

Overcoming structural barriers to tuberculosis treatment in Africa through digital technologies



Millions of people still die from tuberculosis in Africa. The continent is home to 17 of the 30 countries with the highest tuberculosis burdens and 25% of all new cases worldwide. According to the WHO Global Tuberculosis Report 2025,¹ the continent exceeded the first End TB Strategy milestones and recorded one of the strongest global recoveries in tuberculosis control; the efforts of African governments and their international partners have been instrumental in this progress. Despite these advances, the continent is still struggling with monitoring tuberculosis treatment adherence and completion, which directly affects cure, relapse, drug resistance, transmission dynamics, and economic wellbeing. In this Comment, we argue that evaluation of tuberculosis treatment adherence strategies in Africa, particularly digital adherence technologies (DATs), need to extend beyond biomedical treatment outcomes to include patient-centred, economic, health system, and transmission-related effects.

To date, the continent has not benefited from DATs such as video-observed therapy, SMS reminders, medication event reminder monitors, smart pillboxes, and medication sleeves that might otherwise increase treatment adherence. By avoiding the need for daily clinic visits for directly observed therapy (DOT), these tools have the potential to empower individuals with tuberculosis disease to manage their treatment independently while being monitored remotely.² Several individual and cluster-randomised controlled trials have been carried out in high-burden African countries to compare the effectiveness of promising DATs with conventional DOT. However, translating these trial findings into policy and routine practice remains a challenge. This challenge is particularly urgent as tuberculosis programmes across Africa navigate post-COVID-19 recovery, persistent funding constraints, and increasing pressure to adopt patient-centred and cost-effective models of care.

Although DOTs might not improve treatment outcomes in all cases, the system might offer other advantages. In settings wherein adherence under DOT is already high, a DAT intervention could be considered successful when it achieves comparable adherence while providing a more patient-centred and cost-effective alternative. DATs

do appear to improve treatment adherence.^{3,4} Although the scientific value of DATs should guide their adoption, parallel attention is required to ensure equitable access to these technologies and the benefits they generate. Both standard DOT and DAT approaches have distinct potential benefits and drawbacks in the African context, in implementation, uptake, access, or sustainability, which make informing policy and practice more complex. Tuberculosis policy implementers and future studies will need to consider the available data for both DOT and DATs, including individual and societal wellbeing, in addition to treatment outcomes, and make a contextual decision. We propose six domains for the evaluation of tuberculosis treatment adherence systems (figure). Using this framework, we outline six domains that should be systematically incorporated into future evaluations of tuberculosis treatment adherence strategies in Africa.

Patient-centred outcome: this domain would include measures of daily activity, self-care, pain, and anxiety, themes that address quality of life. Daily DOT can be burdensome, requiring extensive travel and causing frustration or difficulties in managing work or family responsibilities. DATs might alleviate these burdens, but data are still scarce in this patient-centred area. The field of tuberculosis could draw on the experience of other infectious disease syndromes in adapting the desirability of outcome rankings (DOOR) end-of-treatment outcomes approach⁵ to focus on outcomes most valued by individuals.

Economic protection: daily DOT imposes substantial economic impacts on individuals and families. According to the 2025 WHO Global Tuberculosis Report,¹ 43% of tuberculosis-affected households face catastrophic costs despite free tuberculosis care and treatment. A multicountry study conducted in Ethiopia, Tanzania, Kenya, and Uganda⁶ found that more than half of tuberculosis-affected households faced catastrophic costs, with DOT associated with the greatest increases in household expenditure. These trends threaten the achievement of the third End TB Strategy target to eliminate catastrophic costs for individuals with tuberculosis disease and their households. In-person visits

