

**Supplement to: Cox SR, Hanrahan CF, Moe AH, Shearer K, Christian C, Sethi S, Hudson M, Ueshima M, Singh K, Dawson J, Angami K, Kubai N, Namasivayam M, Shete P, Golub JE, Kerkhoff AD. Frontline healthcare worker barriers impacting tuberculosis service demand and access in high burden settings: a scoping review. J Glob Health. 2026;16:04243.**

## **Appendix S1: study protocol & search terms**

# **Healthcare worker-related barriers to patient access to and demand for TB-related services: a scoping review**

**Protocol version:** 1.0 dated 11 April 2025

**Funder:** Johnson & Johnson

**Johns Hopkins University:** Kate Shearer, Samyra R. Cox, Aye Hnin Moe, Sejal Sethi, Colleen Hanrahan, Jonathan E. Golub

**UCSF:** Canice Christian, Mollie Hudson, Andrew Kerkhoff, Priya Shete,

## **Background**

Tuberculosis (TB) is the leading infectious cause of death worldwide. In 2023, there were an estimated 10.8 million people who developed active TB disease and 1.25 million deaths.<sup>1</sup> There is extensive literature published on health-seeking behavior and barriers related to uptake of TB preventive treatment, TB screening, TB diagnosis, and TB treatment initiation, with numerous systematic reviews published on these and related topics.<sup>2–28</sup> However, the existing reviews focus primarily on patient-level and health systems-level barriers to TB-related care. Yet, healthcare workers (HCWs) play a pivotal role in determining patient access to TB services. Healthcare workers' knowledge gaps, attitudes, practices, and competing priorities, among others factors, can create barriers that limit patients' access to TB services. Understanding these provider-side barriers is essential for developing effective interventions to improve patient access to TB services, which may lead to greater uptake of TB preventive treatment, improved TB diagnostic and treatment outcomes, and long-term reductions in TB incidence. Thus, this scoping review aims to summarize the literature on healthcare provider-related barriers that may limit patient access to and/or demand for TB-related services (i.e., prevention, diagnosis, treatment initiation, treatment completion) in high TB burden countries.

## **Methods**

We will follow the Joanna Briggs Institute (JBI) guidance for scoping reviews and will report findings as per the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR).

### ***Inclusion criteria***

Studies will be included if they describe healthcare provider-related barriers that limit patient access to and/or demand for TB-related services. Studies published between 2010-2025, in English, and reporting on original research findings from the World Health Organization's high-TB burden countries (TB, TB/HIV or drug-resistant TB) will be included.<sup>31</sup>

### ***Exclusion criteria***

We will exclude papers that do not report original research (i.e. protocol papers, systematic reviews, editorials, and/or commentaries), that are abstracts or conference proceedings only, not available in English, or if we are unable to locate the paper. We will exclude papers published prior to 2010 when major diagnostic advancements like Xpert MTB/RIF were introduced, which may have reduced healthcare worker-related barriers to TB treatment initiation, in particular, due to improved diagnostic accuracy.

## Definitions

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Healthcare provider      | Individuals who provide medical care or treatment for TB—which can include consultation, providing medication, or choosing appropriate TB prevention and/or treatment regimens—and may or may not have formal medical qualifications                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Health-seeking           | How individuals who are ill and/or with presumptive TB seek medical care from health facilities for their symptoms                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Access                   | The opportunity to obtain health care services, including the ability to perceive, seek, reach, pay, and engage with TB-related care                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Demand                   | <p>Efforts employed to create, increase uptake, and sustain demand of TB services (i.e. diagnostic tests, screening, treatment)</p> <p>Strategies that promote awareness, understanding, and uptake of or retention in TB prevention, screening, diagnosis, treatment, and post-treatment services across the care cascade</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Barrier                  | Factors, conditions, or circumstances that impede, restrict, or prevent healthcare providers from effectively delivering—or patients from successfully accessing and utilizing—tuberculosis prevention, screening, diagnosis, and treatment services across the care cascade. Barriers may be structural, organizational, cultural, knowledge-based, attitudinal, or behavioral in nature, and may affect one or multiple points along the TB care pathway.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| TB-related services      | TB preventive treatment, TB diagnosis, TB treatment (initiation/adherence/completion)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| High TB burden countries | <p>As defined by the World Health Organization (2021-2025)</p> <p>30 high TB burden countries: The 20 countries with the highest estimated numbers of incident TB cases, plus the top 10 countries with the highest estimated TB incidence rate that are not in the top 20 by absolute number (threshold, &gt;10 000 estimated incident TB cases per year).</p> <p>30 high TB/HIV burden countries: The 20 countries with the highest estimated numbers of incident TB cases among people living with HIV, plus the top 10 countries with the highest estimated TB/HIV incidence rate that are not in the top 20 by absolute number (threshold, &gt;1000 estimated incident TB/HIV cases per year).</p> <p>30 high MDR/RR-TB burden countries: The 20 countries with the highest estimated numbers of incident MDR/RR-TB cases, plus the top 10 countries with the highest estimated MDR/RR-TB incidence rate that are not in the top 20 by absolute number (threshold, &gt;1000 estimated incident MDR/RR-TB cases per year).</p> |

## ***Selection of papers***

We will search PubMed using search terms covering the concepts of TB, high-burden countries, barriers, and healthcare workers. A complete list of search terms is included as an appendix to the study protocol. The resulting titles and abstracts will be uploaded into Covidence and duplicates will be removed. Two independent reviewers will screen the titles and abstracts of the remaining search results to determine if they should be included in the full text review. Any conflicts will be resolved by a third reviewer. The selected full text articles will then be reviewed by both independent reviewers to determine final inclusion/exclusion status. Conflicts will again be resolved by a third reviewer. Any paper that is deemed ineligible for inclusion will be recorded as rejected with a reason specified in Covidence. Finally, we will search the reference list of each included paper for any additional articles not identified by our original PubMed search. Review of additional papers will follow the same process above. Results of this screening process will be presented using a flow diagram.

## ***Data abstraction***

Results from each of the final included papers will be abstracted using a digital form including the title, authors, year of publication, and location, the study type (qualitative, quantitative, mixed-methods), the TB service(s) (prevention, screening, diagnosis, treatment initiation/completion), TB type(s) (drug-sensitive, drug-resistant, both), healthcare worker characteristics (nurses, doctors, community health workers, other), patient population the healthcare workers provide services for (adults, children, people living with HIV, household contacts, other), health provider-related barriers identified, and the theory or theories used to map or characterize barriers, if any. The first five papers will be reviewed by both reviewers to check for consistency with data abstracted independently thereafter.

## ***Data Synthesis***

Data will be organized using an implementation science framework of healthcare provider-related barriers with findings presented narratively with supporting tables and figures. We will also geographically map identified barriers across high-burden countries to visualize differences across settings and will summarize barriers at each step of the TB care cascade (prevention, screening, diagnosis, treatment) to highlight differences across cascade steps. Finally, we will identify research gaps and priority areas for intervention and strategy development.

