TB REACH WAVE 11

Technical information

Bringing Innovative approaches for TB
and Lung Health closer to the point of need

Stop TB Partnership
TB REACH

hosted by UNOPS

END TB

Despite significant global efforts, TB remains a major cause of morbidity and mortality. Millions of people affected by TB are missed by the health systems or face barriers to timely TB diagnosis, treatment, and prevention[1]. The disruption of health services, including TB service provision during the COVID-19 pandemic emphasized the need for resilient country health systems. Further the increasing burden of non-communicable diseases (NCDs), including chronic respiratory diseases (CRDs), overwhelm health systems that are already struggling to respond to communicable diseases, particularly in lower-middle- income counties (LMICs)[2]. Primary health-care (PHC) is the cornerstone of a sustainable, people-centered, community-based, and integrated TB service delivery system[3].Expanding primary health care (PHC) is critical to health systems strengthening and subsequently, attaining universal health coverage [4].

The TB REACH Wave 11 theme is **Bringing Innovative approaches for TB and Lung Health closer to the point of need**. Wave 11 projects will focus on interventions at both community and primary care level with the aim to:

- improve detection and care for people with TB.
- promote people-centered ISD for TB & lung health closest to the point of need
- include gender-responsive interventions for people affected by TB
- achieve sustainability beyond the lifecycle of the grant.

Wave 11 projects at primary care will contribute to improved coverage for people with TB and other lung conditions, and at a larger level contribute to overall health system strengthening. The figure below shows the proposed Wave 11 theme and the pathways to impact.

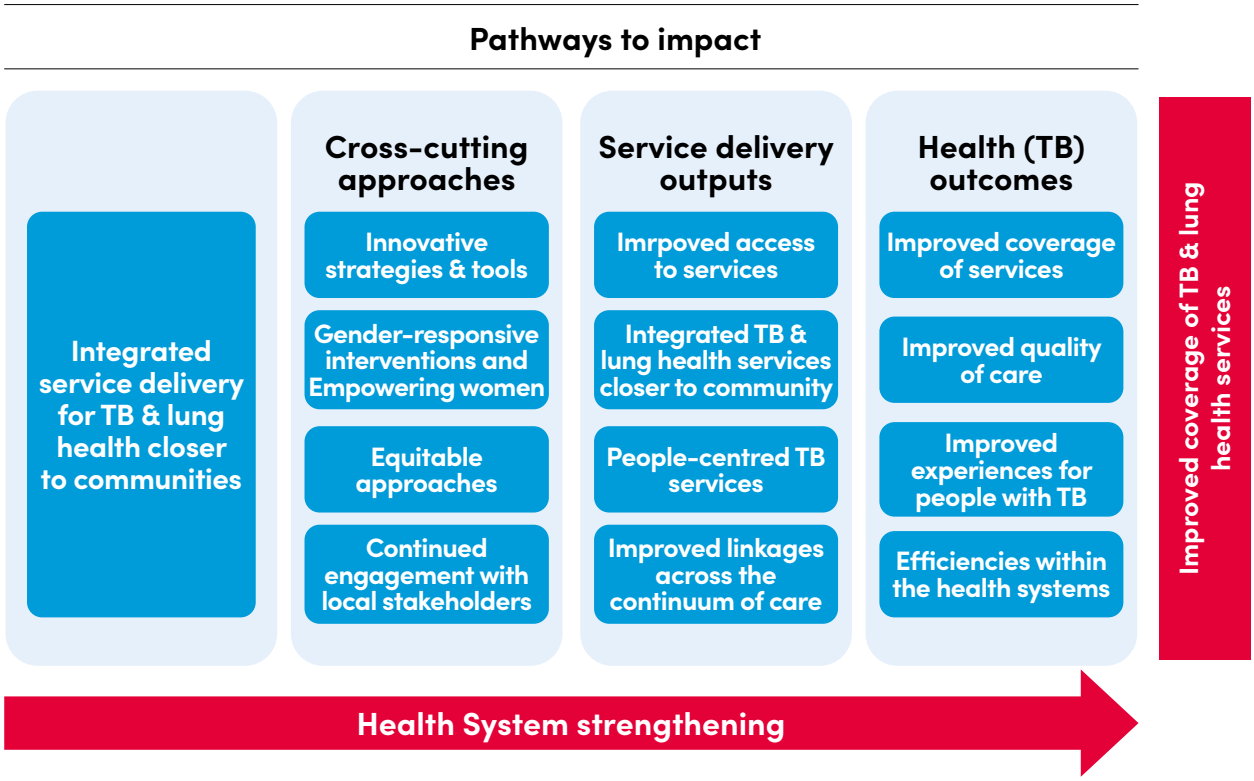

Figure 1: Pathways to impact for TB REACH Wave 11 interventions

Note: *This document outlines the guiding principles for possible interventions. Please note that the examples outlined are for illustration purposes only and are not prioritized during the selection of successful proposals. Applicants are encouraged to consider other innovative ideas not included here.*

