RESEARCH ARTICLE

The World Bank & financing tuberculosis control, 1986-2017

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Abstract

Background: Tuberculosis (TB) is among the leading contributors to global mortality and morbidity from infectious diseases and has had a major socioeconomic cost in recent history. The World Bank is a leading institution for global health governance and financing, but little research has concentrated on the role of the World Bank in global tuberculosis control.

Methods: We tracked the development of the World Bank’s policies and associated financial flows for tuberculosis control. First, we performed a scoping review of both published and grey literature. Second, we used the Bank’s Projects & Operations database to construct a dataset of all World Bank projects with funding allocated to the “Tuberculosis” theme from 1986 to 2017. Finally, we analysed the World Bank’s funding patterns alongside wider funding for tuberculosis using the Institute of Health Metrics and Evaluation’s Development Assistance for Health database.

Results: We identified four periods in the World Bank’s involvement in global tuberculosis control, from the recognition of tuberculosis as a global health issue to the creation of a global coalition against tuberculosis. Between 1986 and 2017 the World Bank undertook 79 projects with financing from its core lending divisions with a tuberculosis control theme or focus. Within the 79 projects the Bank committed 19.6% of funding, or $0.9bn, towards tuberculosis control. The World Bank has been involved in increasingly vertical programming with a growing proportion of project funding invested into tuberculosis control over time. However, after the formation of private-public partnerships against tuberculosis in 2002 such as the Global Fund to Fight HIV/AIDS, TB and Malaria, the Bank’s core financing decreased and private-public partnerships provided increasing levels of substitutive financing for tuberculosis control.

Conclusions: The World Bank has been pivotal in leading global financing, garnering advocacy and creating widespread coalition in the battle against tuberculosis control in recent decades.

Keywords

World Bank, Tuberculosis, Global Health, Financing, Governance
This article is included in the The World Bank in Global Public Health collection.

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Introduction

Tuberculosis (TB) is the principal cause of mortality from infectious diseases globally, causing an estimated 10.4 million new cases and 1.8 million deaths each year. The incidence of tuberculosis has generally declined over the last decade, however this trend has not been uniform across regions; infection rates remain high in HIV/AIDS endemic areas and those experiencing slow economic growth, such as Sub-Saharan Africa and South-East Asia. TB is the sixth leading cause of death in individuals aged 15–49 worldwide. Due to the sustained TB burden over the last several decades, there has been an increasingly co-ordinated global response from multilateral organizations, such as the World Bank and the World Health Organization (WHO).

The World Bank became the largest funder of global health in 1983 and remains the largest health investor within the UN system. Its health disbursements are currently only surpassed by one multilateral organization, the Global Fund to Fight AIDS, Tuberculosis and Malaria. Since 1979, the Bank’s health-related activities have been supported through a dedicated health unit, which is now called the Health, Nutrition and Population (HNP) division. The Bank provides core disbursements through its two major arms, the International Bank for Reconstruction and Development (IBRD) and the International Development Association (IDA). The IBRD provides market-rate loans, whereas the IDA delivers grants and low-interest loans to the poorest states. Core funding can originate from either one of the lending agencies or via blended finance from both agencies. The World Bank’s current HNP portfolio focuses on poverty alleviation, global economic growth and health-specific mandates for universal health coverage and health system strengthening.

Bank presidents from Robert McNamara (1968–1981) to James Lee Kim (2012–present) have suggested that good population health outcomes contribute to a healthy workforce and socioeconomic development. Recently, TB has been a significant source of human and economic loss. The cost of infection can occur as direct losses, such as the cost of medical treatment, and indirect losses associated with loss of wages and education. Indirect losses have been found to be particularly high with TB due to the disease disproportionally affecting individuals of working age. The indirect losses also extend to removing children from education in families affected by TB, with children forced to take up employment to cover the shortfall in family earnings and the increased costs associated with healthcare. Consequently, the World Bank has taken an interest in reducing the substantial economic burden caused by TB.

This paper examines the World Bank’s global influence in TB control. We first review published and grey literature on the Bank’s policies towards TB control. We then analyse the extent and mechanisms of World Bank investments into global TB control initiatives. We will analyse the patterns of the World Bank’s investments with broader development assistance financing for TB control.

