*: availability of policies/services and provisions as per the needs of the country; Evolving#: in the process of developing policies, services and provisions as per the needs of the country; Challenging$: very early stage of developing policies, services and provisions.

### Table 3. Current policies and practices of addressing TB and DM comorbid conditions in selected Asian countries (Bangladesh, China, India, Indonesia, Nepal, Philippines) (contd)

<table>
<thead>
<tr>
<th>Themes/subthemes</th>
<th>Policy focus and key information</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Documenting/recording and reporting of TB–DM services</td>
<td>• Incorporated TB–DM into the national reporting systems</td>
<td>India – evolving# Bangladesh, China, Indonesia, Nepal, Philippines – challenging$</td>
</tr>
<tr>
<td></td>
<td>• Recording, reporting and monitoring of TB–DM comorbid conditions and services</td>
<td>China, India, Philippines – evolving# Bangladesh, Indonesia, Nepal – challenging$</td>
</tr>
<tr>
<td>Referral mechanism</td>
<td>• Existence of established referral mechanism for TB–DM comorbid conditions and services</td>
<td>China, India, Philippines – evolving# Bangladesh, Indonesia, Nepal – challenging$</td>
</tr>
</tbody>
</table>
TB control programme and the Nikshay online TB surveillance system have the facility to capture information on diabetes status. The TB control programme reports the number of TB patients screened and the number of confirmed patients with DM, and the report is shared with the district and state NCD cells. On the other hand, the NCD control programme reports the number of patients with DM assessed for TB and the number of patients with DM with confirmed TB, and the report is shared with the district TB officer and the state TB cell.

**Indonesia.** In Indonesia, TB–DM comorbidity has recently been recognized as a significant public health burden and the Government of Indonesia has developed policies and guidelines to address the problem. The national TB programme and the NCD programme operate independently in Indonesia with separate financial planning and information systems; therefore, these programmes are monitored and supervised by two different directorates in the MoH. In recent years, each programme has focused on addressing TB and/or DM within the scope of its updated service delivery guidelines for TB (i.e. Indonesia National TB Programme in 2020–2024) [89] and NCD (i.e. Management Guideline for NCDs in Indonesia 2019) [120]. These guidelines incorporated evidence-based information on TB–DM co-management and emphasized the importance of bidirectional screening and diagnosis. Also, the government recognized the importance TB–DM co-management and this has been reflected in its policy guidelines. Article 5 of “The Regulation of Ministry of Health No. 67 (2016)” described the provisions for TB control and recognized DM as an important risk factor for TB infection and suggested the provisions for integrated care [89]. Additionally, Decree No. HK.01.07/MENKES/755/2019, section VI of the MoH introduced the national guidelines for TB treatment among patients with DM. It described the screening of and diagnostic pathways for TB among DM patients and vice versa [89]. In 2015, Indonesia developed a national collaborative framework to engage both internal and external partners in the co-management of TB–DM [121] where all service units for both TB and DM are involved. Good administrative management, communication and routine evaluation were identified as important ingredients of the collaborative framework. Also, the NTP 2020–2024 reflects the integration of TB screening among DM patients and the elderly population in health-care facilities and nursing homes. The initiative is expected to gradually expand TB testing to all DM service facilities by implementing an integrated DM–TB service delivery approach (personal communication with the MoH). Further, the Consensus guidelines from the Indonesian Association of Endocrinology for adults with type 2
DM provides treatment protocols for DM, as well as those with TB–DM comorbidity [122]. While all these national guidelines realized the growing burden of TB–DM comorbidity and considered the need for TB–DM co-management, details that describe implementation strategies for TB–DM co-management within the existing health-care systems are lacking.

**Nepal.** The importance of TB–DM comorbidity was first identified by the NTP in 2016/2017 where the focus was to expand TB diagnosis among vulnerable groups within the health services, including those with DM [123]. The 2016 National Strategic Plan for TB prevention recommended that prompt measures be taken for screening, diagnosis and management of TB among those with DM [124]. The recently introduced National TB Management Guidelines 2019 provides guidance for the systematic screening of DM among TB patients and management of TB–DM coinfection [96]. The guideline included: (i) protocols for DM screening in TB patients; (ii) protocols for TB screening in people with DM; and (iii) guidelines for the treatment of TB–DM coinfection [96]. While these guidelines considered the co-management of TB–DM, they have not yet been implemented effectively, suggesting the critical need for strengthening the implementation aspects of these strategies and guidelines. There is also a lack of recording and reporting of institutional data from the private sector, which has also been providing TB- and DM-related services in Nepal.

**Philippines.** In Philippines, as the country’s main public health government body, the DoH leads national efforts to prevent and control TB, DM and TB–DM comorbidity. At the different levels of health service delivery, the DoH offers both DM and TB care in parallel. While there are existing policies and guidelines for both DM and TB service delivery in Philippines [125–128], there were no guidelines available until mid-2020 for integrated TB and DM care [125]. These independent TB and DM guidelines recognize that the NTP and Diabetes Management Programme (DMP) are in parallel, which hinders the provision of services using an integrated health service delivery system. The implementation of TB as a communicable disease, and DM as an NCD have different implementation methods at all levels of health service delivery and should be collaborative by engaging all relevant stakeholders. However, the most recent (2020) guidelines of the DoH, entitled *Guidelines on integrating existing protocols on tuberculosis (TB) and diabetes mellitus (DM) case finding and management activities* [125], sought to integrate the existing protocols on screening and management of cases with TB and DM, as well as define the roles and responsibilities of various stakeholders. The guideline covers nine components where
the NTP and NCD programmes converge. It specifies the bidirectional screening algorithm and provides details on the recording and reporting mechanisms for patients with both TB and DM. Even though the TB–DM integrated guidelines have been developed and introduced at the national level, little effort has been made to introduce and effectively implement TB–DM integrated care programmes at the primary care level. This has affected the delivery of health services in terms of screening, diagnosis, treatment and referral of patients with TB and DM at the primary care and community levels in Philippines. Such disconnect between guidelines development at the policy level and the implementation of services both at the primary care and community levels raises questions on the need for making concerted efforts to translate policies into practice at the population level.