Bringing Innovative approaches for TB and Lung Health closer to the point of need

Primary health care approaches for TB

WHO defines PHC as a "whole-of-society approach to health that aims equitably to maximize the level and distribution of health and well-being by focusing on people's needs and preferences (both as individuals and communities) as early as possible along the continuum from health promotion and disease prevention to treatment, rehabilitation and palliative care, and as close as feasible to people's everyday environment"[4] .

In the application of the PHC model, five core elements have been identified, that are associated with better quality services, lower costs, less inequalities, and better population health[4]. These core functions include

i) **First contact** with the health system,
ii) **Comprehensive** interventions,
iii) **Coordinated** and integrated service delivery
iv) **Continuity** of care
v) **Person-Centered** care;

also known as the (5Cs of PHC). The Stop TB Partnership has long advocated for the PHC approach in TB service delivery with an emphasis on Communities, which moves this model even closer to true point-of-need care. Community based PHC is effective in reducing TB incidence and mortality, particularly among the most vulnerable populations[5]. The PHC emphasis on community- based services ensures equitable access to care for communities that are underserved[4].

Community-based and primary care facilities and providers are often the initial contact for people seeking health care, majority of whom present with respiratory symptoms[6,7]. Yet many people with TB who seek services at these levels remain undiagnosed, face delays in diagnosis or are not linked to treatment[8] . We know from patient pathway analyses and other studies that TB services are often not available where people with TB seek care [9,10]. Additionally, people with non-TB morbidities are often not followed up or linked to care due to lack of diagnostic equipment, inadequate knowledge among staff or lack of treatment. It is against this background that TB REACH launches the next call for proposals with the aim of expanding the access and coverage of TB services even closer to communities.

Wave 11 considerations

TB REACH Wave 11 projects will aim to improve TB services at the community and primary care level. Proposals should adopt the PHC approach (5Cs) to deliver TB services closer to communities and detect more people with TB. Applicants should consider interventions at the first point of contact which includes community-based care and PHC clinics that represent the lowest level health facility where people seek care.

Examples of TB interventions at PHC

<u>TB active case finding at first point of contact.</u>
Many people with TB presenting at primary care are still missed by the health systems. Integrating TB screening at the various entry points within primary care, particularly for people with respiratory symptoms will enhance TB detection. Proposals should include active case finding strategies to detect people with TB within communities, and address barriers to TB diagnosis and treatment particularly to reach

underserved populations. In some contexts, the first contact could include private formal and informal providers and facilities offering primary care.

Strengthening diagnostic capacity at first contact

Many primary care facilities lack diagnostic capacities and consequently refer people with presumptive TB elsewhere. Interventions that decentralize point of care tests and diagnostic solutions down to the community or primary facilities can improve case detection and reduce the delay in TB diagnosis. The use of proven screening and diagnostic methods e.g. chest X rays at community level or PHC facilities has been effective. There is room to expand the use of molecular testing platforms e.g molecular point-of-care (POC) testing further at primary care or within communities. The existing sputum networks that link to diagnostic centers can also be optimized through initiatives such as sputum pooling.

Expanding Integrated testing methods for TB and other pathogens

The use of simultaneous integrated testing approaches for TB and SARS-2 virus is effective in detecting both diseases and facilitated the Covid-19 pandemic response through shared resources. While more studies are still needed to demonstrate the cost-effectiveness of multiplex testing platforms, opportunities to optimize the screening for multiple pathogens can contribute to correct treatment and better outcomes. Using available testing platforms to test for TB and other pathogens e.g. for Streptococcal A, Respiratory syncytial virus (RSV) or Influenza viruses, can be an opportunity to maximize the use of resources and support access to diagnosis and treatment. Applicants are encouraged to review such opportunities for both respiratory and non-respiratory pathogens where applicable.

Innovations and new tools for TB

TB REACH supports innovations in TB. Organizations with the capacity to include new tools that are not yet WHO approved or expand their use in new populations not included in current guidance can contribute to national or global guidelines. Such interventions could include among others: evaluating AI algorithms for children or non-TB lung conditions; extending the use of POC tests and POC ultrasound; molecular testing of non-sputum samples e.g rectal swabs and/or tongue swabs. There are also potential tools that could be included and evaluated for POC diagnosis based on their availability e.g. digital cough apps or breath sounds[11,12], breath analysis and face-mask sampling[13] among many others.