Methods

Scoping review of literature
To summarise the Bank’s policies for TB control, a scoping review of literature was undertaken. Embase, Ovid Medline, and Global Health databases were searched for peer-reviewed academic literature to cover literature from social and health policy. The World Bank Research and Publications database was searched for grey literature. 114 peer-reviewed papers and 453 grey literature papers were assessed, and 11 papers in total were identified as suitable for use in the policy review after application of the inclusion and exclusion criteria (Supplementary File 1 - Appendix A). We primarily focused on the Bank’s global investment patterns and policy history regarding TB control. Selected articulated and reports were reviewed and relevant text was thematically organised and subsequently used to construct a timeline of the key moments of influence that the World Bank has had in TB control history.

Analysis of financial data

First, we searched all health sector projects, as of 27/12/17, in the Bank’s Projects & Operations database, and selected health projects with a ‘tuberculosis’ theme (n=72). We excluded any projects with a tuberculosis theme that were dropped by the Bank (n=1). Next, we identified additional tuberculosis projects by searching for the key words ‘tuberculosis’ and ‘TB’ in the Projects & Operations database. We downloaded the major reports for these identified projects – the most recent and complete Implementation Completion Reports (ICR) and/or the Implementation Status and Results Report (ISR), as available – and manually searched each project document for references to ‘tuberculosis’ or ‘TB’. We included any projects with a specific tuberculosis activity listed in its report (n=8).

We created a tuberculosis financing dataset, using data captured for each of the selected tuberculosis projects (n=79 total). Data collected for each project included the project identifying number, region, country, approval and closing date, project status (active, closed, or dropped), lending instrument (IBRD or IDA), commitment amount and disbursement amount (Supplementary File 1 - Appendix B). Each World Bank project had funding allocated to a number of sectors and themes, the percentage of project funding to each sector and theme was also recorded. Particular attention was given to funding allocated to the ‘health’ sector and to the ‘tuberculosis’ theme. The value of World Bank funding to each sector and theme within each project was calculated by multiplying the Bank’s total commitment to the project with the percentage of funding allocated to the particular sector or theme within the project. Projects and the corresponding funding was classified using the approval date. Data was analysed using RStudio 1.1423 and Microsoft Excel 2016.

The Institute for Health Metrics and Evaluations (IHME) database

IHME’s Development Assistance for Health (DAH) database was downloaded on 24 October 2017. The IHME DAH database tracks financial and in-kind health resources channelled
from public and private development agencies to low- and middle-income countries. It breaks-down these international disbursements by funding agency (including core IBRD/IDA disbursements), geographical region, and health focus area. The current DAH database tracks eight health focus areas from 1990–2016, and one of these areas is tuberculosis. Only disbursements equal to or greater than $1000 were included in the analysis. The database was analysed for funding streams into TB control by geographical region and funding source over time. Data analysis was performed on RStudio 1.1.423.

**Results**

World Bank tuberculosis control policies and funding over time

Tuberculosis was among the primary causes of death from the 17th century until the early 20th century. During the mid-1900s, TB outcomes varied significantly across different income regions, with incidence rarely being found in high-income regions while overwhelming in low-income regions. The adoption of antibiotics, reductions in overcrowding and improved living conditions saw a decline in mortality and morbidity from TB in high-income countries. During this time, TB persisted as one of the leading causes of mortality in poverty-stricken countries. The re-emergence of TB within vulnerable populations in high-income countries during the 1980s once again made TB a priority on the global health agenda.

The first traceable World Bank financing towards TB control began in concurrence with the re-emergence of TB within industrialized countries during the 1980s. During the 1970’s, the Bank’s involvement in the health sector and TB control was limited to support for project components in other sectors. By keyword searching the Bank’s Projects & Operations database, we identified a few early projects in other sectors – like agriculture – that had minor TB components, such as vaccination. The creation of the Population, Health and Nutrition department in 1979 marked a change in the Bank’s stance on health investments and allowed the Bank to pursue direct lending for health. Between 1980 and 1985, the Bank does not mention any TB-specific projects, which makes it relatively safe to assume that large TB-focused projects did not begin until after 1986. In 1986, the adoption of the HNP ‘tuberculosis’ theme allows us to attribute funding directly towards TB control. We have therefore chosen to examine the Bank’s financing of TB control projects occurring after 1986.

