



Deposited via The University of Sheffield.

White Rose Research Online URL for this paper:

<https://eprints.whiterose.ac.uk/id/eprint/242422/>

Version: Accepted Version

Article:

Menzies, N.A., Brown, T.S., Imai-Eaton, J.W. et al. (2025) Potential paediatric tuberculosis incidence and deaths resulting from interruption in programmes supported by international health aid, 2025–34: a mathematical modelling study. *The Lancet Child & Adolescent Health*, 9 (11). pp. 787-795. ISSN: 2352-4642

[https://doi.org/10.1016/s2352-4642\(25\)00218-4](https://doi.org/10.1016/s2352-4642(25)00218-4)

© 2026 The Authors. Except as otherwise noted, this author-accepted version of a journal article published in *The Lancet Child & Adolescent Health* is made available via the University of Sheffield Research Publications and Copyright Policy under the terms of the Creative Commons Attribution 4.0 International License (CC-BY 4.0), which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>

Reuse

This article is distributed under the terms of the Creative Commons Attribution (CC BY) licence. This licence allows you to distribute, remix, tweak, and build upon the work, even commercially, as long as you credit the authors for the original work. More information and the full terms of the licence here: <https://creativecommons.org/licenses/>

Takedown

If you consider content in White Rose Research Online to be in breach of UK law, please notify us by emailing eprints@whiterose.ac.uk including the URL of the record and the reason for the withdrawal request.

Title: Potential pediatric tuberculosis incidence and deaths resulting from interruption in programmes supported by international health aid, 2025-2034: a mathematical modelling study.

Authors: Nicolas A Menzies PhD [1], Tyler S Brown MD [2], Jeffrey W Imai-Eaton PhD [3, 4], Prof. Peter J Dodd PhD [5], Prof. Ted Cohen MD DrPH [6], Leonardo Martinez PhD [7].

Affiliations:

1. Department of Global Health and Population, Harvard TH Chan School of Public Health, Boston, MA, USA.
2. Department of Medicine, Boston University, Chobanian & Avedisian School of Medicine, Boston, MA, USA.
3. Center for Communicable Disease Dynamics, Department of Epidemiology, Harvard TH Chan School of Public Health, Boston, MA, USA.
4. MRC Centre for Global Infectious Disease Analysis, School of Public Health, Imperial College London, London, United Kingdom
5. Division of Population Health, School of Medicine and Population Health, University of Sheffield, Sheffield, UK.
6. Department of Epidemiology of Microbial Diseases, Yale School of Public Health, New Haven, CT, USA.
7. Department of Epidemiology, School of Public Health, Boston University, Boston, MA, USA.

Corresponding author: Nicolas A Menzies (nmenzies@hsph.harvard.edu), 665 Huntington Ave, Department of Global Health and Population, Harvard TH Chan School of Public Health, Boston, MA, USA.

Key Words: USAID, pediatric tuberculosis, PEPFAR, Global Fund.

Abstract

Background: Children experience elevated risks of developing and dying from tuberculosis (TB). We estimated the additional pediatric TB deaths that could occur over 2025-2034 if programmes supported by United States bilateral health aid and the Global Fund to Fight AIDS, Tuberculosis, and Malaria (Global Fund) are discontinued.

Methods: We collated data on funding sources for TB and HIV programs in low- and middle-income countries and constructed scenarios representing reductions in health aid from 2025. Using calibrated transmission-dynamic models of TB and HIV for 130 countries, we projected the discontinuation of TB and HIV treatment services under several funding reduction scenarios, and how this would affect pediatric (ages 0-14 years) TB exposure and treatment access. We projected pediatric TB incidence and mortality over 2025-2034 to calculate the impact of funding reductions.

Findings: Compared to maintenance of pre-2025 service levels, withdrawal of services currently supported by US bilateral health aid was projected to result in an additional 2.5 million (95% uncertainty interval: 1.8–3.3) pediatric TB cases and 340,000 (240,000–460,000) TB deaths over 2025-2034. Withdrawal of US support to the Global Fund and reduction in non-US contributions was projected to result in an additional 8.9 million (6.9–11.5) pediatric TB cases and 1.5 million (1.1–2.0) TB deaths, more than double the number of pediatric TB expected with continued service levels (1.1 million (0.9–1.4)). Impacts were greatest in Sub-Saharan Africa and South-East Asia. Restoration of services in 2026 led to a substantially smaller number of additional deaths.

Interpretation: Without actions to restore discontinued services, cuts to health aid for TB and HIV programs could result in millions of additional childhood TB deaths in low- and middle-income countries over the next decade.

Funding: None.

Research in Context

Evidence before this study: We identified studies estimating the potential impact of recent cuts to health aid on TB outcomes in high burden settings. To do so, we searched PubMed from January 1 2025 until June 4 2025, using search terms (tuberculosis) AND (deaths OR mortality OR DALYs OR "health impact") AND (USAID OR funding OR "Global Fund" OR "United States" OR "foreign assistance"). We identified four studies that projected the future TB incidence and mortality that could occur in high burden countries as a result of recent cuts to U.S. health aid, suggesting that major increases in TB cases and deaths could result from interrupted funding. These studies have not assessed the impact on childhood TB.

Added value of this study: Children are at high risk of developing and dying from tuberculosis, and could be particularly affected by reductions in treatment access resulting from funding cuts. We examined how cuts to U.S. bilateral health aid for TB and HIV as well as reduced contributions to the Global Fund to Fight AIDS, Tuberculosis, and Malaria could affect pediatric tuberculosis in low- and middle-income countries. The results showed that the service disruptions produced by reductions in health aid could result in substantial increases in pediatric TB incidence and deaths over the 2025-2034 period. These additional cases and deaths were greatest in WHO African and South-East Asian regions, and in countries with previously high levels of health aid relative to domestic funding.

Implications of all the available evidence: The closure of USAID and reductions in other health aid threaten to disrupt disease control programs in many low- and middle-income countries. These disruptions will increase the burden of otherwise avertable conditions. These potential impacts include millions of additional pediatric TB cases and deaths. If these consequences are realized they will reverse several decades of progress that have been made in combatting this condition.