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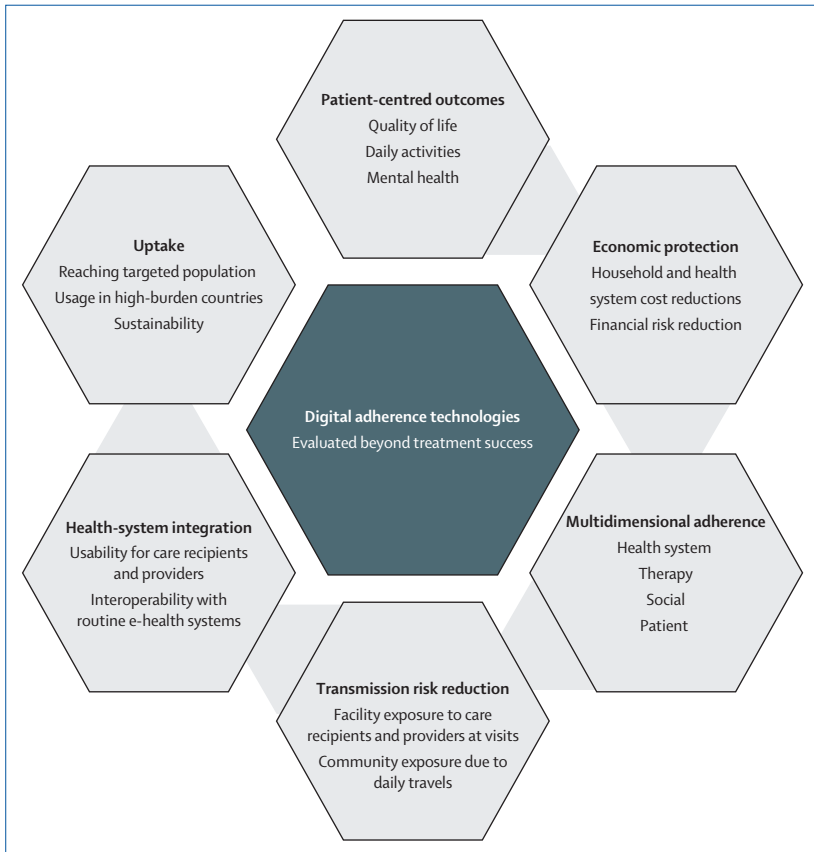


Figure: Six domains for evaluation of tuberculosis treatment adherence systems beyond treatment outcomes

impose financial burdens on the health-care system due to intensive demands for health workforce and facility resources. Importantly, interventions that achieve treatment outcomes comparable to DOT while substantially reducing patient-level and system-level costs should be considered successful within value-based tuberculosis care frameworks. Studies that quantify potential cost savings from reduced clinic visits, including expenses related to transportation, accommodation, food, and health-care access, and savings to the health-care system, are essential to accelerate progress towards the End TB financial protection targets.

Multidimensional adherence: adherence and treatment success are influenced by the health system, type, and duration of anti-tuberculosis therapy, social factors, and patient aspects. The collective assumption that individuals alone are accountable for non-adherence can be misleading, as it ignores other influential factors. DOT often imposes adherence strategies on individuals without accounting for the broader context of non-adherence. In contrast, DATs promote better patient ownership of

treatment adherence, with supportive oversight, while reducing the daily burden on the health-care system. Studies should investigate the role of DATs in supporting multidimensional adherence and enhancing patient self-care capacity.

Transmission risk reduction: since tuberculosis transmission poses risks to individuals and health-care workers,⁷ daily visits for DOT can facilitate the spread of tuberculosis disease to other individuals attending these facilities. Daily transportation to facilities can also pose an additional tuberculosis transmission risk to the community.⁸ Studies of DATs should investigate whether lower facility attendance results in lower risk of secondary tuberculosis transmission in waiting areas and through transportation, and the potential of DATs to mitigate these risks.

Health-system integration: usability and interoperability of DATs within conventional health systems are crucial. Since primary health-care facilities are responsible for routine care,^{9,10} DATs need to be user-friendly for both health-care professionals and individuals with tuberculosis disease at the primary health-care level, and they need to be compatible with current electronic health record systems to guarantee their long-term integration into national tuberculosis programmes. These platforms need to be refined until their design best satisfies these requirements. Future studies should, therefore, evaluate user satisfaction, ease of use, and interoperability with existing electronic health records and tuberculosis surveillance systems.