Integrated service delivery for TB and lung health

Integrated service delivery (ISD) combines multiple interrelated healthcare services, facilitates people-centered care, and the maximization of resources to increase efficiencies in the health system. ISD contributes to health system strengthening, helps progress towards UHC, and is compatible with the global move towards One Health, a multidisciplinary approach to improve global health security (GHS) through collaborative, multisectoral, and transdisciplinary initiatives to combat diseases. For people seeking and receiving health care, ISD can potentially improve their experience by being more convenient, removing access barriers, saving time and costs by allowing for access to multiple services at once and improving continuity of care and coordination of treatments for multiple health conditions.

While TB and human immunodeficiency virus (HIV) programs have been supported to integrate for over a decade, and WHO guidance has been issued on TB and diabetes, there are many more opportunities for improving TB care with other health and service programs[14,15]. A recent systematic review provides a framework for integration of TB and non-communicable diseases (NCDs) services in low- and middle-income countries (LMICs) and suggests integration has the potential to improve health service delivery[16]. Another recent systematic review on integration of HIV services with other health services including TB found that ISD strategies can lead to improved health and health system outcomes[17]. ISD can also contribute to resilient health systems as evidenced during the COVID-19 pandemic. However, there is still a dearth of evidence with regards to integration with other NCDs and in particular CRDs[15,16].

Respiratory symptoms are the most common reason for seeking care at the primary care level globally [6]. While 80-90% of respiratory consultations are due to acute conditions, the burden of chronic respiratory diseases (CRDs) continues to rise. CRDs impose a significant burden on health systems particularly in LMICs, where people affected have unfavorable outcomes [18]. Among CRDs, asthma, chronic obstructive pulmonary disease (COPD) and occupational lung diseases are the most common causes of morbidity[18]. TB and many CRDs share common risk factors such as cigarette smoking, household indoor pollution and exposure to silica [19]. TB (post-TB lung disease, PTLD) is also a risk factor for CRD, in particular bronchiectasis and COPD[19]. At an individual level CRDs are associated with adverse outcomes, poor quality of life and high costs incurred for families and the health systems[20]. Despite evidence showing the feasibility of CRD interventions at primary care, the implementation is still limited and many people still lack a correct diagnosis and treatment[21,22]. ISD has the potential to accelerate the finding of missing persons with TB while simultaneously addressing other lung health conditions [23,24].

The World Health Organization (WHO) launched the Adult Lung Initiative in 1998 that eventually led to the Practical Approach to Lung Health (PAL) strategy[25]. The PAL ISD model aimed to enhance the assessment and management of people presenting with respiratory symptoms, particularly at primary care level through alignment of guidelines, workload management, coordination of care for people affected by lung diseases[26]. Similar to the successful model for children- Integrated Management of Childhood Illnesses (IMCI), the PAL model embraced syndromic approaches to management of respiratory conditions in adults and children >5 years. Implementing PAL demonstrated positive outcomes including improved detection of TB and CRDs, better quality of care, reduced antibiotic prescriptions, costs efficiencies and improved treatment outcomes2[3,27]. However, the implementation of PAL did not catch on in many countries, and many health systems were not ready to accommodate such levels of ISD. PAL implementation also faced challenges including inadequate human resources and skill set, limited availability of diagnostic tools such as spirometry, chest X-ray, and medicines e.g. inhaled steroids or bronchodilators, among others [23,26,28]. Some countries continue to practice the PAL approach to a certain extent [24,29]. Since then, integrated service delivery has gained traction globally as a key mechanism for ensuring people-centered care, contributing to health system strengthening and consequently advancing universal health coverage[4,14].

Previous TB REACH grantees, particularly Wave 10 projects have already implemented ISD for TB and other health conditions including both communicable and NCDs. For this call for proposals, applicants are invited to further explore ISD with a focus on respiratory conditions. Wave 11 projects should aim to provide people-centered ISD, with the combined management of people presenting with respiratory symptoms at primary care and community settings.

Wave 11 considerations

Applicants are invited to propose innovative approaches and ways of working and reaching people with TB and providing ISD for other lung conditions. It is important that the proposed interventions are designed to meet the varied needs of people presenting at the first point of care and consequently other points of service delivery.

<u>Model of Integration</u>
Integration can occur at different locations or sites within the health system. Wave 11 projects should focus on lower-level PHC facilities that are often the first point of care and community- based services.

The level of ISD can vary from partial to fully integrated models depending on the services provided and the location [16]. Level 1 integration only includes screening while level 2 and 3 provide linkages to and/ or providing integrated treatment services. For Wave 11, **proposals should focus on**

integration to facilitate linkages and access to treatment and care for people with TB and other lung conditions. For more information on models of care, applicants should refer to the framework for integrated services for TB and NCDs by Foo et al[16].