3. Challenges and opportunities at the individual, health systems and policy levels for integrated care of TB–DM comorbidities

Through the situation analyses and different approaches to data collection, several challenges to the prevention and management of TB–DM comorbidities have been identified across the focused countries. These are outlined below by country and summarized in Table 4.

**Bangladesh.** Like other South-East Asian countries, Bangladesh faces several challenges to preventing and controlling TB–DM comorbidity. These include a lack of policy initiatives to address TB–DM within primary health care settings; inadequate funding to institutionalize TB–DM services; inadequate attention to bidirectional screening for DM and TB in ongoing health service delivery; and complexities in the provision of free-of-cost health services for patients with TB and DM. Further, the country faces other key challenges to integrated care for those with TB–DM, which include unavailability of services at the primary care level; lack of awareness about TB–DM among the public as well as frontline health workers (i.e. CHWs), inadequate recording and reporting of services being provided by the private health-care sector, and limited effort to integrate data from multiple sources, specifically data from the TB and DM services. In Bangladesh, the services for TB–DM prevention and control are being provided by the public sector, private sector and by NGOs. Inefficiency in coordination and communication within the respective sectors and across all sectors has been another important challenge to implementing integrated TB–DM care in the country.
China. Over the past several years, China has been facing several challenges to prevent and control of TB–DM comorbidity. Despite the government’s efforts to provide essential health-care services free of cost, people with TB and DM often need far more health-care services than essential medicines and tests. Hence, they are forced to pay most of the cost from their own pockets [129–131]. Given the catastrophic health costs for TB–DM care, many patients with comorbid conditions are unable to adhere to treatment [132]. Although there are three basic types of medical insurance in China, which have almost covered the entire Chinese population with a goal of providing financial protection for all enrollees, the distribution of benefits between the rich and the poor has not been equitable [133] and there are still challenges regarding out-of-pocket payments [134]. Also, despite the rapid increase in the prevalence and economic burden of DM and its complications as well as the existence of cost-effective interventions [135], a national strategy or a special financing mechanism to meet these challenges is still insufficient. The patients with a lower socioeconomic status (SES) experience worse clinical outcomes than those with a higher SES, underscoring the existence of inequity in the health-care system [136].

Regarding the integration of TB–DM care within the current health-care system, China has been facing complex challenges. Problems such as an absence of coordination between the TB delivery system and NCD care, insufficient intersectoral plans and actions, and isolated computer networking systems in many settings have not been updated to include other disease management programmes [137,138]. In recent years, China has taken the initiative to integrate TB–DM data (in terms of screening, recording, reporting and data management) from multiple sources. However, there is a lack of effort to collect disaggregated data (i.e. according to age, region, SES) within the national surveillance systems. Further, China’s health-care system emphasizes extensively on hospital care while limited resources or attention is given to primary health care providers or the public health sector [139]. This uneven delivery system has further made it difficult to deliver cost-effective integrated TB–DM services in China. Furthermore, the shortage of trained health-care providers, particularly at the community level and rural areas, makes it difficult to train and retain health-care workers for TB–DM care [140].
Table 4. Barriers and challenges to the prevention and control of TB–DM in selected Asian countries (Bangladesh, China, India, Indonesia, Nepal, Philippines)

<table>
<thead>
<tr>
<th>Themes/subthemes</th>
<th>Challenges and barriers</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policies and strategies</td>
<td>• Policies and strategies to prevent and control TB–DM are developed in a top–down manner without wider consultation at the grassroots level</td>
<td>Bangladesh, Indonesia, Nepal, Philippines</td>
</tr>
<tr>
<td></td>
<td>• Inadequate engagement of broader stakeholders in the process of developing policies and strategies</td>
<td>Bangladesh, Indonesia, Nepal, Philippines</td>
</tr>
<tr>
<td></td>
<td>• Lack of specific guidelines and/or implementation plans in terms of screening, testing, diagnosis and treatment of TB–DM comorbidity</td>
<td>Bangladesh, Indonesia, Nepal, Philippines</td>
</tr>
<tr>
<td></td>
<td>• Lack of access to chest X-ray to screen for TB among patients with DM</td>
<td>Bangladesh, Indonesia, Nepal, Philippines</td>
</tr>
<tr>
<td></td>
<td>• Insufficient coordination and communication between stakeholders and between the central, provincial and local government levels in terms of implementation of policies</td>
<td>Bangladesh, India, Indonesia, Nepal, Philippines</td>
</tr>
<tr>
<td>Human resources</td>
<td>• Unavailability of trained human resources specifically for TB–DM</td>
<td>All countries</td>
</tr>
<tr>
<td></td>
<td>• Lack of capacity among frontline health workers (i.e. CHWs) to deliver TB–DM services</td>
<td>All countries</td>
</tr>
<tr>
<td>Financing for TB–DM</td>
<td>• Lack of budget allocation for prevention and control of TB–DM comorbidity</td>
<td>Bangladesh, Indonesia, Nepal, Philippines</td>
</tr>
<tr>
<td></td>
<td>• Lack of coordination and communication between/among partners in terms of allocation of funds/resources and management</td>
<td>Bangladesh, Indonesia, Nepal, Philippines</td>
</tr>
</tbody>
</table>
Table 4. Barriers and challenges to the prevention and control of TB–DM in selected Asian countries (Bangladesh, China, India, Indonesia, Nepal, Philippines) (contd)