79 **Introduction**

80 For most of the last 100 years, tuberculosis (TB) has been the greatest single cause of
81 infectious disease deaths (1). Over recent decades, efforts to combat TB have reduced
82 incidence rates and saved millions of lives across high-burden countries (2). These
83 achievements are the product of a partnership between domestic governments, civil society,
84 international funders, and high-income country governments that have made ongoing
85 investments to establish and sustain TB services.

86 Until recently, the United States (US) was a global leader in initiatives to combat TB (3). US
87 bilateral health aid for TB has been delivered predominantly through the United States
88 Agency for International Development (USAID) and is estimated to have prevented over 75
89 million TB deaths in partnership with domestic governments and other funders (4). The
90 United States has also been the largest single donor to the Global Fund to Fight AIDS,
91 Tuberculosis, and Malaria (Global Fund) since its establishment in 2002, responsible for
92 one-third of all contributions (5). In addition to TB-specific funding, the US President's
93 Emergency Plan for AIDS Relief (PEPFAR) has supported efforts to combat HIV since 2003,
94 reversing HIV epidemics that had caused a major surge in TB cases (new episodes of TB
95 disease) and deaths across sub-Saharan Africa in the early 2000s (6, 7). In early 2025, soon
96 after the beginning of the second Trump presidential administration, the US government
97 sharply pulled back support to these health aid programs. USAID was effectively
98 disestablished over several months (8, 9), and most PEPFAR activities were stalled (10, 11).
99 The United States also withdrew from the World Health Organization (12, 13), and there are
100 concerns that it will withdraw its support to the Global Fund, which begins its 8th
101 Replenishment Cycle in late 2025.

102 The effect of these health aid cuts is likely to be substantial, with impacts across many
103 countries, diseases, and population groups. Childhood TB is a condition that could be
104 particularly sensitive to the interruption of services caused by funding cuts. Young children

have the highest age-specific risks of developing TB if exposed to *Mtb* infection (14, 15), and those who develop TB are at high risk of death without prompt treatment (16). Cuts to TB treatment services are expected to be followed by a rise in population-level TB incidence and prevalence. This effect could be compounded by cuts to HIV programs, as individuals with untreated HIV are highly susceptible to developing TB (17). For children in affected countries, this implies a potentially rapid increase in *Mtb* infection risks, at the same time that funding cuts interrupt access to diagnosis and treatment services. While pediatric TB is difficult to diagnose, in recent years many countries have made efforts to improve the detection and reporting of pediatric TB (18). These improvements are threatened by potential funding cuts.

In this study, we evaluated the potential impact of cuts to U.S. bilateral health aid on pediatric tuberculosis incidence and mortality in low- and middle-income countries, and the numbers of additional children that could develop and die from TB if the United States and other donors suspend or reduce their support to the Global Fund. We conducted this study for 130 low- and middle-income countries over a 10-year period (2025-2034), to estimate the global impact of service disruptions under different funding scenarios and identify the countries and regions in which the effect of aid cuts could be most acute.

Methods

Population and setting

The population of interest was infants, children, and young adolescents (0-14 years of age) living in low- and middle-income countries (defined by World Bank classifications) (19) during 2025-2034. We excluded one country (Kosovo) due to a lack of adequate data. The remaining 130 countries represent 99.5% of global pediatric TB disease incidence (20). To create the study population we used UN Population Division estimates of annual births in

each country (21), and assumed that without TB these individuals would face general population mortality rates (21).

Pediatric TB model

We simulated successive monthly birth cohorts in each country, from birth until 15 years of age. Cohorts were simulated from 2010 (to produce a full cross-section of the pediatric population in 2025) until the end of 2034. Rates of exposure to *Mycobacterium tuberculosis* (*Mtb*)—the pathogen that causes TB disease—were allowed to vary by age, country, and calendar month (see '*Mtb* force of infection' section). Assumptions around risks of TB incidence and mortality were based on approaches adopted in previous modeling studies (22-24), with the risks of TB for exposed children varying by age, prevalence of malnutrition, and BCG vaccination coverage. Case fatality rates for children developing TB were assumed to vary by age and receipt of TB treatment. For the subset of countries with general population HIV prevalence >1% or HIV prevalence among individuals with TB >5% ('co-prevalent HIV' countries, n=63), we additionally stratified the pediatric population by HIV status (Persons without HIV, Persons with HIV (PWH) receiving ART, PWH not receiving ART), with the fraction of the pediatric population in each HIV stratum based on Spectrum model projections for each country (25) submitted by countries to UNAIDS as part of UNAIDS 2024 Global Epidemiologic Estimates. In these countries the risks of TB incidence and mortality were stratified by HIV status in addition to other factors. **Figure 1** provides a schematic of the analysis, and **Table S1** (appendix p 2-3) reports model parameter values and sources.

[Figure 1]

Mtb force of infection

Rates of *Mtb* exposure for children in the study cohort were based on estimates of the *Mtb* force of infection produced by a published transmission-dynamic model of TB in the overall population for each study country (26, 27). This model was recalibrated to the most recent TB epidemiological estimates for each setting (20, 28), with natural history assumptions matching published ranges for TB modelling analyses (29). For the 63 countries with co-prevalent HIV, the modelled population was distributed across a set of six HIV strata representing HIV status, immune function (categorized by CD4 cell count) and ART receipt. The proportion of the population in each HIV stratum (by age group and year) was based on Spectrum projections (25). **Figure S1** (appendix p 4-7) and **Figure S2** (appendix p 8) compare epidemiological estimates from the transmission-dynamic model against calibration data.

Model validation

The fitted models were used to simulate pediatric TB incidence and deaths in each country over recent years. These results were compared to the most recent estimates produced by the WHO (for TB incidence) and the Global Burden of Disease Study (for TB incidence and TB deaths) among 0-5-year-olds and 0-14-year-olds (**Figures S3 and S4**, appendix p 8-9) (20, 30).

Scenarios

We extracted country-specific data on TB program expenditures by funding source (domestic, U.S. bilateral, Global Fund, other international), for the most recently available year (20). We extracted similar data on HIV funding (31). Missing or anomalous values were checked against other data sources (32, 33). We assumed these values represented pre-2025 funding shares for TB and HIV services in each country. The U.S. share of Global Fund contributions (38%) was based on reported pledges during the 7th Global Fund

Replenishment Cycle (34). **Figures S5-S6** (appendix p 9-10) show country-specific funding shares for TB and HIV.