The selected models of care should be contextually appropriate to tackle the challenges of ISD for TB and lung health at primary care. Interventions should be designed to achieve or demonstrate feasibility for multimorbidity screening and lung care and aim for a comprehensive PHC lung package, reduce costs for affected people and the health systems, and be acceptable to both the healthcare workers and individuals seeking care. Proposals should also take into consideration the potential unintended consequences of ISD that could arise e.g. increased workload, excessive task shifting among others that could lead to demotivation of healthcare workers and poor quality of care, and as far as possible demonstrate possible mitigation strategies.

Examples of ISD approaches

Integrated screening activities.
Community- based active case finding strategies have been used to improve TB detection as they remove geographical and financial barriers to seeking care[30]. These screening interventions could be expanded to include the screening for other respiratory morbidities. Examples include adapting TB screening questionnaires used by community health workers to identify risk factors e.g. smoking or occupational exposure. Screening tools such as AI aided chest X-ray can also provide a basis for further tests and examinations among those negative for TB.

In TB high burden countries, healthcare worker shortages and high volumes of people presenting at PHC facilities can contribute to missed opportunities for systematic TB screening. Activities that seek to improve screening among people at risk of having TB could contribute to early detection and linkage to treatment. Establishing chest/TB screening points within PHCs could identify people who are at high risk of TB or with other CRDs. For wave 11, applicants are encouraged to consider entry points that include people presenting with a variety of different respiratory symptoms or illnesses (e.g. community services, outpatient screening points) as opposed to single disease entry points (e.g. TB clinics or chest clinics).

Beyond integrated testing of infectious diseases, incorporating CRD screening and diagnosis at primary care can be effective in early detection and linkage to care. Spirometry, which is the gold standard for diagnosis, has been shown to be feasible and an effective diagnostic tool when used in primary care by non-specialist staff[31]. However, this is not widely accessible or used among frontline healthcare workers, particularly in rural settings[22,31]. Wave 11 proposals can consider feasible and effective ways to improve the use of spirometry to screen for CRDs either in community or primary care facilities.

Capacity building of health care workers for Integrated service delivery (ISD)

Primary care is usually delivered by non-specialist staff, i.e. nurses or lower cadres that may not have the necessary skill to diagnose or screen for TB and /or other CRDs. In many settings, TB service delivery is centered around the TB unit, which means that other frontline workers- nurses, community volunteers working at the OPD, outreach level who meet symptomatic clients have no capacity or tendency to screen for TB. On the other hand, TB focused screening points and clinicians are not well equipped to deal with other chronic respiratory illnesses. Activities aimed at improving the capacity of health care workers in the syndromic management of respiratory diseases at primary care can facilitate early diagnosis and referral where appropriate.

Task-shifting and sharing is a strategy used in many countries to facilitate efficiency in health systems and address the shortages in workforce. To implement ISD, task shifting could be necessary among and between different cadres of healthcare workers. On the other hand, excessive task shifting may be associated with poor quality of care. Applicants are encouraged to embrace such models of ISD, invest in training according to the terms of reference and also consider ways to mitigating negative unintended consequences that could affect quality of care for people with TB.

Engaging private and informal providers

In many settings private physicians and other informal practitioners offer primary care services within the communities for people with respiratory symptoms. Engaging such providers to integrate TB services in the routine screening can contribute to detecting people with TB and ensure access linking them to appropriate care.

Digital health support

Digital tools can be useful to ensure quality of care and support clinicians particularly where there is a shortage of specialists. In some settings, discussion forums on platforms such as whatsapp have been helpful in supporting clinicians to make clinical decisions. Telemedicine platforms can facilitate consultations and reduce the costs incurred on referrals for people with chronic illnesses. Digital technologies can also be useful for people in care to monitor treatment adherence, provide health information.

Support for costs and linkage to care

The social and economic consequences of TB and CRDs are often catastrophic, and can pose a barrier to care, lead to loss of income and further impoverishment of families affected, and even contribute to poor medical outcomes. Interventions such as food support, transport support or cash transfers may reduce the financial burden incurred by families. Wave 11 Projects can explore ways of shielding affected families from incurring catastrophic costs and social consequences including stigma. Applicants are encouraged to explore cost implications for people accessing care for respiratory illnesses within their contexts and suggest ways to mitigate the cost drivers e.g through partnerships with other partners, NGOs and MOH.

Examples of disease integration

Type of disease/condition for integration

Applicants are invited to explore respiratory conditions that are epidemiologically relevant in the local context. Proposals that include shared risk factors for TB and other respiratory illnesses will be accepted. Proposals that include HIV and Diabetes will not be eligible as there is already alternative funding and programmatic support. Figure 2 lists examples of common respiratory conditions that could be considered by applicants. Please note that this list is NOT exhaustive and TB REACH will consider other conditions not included below.