<table>
<thead>
<tr>
<th>Themes/subthemes</th>
<th>Challenges and barriers</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service delivery for TB–DM</td>
<td>• Unavailability of TB–DM integrated services at primary care levels, such as bidirectional screening, treatment and follow up</td>
<td>Bangladesh, Indonesia, Nepal, Philippines</td>
</tr>
<tr>
<td></td>
<td>• Inadequate recording and reporting systems</td>
<td>Bangladesh, Indonesia, Nepal, Philippines</td>
</tr>
<tr>
<td></td>
<td>• Lack of effort to integrate TB–DM-related data from multiple sources</td>
<td>All countries</td>
</tr>
<tr>
<td></td>
<td>• Lack of coordination and communication between/among central and peripheral level health-care providers</td>
<td>All countries</td>
</tr>
<tr>
<td></td>
<td>• Lack of coordination and collaboration with partners and stakeholders in terms of TB–DM service delivery</td>
<td>All countries</td>
</tr>
<tr>
<td></td>
<td>• Insufficient supervision, monitoring and evaluation systems and practices</td>
<td>All countries</td>
</tr>
<tr>
<td>Remoteness and public awareness</td>
<td>• Geographical barriers to TB–DM service delivery, in particular, difficult for those living in rural and remote island areas</td>
<td>China, India, Nepal, Philippines</td>
</tr>
<tr>
<td></td>
<td>• Lack of awareness and poor health literacy at systems and population levels regarding prevention and control of TB–DM comorbidity</td>
<td>Bangladesh, India, Indonesia, Nepal, Philippines</td>
</tr>
<tr>
<td></td>
<td>• Misconception and stigma towards TB–DM</td>
<td>Bangladesh, India, Nepal</td>
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</tbody>
</table>

**India.** India, over the past several years, has been able to develop key policies and strategies that address TB–DM and has been implementing TB–DM services. However, India faces several challenges at systems and service delivery levels. These include an inadequate number of trained human resources; poor knowledge of TB–DM guidelines among frontline health-care providers; lack of adequate funding for TB–DM prevention and care; improper alignment of policies and strategies being formulated by the
Central Government and state governments; variation in implementation of strategies for TB–DM services across states; inadequate supply of logistics, testing facilities and medications to manage DM independently or DM among TB patients at community level [141,142], and poor access to and utilization of TB–DM services among people living in rural and remote areas [143,144]. Given the cost associated with TB–DM services, particularly DM-related services, people with a low SES and vulnerable populations have not been able to access and utilize TB–DM services as needed. There are some variations in terms of use of services by gender, where males in India are more likely to use TB–DM services compared to females [144]. However, the available data indicate that females show better outcomes once treated, probably attributable to the increased treatment adherence due to better support from DOT providers who are mostly female [143]. Although India has taken the initiative to integrate TB–DM data (in terms of screening, recording, reporting and data management) from multiple sources to better assess the burden of TB–DM, there is a lack of effort to collect disaggregated data according to socioeconomic variables. Since more patients with TB in India undergo DM screening than vice versa [144], a number of patient-level barriers to integrated management of TB–DM have been identified. These include stigma, poor awareness about TB only or DM only or TB–DM comorbid conditions, low health literacy, low testing rate, poor adherence to medication, lack of family/social support, and unhealthy behaviours. With these, women face more social challenges when diagnosed with TB than men [142,145–147].

**Indonesia.** In Indonesia, policies and programmes related to TB and DM prevention and control have been developed in a top–down (vertical) manner rather than bottom–up. Several challenges to the prevention and control of TB–DM comorbidity were identified. These include limited budget allocation; lack of trained human resources for TB–DM screening, diagnosis and treatment; poor knowledge about TB–DM co-management or related guidelines among frontline health workers; low spending in relevant health-care sectors (i.e. in TB- and NCD-related programmes); minimal attention to integrating TB–DM-related data (i.e. screening, recording, reporting and data management) from available sources, and lack of effective strategies and programme implementation plans at district and peripheral levels to prioritize and implement TB–DM programmes. Lack of coordination and effective partnership with the private and nongovernmental sectors are also being considered as challenges to integrated care for TB–DM in Indonesia. Further, low awareness of, misconceptions and stigma towards those with TB–DM have
also been identified as persistent challenges, which are more common among people in the low socioeconomic groups and those living in rural areas. The human resources involved in the delivery of health and related programmes (including communicable diseases and NCDs) at different levels in Indonesia are CHWs/paramedics, nurses, medical care providers/doctors and community health volunteers. The Province Health Office (PHO) and district health offices (DHO) have dedicated human resources for the TB programme. In each PHO and DHO, there is provision for a TB programme manager/vice supervisor also known as “Wasor”, who are civil servants and play a significant role in planning, implementation and evaluation of TB programmes. Similarly, there are CHWs and other health-care providers involved in delivering NCD – including diabetes – related services. However, to date, provision has not been made to train and deploy human resources who can provide TB–DM integrated care at provincial, district and peripheral levels in Indonesia.

**Nepal.** The health-care system in Nepal faces several challenges to addressing TB–DM comorbidity. These are: (i) lack of funding and institutionalization of TB–DM services in the NTP; (ii) high out-of-pocket expenditure; (iii) poor access to and availability of diabetes screening and diagnostic services; (iv) high and unaffordable cost of medication; (v) inadequate awareness of the prevention and management of diabetes among the public; (vi) a lack of attention to integrate TB–DM-related data (i.e. screening, recording, reporting and data management) from available sources; (vii) inadequately trained frontline health-care providers at the community level; and (viii) poor governance of the health sector. Despite the need for implementing TB and DM services on a larger scale in Nepal, budget allocation to these sectors is not a priority [5]. To the best of our knowledge and based on the discussions with key stakeholders, there has not been any provision to allocate a budget specifically for the prevention and control of TB–DM comorbidity in Nepal. Following WHO’s 2013 guidelines [148], the 2019 National TB Management guidelines suggest the provision of mandatory DM screening among those diagnosed with TB; however, little attention is given to effectively implementing these provisions at the primary health care level in Nepal [96]. There are also no guidelines for treating cases with TB–DM comorbid conditions.