## ***Bias assessment***

We will not perform a risk of bias assessment as this is not a standard component of a scoping review.

## Study Protocol References

1. World Health Organization. *Global tuberculosis report 2024*. <https://www.who.int/publications/i/item/9789240101531> (2024).
2. Alene, M., Assemie, M. A., Yismaw, L., *et al.* Patient delay in the diagnosis of tuberculosis in Ethiopia: a systematic review and meta-analysis. *BMC Infect Dis* **20**, (2020).
3. Barnabishvili, M., Ulrichs, T. & Waldherr, R. Role of acceptability barriers in delayed diagnosis of Tuberculosis: Literature review from high burden countries. *Acta Tropica* vol. 161 106–113 (2016).
4. Bello, S., Afolabi, R. F., Ajayi, D. T., *et al.* Empirical evidence of delays in diagnosis and treatment of pulmonary tuberculosis: Systematic review and meta-regression analysis. *BMC Public Health* vol. 19 (2019).
5. Cai, J., Wang, X., Ma, A., *et al.* Factors associated with patient and provider delays for tuberculosis diagnosis and treatment in Asia: A systematic review and meta-analysis. *PLoS One* **10**, (2015).
6. de Vries, S. G., Cremers, A. L., Heuvelings, C. C., *et al.* Barriers and facilitators to the uptake of tuberculosis diagnostic and treatment services by hard-to-reach populations in countries of low and medium tuberculosis incidence: a systematic review of qualitative literature. *The Lancet Infectious Diseases* vol. 17 e128–e143 (2017).
7. Divala, T. H., Lewis, J., Bulterys, M. A., *et al.* Missed opportunities for diagnosis and treatment in patients with TB symptoms: a systematic review. *Public Health Action* **12**, 10–17 (2022).
8. Eltayeb, D., Pietersen, E., Engel, M., *et al.* Factors associated with tuberculosis diagnosis and treatment delays in middle east and North Africa: A systematic review. *Eastern Mediterranean Health Journal* **26**, 477–487 (2020).
9. Finnie, R. K. C., Khoza, L. B., van den Borne, B., *et al.* Revue systématique: Facteurs associés au patient et au système de santé dans le retard du diagnostic et du traitement de la tuberculose dans les pays d'Afrique subsaharienne à forte charge de TB et VIH. *Tropical Medicine and International Health* vol. 16 394–411 (2011).
10. Gamtesa, D. F., Tola, H. H., Mehamed, Z., *et al.* Health care seeking behavior among presumptive tuberculosis patients in Ethiopia: A systematic review and meta-analysis. *BMC Health Serv Res* **20**, (2020).
11. Getnet, F., Demissie, M., Assefa, N., *et al.* Delay in diagnosis of pulmonary tuberculosis in low- and middle-income settings: Systematic review and meta-analysis. *BMC Pulm Med* **17**, (2017).
12. Jhaveri, T. A., Jhaveri, D., Galivanche, A., *et al.* Barriers to engagement in the care cascade for tuberculosis disease in India: A systematic review of quantitative studies. *PLoS Medicine* vol. 21 (2024).
13. Jiang, Y., Cao, B., Ohmagari, N., *et al.* Comprehensive understanding of health-seeking behaviour among pulmonary tuberculosis patients in China. *International Journal of Tuberculosis and Lung Disease* **21**, 1094–1099 (2017).
14. Krishnan, L., Akande, T., Shankar, A. V., *et al.* Gender-Related Barriers and Delays in Accessing Tuberculosis Diagnostic and Treatment Services: A Systematic Review of Qualitative Studies. *Tuberc Res Treat* **2014**, 1–14 (2014).
15. Li, Y., Ehiri, J., Tang, S., *et al.* Factors associated with patient, and diagnostic delays in Chinese TB patients: A systematic review and meta-analysis. *BMC Med* **11**, (2013).
16. Obsa, M. S., Daga, W. B., Wosene, N. G., *et al.* Treatment seeking delay and associated factors among tuberculosis patients attending health facility in Ethiopia from 2000 to 2020: A systematic review and meta analysis. *PLoS ONE* vol. 16 (2021).
17. Samal, J. Health seeking behaviour among tuberculosis patients in India: A systematic review. *Journal of Clinical and Diagnostic Research* vol. 10 (2016).
18. Sreeramareddy, C. T., Panduru, K. V., Menten, J., *et al.* Time delays in diagnosis of pulmonary tuberculosis: A systematic review of literature. *BMC Infectious Diseases* vol. 9 (2009).

19. Sreeramareddy, C. T., Qin, Z. Z., Satyanarayana, S., *et al.* Delays in diagnosis and treatment of pulmonary tuberculosis in India: A systematic review. *International Journal of Tuberculosis and Lung Disease* **18**, 255–266 (2014).
20. Storla, D. G., Yimer, S. & Bjune, G. A. A systematic review of delay in the diagnosis and treatment of tuberculosis. *BMC Public Health* vol. 8 (2008).
21. Sullivan, B. J., Esmaili, B. E. & Cunningham, C. K. Barriers to initiating tuberculosis treatment in sub-Saharan Africa: A systematic review focused on children and youth. *Global Health Action* vol. 10 (2017).
22. Teibo, T. K. A., Andrade, R. L. de P., Rosa, R. J., *et al.* Barriers That Interfere with Access to Tuberculosis Diagnosis and Treatment across Countries Globally: A Systematic Review. *ACS Infectious Diseases* vol. 10 2600–2614 (2024).
23. Teo, A. K. J., Singh, S. R., Prem, K., *et al.* Duration and determinants of delayed tuberculosis diagnosis and treatment in high-burden countries: a mixed-methods systematic review and meta-analysis. *Respir Res* **22**, (2021).
24. Varughese, M., Heffernan, C., Li, M. Y., *et al.* Time to diagnosis and treatment of pulmonary tuberculosis in indigenous peoples: a systematic review. *BMC Infect Dis* **23**, (2023).
25. Yasobant, S., Bhavsar, P., Kalpana, P., *et al.* Contributing factors in the tuberculosis care cascade in india: A systematic literature review. *Risk Management and Healthcare Policy* vol. 14 3275–3286 (2021).
26. Müller, P. & Lapão, L. V. Mixed methods systematic review and metasummary about barriers and facilitators for the implementation of cotrimoxazole and isoniazid-Preventive therapies for people living with HIV. *PLoS One* **17**, (2022).
27. Rutherford, M. E., Hill, P. C., Triasih, R., *et al.* Preventive therapy in children exposed to Mycobacterium tuberculosis: Problems and solutions. *Tropical Medicine and International Health* vol. 17 1264–1273 (2012).
28. Grace, S. G. Barriers to the implementation of isoniazid preventive therapy for tuberculosis in children in endemic settings: A review. *Journal of Paediatrics and Child Health* vol. 55 278–284 (2019).
29. Pollock, D., Evans, C., Menghao Jia, R., *et al.* “How-to”: scoping review? *J Clin Epidemiol* **176**, 111572 (2024).
30. Tricco, A. C., Lillie, E., Zarin, W., *et al.* PRISMA extension for scoping reviews (PRISMA-ScR): Checklist and explanation. *Annals of Internal Medicine* vol. 169 467–473 (2018).
31. World Health Organization. *WHO global lists of high burden countries for tuberculosis (TB), TB/HIV and multidrug/rifampicin-resistant TB (MDR/RR-TB), 2021-2025.* (2021).
32. Albert, H., Nathavitharana, R. R., Isaacs, C., *et al.* Development, roll-out and impact of Xpert MTB/RIF for tuberculosis: What lessons have we learnt and how can we do better? *European Respiratory Journal* vol. 48 516–525 (2016).
33. Michie, S., van Stralen, M. M. & West, R. The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science* **6**, (2011).
34. Bhering, M., Dalcolmo, M., Sarubbi, V., *et al.* Barriers faced by patients in the diagnosis of multidrug-resistant tuberculosis in Brazil. *Rev Saude Publica* **56**, (2022).
35. Asemahagn, M. A., Alene, G. D. & Yimer, S. A. A qualitative insight into barriers to tuberculosis case detection in east gojjam zone, Ethiopia. *American Journal of Tropical Medicine and Hygiene* **103**, 1455–1465 (2020).
36. Jarrett, B. A., Woznica, D. M., Tilchin, C., *et al.* Promoting tuberculosis preventive therapy for people living with HIV in South Africa: Interventions hindered by complicated clinical guidelines and imbalanced patient-provider dynamics. *AIDS Behav* **24**, 1106–1117 (2020).
37. Skinner, D. & Claassens, M. It’s complicated: Why do tuberculosis patients not initiate or stay adherent to treatment? A qualitative study from South Africa. *BMC Infect Dis* **16**, 712 (2016).