We created scenarios representing alternative assumptions about the level of external support to TB and HIV programs from 2025 onwards. *Scenario 1 (base-case)* assumed the uninterrupted continuation of pre-existing funding levels. *Scenario 2 (US bilateral funding cut in 2025)* assumed that US bilateral funding for TB and HIV services would be completely cut from 2025 onwards, and other funding maintained at pre-existing levels. *Scenario 3 (US Global Fund contributions cut in 2026)* was based on Scenario 2 and additionally assumed that US Global Fund contributions would be completely cut from 2026 onwards. *Scenario 4 (50% of non-US Global Fund contributions cut in 2026)* was based on Scenario 3 and additionally assumed that 50% of non-US Global Fund contributions would be cut from 2026 onwards. This 50% reduction was used to illustrate the implications of partial Global Fund support by non-US countries. Under each scenario, we assumed other sources of TB and HIV funding continued at pre-2025 levels.

Evidence is emerging on how reductions in disease-specific international funding may affect TB and HIV services, with reports describing personnel layoffs, suspension of clinical services, decreased availability of diagnostic tools, and reduced resources for patient outreach and case finding (35, 36). We represented the impact of funding changes as reductions in access to treatment for each disease (proportion of PWH receiving ART, proportion of individuals with TB diagnosed and treated). We assumed that reductions in funding would produce less-than-proportional reductions in treatment coverage, as might result from reallocation of resources to highest priority interventions, improvements in technical efficiency, and other actions within affected countries. We operationalized this as an adjustment ratio of 0.5, varied between 0.25 and 0.75. Under this approach, a 20% reduction in total funding would produce a 10% (95% interval: 5, 15) reduction in service coverage. These reductions were applied separately for each country and disease. Using these scenario definitions, we simulated future pediatric TB outcomes for each country and

scenario over the 2025-2034 period. To do so, we first estimated changes in the *Mtb* force of infection for each country using the transmission-dynamic model, then used the pediatric model to estimate the change in pediatric TB cases and deaths produced by the increase in the force of infection and the reduction in treatment access.

Statistical methods

We incorporated uncertainty in parameters defining TB epidemiology and how service coverage responded to changes in funding levels. We calibrated the transmission-dynamic TB models with a Hamiltonian Monte Carlo approach (37), producing a sample of 1000 trajectories for the *Mtb* force of infection over the study period by country and scenario. For other model inputs we created probability distributions representing uncertainty in each parameter (**Table S1**, appendix p 2-3) and sampled 1000 parameter sets using a Latin hypercube design. We simulated pediatric TB outcomes for each of these 1000 sets of model inputs. Results were calculated as the mean value of each outcome across simulations, and 95% uncertainty intervals created as the 2.5th and 97.5th percentiles of the simulated results. Analyses were conducted in R (v4.4.3) using the rstan (v2.32.7) and Rcpp (v1.0.14) packages (38-40).

Sensitivity and scenario analyses

We calculated partial rank correlation coefficients quantifying the relationship between individual parameters and total TB deaths 2025-2034 under Scenario 4 (41). We also assessed two additional scenarios: a *low-impact scenario* in which US bilateral funding is cut for the 12 months of 2025 but then restored to full funding in 2026, and a *high-impact scenario*, which was based on Scenario 4 but with treatment coverage reduced proportional to funding reductions for each disease.

Role of the funding source

There was no funding for this study.

Ethics statement

No ethical review was required, as this was a modelling study using aggregated secondary data sources.

Results

In the base-case projections, we estimated there were 1.23 million (95% uncertainty interval: 1.01–1.50) pediatric TB cases in the 130 modelled low and middle-income countries in 2024, and 118 thousand (96–145) pediatric TB deaths. Under pre-2025 service coverage levels (Scenario 1) we projected a slow decline in pediatric TB over future years, with 1.06 million (0.85–1.33) pediatric TB cases and 105 thousand (83–133) pediatric TB deaths projected for 2034 respectively (average annual decline 1.5% [0.4–2.5] and 1.2% [0.2–2.3], respectively). Total projected pediatric TB cases and deaths over 2025–2034 were 11.3 million (9.2–14.0) and 1.10 million (0.89–1.38), respectively.

Under the reduced funding scenarios (with interruption of TB and HIV service delivery), children were projected to face progressively increasing risks of TB exposure (**Figure S7**, appendix p 11–14), with those developing TB less likely to receive effective diagnosis and treatment (**Table S2**, appendix p 15–17). As a consequence, pediatric TB cases and deaths were projected to rise progressively under these scenarios (**Figure 2**). For Scenario 2, representing the impact of US bilateral funding cuts from 2025 onwards, TB cases and deaths were projected to rise to 1.52 million (1.23–1.91) and 161 thousand (127–205) by 2034 (average annual increase 2.1% [0.9–3.5] and 3.1% [1.8–4.7], respectively). For Scenario 3, representing the additional impact of the United States cutting future Global Fund contributions, TB cases and deaths rose to 2.28 million (1.84–2.86) and 277 thousand (216–354) by 2034 (average annual increase 6.4% [4.9–8.1] and 8.9% [7.1–11.0] respectively). For Scenario 4, representing the additional impact of future Global Fund contributions from non-US sources falling by 50%, TB cases and deaths rose to 3.01 million

(2.42–3.78) and 411 thousand (316–541) by 2034 (average annual increase 9.4% [7.7–11.4] and 13.2% [11.0–15.8] respectively). **Table 1** shows total projected pediatric TB cases and deaths over the 10-year study period for each scenario. As compared to the base-case scenario, total pediatric TB deaths for 2025-2034 were projected to rise by 31% (24–40), 84% (67–106), and 134% (110–178), under Scenarios 2, 3, and 4 respectively (**Table S3**, appendix p 18).

[Figure 2]

[Table 1]

Additional TB cases and deaths projected under the reduced funding scenarios were concentrated in countries and regions with high current TB incidence, low current TB treatment coverage, and a high share of current TB and HIV program funding from non-domestic sources (**Table 2**). Consequently, impacts were inversely related to country income level, with relative increases in pediatric cases and deaths highest for low-income countries, followed by lower-middle and upper-middle income countries respectively (**Table S4**, appendix p 19)

[Table 2]

In 42 countries with at least 80% of TB and/or HIV funding from non-domestic sources, TB cases and deaths for 2025-2034 were 120% (92–159) and 190% (137–270) higher under Scenario 4 compared to the base-case. Additional TB cases and deaths were concentrated in African and South-East Asian regions (**Figure 3**). **Table S5** (appendix p 20-22) reports results for individual countries.