**Philippines.** In Philippines, policies and programmes related to TB and DM have been built through a top–down rather than a bottom–up manner. Several challenging factors were identified, including: insufficient engagement of different stakeholders in developing the programme or
service plan; lack of inclusion of local stakeholders in policy formulation; inadequate coordination mechanism between TB and DM service delivery plans; lack of competence among local health workers for screening and detection of TB–DM patients; inadequate plan for continuous adaptation of the programme; lack of attention to increasing awareness of the public about the consequences of these dual diseases; no attention to building trust among the public/patients about public health service delivery; and poor plan for TB–DM data integration, data collection and monitoring of the programme. In addition, disease misconceptions and stigma were also identified as persistent challenges, which is more common among those in the low socioeconomic groups and those in rural areas than those in the higher socioeconomic groups and urban areas. As facilitating factors, having an independent TB–DM manager in some settings was useful in facilitating smooth implementation. Also, availability of funds to offer transport and ensure easy access to health-care services was useful for timely initiation of treatment and subsequent follow ups.

4. Geographical locations, gender, socioeconomic status and disease condition as barriers to integrated TB–DM care

Many of the barriers identified in terms of these socioeconomic or geographical factors are similar across the study countries; however, there are differences. These are outlined below by country and summarized in Table 5.

Bangladesh. Bangladesh has been witnessing geographical and socioeconomic variation in terms of the burden of TB and DM and access to and use of services to prevent and control these disease conditions. The burden of TB in Bangladesh is mainly concentrated among people living in urban slums and rural areas. Also, these disease conditions are prevalent among people with low SES and those with low education levels. However, the burden of DM is higher among those in urban areas compared to those living in rural areas. TB prevention and control services are mainly provided by the public sector; however, the NGO sector is also adding its efforts to TB service delivery. Similarly, NCD services, including diabetes prevention and management services in Bangladesh, are provided through the network of public sector facilities, private facilities and NGO providers, but these facilities are not adequately available everywhere; in particular, the rural population has poor access to and utilization of diabetes-related services. Further, illiteracy, poverty and those living in slum areas have poor access to and utilization of TB–DM services in
Bangladesh [149]. These socioeconomic factors cause poor adherence to TB–DM treatment and care. In general, women in Bangladesh face more sociocultural barriers than men while accessing health services, which might highlight the underutilization of TB–DM health services by women in Bangladesh.

**China.** China has been experiencing geographical variation in terms of TB–DM burden as well as access to and utilization of services to address the problem of TB–DM comorbidity. Migration of large numbers of the population within the country, mostly rural to urban, has caused difficulties in the detection, recording, reporting as well as provision of essential health care for TB–DM. Due to poor SES, such as job instability, low income, poor living and working conditions, TB-affected migrants have relatively poor health awareness and unhealthy behaviours [150,151]. Migrant TB cases in urban areas were less likely to access and complete TB treatment [152,153]. Therefore, such groups are at greater risk of developing diseases, as well as having worse treatment outcomes due to poor SES, poor access to and knowledge of TB and relevant services, lack of support and stigma [132]. In China, TB–DM and other health-care services are relatively poorly accessible in rural areas compared to urban areas; and also access to and utilization of these services are inadequate among rural populations [154,155]. Consequently, the TB burden in rural China is declining more slowly compared to urban areas [156]. There is also marked geographical variation in terms of detection, screening, diagnosis and providing care for those people with TB or DM and TB–DM across different regions in China. Further, people with low SES, low education level, poverty and those living in rural areas have a higher burden of TB–DM comorbidity as well as poor access to and utilization of care.

**India.** India is witnessing a variation in the TB and DM burden in terms of geography, SES, age, and sex of the population. The overall burden of TB in India is substantially higher among those in the poorest stratum, who are also least likely to access TB diagnosis and care [146]. The burden is also higher among those living in rural areas compared to those living in urban areas [33]. Similarly, the rapid reversal of socioeconomic gradient for cardiometabolic risk factors in urban India has led to a convergence of DM prevalence rates among people in the middle and lower income groups [147]. Similarly, the burden of NCDs, including DM, is increasing substantially among the rural adult population compared to those living in urban areas. Additionally, access to and utilization of health services for the prevention and control of TB and DM vary between males and
females in India [157]. Female patients, more so in the younger and older age groups compared with middle-aged women and those residing farther away from health facilities, are less likely to access and use services for TB and DM prevention and control.

Table 5. Geographical locations, gender, socioeconomic status and disease condition as barriers to integrated TB–DM care in selected Asian countries (Bangladesh, China, India, Indonesia, Nepal, Philippines)

<table>
<thead>
<tr>
<th>Themes/subthemes</th>
<th>Potential issues</th>
<th>Countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographical difference</td>
<td>• Geographical differences in terms of TB–DM comorbidity exists, particularly among those residing in rural and remote areas</td>
<td>All countries</td>
</tr>
<tr>
<td></td>
<td>• The burden of TB is more concentrated in those those populations living in rural than in urban areas</td>
<td>Bangladesh, India, Nepal</td>
</tr>
<tr>
<td></td>
<td>• The burden of DM is more concentrated among those living in urban areas, but the trend in the DM burden is increasing among rural populations</td>
<td>Bangladesh, India, Nepal</td>
</tr>
<tr>
<td></td>
<td>• Poor access to and utilization of TB–DM services in rural and remote areas</td>
<td>Bangladesh, India, Nepal</td>
</tr>
<tr>
<td></td>
<td>• Inadequate recording and reporting systems in terms of geographical variability</td>
<td>All countries</td>
</tr>
<tr>
<td>Socioeconomic status (SES)</td>
<td>• The burden of TB only or DM only or TB–DM is higher among those with a low SES and poor educational attainment</td>
<td>All countries</td>
</tr>
<tr>
<td></td>
<td>• Those with a low SES and poor educational status have poor access to and utilization of TB–DM services</td>
<td>All countries</td>
</tr>
<tr>
<td></td>
<td>• Inadequate recording and reporting systems in terms of SES variability; use of disaggregated data to address inequities</td>
<td>All countries</td>
</tr>
</tbody>
</table>
Terms, subthemes, Potential issues, Countries