38. Mavhu, W., Dauya, E., Bandason, T., *et al.* Chronic cough and its association with TB-HIV co-infection: Factors affecting help-seeking behaviour in Harare, Zimbabwe. *Tropical Medicine and International Health* **15**, 574–579 (2010).
39. Mathew, G., Kumar, S. C. S., Cherian, K. M., *et al.* Revisions in TB programme - boon or bane? A qualitative study exploring barriers and facilitators among health care workers in private and public sector, Kerala. *Indian Journal of Tuberculosis* **68**, 356–362 (2021).
40. Oga-Omenka, C., Boffa, J., Kuye, J., *et al.* Understanding the gaps in DR-TB care cascade in Nigeria: A sequential mixed-method study. *J Clin Tuberc Other Mycobact Dis* **21**, 100193 (2020).
41. Atre, S., Jagtap, J., Faqih, M., *et al.* Addressing patients' unmet needs related to multidrug-resistant tuberculosis (MDR-TB) care: A qualitative research study from Pune city, India. *PLoS One* **18**, e0295508 (2023).
42. Chilala, S. B., Silumbwe, A., Zulu, J. M., *et al.* Individual, community and health systems factors influencing time to notification of tuberculosis: situating software and hardware bottlenecks in local health systems. *BMC Health Serv Res* **24**, 1241 (2024).

## **Study Protocol Appendix: PubMed Search Terms**

### **Concept: TB**

"Tuberculosis"[Mesh:NoExp] OR "tuberculosis" [tiab] OR tuberculos\*[tiab] OR TB[tiab] OR Tuberculosis, Multidrug-Resistant[mesh] OR Multidrug-Resistant Tuberculosis[tiab] OR Multi-Drug Resistant Tuberculosis[tiab] OR MDR-TB[tiab] OR Extensively Drug-Resistant Tuberculosis[Mesh] OR Extensively Drug Resistant Tuberculosis[tiab] OR Extremely Drug-Resistant Tuberculosis[tiab] OR Extensively Drug-Resistant Tuberculoses[tiab] OR XDR-TB[tiab] OR Tuberculosis, Extrapulmonary[mesh] OR Extrapulmonary Tuberculos\*[tiab] OR Extra Pulmonary Tuberculosis[tiab] OR EPTB[tiab] OR DS-TB[tiab] OR DS TB[tiab]

### **Concept: High burden countries (TB, TB-HIV, MDRTB)**

angola[mh] OR azerbaijan[mh] OR bangladesh[mh] OR republic of belarus[mh] OR botswana[mh] OR brazil[mh] OR cameroon[mh] OR central african republic[mh] OR china[mh] OR democratic republic of the congo[mh] OR congo[mh] OR eswatini[mh] OR Ethiopia[mh] OR gabon[mh] OR guinea[mh] OR guinea-bissau[mh] OR india[mh] OR indonesia[mh] OR kazakhstan[mh] OR kenya[mh] OR democratic people's republic of korea[mh] OR kyrgyzstan[mh] OR lesotho[mh] OR liberia[mh] OR malawi[mh] OR moldova[mh] OR mongolia[mh] OR mozambique[mh] OR myanmar[mh] OR namibia[mh] OR nepal[mh] OR nigeria[mh] OR pakistan[mh] OR papua new guinea[mh] OR peru[mh] OR philippines[mh] OR russia[mh] OR sierra leone[mh] OR somalia[mh] OR south africa[mh] OR tajikistan[mh] OR thailand[mh] OR tanzania[mh] OR uganda[mh] OR ukraine[mh] OR uzbekistan[mh] OR Vietnam[mh] OR zambia[mh] OR zimbabwe[mh] OR angola[tiab] OR azerbaijan[tiab] OR bangladesh[tiab] OR republic of belarus[tiab] OR botswana[tiab] OR brazil[tiab] OR cameroon[tiab] OR central african republic[tiab] OR china[tiab] OR democratic republic of the congo[tiab] OR congo[tiab] OR eswatini[tiab] OR Ethiopia[tiab] OR gabon[tiab] OR guinea[tiab] OR guinea-bissau[tiab] OR india[tiab] OR indonesia[tiab] OR kazakhstan[tiab] OR kenya[tiab] OR democratic people's republic of korea[tiab] OR kyrgyzstan[tiab] OR lesotho[tiab] OR liberia[tiab] OR malawi[tiab] OR moldova[tiab] OR mongolia[tiab] OR mozambique[tiab] OR myanmar[tiab] OR namibia[tiab] OR nepal[tiab] OR nigeria[tiab] OR pakistan[tiab] OR papua new guinea[tiab] OR peru[tiab] OR philippines[tiab] OR russia[tiab] OR sierra leone[tiab] OR somalia[tiab] OR south africa[tiab] OR tajikistan[tiab] OR thailand[tiab] OR tanzania[tiab] OR uganda[tiab] OR ukraine[tiab] OR uzbekistan[tiab] OR Vietnam[tiab] OR zambia[tiab] OR zimbabwe[tiab]