We have identified four key periods in the Bank’s involvement in TB control between 1986 and 2017 (Figure 1). For each

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**Figure 1.** A timeline showing notable events and World Bank tuberculosis (TB) policies over four key periods (1986–2017). The World Bank supported TB control initiatives and published guidance over four key periods between 1986–2017. From 1986–1993, the Bank recognised TB as a critical global health issue. From 1994–1997, the Bank supported the adoption of Direct Observation of Treatment, Short-course chemotherapy (DOTS). From 1998–2002, the Bank helped establish private-public partnerships (PPP) to tackle TB. From 2003–2017, PPP became the leading organizations in global TB control with the Bank supporting these initiatives.

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distinct period, we discuss the development of TB control policies and the financial commitments given to TB projects at the Bank.

We identified 79 projects with a TB theme or emphasis from 1986–2017. The total value of these projects was $15.9bn. From 1986, the World Bank committed $5.4bn over the projects with the remaining amounts disbursed by co-financiers, such as other development banks or UN agencies (Supplementary File 1 - Appendix C).

Over the 79 World Bank projects with a TB focus, 19.6% of IBRD/IDA core funding was allocated towards TB, equaling $0.9bn. A total of 74 projects had funding from a single core lending agency only, either the IBRD or IDA. Five projects had a blend of core funding, with funding from both the IBRD and IDA within the projects. In total, IBRD provided 31% of funding towards TB and IDA provided the remaining 69%. Blended financing made up only 4% of overall TB funding.

**Period I: Recognizing TB as a critical global health issue (1986–1993).** The World Bank first began funding TB-related projects in 1986, for the expansion of disease surveillance and immunization in China. Following the World Health Assembly’s recognition of TB as an emerging global health issue requiring improved control measures in 1991, the World Bank funded a project in China studying short-course chemotherapy as a means of TB control and management. In 1993, the WHO declared TB a global emergency due to rising rates of multi-drug resistant TB (MDR-TB) and co-infection in HIV/AIDS patients, particularly in high-income regions. The same year, the World Bank published its China project findings in its seminal *Investing in Health* World Development report, deeming short-course chemotherapy for TB “one of the most cost-effective of all interventions”.

The Bank committed $89.7m for TB control over this period. The IBRD was the largest donor of the Bank’s TB funding providing $68.1m, compared to the IDA which committed $21.5m in funding. The average size of the Bank’s commitment to TB initiatives per project was $12.8m, the largest contribution per project of any period (Table 1).

**Period II: Supporting direct observation of treatment, short-course chemotherapy (DOTS) (1994–1997).** Following from the World Bank’s endorsement of short-course chemotherapy as a cost-effective TB treatment, the WHO announced new methods for TB detection and plans for widespread provision of short-course chemotherapy for the treatment of TB in 1994. During the following year, short-course chemotherapy was packaged alongside TB management guidelines into direct observation of treatment, short-course chemotherapy (DOTS). DOTS was aggressively promoted as the leading global strategy for TB control by both the World Bank and the WHO, and by 1997 bilateral support for DOTS was applied in 96 countries. DOTS would later be extended to include second-line drugs for MDR-TB, via the DOTS-plus initiative.

During this period, the World Bank committed $75.9m for TB control. The IDA was the largest donor of the Bank’s TB funding providing $72.1m, compared to the IBRD which committed only $3.7m in funding. The Bank committed an average of $12.6m to each TB-focused project (Table 1). The relative proportion of project funding committed to TB control peaked during this period (Figure 2).

**Period III: Establishing private-public partnerships to tackle TB (1998–2002).** Between 1998 and 2002 there was a growing consensus among policymakers that a coordinated partnership of agencies was required in the battle against MDR-TB. In 1998, the World Bank was among the founding partners of a private-public partnership (PPP) which would later coalesce to form the Stop TB Partnership. The new millennium saw two important milestones in the global battle against TB. The first was the formalization of the structure of the Stop TB Partnership on March 24th, 2000, the first World TB Day. On this day, the WHO and World Bank jointly hosted a conference in Amsterdam in which leading figures from both organizations signed the Amsterdam Declaration as partners, committing to the greater international coalition, political will and financial

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### Table 1. World Bank funding for projects with a tuberculosis (TB) focus, relative to total Bank funding and Bank health sector funding (1986–2017).