Gender and/or age differences

- The TB burden is higher among women than men
  - Bangladesh

- Older and younger populations have relatively poor access to and use of services compared to adults
  - India, Indonesia, Nepal

- Female patients with TB or DM or TB–DM have poor access to and use of services compared to males
  - Bangladesh, India, Indonesia, Nepal

**Indonesia.** Indonesia has been experiencing geographical variation in terms of TB and DM burden in the country. Most of the TB cases are among those residing in rural areas whereas DM cases are higher in urban areas. However, in recent years, the number of people with NCDs, including DM, in rural areas is increasing substantially. In terms of TB prevention and control, TB services are widely available in both rural and urban areas. However, DM services are not adequately available in rural areas compared to urban-based health facilities. In addition, public primary health care centres in rural and geographically hard-to-reach areas do not have an adequate number of trained human resources as well as diabetes medicines compared to health-care facilities in urban areas. Furthermore, all the diabetes medicines, especially the newer and expensive drugs, are not covered by the health insurance system [158], making it difficult for those with low SES to afford these medications.

**Nepal.** People with a low SES, those living in rural areas, and those with a low educational status or illiterate persons have a higher burden of TB compared to those living in urban areas and those with a higher SES. Due to Nepal’s topographical structure, the majority of people live in hilly and mountainous regions. Poor access to and utilization of TB- and DM-related services among those with TB has been a chronic challenge. On the other hand, the burden of DM and NCDs is increasing substantially among those living in rural areas as well as those with poor SES. While the Government of Nepal in recent years has introduced the WHO PEN programme to support NCD care, access to and utilization of DM services in rural populations is yet to be improved. The policies and strategies that
have been developed so far at the national level are yet to trickle down to peripheral health facilities. Those at the peripheral level and those located in rural mountainous and hilly areas also experience inadequate availability of logistics, supplies and medications. There are also challenges of not having an adequate number of trained human resources at health facilities located in rural and remote areas. These all have an impact on the delivery of, access to, and utilization of TB or DM or TB–DM services in Nepal.

**Philippines.** The low SES of TB–DM patients plays a role in access to integrated TB–DM care, which is like other stand-alone programmes for NCDs or TB. However, respondents identified misconceptions and stigma as persistent challenges to accessing TB services, which is more common among the public in low socioeconomic groups and those in rural areas. Also, seeking health care for either TB or DM varies according to SES and geographical location. For example, patients with DM would delay getting treatment until their condition became serious or when they developed complications. This situation is more common among the rural than urban population, and those in low than high socioeconomic groups. While the central and regional governments try to take these socioeconomic and other variations into consideration during service delivery, these are not yet well incorporated into the overall medical service delivery in the country as well as in TB–DM programmes.
4. Policy implications and recommendations for integrated TB–DM care

This study explored the potential for developing interventional approaches to the prevention and control of TB–DM comorbidity within the existing health-care systems in six selected countries of Asia: Bangladesh, China, India, Indonesia, Nepal and Philippines. Our findings are based on the situation analyses and exploratory studies among policy-makers and frontline health-care workers in these six countries. It should be noted that, due to the nature of the study, our study cannot provide strong evidence-based countrywide or cross-national recommendations. The recommendations that we have made here can be referenced only for further discussion and validation based on country-specific contextual factors.

4.1 Country-specific situation and factors associated with TB–DM comorbidity

Despite substantial differences in terms of situation and factors such as economic development, education, culture, geography, health service delivery and social context across the six case study countries of Asia, they face the emerging problem of TB–DM comorbidity. The governments of these countries have taken several initiatives, though each country is at different stages, at the health system and service delivery levels to address the growing problem of TB–DM comorbidity. Common initiatives include formulation of policies, development of guidelines and strategies, improvement in intergovernmental cooperation, allocation of resources, training and capacity-building of relevant personnel, assurance of logistics and supplies, and delivery of TB–DM-related services at the community level. These countries have prioritized the development of an effective systemwide approach to screening and diagnosis of those with TB–DM as well as ensuring that there are adequate health-care services to address these comorbid conditions.
Even though the prevention and control of TB–DM comorbidity is a key priority in these countries, differences exist in terms of the current magnitude of the TB–DM comorbidity, provision of screening and diagnostic services for TB–DM, availability of trained human resources, provision of health-care services to address TB–DM comorbidity, and mechanisms for recording and reporting TB–DM comorbidity in national health-care systems. For example, China, India and Philippines have trained human resources for TB–DM service delivery and these countries have well-developed systems for recording and reporting of TB–DM services. Similarly, China, India and Philippines have developed referral systems for TB–DM comorbidity within their respective primary health care systems.