Lower respiratory tract Infections (LRTIs)	Chronic hyperactive airway diseases	Chronic obstructive lung diseases (COPD)	Preventive and promotive care	Cancers
• Bacterial Pneumonias • Viral pneumonias e.g. Covid-19	• Asthma • Chronic bronchitis	• COPD • Bronchiectasis • Pneumoconiosis e.g. silicosis, coal exposure	• Cigarrette smoking • Household/ • Indoor pollution	• Primary lung cancers

Figure 2. Examples of respiratory conditions for integration

Applicants should consider the complexity of ISD and minimize the number of morbidities & risk factors they address in their interventions, to maintain a decent quality of care.

Note that the following examples are meant to show a wide variety of possibilities and is not meant to be ither exhaustive or represent priorities for TB REACH.

- **Syndromic screening and management for TB, Asthma and COPD in primary care settings**

  COPD is a major cause of illness and mortality particularly in LMICs[18]. Although it is preventable and treatable, people with COPD are often diagnosed late in disease if ever or remain undiagnosed and do not receive appropriate care[20]. Apart from increased mortality and high morbidity, COPD also results in significant socio-economic burden in LMICs due to its impact on work productivity[20]. In LMIC settings, the most common risk factors for COPD include smoking for men and household air pollution especially from biomass fuels in women and are more prevalent among the poor[18]. Asthma is the most common CRD globally, affecting close to 300million people[32]. While asthma morbidity and

mortality is largely preventable, LMICs contribute 96% of asthma related deaths and 84% of disability adjusted life years (DALYs)[33]. In addition to the poor health status, social consequences such as missed school and economic consequences lead to societal inequalities among the poor[33]. Both COPD and asthma may present with similar symptoms to TB at community screening events or at primary care facilities.

Incorporating spirometry at these entry points can improve the detection and linkage to care for affected people, after ruling out TB. Spirometry use by frontline health care workers is feasible with appropriate training [31]. Additionally using validated questionnaires or even enhanced diagnostic symptomatic checklists that evaluate symptoms and risk factors is a cost-effective strategy that can identify people with COPD and asthma and save costs for those affected[21,34].

- **TB, Lung Cancer, and the use of Artificial Intelligence (AI)**

  Lung cancer is the leading cause of all cancer deaths worldwide, contributing to 18% of all cancer deaths in 2020[35]. Early diagnosis and treatment of lung cancer can improve outcomes while delayed diagnosis can result in poorer survival[35]. However, lung cancer is often asymptomatic until later stages and can be difficult to diagnosis in the presence of other co-existing respiratory diseases. In LMICs there are gaps in screening and detection due to lack of resources and technical capacity[36].

  CXRs are being increasingly used as an initial screening tool for TB given their high sensitivity[37]. But the CXR is an incredibly useful tool to identify other lung conditions as part of an integrated screening processes. Furthermore, using artificial intelligence (AI) to read CXR provides an opportunity to screen for multiple lung conditions such as TB, nodules, and other lung diseases, where human readers might not be available or could take a long time to provide a thorough reading. Follow-up confirmatory testing would then be required for linkages to care. Additionally, AI tools can scan large numbers of images in a short time. Primary care clinics conducting routine health screenings or mobile vans conducting ACF can leverage AI-CXR to screen for additional lung conditions[38].

- **TB, silica exposure and silicosis**

  The risk of tuberculosis (TB) and silica exposure and silicosis among miners, particularly those involved in hard rock mining is high[39,40]. Exposure to silica dust associated with poorly ventilated working areas increases the risk of developing and transmitting TB[39,40]. Although lung damage due to silicosis is irreversible, health promotion interventions such as use of personal protective equipment, PPE, smoking cessation, and dust control when implemented can prevent further lung damage

and slow down the progression of disease. Wave 11 proposals could incorporate TB screening using chest X rays combined with spirometry to improve the detection of TB, and facilitate linkage to TB treatment, TPT or care for other CRDs. Similar interventions can be carried out for people exposed to indoor house pollution.

- **TB, Lung health and cigarette smoking**

  Smoking increases susceptibility to TB infection, progression and severity of TB disease and can adversely affect the TB treatment outcomes[41]. This is true for other respiratory conditions including CRDs and lung cancer. Many countries have tobacco control programs, but this may not be routinely integrated with TB and chest clinics, particularly at primary level. Screening of TB and CRDs among smokers with a cough can facilitate early detection and care. Conversely, smoking cessation can reduce the severity of symptoms and slow disease progression for people with TB and CRDs. People with TB who smoke also have poor treatment outcomes and are less likely to adhere to treatment. Wave 11 proposals could consider both smoking cessation and prevention interventions to complement care for people with TB and CRDs and the affected communities.