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Number of Projects</th>
<th>World Bank (IBRD/IDA) Total Commitments ($ Millions USD)</th>
<th>World Bank Commitments to the Health Sector ($ Millions USD)</th>
<th>World Bank Commitment to Projects with a TB focus ($ Millions USD)</th>
<th>Average size of commitment per TB Project ($ Millions USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986–1993</td>
<td>7</td>
<td>705.8</td>
<td>675.4</td>
<td>89.7</td>
<td>12.8</td>
</tr>
<tr>
<td>1994–1997</td>
<td>6</td>
<td>339.7</td>
<td>314.2</td>
<td>75.9</td>
<td>12.6</td>
</tr>
<tr>
<td>1998–2002</td>
<td>20</td>
<td>994.14</td>
<td>800.0</td>
<td>241.4</td>
<td>12.1</td>
</tr>
<tr>
<td>2003–2017</td>
<td>46</td>
<td>3339.94</td>
<td>1969.7</td>
<td>524.9</td>
<td>11.4</td>
</tr>
</tbody>
</table>

resources required to implement DOTS in 20 high burden countries. The second milestone was the inclusion of TB in the Millennium Development Goals. In 2001, the Washington Commitment operationalized the Amsterdam Declaration, uniting the World Bank, the WHO and over 200 other agencies to build the political backing for the Stop TB Partnership and the Global Plan to Stop TB 2001–2005. In response the inclusion of TB in the Millennium Development Goals, the Global Fund to Fight Aids, Tuberculosis and Malaria (Global Fund) was formed, with the World Bank acting as a trustee and board member. Over this short four-year period, the World Bank funded 20 TB-focused projects and committed $241.4m towards TB control. The IBRD was the largest donor of the Bank’s TB funding providing $124.2m, compared to the IDA which committed $117.1m in funding. The average size of the Bank’s commitment to TB initiatives per project was marginally smaller than in the previously two periods, with the Bank committing $12.1m on average to TB control per project (Table 1). Over this period the Bank’s commitments to TB peaked, particularly in 2002 (Figure 3).

Period IV: Private-public partnerships become the leading authorities in global TB control (2003–2017). From 2003, the World Bank invested its financial and political resources to further the Stop TB Partnership. The Bank became an integral collaborator of the Stop TB programme. The Bank serves as a permanent member of the Stop TB Partnership’s Coordinating Board and acts as both a financier and knowledge institution for the partnership. The World Bank provides board-level administrative support, annual financial contributions and economic studies for the partnership. The launch of the Global Plan 2006–2015 by the Stop TB Partnership at the 2006 World Economic Forum aimed to enhance global cohesion and advocacy for TB control, working towards the TB-specific Millennium Development Goals. The 2006–2015 Global Plan looked to expand DOTS coverage and secure greater long-term funding to tackle MDR-TB and co-infection of TB with HIV. Subsequent joint initiatives from the World Bank helped extend DOTS to become the Stop TB Partnership’s leading strategy and encouraged global expansion of DOTS coverage in line with the 2006–2015 Global Plan. In 2015, the Bank committed to tackling the issue of TB in the mining sector in Southern Africa, culminating in the creation of the South Africa Knowledge Hub, with the aim to drive improvement in TB outcomes in this population.

Between 2003 and 2017 the World Bank funded 46 TB-focused projects and committed $524.9m towards TB control. The Bank committed $11.4m on average to TB control per project, the smallest of any period (Table 1). However, an increasing proportion of total IBRD/IDA project funding, within the World Bank TB projects, was allocated to TB control (Figure 2). The IDA committed significantly more ($431.3m) to TB-focused projects than IBRD ($88.5m). This high proportion of low-interest and concessional loans given out by the Bank during this
The value of World Bank commitments to tuberculosis (TB) peaked during the third key period between 1998–2002, during this time the World Bank was a leading figure, along with the WHO, in the creation of a coalition against TB and formation of the Stop TB Partnership. This period reflects the Bank’s policy guidance on expanding DOTS in Sub-Saharan Africa and other low-income countries, which are most frequent recipients of IDA loans.

**World Bank funding by region and country**

Africa had the largest number of TB-focused projects across all regions (Figure 4), with 20 projects in the region from 2002–2017. However, South Asia, which had the third-largest number of projects, was the largest recipient of total TB project funding ($278m) with projects in the region from 1991–2017 (Figure 5) (Supplementary File 1 - Appendix D).