Other countries such as Bangladesh, Indonesia and Nepal have well-established systems for the prevention and control of TB and DM separately. These countries have made significant progress in terms of detection and treatment of TB cases, provision of trained human resources, delivery of (health-care) services, and overall management of TB. Similarly, these countries have considered DM prevention and control as a key policy and systems priority, and have developed a range of policies, guidelines and initiatives for capacity-building of health-care providers. These countries also have initiated pilot service delivery programmes in recent years. However, Bangladesh, Indonesia and Nepal are lagging behind when it comes to establishing systems for the prevention and control of TB–DM comorbidity. At the same time, as these countries do not have a mechanism for recording and reporting of TB–DM services as well as mechanisms for integration of data from multiple sources. They would need to establish/strengthen their electronic data collection, recording and reporting systems. Further, sharing data between and among key sectors and stakeholders is essential to decision-making, effective collaboration and coordination, programme development and service delivery. Further, the private sector in these countries also delivers DM- as well as TB-related services. It is important to capture the data for the services being delivered by the private sector too. Given the contextual differences and the variation in terms of policies and guidelines, logistics and supplies, and service delivery for TB–DM prevention and control in these countries, it is uncertain whether all case study countries will be able to develop an integrated primary health care system for prevention and control of TB–DM comorbidity. In all six countries, the need for health system readjustment or reorganization was recognized as a necessary component for accelerating efforts at developing an integrated primary health care system for the prevention and control of TB–DM comorbidity. This would
include mandatory provision of screening and testing of DM among those with TB and vice versa and increasing the number of testing facilities for screening and diagnosis of DM at the primary care level. Likewise, improvements in the health system building blocks should be sought, such as the utilization of cost-effective technologies for improving TB–DM service delivery, financial allocation to integrated TB–DM programmes, and provision of training of frontline health-care workers (i.e. primary care physicians and CHWs) in TB–DM. Further, there is a need for assurance of supplies and logistics, provision of recording/documenting, creation of integrated mechanisms for reporting and referrals, and improvement in access to and availability of real-time data on TB–DM comorbidity in these case study countries of Asia.

4.2 Strengthening primary health care systems for TB–DM management

An integrated TB–DM programme entails a re-engineering of how these two independent programmes can be meshed into a singular programme. This would require rigorous evaluation of current service provision, basic infrastructure requirements, available human resources and skills gaps, and adequate financial allocation and arrangements for TB alone or DM alone or TB–DM integrated care. Although the case study countries of Asia are willing to establish integrated TB–DM care at the primary care level, there is also a need for rigorous evaluation of the contextual and health system-level complexities that will enable or hinder this initiative. Establishing periodic and performance-based evaluation systems is a promising approach that could be explored to strengthen integrated primary health care systems for TB–DM prevention and care in these countries.

All case study countries should prioritize the development of a service delivery guideline for an integrated programme to address the problem of TB–DM comorbidity and its associated risk factors (i.e. tobacco use, harmful use of alcohol, physical inactivity and unhealthy diet). Also, a clear treatment protocol for the clinical management of patients with TB–DM at the primary care level would be necessary. The protocol should clarify drug interactions, especially with the use of new drugs for drug-resistant TB cases alongside antidiabetic medications, including insulin. Policy priority for an earmarked budget is imperative to support integrated service delivery for TB and DM as well as health promotion and education activities.
To buttress an integrated primary health care system for TB–DM prevention and care, there is a need to link TB–DM services with functional and high-performing primary health care facilities or specialized health facilities, which may offer supervision, support and follow-up services to ensure the quality of TB–DM care. While CHWs would play an important role in delivering integrated TB–DM care at the primary care level, there is a need for functional collaboration between CHWs and clinicians/medical officers, who are generally based at the district level or beyond. Such collaboration would help to enhance CHWs’ engagement in TB–DM care, ensure mentoring support and strengthen the referral mechanism of patients with TB–DM comorbidity.

Once a TB–DM integrated programme is established, significant changes in the roles and responsibilities of health workers would be necessary. With this expansion, coupled with the call for integration of and collaboration for service delivery, there would be a need for better coordination and supervisory arrangements across the different tiers of the health-care delivery system (i.e. community level to subdistrict level to district level) in each country. Examples of the horizontal approach taken by China and India to integrate TB–DM care within their current health-care systems could be followed. Creating a TB/DM programme manager’s position at the national and provincial/state TB programme structure level would be useful to oversee TB–DM coordination, like the existing HIV/TB coordinator positions in some regional countries. Should the formation of a designated TB–DM care provider team be pursued, which may include medical officers, paramedics and nursing staff, this would entail investment in the capacity-building of CHWs on the integrated management of TB and DM. Furthermore, it is imperative to develop retention programmes for such personnel. These include provision of occupational health and safety services, establishment of job security guidelines, inclusion of opportunities to undergo supervisorial training such as on human resource management, and development of clear career promotion mechanisms. A strong commitment from the primary health care system and its leadership is essential to advocate for an integrated TB–DM programme to combat the growing burden of TB–DM comorbidity in countries of Asia.
4.3 Revitalizing the primary health care system for TB–DM co-management through health policy and financing

Countries should review their overall health systems policy and financing mechanisms for strengthening TB–DM prevention, management and care. In recent years, these case study countries in Asia have already prioritized the prevention and control of TB–DM comorbidity as one of the key policy priority areas. By capitalizing on such an opportunity at the systems level, more TB–DM-related services could be prioritized and integrated within the primary health care systems of these countries. Designing and implementing TB–DM-related programmes adjusted to local and country-level circumstances, coupled with strengthening or reforming primary health care systems, would be critically important.

Countries that already have provision of TB–DM services within the current health-care systems (i.e. China, India) would need to revitalize their existing services with up-to-date service delivery guidelines, assure necessary funding, provide bidirectional screening, ensure the steady supply of medication, technologies and logistics, and put in place mechanisms for TB–DM documentation, reporting, referral and follow up. Countries that are now in the process of initiating TB–DM integrated care should also take similar approaches. Co-locating diabetes screening and testing facilities at existing TB laboratories would be helpful for increasing access to DM screening and streamlining testing and follow up. Identifying and including TB–DM-specific programme line items in the budget would be a practical way to begin in countries that are yet to have a formal coordination mechanism in place. Forecasting can be thought of based on existing in-country programme data or modelling for the testing and treatment requirements, including the requirement for insulin and oral hypoglycaemic agents, and devising the means to procure, distribute and manage the logistics.