### **Concept: Barriers**

barrier\*[tiab] OR challenge\*[tiab] OR delay[tiab] OR obstacle\*[tiab] OR problem\* [tiab] OR factor\* [tiab] OR gap [tiab] OR observation\*[tiab] OR experience\*[tiab] OR perception\*[tiab] OR determinant\*[tiab] OR implementation[tiab] OR provision[tiab]

### **Concept: Healthcare worker**

"Health Personnel"[Mesh:NoExp] OR Community Health Workers[mesh] OR Health Worker\*[tiab] OR Healthcare Worker\*[tiab] OR Health Care Provider\*[tiab] OR Provider\*[tiab] OR Health Care Professional\* [tiab] OR Physicians[mesh] OR Physician\*[tiab] OR doctor\*[tiab] OR nurses[mesh] OR nurs\*[tiab] OR pharmacist\*[tiab] OR clinic[tiab] OR hospital[tiab] OR facilit\*[tiab]

### **Concept: Article type**

Review [Publication Type]

## **Appendix S2: Thematic category definitions and considerations**

We distinguished between knowledge and skills, and motivation as follows: knowledge and skills were related to barriers such as a lack of understanding or ability to provide TB services per guidelines; and motivation was related to barriers such as the amount of effort a FLHCW was willing to engage in to provide quality TB services. Some overlap is inherent to the barriers as categorized. For example, poor provider communication and attitudes may also be related to inadequate knowledge and skills; we analyzed these as mutually exclusive categories because issues with FLHCW communication and attitudes were frequently mentioned in the included papers. Similarly, the communication and attitudes category does not include use of stigmatizing or discriminatory language, which was analyzed separately because it arose as a clear theme.

### Appendix S3: Complete list of high TB burden countries included in the review

| The 30 high TB burden countries                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | The 30 high TB/HIV burden countries                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | The 30 high MDR-TB burden countries                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>The 20 countries with the highest estimated numbers of incident TB cases:</p> <ol style="list-style-type: none"> <li>1. Angola</li> <li>2. Bangladesh</li> <li>3. Brazil</li> <li>4. China</li> <li>5. Democratic People's Republic of Korea</li> <li>6. Democratic Republic of Congo</li> <li>7. Ethiopia</li> <li>8. India</li> <li>9. Indonesia</li> <li>10. Kenya</li> <li>11. Mozambique</li> <li>12. Myanmar</li> <li>13. Nigeria</li> <li>14. Pakistan</li> <li>15. Philippines</li> <li>16. South Africa</li> <li>17. Thailand</li> <li>18. Uganda</li> <li>19. United Republic of Tanzania</li> <li>20. Viet Nam</li> </ol> <p>The additional 10 countries with the highest estimated TB incidence rate that are not in the top 20 by absolute number (threshold, &gt;10 000 estimated incident TB cases per year):</p> <ol style="list-style-type: none"> <li>21. Central African Republic</li> <li>22. Congo</li> <li>23. Gabon</li> <li>24. Lesotho</li> <li>25. Liberia</li> <li>26. Mongolia</li> <li>27. Namibia</li> <li>28. Papua New Guinea</li> <li>29. Sierra Leone</li> <li>30. Zambia</li> </ol> | <p>The 20 countries with the highest estimated numbers of incident TB cases among people living with HIV:</p> <ol style="list-style-type: none"> <li>1. Brazil</li> <li>2. Cameroon</li> <li>3. China</li> <li>4. Democratic Republic of Congo</li> <li>5. Ethiopia</li> <li>6. India</li> <li>7. Indonesia</li> <li>8. Kenya</li> <li>9. Malawi</li> <li>10. Mozambique</li> <li>11. Myanmar</li> <li>12. Nigeria</li> <li>13. Philippines</li> <li>14. Russian Federation</li> <li>15. South Africa</li> <li>16. Thailand</li> <li>17. Uganda</li> <li>18. United Republic of Tanzania</li> <li>19. Zambia</li> <li>20. Zimbabwe</li> </ol> <p>The additional 10 countries with the highest estimated TB/HIV incidence rate that are not in the top 20 by absolute number (threshold, &gt;1000 estimated incident TB/HIV cases per year):</p> <ol style="list-style-type: none"> <li>21. Boswana</li> <li>22. Central African Republic</li> <li>23. Congo</li> <li>24. Eswatini</li> <li>25. Gabon</li> <li>26. Guinea</li> <li>27. Guinea-Bissau</li> <li>28. Lesotho</li> <li>29. Liberia</li> <li>30. Namibia</li> </ol> | <p>The 20 countries with the highest estimated numbers of incident MDR/RR-TB cases:</p> <ol style="list-style-type: none"> <li>1. Angola</li> <li>2. Bangladesh</li> <li>3. China</li> <li>4. Democratic People's Republic of Korea</li> <li>5. Democratic Republic of Congo</li> <li>6. India</li> <li>7. Indonesia</li> <li>8. Kazakhstan</li> <li>9. Mozambique</li> <li>10. Myanmar</li> <li>11. Nigeria</li> <li>12. Pakistan</li> <li>13. Peru</li> <li>14. Philippines</li> <li>15. Russian Federation</li> <li>16. Somalia</li> <li>17. South Africa</li> <li>18. Ukraine</li> <li>19. Uzbekistan</li> <li>20. Viet Nam</li> </ol> <p>The additional 10 countries with the highest estimated MDR/RR-TB incidence rate that are not in the top 20 by absolute number (threshold, &gt;1000 estimated incident MDR/RR-TB cases per year):</p> <ol style="list-style-type: none"> <li>21. Azerbaijan</li> <li>22. Belarus</li> <li>23. Kyrgyzstan</li> <li>24. Mongolia</li> <li>25. Nepal</li> <li>26. Papua New Guinea</li> <li>27. Republic of Moldova</li> <li>28. Tajikistan</li> <li>29. Zambia</li> <li>30. Zimbabwe</li> </ol> |

The countries in each category are listed in alphabetical order.

Abbreviations: TB=tuberculosis; HIV= human immunodeficiency virus; MDR=multi-drug resistant; RR=rifampicin resistant

Reference: WHO global lists of high burden countries for TB, multidrug/rifampicin-resistant TB (MDR/RR-TB) and TB/HIV, 2021–2025. Geneva: World Health Organization; 2021. Licence: CC BY-NC-SA 3.0 IGO.