[Figure 3]

We undertook sensitivity analyses to identify the inputs with the most influence on study results, comparing Scenario 4 to the base-case. The most influential inputs included parameters describing the force of infection faced by children, the sensitivity of TB and HIV service coverage to funding reductions, and the probability of TB following infectious exposure (partial rank correlation coefficients shown in **Figure S8**, appendix p 23). **Table S6** (appendix p 24) reports results for the *low-impact scenario* (US bilateral funding cut for the 12 months of 2025 then restored to full funding) and the *high-impact scenario* (same assumptions as Scenario 4, but with treatment coverage reduced proportional to funding reductions), which represent optimistic and pessimistic scenarios for the impact of funding reductions. Under the *low-impact scenario* an additional 39 thousand (29–51) pediatric TB deaths were projected, 3.5% (2.8–4.3) greater than the base-case. Under the *high-impact scenario* an additional 3.62 million (2.93–4.52) pediatric TB deaths were projected, 330% (279–385) greater than the base-case.

Discussion

In this global analysis of pediatric tuberculosis incidence and mortality, disruption of TB and HIV services arising from broad-scale cuts to US health aid were projected to result in

substantial numbers of children developing and dying from TB over 2025-2034. Under a conservative scenario in which only US bilateral health aid is discontinued, approximately 2.5 million additional pediatric tuberculosis cases and 340,000 pediatric tuberculosis deaths are expected. If the United States and other countries reduce support for the Global Fund a further 3–7 million additional cases and 0.6–1.2 million additional child deaths could occur, reflecting the central role of this multilateral funder in supporting TB and HIV services in the most affected countries. These findings suggest catastrophic impacts that could result from health aid cuts, which will grow over time as the duration of service disruptions increases.

Our analysis suggests that the impacts of recent funding cuts will be most apparent in the WHO African and South-East Asian regions. In these regions many countries had high TB and HIV burden before 2025, face substantial health system constraints, and had a heavy reliance on health aid to support current services. We projected the Americas and European regions would be largely unaffected. Some of the countries projected to incur the greatest impacts included those with high HIV prevalence. In these countries, reductions in HIV funding contributed to the overall impact, with reduced ART access projected to produce a growing pool of persons with untreated HIV, highly susceptible to TB.

These results are consistent with other studies that investigated the potential implications of TB funding cuts (42-45). Compared to those analyses, this study included more countries, considered the additional implications of HIV funding cuts for TB, and focussed on an age group at high risk of TB and mortality. Nevertheless, several key findings are shared with these analyses - that the largest impacts are estimated for settings with limited capacity to respond to these challenges, and that the magnitude of harm will grow over time as the duration of the funding gap increases.

There are several potential policy implications from this analysis. Importantly, this analysis illustrates what is at stake under different levels of health aid to support TB and HIV services. Notably, the projected number of pediatric TB deaths was substantially smaller

when we assumed funding would be restored after one year, with the additional deaths projected for this scenario reduced by 90% or more compared to our other scenarios. This demonstrates that the prompt restoration of funding, or the creation of alternative financing mechanisms to sustain current services, could greatly reduce the consequences of funding cuts. In parallel with actions to restore or replace lost funding, efforts to identify efficiencies, prioritize the highest impact interventions, and target services to the highest need populations will play a key role in limiting service disruptions and their health consequences. In our analyses we assumed that improvements in technical and allocative efficiency could produce a less-than-proportional reduction in service coverage following funding cuts. How to achieve these efficiencies is an urgent research priority.

Strengths of our analysis include the detailed country-specific estimates of risk, the consideration of both TB and HIV funding cuts, and inclusion of all low- and middle-income countries to estimate how funding cuts could impact global outcomes. Moreover, several prior analyses have not considered possible cuts to Global Fund contributions, yet the Global Fund is the major distributor of TB and HIV health aid from high-income countries, and contribution levels for the next Global Fund replenishment were not set as of mid-2025. In our analyses reductions in Global Fund contributions had the largest consequences for future outcomes.

This analysis had several limitations. First, we examined a small number of funding scenarios. While these reflect a range of funding levels, the timing and magnitude of actual funding cuts will differ from those examined. Second, we assumed the same relationship between funding reductions and service coverage for all countries. In reality, these relationships may vary between countries and over time, as policy and clinical practice respond to new resource constraints. Moreover, the parameter value defining this relationship—which assumes a less-than-proportional relationship between funding cuts and coverage reductions—does not have a firm empirical basis, and this approach could underestimate the negative impacts of funding cuts. For these reasons, impact estimates will

need to be updated as new evidence becomes available (46). Third, while we considered how reductions in ART coverage could increase individual-level susceptibility to developing TB, we did not simulate the changes in HIV prevalence that could be produced by elevated HIV transmission and mortality. Fourth, there is substantial uncertainty about many of the other determinants of pediatric TB outcomes, reflected in wide uncertainty intervals for country-specific results. While we conducted a limited number of sensitivity analyses, these highlighted the sensitivity of results to several epidemiological inputs and analytic assumptions. Finally, we didn't consider all potential mechanisms through which funding cuts could affect pediatric TB deaths. Increases in malnutrition (47), reduced BCG coverage (48), and broad health system failure are each possible, as well as disruption of non-modelled TB or HIV services such as TB preventive treatment. Each of these could further increase pediatric TB deaths.

Taken together, these results suggest that unless reversed or mitigated through alternative mechanisms, cuts to global health aid will have amongst the largest impacts on the pediatric tuberculosis epidemic of any single event of the past three decades, reversing global declines in pediatric TB that have been achieved during this time.

375 **Author contributions**

376 NAM, TSB, TC, and LM conceptualized the study. All authors designed the analysis. JWIE
377 conducted HIV analyses. NAM conducted TB analyses. All authors reviewed the results.
378 NAM drafted the manuscript. All authors edited the manuscript. All authors had access to the
379 data reported in the study.