World Bank TB projects targeted 49 individual countries (Figure 6). India was the largest recipient of funding for TB with $230.5 million committed to the nation in total. Brazil, Russia, India and China were among the top five countries receiving commitments for TB from 1986–2017 (Figure 6) (Supplementary File - Appendix D). These countries all ranked in the top 20 countries with the highest TB incidence per 100,000 population from 2000–2016 (Figure 7).

**Total development assistance for health funding towards TB control**

The IHME recorded a total of 45,931 DAH disbursements towards TB control between 1990 and 2016, spread over 146 countries (Figure 8).

From 2002, there was an increase in development assistance to TB in all regions except high-income regions. Sub-Saharan Africa received the most disbursements of any region at $2.8bn (Figure 9). Around $2.5bn of the development assistance for TB to Sub-Saharan Africa was disbursed to between 2002–2016.

The Global Fund disbursements began in 2002, a decade later than all other funding sources. However, the Global Fund provided the greatest value of disbursements towards TB of any funding source disbursing $6.5bn towards TB control between 2002–2016 (Figure 10).

**Discussion**

**Increasingly TB-focused projects**

From 1986–2017, more funding was given to tuberculosis with a greater proportion of project funding specified towards TB over each of the four key periods. This progressively vertical funding approach coincides with greater international recognition of TB as a global health issue. While the global incidence of TB has been declining, the infection still inflicts major human and economic damage with 40 million disability-adjusted life years (DALYs) lost to the disease each year. TB now has its own targets within Sustainable Development Goal 3 and there is a growing international recognition of global funding shortages for TB. This has intensified the political impetus on the Bank for continued international cooperation and investment in TB control.

Tackling TB’s economic toll aligns with the Bank’s greater agenda to increase global financial prosperity. The Bank has historically utilised the concepts of global burden of disease and cost-effectiveness of health interventions in priority setting and resource allocation. The rise of TB as a global emergency in the
The number of World Bank funded tuberculosis (TB)-focused projects from 1986–2017 per region. The Africa region had the greatest number of TB-focused projects, despite projects only taking place in the region from 2002–2017.

The proportion of World Bank commitments towards tuberculosis (TB) control from 1986–2017 per region. South Asia which had the third largest number of projects was the largest recipient of funding receiving 32% of all TB commitments between 1986–2017.

Substitutive development assistance from the Global Fund, Non-governmental organization (NGO)s, and foundations From the 1980’s the World Bank has been viewed as an increasingly supportive lender towards health. It has been instrumental in financing and shaping global health priorities, including TB control strategies through the Bank’s leadership in the coalition of the Stop TB partnership in 2001. The Bank’s political investment was seemingly matched by its financial commitments, providing high levels of funding to TB projects during the third key period in the Bank’s funding for TB control between 1998 and 2002. After this period, the Bank’s commitments towards TB decreased, with fewer dollars committed on average per project towards TB control. The early 1990’s and the discovery of highly cost-effective nature of short-course chemotherapy for the treatment in 1993 promoted TB control on the Bank’s agenda and this likely resulted in the greater allocation of World Bank financing to TB control after this time. MDR-TB and co-infection with HIV have become increasingly significant issues over time. The inflated cost of treating these infections has intensified the need for adapted policies and greater funding to reflect the changing nature of TB. The Bank has responded by publishing guidance such as the DOTS-plus strategy to help tackle the emerging issues. The continual investments from the Bank towards new policies to reflect the changing demands of TB and have been mirrored in the Bank’s funding patterns within its increasingly TB-focused projects.
Figure 6. Value of World Bank commitments ($Millions of USD) to tuberculosis (TB)-focused projects from 1986–2017 per country. India ($230.5m), China ($69.2m), Brazil ($45.4m), Russia ($43.5m) were among the top five recipients of World Bank commitments for TB control from 1986–2017. Nigeria ($50.44m) was the third largest recipient country of World Bank commitments for TB from 1986–2017.