#### Appendix S4: Complete list of included publications

| #  | Author & Year of publication | Country in which the study conducted | Care steps covered                                                 | Patient population | Patient risk factors |
|----|------------------------------|--------------------------------------|--------------------------------------------------------------------|--------------------|----------------------|
| 1  | Abbas 2023                   | Pakistan                             | Treatment Completion/Adherence                                     | Adult              | None                 |
| 2  | AbbasAli 2024                | India                                | Treatment Completion/Adherence                                     | Adult              | None                 |
| 3  | Abebe 2022                   | Ethiopia                             | Treatment Completion/Adherence                                     | Not specified      | None                 |
| 4  | Abraham 2024                 | Ethiopia                             | Active Case Finding                                                | Not specified      | None                 |
| 5  | Abubakar 2024                | Pakistan                             | Treatment Completion/Adherence                                     | Not specified      | None                 |
| 6  | Achanta 2013                 | India                                | Diagnosis & Treatment Initiation<br>Treatment Completion/Adherence | Not specified      | None                 |
| 7  | Adams 2017                   | South Africa                         | General TB care                                                    | Not specified      | Mining               |
| 8  | Ahmad 2024                   | India                                | Diagnosis & Treatment Initiation                                   | Not specified      | None                 |
| 9  | Ahmed 2021                   | South Africa                         | TB Preventive Treatment                                            | Adult              | None                 |
| 10 | Aibana 2020                  | Ukraine                              | Treatment Completion/Adherence                                     | Adult              | None                 |
| 11 | Ajudua 2022                  | South Africa                         | Active Case Finding                                                | Not specified      | None                 |
| 12 | Akamike 2022                 | Nigeria                              | TB Preventive Treatment                                            | Not specified      | PLWH                 |
| 13 | Ali 2019                     | Pakistan                             | Treatment Completion/Adherence                                     | Not specified      | None                 |
| 14 | Alvi 2024                    | India                                | TB Preventive Treatment                                            | Pediatric Adult    | Household contacts   |
| 15 | Amuge 2024                   | Uganda                               | TB Preventive Treatment                                            | Pediatric          | PLWH                 |
| 16 | Andom 2022                   | Lesotho                              | Diagnosis & Treatment Initiation                                   | Pediatric Adult    | None                 |
| 17 | Arini 2022                   | Indonesia                            | General TB care                                                    | Not specified      | Diabetes             |
| 18 | Arscott-Mills 2017           | Botswana                             | TB Preventive Treatment<br>Diagnosis & Treatment Initiation        | Pediatric          | None                 |
| 19 | ArtawanEka Putra 2013        | Indonesia                            | Diagnosis & Treatment Initiation                                   | Not specified      | None                 |
| 20 | Asemahagn 2020               | Ethiopia                             | Active Case Finding                                                | Not specified      | None                 |
| 21 | Atif 2016                    | Pakistan                             | Diagnosis & Treatment Initiation<br>Treatment Completion/Adherence | Adult              | None                 |

|    |                              |              |                                                                                             |                    |                       |
|----|------------------------------|--------------|---------------------------------------------------------------------------------------------|--------------------|-----------------------|
| 22 | Atkins 2011                  | South Africa | Diagnosis & Treatment<br>Initiation<br>Treatment<br>Completion/Adherence                    | Not<br>specified   | None                  |
| 23 | Atre 2023                    | India        | General TB care                                                                             | Adult              | None                  |
| 24 | Ayakaka<br>2017              | Uganda       | Active Case Finding                                                                         | Not<br>specified   | Household<br>contacts |
| 25 | Baloyi 2022                  | South Africa | TB Preventive Treatment                                                                     | Pediatric<br>Adult | None                  |
| 26 | Baloyi 2024                  | South Africa | General TB care                                                                             | Pediatric          | None                  |
| 27 | Baniqued<br>2020             | Philippines  | Treatment<br>Completion/Adherence                                                           | Adult              | None                  |
| 28 | Belgaumkar<br>2018           | India        | TB Preventive Treatment<br>Active Case Finding                                              | Pediatric          | Household<br>contacts |
| 29 | Bhagat<br>2011               | India        | Treatment<br>Completion/Adherence                                                           | Not<br>specified   | None                  |
| 30 | Bhering<br>2022              | Brazil       | Diagnosis & Treatment<br>Initiation                                                         | Adult              | None                  |
| 31 | Bieh 2017                    | Nigeria      | General TB care                                                                             | Adult              | None                  |
| 32 | Bjerrum<br>2012              | Tanzania     | Diagnosis & Treatment<br>Initiation                                                         | Pediatric          | None                  |
| 33 | Boffa 2021                   | South Africa | Diagnosis & Treatment<br>Initiation                                                         | Adult              | None                  |
| 34 | Brady 2018                   | Angola       | Diagnosis & Treatment<br>Initiation<br>Treatment<br>Completion/Adherence<br>General TB care | Adult              | Migrant<br>workers    |
| 35 | Bulage<br>2014               | Uganda       | General TB care                                                                             | Adult              | None                  |
| 36 | Catalani<br>2014             | Kenya        | TB Preventive Treatment<br>Diagnosis & Treatment<br>Initiation                              | Not<br>specified   | PLWH                  |
| 37 | Cattamanch<br>i 2015         | Uganda       | Diagnosis & Treatment<br>Initiation<br>General TB care                                      | Not<br>specified   | None                  |
| 38 | Caturegli<br>2020            | South Africa | TB Preventive Treatment                                                                     | Adult              | PLWH                  |
| 39 | Chawla<br>2021               | India        | Diagnosis & Treatment<br>Initiation                                                         | Pediatric          | Household<br>contacts |
| 40 | Chetty-<br>Makkan<br>2021    | South Africa | Active Case Finding<br>General TB care                                                      | Not<br>specified   | None                  |
| 41 | Chiang<br>2015               | Peru         | Diagnosis & Treatment<br>Initiation                                                         | Pediatric          | Household<br>contacts |
| 42 | Chiang<br>2017               | Peru         | Diagnosis & Treatment<br>Initiation                                                         | Pediatric          | None                  |
| 43 | Chihota<br>2015              | South Africa | Diagnosis & Treatment<br>Initiation                                                         | Adult              | None                  |
| 44 | Chijioke-<br>Akaniro<br>2023 | Nigeria      | Diagnosis & Treatment<br>Initiation                                                         | Pediatric<br>Adult | None                  |