380 **Declaration of interest**

381 We declare no competing interests.

382 **Data sharing statement**

383 Data inputs and detailed simulation results are available from
384 <https://zenodo.org/records/16053373> (DOI:10.5281/zenodo.16053372).

385

Figures and legends

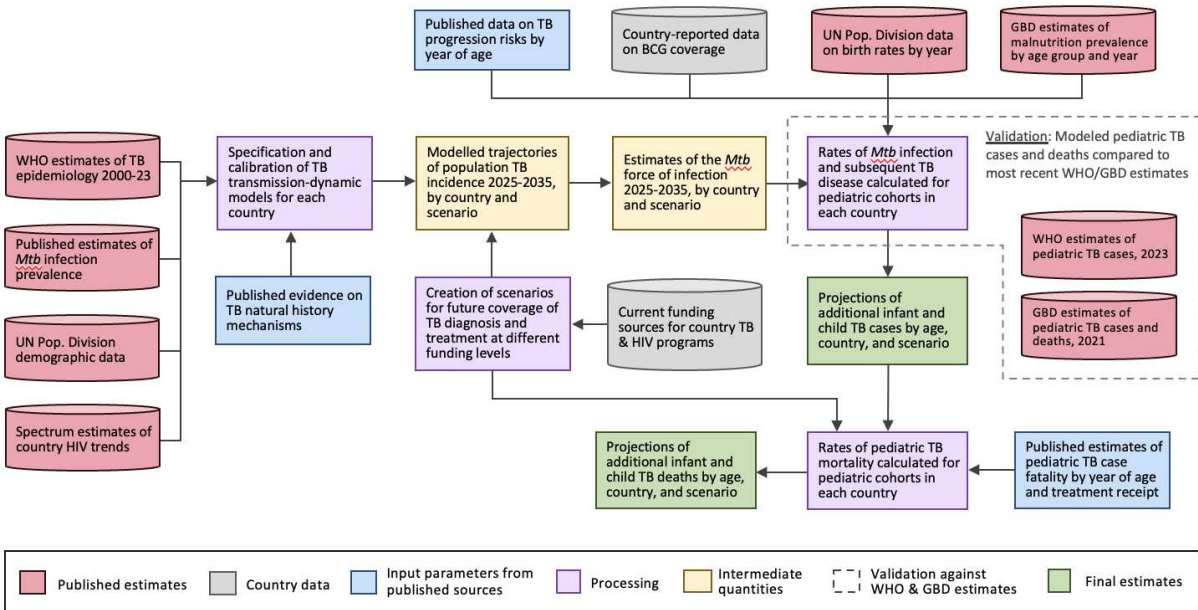


Figure 1: Schematic of analytic approach and data sources.

TB = tuberculosis. *Mtb* = *Mycobacterium tuberculosis*. UN = United Nations. WHO = World Health Organization. Pop. = population. BCG = Bacillus Calmette-Guérin vaccination. GBD = Global Burden of Disease Study. Spectrum estimates represent UNAIDS Epidemiologic Estimates of country HIV trends.

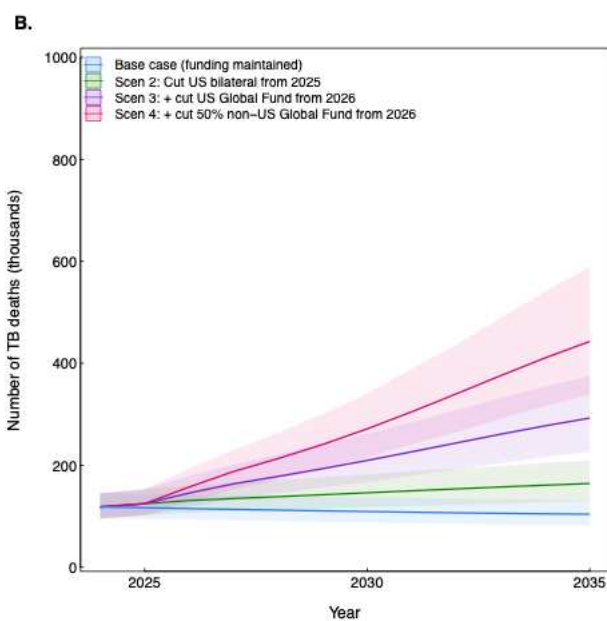
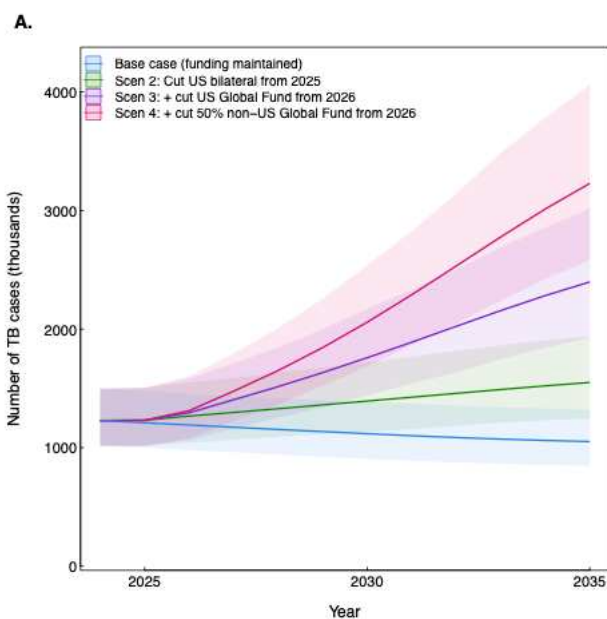
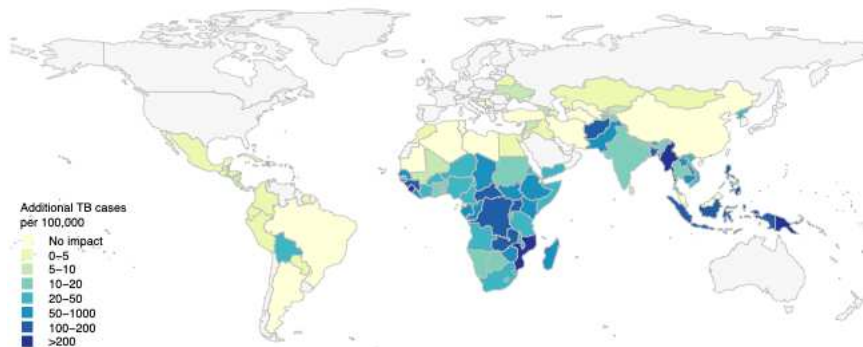


Figure 2: Annual pediatric TB cases (Panel A) and deaths (Panel B) in 130 low- and middle-income countries projected under each funding scenario, 2025-2034.