Figure 7. Incidence of tuberculosis (TB) per 100,000 population from 2000–2016 (WHO). The highest TB incidence between 2000–2016 occurred in Sub-Saharan Africa. India (1), China (2), Brazil (19) and Russia (18) are all ranked within the top 20 nations with the highest annualized number of cases.
Figure 8. The value of Development Assistance for Health (DAH) disbursements for tuberculosis (TB) (US$) between 1990–2016 per country. India ($848.5m), China ($688.9m) and Nigeria ($346m) were the three largest recipients of DAH for TB between 1990–2016. Russia ($166.3m) and Brazil ($110.7m) were the 11th and 20th largest recipients of DAH for TB disbursements respectively, between 1990–2016.

Figure 9. The total value of development assistance for tuberculosis (TB) from 1990–2016 per region. Development assistance for TB remained stable with minimal growth in disbursement across all regions between 1990–2002. From 2002–2016, development assistance for TB grew rapidly in four regions: Sub-Saharan Africa; South Asia; Southeast Asia, East Asia and Oceania and also Central Europe, Eastern Europe and Central Asia. The most rapid growth in disbursements after 2002 occurred in Sub-Saharan Africa.
The Global Fund ($6.5bn) was the largest funding source of development assistance for TB, with disbursements from 2002–2016. Non-governmental organization (NGOs) and Foundations ($3.7bn), UN Agencies ($2.5bn), Bilateral Agencies ($2.4bn) and the World Bank (0.8bn) also provided development assistance for TB from 1990–2016. Development assistance for TB from all funding sources remained relatively stable between 1990–2002. From 2002–2016, development assistance for TB grew rapidly across multiple financiers, most notably the Global Fund grew rapidly.

The rapid rise of funding from these financiers alongside the relative decrease in TB funding per project during the Bank’s fourth key period indicates that financing towards TB from the Global Fund, NGOs and Foundations can be seen as substitutive rather than supplementary to the World Bank’s commitments.

Comparing the World Bank’s financing for TB control in the context of wider development assistance funding reveals that IDA and the IBRD constitute a smaller role in global health funding than newer health financiers, such as the Global Fund. Within the past three decades, global DAH grew at the fastest rate between 2000 and 2009, at an annualized rate of 11.3%. This decrease in the Bank’s relative contributions to DAH through core channels reflects its use of ‘extra-budgetary’ or voluntarily-contributed resources from public and private donors. These resources, typically called trust funds, have become an increasingly popular mechanism of financing health initiatives, and their disbursements for health now rival core IDA and IBRD funding. Trust funds allow donors to bypass the Bank’s traditional country-based lending system by earmarking funds for initiatives in particular countries or with specific scopes and objectives. Trust funds also allow the World Bank to accept greater levels of funding from a more diverse set of donors, namely private benefactors. A large proportion of the global growth in DAH can be attributed to newer organizations: NGOs and Foundations, such as the Bill and Melinda Gates Foundation, and PPP, such as the Global Fund. These models of global health financing have become increasingly popular among donors, as these newer institutions allow greater discretionary financing due to their narrower, problem-focused mandates.

The growth of trust fund financing at the World Bank alongside the meteoric rise in development assistance from PPP signals a declining role for Bank-led core funding in development assistance for TB control and a growing role for discretionary funding for TB control. Increased discretionary funding from donors will introduce greater incentive for the Bank to act in the interests of individual donors rather than towards greater cooperation and common objectives set out by the international community. The Stop TB partnership was formed during an era of immense international cooperation and thus, erosion of this principle due to changing financial incentives may reduce the capacity for sustained partnership against TB control.
TB financing patterns reflect the global burden of disease

Regional funding patterns for TB-focused projects from the World Bank were largely aligned with the historical burden of disease. The majority of TB cases each year occur in LMICs. Over two-thirds of World Bank funding towards TB was disbursed through the Bank’s IDA core lending division. As the largest proportion of the World Bank’s TB financing was disbursed through the IDA, the largest recipients of the Bank’s funding were LMICs. Both World Bank funding and development assistance for TB control was highest in South Asia and Africa, reflecting the sustained high TB incidence in these regions, compared with other regions. Almost half of the global TB prevalence occurs in Brazil, Russia, India, China and South Africa (BRICS) each year. BRICS were among the largest recipients for World Bank commitments for TB projects. Between 1986–2017, India and China received the highest level of World Bank commitments and development assistance for TB, reflecting the huge burden of both drug-sensitive and MDR-TB found in these two countries. Over one-third of the global burden of MDR-TB is found in India and China and it is acknowledged that MDR-TB can be up to 25 times costlier to treat than drug-sensitive TB. Thus, the socioeconomic cost from TB is compounded in countries with a high prevalence of drug-resistant disease, and consequently these countries require greater financing. The countries with the highest disease burden are likely to suffer the greatest economic toll and therefore the World Bank has targeted LMICs and BRICS with elevated levels of financial support to help tackle the disease burden in these regions.