|    |                     |              |                                                                                       |                 |      |
|----|---------------------|--------------|---------------------------------------------------------------------------------------|-----------------|------|
|    |                     |              | Treatment Completion/Adherence                                                        |                 |      |
| 45 | Chilala 2024        | Zambia       | Diagnosis & Treatment Initiation                                                      | Adult           | None |
| 46 | Chimbatata NBW 2017 | Malawi       | Diagnosis & Treatment Initiation                                                      | Not specified   | None |
| 47 | Christian 2024      | Uganda       | TB Preventive Treatment                                                               | Adult           | PLWH |
| 48 | Colvin 2019         | Philippines  | TB Preventive Treatment<br>Treatment Completion/Adherence<br>General TB care          | Adult           | None |
| 49 | Cowan 2013          | Ethiopia     | TB Preventive Treatment<br>General TB care                                            | Not specified   | None |
| 50 | Dabaro 2017         | Ethiopia     | Diagnosis & Treatment Initiation                                                      | Not specified   | None |
| 51 | Daboer 2013         | Nigeria      | General TB care                                                                       | Not specified   | None |
| 52 | Daftary 2014        | South Africa | Diagnosis & Treatment Initiation<br>Treatment Completion/Adherence<br>General TB care | Adult           | PLWH |
| 53 | Daftary 2016        | South Africa | General TB care                                                                       | Not specified   | PLWH |
| 54 | daSilva 2017        | Brazil       | Treatment Completion/Adherence                                                        | Adult           | None |
| 55 | Deshmukh 2015       | India        | Treatment Completion/Adherence                                                        | Adult           | None |
| 56 | Elbireer 2011       | Uganda       | Treatment Completion/Adherence                                                        | Adult           | PLWH |
| 57 | Endo 2022           | Philippines  | Treatment Completion/Adherence                                                        | Not specified   | None |
| 58 | Feyisa 2022         | Ethiopia     | Diagnosis & Treatment Initiation                                                      | Not specified   | None |
| 59 | Foster 2023         | South Africa | General TB care                                                                       | Pediatric Adult | PLWH |
| 60 | Garg 2020           | India        | Diagnosis & Treatment Initiation                                                      | Not specified   | None |
| 61 | Gayathri 2020       | India        | Diagnosis & Treatment Initiation                                                      | Not specified   | None |
| 62 | Geadas 2024         | Peru         | Diagnosis & Treatment Initiation                                                      | Adult           | None |
| 63 | Gebremariam 2010    | Ethiopia     | Treatment Completion/Adherence                                                        | Not specified   | None |
| 64 | Getnet 2017         | Ethiopia     | Active Case Finding<br>Diagnosis & Treatment Initiation                               | Adult           | None |
| 65 | GugssaBoru 2017     | Ethiopia     | Treatment Completion/Adherence                                                        | Adult           | None |
| 66 | Haldane 2024        | China        | Diagnosis & Treatment Initiation                                                      | Not specified   | None |
| 67 | Hasker 2010         | Uzbekistan   | Treatment Completion/Adherence                                                        | Not specified   | None |

|    |                |              |                                                                 |                 |                    |
|----|----------------|--------------|-----------------------------------------------------------------|-----------------|--------------------|
| 68 | Hayward 2024   | South Africa | General TB care                                                 | Pediatric Adult | None               |
| 69 | Ibrahim 2014   | Nigeria      | Treatment Completion/Adherence                                  | Adult           | None               |
| 70 | Ibrahim 2014   | Nigeria      | Treatment Completion/Adherence                                  | Not specified   | None               |
| 71 | Izudi 2019     | Uganda       | General TB care                                                 | Not specified   | None               |
| 72 | Jacobson 2017  | South Africa | TB Preventive Treatment                                         | Adult           | PLWH               |
| 73 | Jaramillo 2023 | Philippines  | General TB care                                                 | Not specified   | None               |
| 74 | Jarrett 2020   | South Africa | TB Preventive Treatment                                         | Adult           | PLWH               |
| 75 | Kalema 2021    | Uganda       | TB Preventive Treatment                                         | Adult           | PLWH               |
| 76 | Kallon 2022    | South Africa | General TB care                                                 | Adult           | PLWH               |
| 77 | Katende 2021   | Uganda       | General TB care                                                 | Adult           | PLWH               |
| 78 | Kaumba 2024    | Zambia       | TB Preventive Treatment Diagnosis & Treatment Initiation        | Pediatric       | None               |
| 79 | Khan 2016      | Pakistan     | Treatment Completion/Adherence                                  | Not specified   | None               |
| 80 | Kigozi 2020    | South Africa | Active Case Finding                                             | Not specified   | None               |
| 81 | KS 2018        | India        | TB Preventive Treatment Diagnosis & Treatment Initiation        | Pediatric       | None               |
| 82 | Kumar 2025     | India        | TB Preventive Treatment                                         | Pediatric       | Household contacts |
| 83 | Kumwenda 2016  | Malawi       | General TB care                                                 | Not specified   | None               |
| 84 | Kumwenda 2017  | Malawi       | Diagnosis & Treatment Initiation                                | Adult           | Pregnancy          |
| 85 | Laghari 2021   | Pakistan     | Treatment Completion/Adherence                                  | Pediatric       | None               |
| 86 | Lai 2019       | Ethiopia     | TB Preventive Treatment                                         | Not specified   | PLWH               |
| 87 | Lajore 2024    | Ethiopia     | General TB care                                                 | Not specified   | None               |
| 88 | Lester 2010    | South Africa | TB Preventive Treatment                                         | Adult           | PLWH               |
| 89 | Li 2014        | China        | General TB care                                                 | Adult           | None               |
| 90 | Loveday 2019   | South Africa | Diagnosis & Treatment Initiation Treatment Completion/Adherence | Adult           | Pregnancy          |
| 91 | Loveday 2020   | South Africa | Diagnosis & Treatment Initiation Treatment Completion/Adherence | Adult           | Pregnancy          |
| 92 | Lyakurwa 2021  | Tanzania     | Treatment Completion/Adherence                                  | Adult           | None               |

|     |                |                                             |                                                                    |                    |      |
|-----|----------------|---------------------------------------------|--------------------------------------------------------------------|--------------------|------|
| 93  | Mabunda 2016   | South Africa                                | Treatment Completion/Adherence                                     | Not specified      | None |
| 94  | Mabuza 2018    | South Africa                                | General TB care                                                    | Adult              | PLWH |
| 95  | Mala 2014      | Ethiopia                                    | Diagnosis & Treatment Initiation                                   | Adult              | None |
| 96  | Mandera 2024   | Uganda                                      | Diagnosis & Treatment Initiation                                   | Pediatric          | None |
| 97  | Marahatta 2020 | Nepal                                       | Diagnosis & Treatment Initiation<br>Treatment Completion/Adherence | Not specified      | None |
| 98  | Marais 2019    | South Africa                                | TB Preventive Treatment<br>Diagnosis & Treatment Initiation        | Not specified      | None |
| 99  | Marangu 2017   | Kenya                                       | Diagnosis & Treatment Initiation                                   | Not specified      | None |
| 100 | Matakanye 2019 | South Africa                                | Diagnosis & Treatment Initiation<br>Treatment Completion/Adherence | Not specified      | None |
| 101 | Mathew 2021    | India                                       | General TB care                                                    | Pediatric<br>Adult | None |
| 102 | Mavhu 2010     | Zimbabwe                                    | Diagnosis & Treatment Initiation                                   | Adult              | None |
| 103 | McDowell 2016  | India                                       | Diagnosis & Treatment Initiation                                   | Not specified      | None |
| 104 | McNally 2019   | Peru                                        | Diagnosis & Treatment Initiation<br>Treatment Completion/Adherence | Adult              | None |
| 105 | Megerso 2020   | Ethiopia                                    | Diagnosis & Treatment Initiation<br>Treatment Completion/Adherence | Adult              | None |
| 106 | Melgar 2021    | Zambia                                      | TB Preventive Treatment                                            | Pediatric<br>Adult | PLWH |
| 107 | Mercaldo 2021  | Uganda                                      | Diagnosis & Treatment Initiation                                   | Adult              | None |
| 108 | Mindachew 2014 | Ethiopia                                    | TB Preventive Treatment                                            | Adult              | PLWH |
| 109 | Mnyambwa 2021  | Other:<br>Tanzania,<br>Kenya, and<br>Uganda | Active Case Finding<br>Diagnosis & Treatment Initiation            | Pediatric<br>Adult | PLWH |
| 110 | Moodley 2020   | South Africa                                | Treatment Completion/Adherence                                     | Adult              | None |
| 111 | Moolphate 2013 | Thailand                                    | TB Preventive Treatment                                            | Not specified      | PLWH |
| 112 | Mpagama 2019   | Tanzania                                    | Diagnosis & Treatment Initiation                                   | Not specified      | PLWH |
| 113 | Mpagama 2020   | Tanzania                                    | Diagnosis & Treatment Initiation<br>General TB care                | Adult              | None |