- **TB, Respiratory health and antimicrobial resistance (AMR)**

  Acute respiratory infections (ARIs) account for majority of antibiotic use in primary care settings[42]. Whereas majority of these are viral and self-limiting, simple ARIs are often overtreated with antibiotics, contributing to the global risk of antimicrobial resistance[43]. Inappropriate antibiotic use is an important contributor to antibiotic resistance , and can also result from incorrect diagnosis or in some cases the unavailability of appropriate antibiotics [43]. PAL interventions implemented at the primary care level demonstrated improved quality of care and a reduction in antibiotic prescriptions[23,26]. Interventions that ensure accurate diagnosis and appropriate treatment for TB and other respiratory illnesses can contribute to inappropriate antibiotic use and consequently lower the risk of antimicrobial resistance. Proposals that engage prescribers, particularly private providers could also track the prescribing habits including the availability and the local use of pre-selected tracer antibiotics and provide an insight into the use of antibiotics in the context of TB and chest clinics, and risk factors for antimicrobial resistance.

Gender responsive interventions

Gender plays a crucial role in the likelihood of developing TB disease, seeking and engaging with care, and affects treatment outcomes[44]. Men have a higher burden of TB and are more likely to be missed by active case finding strategies[8,45]. Lifestyle factors including smoking, alcohol consumption and socialization in crowd settings predispose men to a higher risk of TB exposure and transmission. Other factors such as occupational exposure e.g mining, incarceration and incarceration also affect men. Moreover the understanding the role of 'masculinity' contributes to delayed health seeking among men and can pose a barrier to care [46]. Women on the other hand have gendered vulnerabilities that are often exacerbated by other intersecting factors in the society such as education, age, religion, ethnicity among other others. Women face barriers accessing care due to economic reasons and suffer more adverse social consequences of TB[47]. Women face specific TB associated risks including higher HIV prevalence, higher rates of malnutrition and related to their role as caregivers both at home and as part of the health workforce[48,49.] Their lower socio-economic status may contribute to delays in seeking care and which has a deleterious effect on their health, adverse impact on their children and families, as well as predisposes them to more stigma and discrimination[48,49]. There is growing evidence showing the impact and worse outcomes of TB among people with non-binary identities.

Similar risk factors apply to CRDs, with both genders facing challenges influenced by societal gender norms. For instance, in LMICs, both men and women are witnessing a rise in COPD due to exposure to risk factors. While men are more exposed to silicosis due to occupations like mining, women encounter indoor air pollutants in their homes. Men might postpone health check-ups because of their jobs or reluctance to visit overcrowded PHCs that cater more to women and children. Conversely, women might struggle to afford care, especially for CRDs that are costlier to treat.

Wave 11 applicants **must** explore contextual epidemiological and societal aspects of TB disease and the arising gender-related inequalities. All TB REACH applications should investigate the influence of gender on access to TB diagnosis, and care. Proposals should clearly illustrate how the suggested interventions plan to overcome these barriers.
Some examples are listed below, and applicants are asked to explore more contextually relevant interventions:

- Establishing gender-sensitive spaces in communities and medical facilities can boost their usage by men, women, and non-binary individuals, ensuring they feel safe when seeking care.
- Incorporating TB care into primary care settings, such as women's reproductive clinics and male-specific clinics, can guarantee access for all genders, reducing missed TB diagnosis opportunities and improving linkage to care.
- NTPs already disaggregate TB data by age and gender. All proposals should use local data to help ensure no group or population is missed by their interventions due to challenges like limited access, stigma among others. This approach will also be applied to other comorbidities included in the projects.

Empowering women and girls

In many settings women, particularly young women, and girls, also make up a larger proportion of the world's extreme poor and are more vulnerable to social and economic inequalities[50]. TB REACH projects through a previous call (Wave 7) supported by Global Affairs Canada worked with community organizations to successfully bring focus to women's empowerment[49]. TB REACH projects will continue to further explore ways of supporting women and girls through the interventions.

Successful applicants invited for Stage 2 proposal submission will be asked to demonstrate how they plan to empower women working within their organizations and in the communities they work in.

Conclusion

The uptake, sustainability, and scale-up of successful TB REACH piloted interventions by Ministries of Health (MOH), Global Fund, or other local or international donors remains a priority. Applicants are advised to refer to the Wave 11 concept note for further information on engaging with in country stakeholders to maximize and promote the uptake of successful projects into other funding streams.

Additionally, results and lessons-learned from this Wave will be documented and disseminated to inform national or global policies.