Scen = scenario. TB = tuberculosis. US = United States. Scenarios 2-4 represent progressively greater funding cuts, such that Scenario 4 includes 100% reductions in US bilateral funding in 2025 and Global Fund support in 2026, and 50% reductions in non-US Global Fund support in 2026.

A.



B.

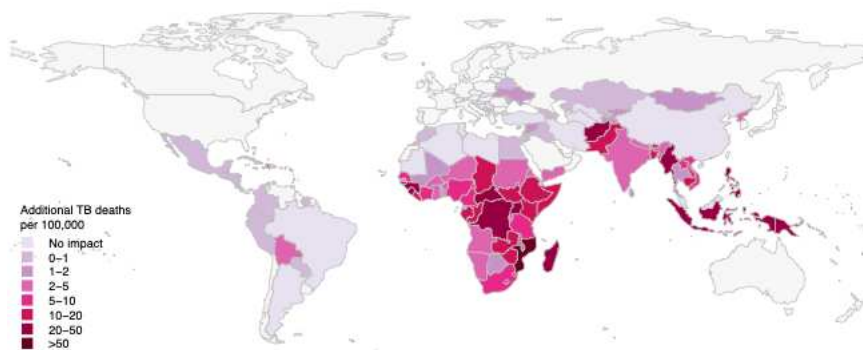


Figure 3: Additional TB cases (Panel A) and deaths (Panel B) under the most extreme funding reduction scenario, as compared to continued funding, 2025-2034.

TB = tuberculosis. US = United States. Scenario represents 100% of US bilateral funding cut in 2025, plus 100% of US and 50% of non-US Global Fund contributions cut in 2026 (Scenario 4).

424 **Table and legends**

425

426 **Table 1: Pediatric TB cases and deaths in 130 low- and middle-income countries**
427 **projected under each funding scenario, 2025-2034.**

428 TB = tuberculosis. US = United States. Scenarios 2-4 represent progressively greater funding cuts, such that
429 Scenario 4 includes 100% reductions in US bilateral funding in 2025 and Global Fund support in 2026, and 50%
430 reductions in non-US Global Fund support in 2026.

	Pediatric TB cases (millions)			Pediatric TB deaths (millions)		
	2025-2029	2030-2034	Whole period	2025-2029	2030-2034	Whole period
Scenario 1: no funding cuts (base-case)	5.86 (4.82–7.17)	5.44 (4.39–6.78)	11.30 (9.18–13.95)	0.57 (0.46–0.70)	0.53 (0.43–0.67)	1.10 (0.89–1.38)
Scenario 2: US bilateral funding cut in 2025	6.48 (5.33–7.94)	7.29 (5.91–9.08)	13.77 (11.26–17.01)	0.67 (0.55–0.82)	0.77 (0.61–0.96)	1.44 (1.16–1.79)
Scenario 3: + US Global Fund contributions cut in 2026	7.08 (5.87–8.65)	10.11 (8.17–12.50)	17.19 (14.07–21.11)	0.81 (0.66–0.99)	1.22 (0.96–1.54)	2.02 (1.62–2.52)
Scenario 4: + 50% of non-US Global Fund contributions cut in 2026	7.51 (6.23–9.15)	12.67 (10.25–15.71)	20.18 (16.52–24.73)	0.92 (0.75–1.14)	1.70 (1.33–2.19)	2.63 (2.08–3.30)

431

432

Table 2: Additional pediatric TB cases and deaths under alternative funding scenarios as compared to continued funding, 2025-2034, by country grouping.

TB = tuberculosis. US = United States. Scenario 2: 100% of US bilateral funding cut in 2025. Scenario 3: 100% of US bilateral funding cut in 2025, plus 100% of US Global Fund contributions cut in 2026. Scenario 4: 100% of US bilateral funding cut in 2025, plus 100% of US and 50% of non-US Global Fund contributions cut in 2026. Income groups defined according to World Bank categorizations. High TB burden group includes the 30 countries identified as having high TB burden by WHO. High non-domestic funding group represents countries with >80% non-domestic funding for TB or HIV programs.

	Thousands of pediatric TB cases			Thousands of pediatric TB deaths		
	Scenario 2	Scenario 3	Scenario 4	Scenario 2	Scenario 3	Scenario 4
Total	2,473 (1,806–3,336)	5,888 (4,580–7,599)	8,885 (6,884–11,454)	337 (244–459)	921 (696–1,225)	1,524 (1,138–2,031)
WHO region						
<i>Eastern Mediterranean Region</i>	65 (22–147)	733 (352–1,387)	1,340 (633–2,594)	8.2 (2.6–20.8)	117 (54–241)	239 (106–505)
<i>African Region</i>	1,425 (944–2,111)	2,926 (2,046–4,190)	4,244 (3,018–6,026)	205 (132–307)	484 (324–722)	770 (522–1,152)
<i>European Region</i>	2.0 (0.8–4.0)	8.2 (4.7–13.7)	14 (8–24)	0.30 (0.12–0.60)	1.1 (0.6–1.9)	1.9 (1.1–3.2)
<i>Region of the Americas</i>	1.6 (0.7–3.3)	26 (15–47)	49 (27–90)	0.12 (0.05–0.26)	3.4 (1.8–6.3)	7.2 (3.5–14.2)
<i>South-East Asian Region</i>	822 (461–1,420)	1,809 (1,071–2,942)	2,655 (1,540–4,280)	98 (55–164)	253 (140–409)	406 (218–678)
<i>Western Pacific Region</i>	157 (65–319)	386 (203–686)	584 (322–995)	25 (10–52)	63 (31–117)	100 (51–180)
Income group						
<i>Low income</i>	1,119 (668–1,769)	2,380 (1,569–3,602)	3,484 (2,309–5,179)	147 (84–243)	370 (229–603)	604 (386–986)
<i>Lower middle income</i>	1,222 (819–1,848)	2,884 (2,066–3,997)	4,355 (3,114–6,105)	170 (114–244)	448 (310–632)	733 (506–1,047)
<i>Upper middle income</i>	132 (65–250)	624 (275–1,274)	1,046 (449–2,156)	19 (9–38)	104 (43–223)	188 (73–418)
TB burden category						
<i>High TB burden</i>	2,345 (1,681–3,193)	5,167 (3,889–6,876)	7,624 (5,720–10,208)	320 (228–441)	801 (576–1,110)	1,290 (916–1,795)
<i>Not high TB burden</i>	128 (76–216)	721 (542–979)	1,261 (961–1,674)	17 (10–29)	120 (89–165)	234 (173–321)
Funding category						
<i>High non-domestic funding</i>	1,545 (1,053–2,223)	3,322 (2,375–4,630)	4,878 (3,551–6,710)	220 (143–329)	546 (374–798)	883 (610–1,284)
<i>Non high non-domestic funding</i>	928 (550–1,494)	2,565 (1,730–3,748)	4,007 (2,666–5,803)	117 (68–191)	375 (251–555)	641 (415–980)