It is important that the human resources involved in delivering TB–DM-related services are capable and motivated, which would lead to the effective delivery of TB–DM services and ensure the sustainability of such important programmes at the primary care level. Furthermore, building the capacity of frontline health-care workers, particularly CHWs, to support bidirectional screening and care of people with TB–DM comorbidity would be useful to promote integrated TB–DM services within the existing primary health care system. Allocation of an adequate budget is essential
to build and strengthen the capacity of human resources involved in TB–DM care.

As the private sector in these countries of Asia has been contributing significantly to the delivery of TB- and DM-related services, it is essential to involve them in the establishment and delivery of integrated TB–DM care at the primary care level. Given the use of the private health-care sector as the first point of care for both TB and DM in all the case study countries except China, improving the referral system between the private and public sectors would ensure case detection, diagnosis and effective treatment. The private sector should also participate in the planning, establishment and delivery of TB–DM integrated care in these case study countries. Establishing regulations and programmes to boost the private sector’s role in TB–DM co-management would facilitate public–private partnerships. Further, development partners such as WHO, the World Bank, the Global Fund to Fight AIDS, TB and Malaria (Global Fund), The Union, bilateral agencies and universities play significant roles in the prevention and control of TB and NCDs, including DM. Functional collaborations with these partners are essential in establishing and strengthening integrated TB–DM care at the primary care level. It is not ideal for a country to copy exactly the same strategies from another country. Experiences learned in a country could be referenced and adapted after addressing country contextual barriers for the co-management of TB–DM comorbidity in each country.

4.4 Public education and societal-level impact

Strengthening public education for the prevention and management of TB–DM comorbidity and encouraging community participation in ongoing TB–DM integrated service delivery are essential to ensure ownership and sustainability of the programme. To increase community awareness of TB–DM service delivery, primary health care centres can integrate community-based diabetes screening initiatives alongside TB symptom screening activities, which might require additional training of existing personnel and resources. To establish integrated TB–DM care, it is important to enhance societal acceptance of the programme, inculcate shared values among community members, and recognize contributions made by CHWs and other personnel, in addition to medical officers, auxiliary nurse midwives and allied health-care workers (e.g. laboratory technicians). Strengthening intersectoral collaboration for TB–DM prevention and management by aligning current TB-only or DM-only or TB–DM services
within the integrated community-based primary health care system is strongly recommended.

4.5 Research implications

While developing integrated primary health care to deliver TB–DM programmes and having supportive policy decisions is suggested, more research and real-time data are needed for evidence-based decision-making. Any future programme should incorporate more data points related to TB–DM epidemiology, screening, diagnosis and co-management, including geographical and socioeconomic variables. Linking data systems in primary, secondary and tertiary care locations, as well as those in any private health system, is critical to plan for future research. Within a given country, research priority should be given to geographical areas with a high burden of disease, or to those populations who are at highest risk. Prioritizing operational research that examines different programme implementation models for bidirectional screening and TB–DM integrated care within the local context would provide useful insights into integrated TB–DM care in these case study countries.
5. Limitations of the study

This report examined the health system efficiencies for developing and delivering integrated care for TB–DM comorbidity within the primary health care systems of six selected South and South-East Asian countries; therefore, caution may be needed to extrapolate the findings to the whole region. Mainly qualitative data were gathered for this report and quantitative data were not collected. Moreover, most data were collected via telephone or Zoom interviews with a few exceptions. Mobility restrictions due to the COVID-19 pandemic and poor (occasional) Internet connectivity during the Zoom meetings constrained (or interrupted) the team’s ability to engage in direct dialogue with multiple stakeholders. Also, some stakeholders were unwilling to join the meeting/discussion via Zoom. It is possible that their perspectives and experiences would have provided a deeper appreciation of the challenges and opportunities for an integrated TB–DM programme.
Appendices

Appendix A: Topic guides for in-depth interview and focus group discussions (for programme leaders and policy-makers)

[This guide is generic and should be modified by each country as needed. The guide was translated/back-translated into the local languages.]

Consent process
Written or verbal consent forms must be collected before the start of the discussion.

Name of participant: __________________________ Age: _____ Years
Position: _______________________________________
Department/ Section at MoH: __________________________
Programme: TB Programme/Noncommunicable disease Programme
Interviewer: __________________________ Date of interview: ________

1. Please briefly introduce yourself and your work in the MoH.
   a. How long have you been working in this position?
   b. Please briefly describe your job responsibility.
2. Please briefly tell us about the trends in the TB and diabetes burden in Country X.
   a. Burden in terms of morbidity and mortality due to TB only, diabetes only and TB and diabetes together.

3. Would you please tell us about the national TB and DM management programme in (Country X)?
   a. When did the TB and DM programme begin in (Country X)?
   b. What are the key agencies involved in TB and DM prevention and management programmes in (Country X)?

4. What is the current management mechanism for TB patients who are diagnosed with DM? How about DM patients diagnosed with TB? What will be the follow-up arrangements for these patients (TB patients with DM or DM patients with TB)?

5. Based on your experience, what proportion of patients with TB might have DM? And what proportion of patients with DM might have TB?

6. Can you please tell us about the financial aspects of the TB and DM programmes in (Country X)?
   a. What are the main financial sources for the TB and DM programmes in (Country X)?
   b. How do you perceive the sustainability of the different sources of funds or other challenges in terms of financing for TB and DM programmes?
   c. Do you have other comments on the financing for TB and DM programmes in (Country X)?

7. Is there any integrated service within the TB clinic to manage patients with DM (or other NCDs) in Country X (or in your centre)? Any pilot programmes for TB–DM co-management in Country X? How do you perceive the necessity and importance of TB–DM co-management in Country X and why?