Whilst further political commitment and financing is needed to tackle TB in LMICs, there are numerous structural barriers, including weak health systems, workforce shortages, and supply chain management issues. Improving disease control will require tackling these underlying issues through greater investment in health system strengthening. However, there is a risk that increasingly TB-focused Bank funded projects alongside financial instruments such as trust funds and new financiers seeking rapid results with quantifiable returns may produce more vertical, disease-specific funding. This type of programming is unlikely to challenge the underlying structural drivers of sub-optimal TB control in LMIC and may reduce countries’ the ability for long-term, country-led priority setting.

Conclusions

From 1986, the World Bank has been heavily involved in developing and promoting key global TB control policies, including the formation and coordination of the Stop TB partnership and the widespread expansion of the DOTS programme. The Bank’s peak political commitments between 1998 and 2002, were matched by its highest financial commitments during this period. Subsequently, commitments towards TB initiatives from the World Bank core divisions have steadily declined with newer financiers of global health funding the deficits. However, the Bank has increased the proportion of project funding allocated to TB control over time, likely in recognition of the sustained socioeconomic cost each year due to TB. The Bank also remains involved in the global governance of TB through its inclusion in the executive boards of the Stop TB Partnership and the Global Fund.

The World Bank’s agenda to reduce global poverty and increase economic output makes TB a prime candidate for targeted funding because of its continued contribution to significant socioeconomic losses around the world. Ambitious targets set for TB control, combined with the rising cost of treating new forms of the disease, means that greater funding will be required in the future. Given the need for further financing and policies to meet new challenges set by drug resistant TB, the Bank will continue to be a key financial and knowledge institution in this area. As trust funds and alternative financiers such as the Global Fund, NGOs and Foundation provide a greater source of financing for TB initiatives it is likely that the World Bank’s core funding for TB control will be further eroded. Therefore, close attention and future study will be required as to the effect of this type of programming on issues such as international cooperation and long-term, regional priority setting in countries affected by TB.

Data availability

Data and R code used for this study is available from Zenodo. Dataset 1: The Role of the World Bank in Financing Tuberculosis Control- Dataset  [http://doi.org/10.5281/zenodo.1332052](http://doi.org/10.5281/zenodo.1332052)

Data is available under a CC BY 4.0 licence

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Supplementary material

Supplementary File 1: Supplementary methods, data guide and summary data

Click here to access the data.
References


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In this article, the authors detail the World Bank’s engagement with financing global TB control, drawing on literature and quantitative financing data available via the World Bank’s website. The authors are commended for adding this important component of the history of global TB control to the literature, emphasizing the World Bank’s critical role during a turning point in TB programs, with insights to understand current global coordination to End TB.

I have two general, substantive comments that the authors should consider during revisions.

First, currently, the manuscript has statements that need to be substantiated, rephrased, or deleted. While seemingly mundane or inconsequential, such words and phrasing have important bearing on the nuances of TB history, especially phrasing that implies causality. For example, in the opening paragraph, the authors write: “Due to the sustained TB burden over the last several decades, there has been increasingly [sic] co-ordinated global response from multilateral organizations, such as the World Bank and WHO.” What exactly is meant by “last several decades”? Has TB burden been “sustained,” and is this, and this alone, the causal reason for increased global coordination, as implied by “due to”? How to measure “global coordination” to assess if it is increasing? To avoid aphorisms, authors should critically review the words and phrasing used and their implications. Statements that are editorial or cannot be substantiated should be rephrased or eliminated. Precision is needed.