Uptake: there is scarce evidence available on the extent of DATs uptake, their equitable reach, and coverage among target populations, and the contextual factors influencing the deployment of DATs at facility and community levels. There is also insufficient understanding of the factors affecting the sustainable use of DATs and the fidelity with which DAT activities are implemented according to intended protocols and workflows. DATs are associated with potential barriers linked to the digital divide in Africa, including intermittent power outages; the availability and cost of mobile network services; the availability, upgrading, and maintenance of digital devices or mHealth Apps; and verifying levels of literacy and technological comfort, particularly among older populations. These potential barriers warrant rigorous investigation alongside deployment and implementation planning to inform equitable access, scale-up, and sustainable use of DATs in Africa.

In conclusion, although strong studies are under way on the continent, various factors such as funding constraints, concerns about future adoption, and local availability of technologies have constrained the uptake of DATs. We recommend that future research for evaluating DATs in Africa should explore beyond treatment outcomes (appendix p 1), and wherever DATs achieve comparable results to DOT in biomedical metrics, evidence of their broader benefits in overcoming structural barriers, mitigating transmission risk, and alleviating patient and health-system burdens should play a decisive role in guiding tuberculosis policy and programmatic decision making in Africa.

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See Online for appendix

- 1 WHO. Global tuberculosis report 2025. Nov 12, 2025. <https://www.who.int/publications/i/item/9789240116924> (accessed Dec 6, 2025).
- 2 Li W, Wu S, Su M, et al. Barriers and facilitators to the implementation of electronic monitors to improve adherence and health outcomes in patients with tuberculosis: a systematic review. *Lancet Infect Dis* 2025; **25**: e153–64.
- 3 Jerene D, van Kalmthout K, Levy J, et al. Effect of digital adherence technologies on treatment outcomes in people with drug-susceptible tuberculosis: four pragmatic, cluster-randomised trials. *Lancet* 2025; **405**: 1155–66.
- 4 Manyazewal T, Woldeamanuel Y, Holland DP, Fekadu A, Marconi VC. Effectiveness of a digital medication event reminder and monitor device for patients with tuberculosis (SELFTB): a multicenter randomized controlled trial. *BMC Med* 2022; **20**: 310.
- 5 Howard-Anderson J, Hamasaki T, Dai W, et al. Improving traditional registrational trial end points: development and application of a desirability of outcome ranking end point for complicated urinary tract infection clinical trials. *Clin Infect Dis* 2023; **76**: e1157–65.
- 6 Ngadaya FD, Philbert D, Wilfred A, et al. Incidence and determinants of households' catastrophic payments for TB care: evidence from a multi-country trial (EXIT-TB project) implemented in East Africa. *BMJ Public Health* 2025; **3**: e001543.
- 7 Njagi LN, Tram KH, Zifodya JS, et al. Pulmonary tuberculosis infectiousness of persons identified through active and passive case-finding in a high-burden setting. *Open Forum Infect Dis* 2025; **12**: ofaf077.
- 8 Banholzer N, Middelkoop K, Schmutz R, et al. Infection prevention and control measures during the COVID-19 pandemic and airborne tuberculosis transmission during primary care visits in South Africa. *Int J Infect Dis* 2025; **156**: 107921.
- 9 Manyazewal T, Woldeamanuel Y, Getinet T, et al. Patient-reported usability and satisfaction with electronic medication event reminder and monitor device for tuberculosis: a multicentre, randomised controlled trial. *EClinicalMedicine* 2023; **56**: 101820.
- 10 Musiimenta A, Tumuhimbise W, Atukunda EC, et al. The feasibility, acceptability, and preliminary impact of real-time monitors and SMS on tuberculosis medication adherence in southwestern Uganda: findings from a mixed methods pilot randomized controlled trial. *PLoS Glob Public Health* 2023; **3**: e0001813.