|     |                        |              |                                                                          |                    |                             |
|-----|------------------------|--------------|--------------------------------------------------------------------------|--------------------|-----------------------------|
| 114 | Mphothulo<br>2025      | South Africa | Diagnosis & Treatment<br>Initiation<br>Treatment<br>Completion/Adherence | Adult              | None                        |
| 115 | Mukerji<br>2020        | India        | Diagnosis & Treatment<br>Initiation<br>Treatment<br>Completion/Adherence | Adult              | None                        |
| 116 | Mulaku<br>2023         | Kenya        | Diagnosis & Treatment<br>Initiation                                      | Adult              | None                        |
| 117 | Mundra<br>2019         | India        | Diagnosis & Treatment<br>Initiation                                      | Not<br>specified   | None                        |
| 118 | Murdoch<br>2021        | South Africa | Diagnosis & Treatment<br>Initiation<br>General TB care                   | Not<br>specified   | None                        |
| 119 | Mussie<br>2021         | Ethiopia     | General TB care                                                          | Not<br>specified   | None                        |
| 120 | Mustafa<br>2018        | Pakistan     | Diagnosis & Treatment<br>Initiation                                      | Not<br>specified   | None                        |
| 121 | Muttamba<br>2021       | Uganda       | Diagnosis & Treatment<br>Initiation<br>General TB care                   | Pediatric          | None                        |
| 122 | Nagarajan<br>2022      | India        | General TB care                                                          | Adult              | None                        |
| 123 | Naidoo<br>2015         | South Africa | Diagnosis & Treatment<br>Initiation                                      | Adult              | None                        |
| 124 | Nakaggwa<br>2016       | Uganda       | Treatment<br>Completion/Adherence                                        | Pediatric<br>Adult | PLWH<br>Prior TB<br>disease |
| 125 | Nansera<br>2010        | Uganda       | Diagnosis & Treatment<br>Initiation                                      | Not<br>specified   | PLWH                        |
| 126 | Newtonraj<br>2019      | India        | Diagnosis & Treatment<br>Initiation                                      | Pediatric<br>Adult | PLWH                        |
| 127 | Nezenega<br>2013       | Ethiopia     | Treatment<br>Completion/Adherence                                        | Pediatric<br>Adult | None                        |
| 128 | Nóbrega<br>2010        | Brazil       | Active Case Finding<br>Diagnosis & Treatment<br>Initiation               | Not<br>specified   | None                        |
| 129 | Oga-<br>Omenka<br>2020 | Nigeria      | Diagnosis & Treatment<br>Initiation<br>Treatment<br>Completion/Adherence | Pediatric<br>Adult | None                        |
| 130 | Oga-<br>Omenka<br>2020 | Nigeria      | General TB care                                                          | Not<br>specified   | None                        |
| 131 | Oladimeji<br>2022      | Nigeria      | Treatment<br>Completion/Adherence                                        | Pediatric<br>Adult | PLWH                        |
| 132 | Oliwa 2020             | Kenya        | Diagnosis & Treatment<br>Initiation                                      | Pediatric          | None                        |
| 133 | Omar 2024              | Somalia      | Treatment<br>Completion/Adherence                                        | Adult              | None                        |
| 134 | Oonyu 2022             | Uganda       | TB Preventive Treatment                                                  | Pediatric<br>Adult | PLWH                        |
| 135 | Phiri 2021             | Malawi       | General TB care                                                          | Adult              | None                        |

|     |                         |              |                                                                          |                    |                                                                 |
|-----|-------------------------|--------------|--------------------------------------------------------------------------|--------------------|-----------------------------------------------------------------|
| 136 | Phyo 2019               | Myanmar      | Active Case Finding                                                      | Pediatric<br>Adult | Household<br>contacts                                           |
| 137 | Pradhan<br>2010         | India        | Diagnosis & Treatment<br>Initiation                                      | Adult              | None                                                            |
| 138 | Pradipta<br>2021        | Indonesia    | Treatment<br>Completion/Adherence                                        | Adult              | Treatment<br>adherence<br>issues/ poor<br>treatment<br>outcomes |
| 139 | Pradipta<br>2022        | Indonesia    | Diagnosis & Treatment<br>Initiation<br>Treatment<br>Completion/Adherence | Not<br>specified   | None                                                            |
| 140 | Prakoso<br>2023         | Indonesia    | Diagnosis & Treatment<br>Initiation                                      | Not<br>specified   | Diabetes                                                        |
| 141 | Probandari<br>2019      | Indonesia    | General TB care                                                          | Not<br>specified   | None                                                            |
| 142 | Purohit<br>2015         | India        | Diagnosis & Treatment<br>Initiation                                      | Not<br>specified   | None                                                            |
| 143 | Reddy 2020              | India        | TB Preventive Treatment                                                  | Pediatric<br>Adult | PLWH                                                            |
| 144 | Reta 2018               | Ethiopia     | General TB care                                                          | Adult              | None                                                            |
| 145 | Roscoe<br>2020          | Namibia      | TB Preventive Treatment                                                  | Pediatric<br>Adult | PLWH                                                            |
| 146 | Roy 2015                | India        | Treatment<br>Completion/Adherence                                        | Not<br>specified   | None                                                            |
| 147 | Ruru 2018               | Indonesia    | Treatment<br>Completion/Adherence                                        | Adult              | None                                                            |
| 148 | Rutherford<br>2013      | Indonesia    | Treatment<br>Completion/Adherence                                        | Adult              | None                                                            |
| 149 | Salazar-<br>Austin 2021 | South Africa | TB Preventive Treatment                                                  | Pediatric          | Household<br>contacts                                           |
| 150 | Sardar 2010             | India        | Treatment<br>Completion/Adherence                                        | Adult              | PLWH                                                            |
| 151 | Sarwar<br>2023          | Bangladesh   | Active Case Finding                                                      | Adult              | PLWH                                                            |
| 152 | Serapelwan<br>e 2016    | South Africa | Treatment<br>Completion/Adherence                                        | Adult              | None                                                            |
| 153 | Shah 2024               | India        | Diagnosis & Treatment<br>Initiation<br>Treatment<br>Completion/Adherence | Not<br>specified   | None                                                            |
| 154 | Shamanewa<br>di 2020    | India        | Active Case Finding                                                      | Not<br>specified   | None                                                            |
| 155 | Sharma<br>2015          | India        | General TB care                                                          | Not<br>specified   | None                                                            |
| 156 | Shewade<br>2018         | India        | Diagnosis & Treatment<br>Initiation                                      | Not<br>specified   | None                                                            |
| 157 | Shitol 2023             | Bangladesh   | Diagnosis & Treatment<br>Initiation                                      | Pediatric          | None                                                            |
| 158 | Simbwa<br>2021          | Uganda       | General TB care                                                          | Not<br>specified   | None                                                            |
| 159 | Singh 2017              | India        | TB Preventive Treatment                                                  | Pediatric          | Household<br>contacts                                           |