8. Proposed integrated co-management of TB and DM (*for health-care settings that do not have fully integrated programmes*)

Now I would like to hear your ideas about integrated care for TB and DM. We would like to help our policy-makers in crafting guidelines on an integrated TB–DM programme at the community level. This proposed programme will build on current efforts in co-management practices. Our study is focused on strengthening the current health-care delivery system so that both TB and DM can be managed concurrently.
Before I ask you what you think about this idea, do you have any questions about what I just described?

a.  What was your initial reaction that came to mind as we were explaining the idea of an integrated TB and DM programme?

i.  Do you think this idea will help to reduce the burden on your local health system to provide integrated TB or DM health care? Why do you think so?

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<tr>
<th>Reasons</th>
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<td>Yes</td>
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<tr>
<td>No</td>
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ii.  Do you think this idea will help to reduce the burden on your local health system to provide NCD care (i.e., hypertension, cardiovascular disease, cancer, chronic obstructive pulmonary disease)? Why do you think so?

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<th>Reasons</th>
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<tr>
<td>Yes</td>
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<tr>
<td>No</td>
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iii.  What do you think will be the patients’ reaction to this joint programme? Probe into aspects of the programme that they would “like” and those that they would not be interested in.

b.  What do you think will be the anticipated difficulties or challenges in making this work? Probe into the barriers at different points of care.

<table>
<thead>
<tr>
<th>Barriers</th>
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<tbody>
<tr>
<td>Detection and screening (case-finding) of DM among TB patients</td>
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<td>Detection and screening (case-finding) of TB among DM patients</td>
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<td>Diagnosis of DM among TB patients</td>
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<tr>
<td>Diagnosis of TB among DM patients</td>
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<tr>
<td>Treatment and management of TB–DM</td>
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<tr>
<td>Prevention of TB–DM</td>
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</table>
c. What skills set do you think health workers would need under integrated care for TB and DM? Probe into the kind of training the respondents would need, and the time needed to finish this kind of training.

d. What other resources do you think you would need to engage in this integrated service? Probe into the necessity of additional financial incentives, etc.

e. What role do you think other health workers or health professionals play in the integrated TB–DM programme?

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<tr>
<th>Roles</th>
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<tr>
<td>Doctors</td>
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<tr>
<td>Nurse</td>
</tr>
<tr>
<td>Community health workers</td>
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<tr>
<td>Other health-care workers</td>
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<tr>
<td>(specify each)</td>
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f. What role could the private sector (e.g. private physicians, clinics and hospitals) play in the proposed TB–DM integrated programme?

g. How acceptable would an integrated TB–DM programme be in your local community or city or health department? Please elaborate.

h. How easy or difficult would it be to implement an integrated TB–DM programme in your local community or city or health department? Please elaborate.

9. Are there sufficient physicians/community health workers to implement TB–DM-related programmes or care in (Country X)? What are the training programmes being provided to these health workers?

10. Can you please shed light on the problems and challenges faced in terms of TB–DM programmes in (Country X)?

   The problems in terms of budget allocation; not having a proper focus on TB–DM in Country X; capacity-building of CHWs; not having insurance provision for TB–DM prevention and management; ineffective implementation of the programme; not having a proper monitoring and evaluation mechanism in place, etc.

11. Do you have any suggestions for addressing these challenges and improving the design and implementation of the TB–DM programme?
At this point, kindly share your questions if you have any.

Thank you all for your active participation in today’s discussion. Your inputs will be considered for developing an integrated programme for TB and DM co-management.

**THE END**
Appendix B: Topic guides for in-depth interviews and focus group discussions

(for health-care workers)

[This guide is generic and should be modified by each country as needed. The guide was translated/back-translated into the local languages.]

Consent process
Written or verbal consent forms must be collected before the start of the discussion.

Name of participant: ____________________________ Age: ______ Years
Position: ______________________________________
Department/ Section at MoH: ________________________
Programme: TB Programme/Noncommunicable disease Programme
Interviewer: ____________________ Date of interview: ________

1. Please briefly introduce yourself and your work in the Center for Disease Prevention and Control (CDC)/TB clinic/MoH
   a. How long have you been working in this position?
   b. Please briefly describe your job responsibility.

2. Please briefly tell us about the trends in the TB and diabetes burden in China.
   In clinical work, please tell us about the changes in incidence and mortality due to TB and DM.

3. Based on your experience, what is the prevalence of DM among TB patients in (Country X)? And TB among DM patients in Country X?

4. Would you please briefly tell us about TB and DM management under the current national health programme in Country X?
a. How are TB and DM patients managed under the current national health programme in your country (Country X)? What are the key agencies involved in the overall management?

b. In clinical work, in your country (Country X) is there screening for DM among patients with TB? And screening for TB among patients with DM?

5. Could you please introduce the financial aspect of the management of TB and DM in Country X? How does reimbursement/health insurance work?

6. For TB patients diagnosed with DM, what is the management mechanism? For DM patients diagnosed with TB, what is the management mechanism? What is the follow-up arrangement for TB–DM patients?

7. In clinical work, for TB–DM patients, what are the problems health workers and patients could encounter? What are the difficulties in managing patients with TB–DM?

8. What do you think will be the anticipated difficulties or challenges while conducting the following work under the National Health Programme in Country X?

<table>
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<tr>
<th>Barriers</th>
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<tbody>
<tr>
<td>Detection and screening (case-finding) of DM among TB patients</td>
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<td>Diagnosis of TB among DM patients</td>
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<tr>
<td>Treatment and management for TB–DM</td>
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<tr>
<td>Prevention of TB–DM</td>
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</table>

9. For the management of TB and DM in (Country X), are there other anticipated difficulties and barriers?

10. To solve these problems and improve the management of TB and DM based on the national health programme, do you have any advice?

At this point, kindly share your questions if you have any.

Thank you all for your active participation in today’s discussion. Your inputs will be considered for developing an integrated programme for TB and DM co-management.

**THE END**
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- Solomon Islands (2015)
- The Kingdom of Cambodia (2015)
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