References

1. Global Tuberculosis Report 2021. https://www.who.int/teams/global-tuberculosis-programme/tb-reports/global-tuberculosis-report-2021.
2. Kabir, A., Karim, M. N., Islam, R. M., Romero, L. & Billah, B. Health system readiness for non-communicable diseases at the primary care level: a systematic review. *BMJ Open* **12**, e060387 (2022).
3. *Global Plan to End TB 2023-2030 · Omnibook.*
4. A vision for primary health care in the 21st century. https://www.who.int/publications-detail-redirect/WHO-HIS-SDS-2018.15.
5. Jesus, G. S. *et al*. The effect of primary health care on tuberculosis in a nationwide cohort of 7·3 million Brazilian people: a quasi-experimental study. *The Lancet Global Health* **10**, e390–e397 (2022).
6. Finley, C. R. et al. What are the most common conditions in primary care? *Can Fam Physician* **64**, 832–840 (2018).
7. Ottmani, S.-E. *et al.* Respiratory care in primary care services: a survey in 9 countries. (2004).
8. Law, I., Floyd, K., & African TB Prevalence Survey Group. National tuberculosis prevalence surveys in Africa, 2008-2016: an overview of results and lessons learned. *Trop Med Int Health* **25**, 1308–1327 (2020).
9. Titahong, C. N. *et al*. Patient-Pathway Analysis of Tuberculosis Services in Cameroon. *Tropical Medicine and Infectious Disease* **6**, 171 (2021).
10. Odume, B. et al. Spatial Disparity in Availability of Tuberculosis Diagnostic Services Based on Sector and Level of Care in Nigeria. *Journal of Tuberculosis Research* **11**, 12–22 (2023).
11. Botha, G. H. R. *et al*. Detection of tuberculosis by automatic cough sound analysis. *Physiol Meas* **39**, 045005 (2018).
12. Becker, K. W., Scheffer, C., Blanckenberg, M. M. & Diacon, A. H. Analysis of adventitious lung sounds originating from pulmonary tuberculosis. *Annu Int Conf IEEE Eng Med Biol Soc* **2013**, 4334–4337 (2013).
13. Williams, C. M. *et al*. Exhaled Mycobacterium tuberculosis output and detection of subclinical disease by face-mask sampling: prospective observational studies. *The Lancet Infectious Diseases* **20**, 607–617 (2020).
14. Bulstra, C. A. *et al*. Integrating HIV services and other health services: A systematic review and meta-analysis. *PLoS Med* **18**, e1003836 (2021).
15. Jarde, A. *et al.* Addressing TB multimorbidity in policy and practice: An exploratory survey of TB providers in 27 high-TB burden countries. *PLOS Glob Public Health* **2**, e0001205 (2022).
16. Foo, C. De *et al*. *Integrating tuberculosis and noncommunicable dis-*

eases care in low- and middle-income countries (LMICs): A systematic review. PLOS Medicine vol. 19 (2022).

17. Creswell, J. *et al*. Series: 'Update on tuberculosis' - Tuberculosis and noncommunicable diseases: Neglected links and missed opportunities. *European Respiratory Journal* **37**, 1269–1282 (2011).
18. Prevalence and attributable health burden of chronic respiratory diseases, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet Respir Med* **8**, 585–596 (2020).
19. Byrne, A. L., Marais, B. J., Mitnick, C. D., Lecca, L. & Marks, G. B. Tuberculosis and chronic respiratory disease: a systematic review. *Int J Infect Dis* **32**, 138–146 (2015).
20. van Gemert, F., van der Molen, T., Jones, R. & Chavannes, N. The impact of asthma and COPD in sub-Saharan Africa. *Prim Care Respir J* **20**, 240–248 (2011).
21. Rossaki, F. M. *et al*. Strategies for the prevention, diagnosis and treatment of COPD in low- and middle- income countries: the importance of primary care. *Expert Review of Respiratory Medicine* **15**, 1563–1577 (2021).
22. Meghji, J. *et al*. Improving lung health in low-income and middle-income countries: from challenges to solutions. *The Lancet* **397**, 928–940 (2021).
23. Banda, H., Robinson, R., Thomson, R., Squire, S. B. & Mortimer, K. The 'Practical Approach to Lung Health' in sub-Saharan Africa: a systematic review. *The International Journal of Tuberculosis and Lung Disease* **20**, 552–559 (2016).
24. José, B. P. S. *et al*. Practical approach lung health-global alliance against chronic respiratory diseases (PAL-GARD) initiative in Brazil. *Journal of Thoracic Disease* **14**, (2022).
25. *Practical Approach to Lung Health: Manual on Initiating PAL Implementation*. (World Health Organization, 2008).
26. Hamzaoui, A. & Ottmani, S. Practical approach to lung health: lung health for everyone? *Eur Respir Rev* **21**, 186–195 (2012).
27. Ottmani, S.-E., Scherpbier, R., Chaulet, P. & Pio, A. World Health Organization Geneva 2004.
28. Meghji, J. *et al.* Improving lung health in low-income and middle-income countries: from challenges to solutions. *Lancet* **397**, 928–940 (2021).
29. Cornick, R. *et al*. The Practical Approach to Care Kit (PACK) guide: developing a clinical decision support tool to simplify, standardise and strengthen primary healthcare delivery. *BMJ Glob Health* **3**, e000962 (2018).
30. Burke, R. M. *et al*. Community-based active case-finding interven-