|     |                       |              |                                                                    |                    |                            |
|-----|-----------------------|--------------|--------------------------------------------------------------------|--------------------|----------------------------|
| 160 | Singh 2017            | India        | General TB care                                                    | Not specified      | None                       |
| 161 | Singh 2021            | India        | Diagnosis & Treatment Initiation                                   | Pediatric          | Malnutrition               |
| 162 | Skinner 2016          | South Africa | Diagnosis & Treatment Initiation<br>Treatment Completion/Adherence | Not specified      | None                       |
| 163 | Skordis-Worrall 2010  | South Africa | Diagnosis & Treatment Initiation                                   | Adult              | PLWH                       |
| 164 | SouzaLLL 2021         | Brazil       | Treatment Completion/Adherence                                     | Adult              | None                       |
| 165 | Sreevidya 2025        | India        | TB Preventive Treatment                                            | Pediatric          | Household contacts         |
| 166 | Sultana 2022          | Bangladesh   | Diagnosis & Treatment Initiation<br>Treatment Completion/Adherence | Pediatric<br>Adult | None                       |
| 167 | Suseendar 2024        | India        | General TB care                                                    | Not specified      | None                       |
| 168 | Sylvia 2017           | China        | Diagnosis & Treatment Initiation                                   | Not specified      | None                       |
| 169 | Tadesse 2013          | Ethiopia     | Diagnosis & Treatment Initiation                                   | Adult              | None                       |
| 170 | Teklay 2016           | Ethiopia     | TB Preventive Treatment                                            | Adult              | PLWH                       |
| 171 | Tesfaye 2020          | Ethiopia     | Active Case Finding                                                | Pediatric<br>Adult | Household contacts         |
| 172 | Thomas 2020           | India        | Diagnosis & Treatment Initiation                                   | Adult              | None                       |
| 173 | Tupasi 2016           | Philippines  | Treatment Completion/Adherence                                     | Adult              | None                       |
| 174 | Tusho 2025            | Ethiopia     | Treatment Completion/Adherence                                     | Adult              | None                       |
| 175 | vandeWater 2023       | South Africa | TB Preventive Treatment                                            | Pediatric<br>Adult | PLWH<br>Household contacts |
| 176 | VanGinderd euren 2019 | South Africa | TB Preventive Treatment                                            | Adult              | PLWH                       |
| 177 | Vanleeuw 2020         | South Africa | General TB care                                                    | Adult              | None                       |
| 178 | Vanqa 2021            | South Africa | Diagnosis & Treatment Initiation                                   | Adult              | None                       |
| 179 | Vijay 2010            | India        | Treatment Completion/Adherence                                     | Adult              | None                       |
| 180 | Vijayageetha 2019     | India        | Active Case Finding                                                | Adult              | Pregnancy                  |
| 181 | Wakjira 2023          | Ethiopia     | General TB care                                                    | Adult              | None                       |
| 182 | WambiyaE OA 2018      | Kenya        | TB Preventive Treatment                                            | Not specified      | PLWH                       |
| 183 | Watermeyer 2019       | South Africa | General TB care                                                    | Adult              | None                       |

|     |               |       |                                  |                 |                                                                  |
|-----|---------------|-------|----------------------------------|-----------------|------------------------------------------------------------------|
| 184 | Yellappa 2016 | India | Treatment Completion/Adherence   | Adult           | None                                                             |
| 185 | Yuen 2021     | Peru  | TB Preventive Treatment          | Pediatric Adult | PLWH Household contacts People living with medical comorbidities |
| 186 | Zaidi 2024    | India | Treatment Completion/Adherence   | Adult           | None                                                             |
| 187 | Zhang 2020    | China | Treatment Completion/Adherence   | Adult           | None                                                             |
| 188 | Zhou 2022     | China | Diagnosis & Treatment Initiation | Adult           | None                                                             |
| 189 | Zhou 2024     | China | General TB care                  | Not specified   | None                                                             |

## **Appendix S5: Descriptive statistics on included studies**

Three countries contributed to more than 50% of the included publications: India (n=38; 20%), South Africa (n=38; 20%), and Ethiopia (n=22; 12%).

Among the included studies, the type of FLHCW cadre reported included doctors (n=101; 53%), nurses (n=82; 43%), community health workers (n=38; 20%), pharmacists (n=19; 10%), TB focal point persons (FLHCWs dedicated to providing TB services in a primary care or non-TB specialty setting; n=11; 6%), and other cadres (n=67; 35%). One hundred (53%) papers described barriers specifically related to adults, and 42 (22%) described barriers related to pediatric populations (defined as <15 or <18 years depending on the study).

In comparing the three countries that contributed the most studies to this scoping review, knowledge and skills gaps were commonly reported across India (27/38; 71%), South Africa (22/38; 58%), and Ethiopia (17/22; 77%). Similarly, patient-provider communication challenges were also commonly reported (South Africa: 20/38; 53%, Ethiopia: 9/22; 41%, India: 12/38; 32%). Discrimination and stigma from FLHCW while providing TB services were more frequently reported in South Africa (11/38; 29%) compared to India (3/38; 8%) and Ethiopia (3/22; 14%). Motivation to provide quality care was reported as a barrier in less than a quarter of papers in each of these three countries (South Africa: 6/38; 16%, Ethiopia: 5/22; 23%, and India: 5/38; 13%).