444 Citations

- 445 1. Paulson T. Epidemiology: A mortal foe. *Nature*. 2013;502(7470):S2-3.
- 446 2. Glaziou P, Floyd K, Korenromp EL, Sismanidis C, Bierrenbach AL, Williams BG, et al.
447 Lives saved by tuberculosis control and prospects for achieving the 2015 global target
448 for reducing tuberculosis mortality. *Bull World Health Organ*. 2011;89(8):573-82.
- 449 3. Dieleman JL, Apeagyei AE, Hay SI, Mokdad AH, Murray CJL. The USA's role in global
450 development assistance for health, 2000-30. *Lancet*. 2024;404(10469):2258-60.
- 451 4. USAID. USAID'S Global Tuberculosis (TB) Strategy 2023–2030. Washington DC: U.S.
452 Agency for International Development; 2022.
- 453 5. Sabin ML. Global Fund secures \$14·3 billion from donors. *Lancet*.
454 2022;400(10358):1091-2.
- 455 6. Corbett EL, Charalambous S, Fielding K, Clayton T, Hayes RJ, De Cock KM, et al.
456 Stable incidence rates of tuberculosis (TB) among human immunodeficiency virus
457 (HIV)-negative South African gold miners during a decade of epidemic HIV-associated
458 TB. *J Infect Dis*. 2003;188(8):1156-63.
- 459 7. Harries AD, Zachariah R, Corbett EL, Lawn SD, Santos-Filho ET, Chimzizi R, et al. The
460 HIV-associated tuberculosis epidemic--when will we act? *Lancet*. 2010;375(9729):1906-
461 19.
- 462 8. Balakrishnan VS. USAID funding freeze fails children globally. *Lancet Child Adolesc*
463 *Health*. 2025;9(4):220-1.
- 464 9. Burki T. WHO, USAID, PEPFAR: first targets of Trump's presidency. *Lancet Microbe*.
465 2025;6(3):101101.
- 466 10. Ratevosian J, Millett G, Honermann B, Bennett S, Connor C, Bekker LG, et al. PEPFAR
467 under review: what's at stake for PEPFAR's future. *Lancet*. 2025;405(10479):603-5.
- 468 11. Cluver L, Makangila G, Hillis S, Ntwali-N'Konzi JP, Flaxman S, Unwin J, et al. Protecting
469 Africa's children from extreme risk: a runway of sustainability for PEPFAR programmes.
470 *Lancet*. 2025;405(10490):1700-12.
- 471 12. Yamey G, Titanji BK. Withdrawal of the United States from the WHO - How President
472 Trump Is Weakening Public Health. *N Engl J Med*. 2025;392(15):1457-60.

- 473 13. Kickbusch I. US exit from WHO: it is about much more than WHO. *Lancet*.
474 2025;405(10477):444-6.
- 475 14. Comstock GW, Livesay VT, Woolpert SF. The prognosis of a positive tuberculin
476 reaction in childhood and adolescence. *Am J Epidemiol*. 1974;99(2):131-8.
- 477 15. Martinez L, Cords O, Horsburgh CR, Andrews JR. The risk of tuberculosis in children
478 after close exposure: a systematic review and individual-participant meta-analysis.
479 *Lancet*. 2020;395(10228):973-84.
- 480 16. Jenkins HE, Yuen CM, Rodriguez CA, Nathavitharana RR, McLaughlin MM, Donald P,
481 et al. Mortality in children diagnosed with tuberculosis: a systematic review and meta-
482 analysis. *Lancet Infect Dis*. 2017;17(3):285-95.
- 483 17. Suthar AB, Lawn SD, del Amo J, Getahun H, Dye C, Sculier D, et al. Antiretroviral
484 therapy for prevention of tuberculosis in adults with HIV: a systematic review and meta-
485 analysis. *PLOS Med*. 2012;9(7):e1001270-e.
- 486 18. World Health Organization. Roadmap Towards Ending TB in Children and Adolescents.
487 Geneva, Switzerland: World Health Organization; 2018.
- 488 19. World Bank Country and Lending Groups
489 [[https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-](https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups)
490 [country-and-lending-groups](https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups)], accessed April 1, 2025] [Internet]. World Bank. 2025.
- 491 20. WHO Global TB Database [[https://www.who.int/teams/global-tuberculosis-](https://www.who.int/teams/global-tuberculosis-programme/data)
492 [programme/data](https://www.who.int/teams/global-tuberculosis-programme/data)], accessed March 15 2025] [Internet]. WHO Global TB Programme.
493 2025.
- 494 21. World Population Prospects 2024 [<https://population.un.org/wpp/>], accessed March 15
495 2025] [Internet]. United Nations Department of Economic and Social Affairs. 2024.
- 496 22. Dodd PJ, Yuen CM, Sismanidis C, Seddon JA, Jenkins HE. The global burden of
497 tuberculosis mortality in children: a mathematical modelling study. *Lancet Glob Health*.
498 2017;5(9):e898-e906.
- 499 23. Dodd PJ, Gardiner E, Coghlan R, Seddon JA. Burden of childhood tuberculosis in 22
500 high-burden countries: a mathematical modelling study. *Lancet Glob Health*.
501 2014;2(8):e453-9.