tions for tuberculosis: a systematic review. *The Lancet Public Health* **6**, e283–e299 (2021).

31. Ayuk, A., Ndukwu, C., Uwaezuoke, S. & Ekop, E. Spirometry practice and the impact of a phase 1 training workshop among health workers in southern Nigeria: a cross-sectional study. *BMC Pulmonary Medicine* **20**, 258 (2020).
32. Vos, T. *et al.* Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *The Lancet* **396**, 1204–1222 (2020).
33. Asher, I. *et al*. Calling time on asthma deaths in tropical regions-how much longer must people wait for essential medicines? *Lancet Respir Med* **7**, 13–15 (2019).
34. Siddharthan, T. *et al.* Effectiveness-implementation of COPD case finding and self-management action plans in low- and middle-income countries: global excellence in COPD outcomes (GECo) study protocol. *Trials* **19**, 571 (2018).
35. Lung cancer. https://www.who.int/news-room/fact-sheets/detail/lung-cancer.
36. Lubuzo, B., Ginindza, T. & Hlongwana, K. The barriers to initiating lung cancer care in low-and middle-income countries. *Pan Afr Med J* **35**, 38 (2020).
37. Qin, Z. Z. *et al*. Tuberculosis detection from chest x-rays for triaging in a high tuberculosis-burden setting: an evaluation of five artificial intelligence algorithms. *Lancet Digit Health* **3**, e543–e554 (2021).
38. Shankar, A. *et al.* Feasibility of lung cancer screening in developing countries: challenges, opportunities and way forward. *Transl Lung Cancer Res* **8**, S106–S121 (2019).
39. Ehrlich, R., Akugizibwe, P., Siegfried, N. & Rees, D. The association between silica exposure, silicosis and tuberculosis: a systematic review and meta-analysis. *BMC Public Health* **21**, 953 (2021).
40. Jamshidi, P. *et al*. Silicosis and tuberculosis: A systematic review and meta-analysis. *Pulmonology* (2023) doi:10.1016/j.pulmoe.2023.05.001.
41. Smoking and tuberculosis: a dangerous combination. https://www.who.int/europe/news/item/22-03-2018-smoking-and-tuberculosis-a-dangerous-combination.
42. Harris, A. M., Hicks, L. A. & Qaseem, A. Appropriate Antibiotic Use for Acute Respiratory Tract Infection in Adults: Advice for High-Value Care From the American College of Physicians and the Centers for Disease Control and Prevention. *Ann Intern Med* **164**, 425–434 (2016).
43. Llor, C. & Bjerrum, L. Antimicrobial resistance: risk associated with antibiotic overuse and initiatives to reduce the problem. *Ther Adv Drug Saf* **5**, 229–241 (2014).

44. Support Gender Equality in TB | Stop TB Partnership. https://www.stoptb.org/communities-rights-and-gender-crg/support-gender-equality-tb.

45. Onozaki, I. *et al*. National tuberculosis prevalence surveys in Asia, 1990–2012: an overview of results and lessons learned. *Tropical Medicine & International Health* **20**, 1128–1145 (2015).

46. Chikovore, J. *et al*. Control, struggle, and emergent masculinities: a qualitative study of men's care-seeking determinants for chronic cough and tuberculosis symptoms in Blantyre, Malawi. *BMC Public Health* **14**, 1053 (2014).

47. Hudelson, P. Gender differentials in tuberculosis: the role of socio-economic and cultural factors. *Tuber Lung Dis* **77**, 391–400 (1996).

48. Role_of_Gender_in_TB_Control.pdf.

49. Stop TB Partnership | TB REACH - Wave 7. https://stoptb.org/global/awards/tbreach/wave7GenderPaper.asp.

50. Munoz Boudet, A. M. *et al*. Gender Differences in Poverty and Household Composition through the Life-Cycle: A Global Perspective. (2018) doi:10.1596/1813-9450-8360.

Stop TB Partnership

TB REACH

hosted by UNOPS

END TB