- 502 24. Yerramsetti S, Cohen T, Atun R, Menzies NA. Global estimates of paediatric
503 tuberculosis incidence in 2013-19: a mathematical modelling analysis. *Lancet Global*
504 *Health*. 2022;10(2):e207-e15.
- 505 25. Stover J, Glaubius R. Methods and Assumptions for Estimating Key HIV Indicators in
506 the UNAIDS Annual Estimates Process. *J Acquir Immune Defic Syndr*. 2024;95(1s):e5-
507 e12.
- 508 26. Menzies NA, Bellerose M, Testa C, Swartwood NA, Malyuta Y, Cohen T, et al. Impact of
509 Effective Global Tuberculosis Control on Health and Economic Outcomes in the United
510 States. *American Journal of Respiratory and Critical Care Medicine*.
511 2020;202(11):1567-75.
- 512 27. Menzies NA, Swartwood NA, Cohen T, Marks SM, Maloney SA, Chappelle C, et al. The
513 long-term effects of domestic and international tuberculosis service improvements on
514 tuberculosis trends within the USA: a mathematical modelling study. *Lancet Public*
515 *Health*. 2024;9(8):e573-e82.
- 516 28. Houben RM, Dodd PJ. The Global Burden of Latent Tuberculosis Infection: A Re-
517 estimation Using Mathematical Modelling. *PLoS Med*. 2016;13(10):e1002152. doi:
518 10.1371/journal.pmed.. eCollection 2016 Oct.
- 519 29. McQuaid CF, Clarkson MC, Bellerose M, Floyd K, White RG, Menzies NA. An approach
520 for improving the quality of country-level TB modelling. *International Journal of*
521 *Tuberculosis and Lung Disease*. 2021;25(8):614-9.
- 522 30. Global Burden of Disease Study 2021 Results [[https://vizhub.healthdata.org/gbd-
523 results/](https://vizhub.healthdata.org/gbd-
523 results/). accessed March 30 2025] [Internet]. IHME, University of Washington. 2024.
- 524 31. UNAIDS Global AIDS Monitoring Reports
525 [<https://hivfinancial.unaids.org/hivfinancialdashboards.html>, accessed April 1 2025]
526 [Internet]. UNAIDS. 2025.
- 527 32. ForeignAssistance.gov [<https://foreignassistance.gov/>, accessed April 1, 2025]
528 [Internet]. U.S. Department of State. 2025.
- 529 33. UNAIDS Sustainability Reports [<https://sustainability.unaids.org/>, accessed April 1,
530 2025] [Internet]. UNAIDS. 2025.

- 531 34. Pledges at Global Fund Seventh Replenishment Conference
532 [\[https://www.theglobalfund.org/media/12328/archive_seventh-replenishment-](https://www.theglobalfund.org/media/12328/archive_seventh-replenishment-pledges_list_en.pdf)
533 [pledges_list_en.pdf](https://www.theglobalfund.org/media/12328/archive_seventh-replenishment-pledges_list_en.pdf), accessed April 1 2025 [Internet]. The Global Fund. 2025.
- 534 35. Koura KG, Soe AN, Dlodlo RA, Lin Y, Sinha P, Badoum G, et al. Impact of US
535 Government funding cessation on TB care and prevention: a multicountry survey in
536 Africa. *Int J Tuberc Lung Dis*. 2025;29(5):239-41.
- 537 36. Ndjeka N, Kubjane M, Abdullah F, Mohr-Holland E, Subrayen P, Loveday M, et al.
538 Impact of US funding cuts and stop work orders on TB services and research in South
539 Africa. *IJTLTD Open*. 2025;2(4):241-3.
- 540 37. Hoffman MD, Gelman A. The No-U-Turn sampler: adaptively setting path lengths in
541 Hamiltonian Monte Carlo. *J Mach Learn Res*. 2012;15(1):1593-623.
- 542 38. R Core Team. R: A language and environment for statistical computing [\[https://www.R-](https://www.R-project.org)
543 [project.org\]](https://www.R-project.org). Vienna, Austria: R Foundation for Statistical Computing; 2022.
- 544 39. Eddelbuettel D, Francois R. Rcpp: Seamless R and C++ Integration. *J Stat Softw*.
545 2011;40(8):1-18.
- 546 40. Stan Development Team. RStan: the R interface to Stan. R package version 2.32.7.
547 <https://mc-stan.org/>. 2025.
- 548 41. Iman RL, Helton JC, Campbell JE. An approach to sensitivity analysis of computer
549 models: part II—ranking of input variables, response surface validation, distribution
550 effect, and technique synopsis variable assessment. *J Qual Technol*. 1981;13:232-40.
- 551 42. Clark RA, McQuaid CF, Richards AS, Bakker R, Sumner T, Prÿs-Jones T, et al. The
552 potential impact of reductions in international donor funding on tuberculosis in low- and
553 middle-income countries. *medRxiv*. 2025.
- 554 43. Mandal S, Nair S, Sahu S, Ditiu L, Pretorius C. A Deadly Equation: The Global Toll of
555 US TB Funding Cuts. *medRxiv*. 2025:2025.03.04.25323340.
- 556 44. Tuberculosis Program Impact Tracker [\[https://tb.impactcounter.com/\]](https://tb.impactcounter.com/), accessed May 24,
557 2025 [Internet]. Stop TB Partnership. 2025.
- 558 45. Stover J, Sonnevelft E, Tam Y, Clark R, Phillips AN, Smith J, et al. The Effects of
559 Reductions in United States Foreign Assistance on Global Health. 2025.

- 560 46. Hussein S, Samet JM. Measuring population health impact of the Trump
561 administration's withdrawal from WHO and cuts to USAID: time to start counting. *Popul*
562 *Health Metr.* 2025;23(1):13.
- 563 47. Osendarp S, Ruel M, Udomkesmalee E, Tessema M, Haddad L. The full lethal impact
564 of massive cuts to international food aid. *Nature.* 2025;640(8057):35-7.
- 565 48. Burki T. Gavi under threat from US funding cuts. *The Lancet Infectious Diseases.*
566 2025;25(5):e266-e7.
- 567