Second, the authors should more fully attend to the World Bank’s relative position within global TB control as well as changes in global health more generally. When the World Bank began financing health projects at the end of the 1970s and into the 1980s, it did so in a moment of transition for global coordination for health. The valiant goals of “Health for All,” put forward by the primary health care movement and galvanized by the Alma Ata Declaration (1979), had to be scaled back given global economic downturn starting in the 1970s and leading into the 1980s. Such economic downturn resulted in decreased international aid, increased non-governmental actors in health, and structural adjustment programs that affected public services (including health). As the major director of such programs, World Bank was at the locus of restructuring of health. Conceptually, these changes marked a transition from “international” to “global” health paradigms.
For TB, major funding cuts during the 1970s and 1980s coincided with an increase burden after a period of decline following introduction of effective chemotherapies (along with increased wealth and other factors affecting TB epidemiology), the emergence of HIV-TB coinfections, and increased cases of multidrug resistant TB. Renewed attention to TB galvanized by WHO Director Nakajima’s declaration of a “TB Global Emergency” coincided with World Bank’s Global Development report (both in 1993), which reported that TB was the most cost-effective disease control program, stemming largely from positive preliminary results from the large-scale implementation of the Union’s program in coordination with China MOH and WHO, which later was branded as DOTS by WHO and partners. At the time, TB burden remained high in China, and the focus on TB dovetailed with the much larger changes taking place following economic liberalization again starting in the late 1970s and early 1980s; World Bank had interests in China beyond TB.

There are many references that could be useful for contextualizing this review. Here are a few:

8. Wang et al. (2014)

Additional Comments:

General
- Consistency: World Bank vs. the Bank? Poverty-stricken countries vs low- and middle-income countries (LMICs)?
- Citations: As much as possible, use primary sources for citations (e.g., Najakima’s Global TB Emergency). Also, review citations in-text (seems like not all are appropriately connected to citations in Bibliography).

Introduction
- Pg 3: WHO Global TB Report should be used as citation for first sentence. Also, it can be updated with most recent Global TB Report, out in September 2018.

Methods
- Remove editorial comments from the Methods; should appear in Discussion.
- What was the criteria for differentiating the time periods? Post-hoc? Could this history be split up in a different way more closely following from the quantitative analysis?
- Pg 3: Consider adding a flow diagram to supplement to illustrate the results of literature review

Results
- Remove editorial comments from the Results; should appear in Discussion.
- Would be interesting to see the breakdown of what was funded, especially to support the author’s different time periods. Might also be interesting to show trends of the number of TB patients supported through World Bank-funded programs.
- Results miss many important events in TB history that happened over this time. Consider revising Results so it sticks more closely to describing quantitative analysis or providing a more detailed history of development of TB control over this time period.
- Pg 4-5: Much of the first 4 paragraphs should be in Background, not Results.
Pg 5: The first World TB Day was coordinated by the Union in 1982, celebrating the 100 year anniversary of Robert Koch’s isolation of *Mycobacterium tuberculosis*. I believe WHO started also celebrating World TB Day in the 1990s, prior to the 2000 event mentioned in text.

Discussion

Pg 8: The DOTS-Plus Strategy was spearheaded by WHO with partners; World Bank did not publish this guidance. Please check your citation.

Figures/Tables

- Print these out in black and white to ensure that Figures/Tables retain important shading/formatting. E.g., Figure 1 cannot differentiate between shades.
- Consider selecting the 3-4 main figures and tables, and putting the rest as supplements.

References


Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Yes

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Not applicable

Are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions drawn adequately supported by the results?
Partly

**Competing Interests:** No competing interests were disclosed.
Reviewer Expertise: History of TB control; history of global health

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 13 Jun 2019

Manveer Rahi, University of Edinburgh, Edinburgh, UK

We would like to thank Dr Dirlikov for his insightful comments regarding this study. The comments from Dr Dirlikov have encouraged a richer analysis of the history of TB control and have encouraged greater precision within the paper.

In this article, the authors detail the World Bank’s engagement with financing global TB control, drawing on literature and quantitative financing data available via the World Bank’s website. The authors are commended for adding this important component of the history of global TB control to the literature, emphasizing the World Bank’s critical role during a turning point in TB programs, with insights to understand current global coordination to End TB.

I have two general, substantive comments that the authors should consider during revisions.

1) First, currently, the manuscript has statements that need to be substantiated, rephrased, or deleted. While seemingly mundane or inconsequential, such words and phrasing have important baring on the nuances of TB history, especially phrasing that implies causality. For example, in the opening paragraph, the authors write: “Due to the sustained TB burden over the last several decades, there has been increasingly [sic] co-ordinated global response from multilateral organizations, such as the World Bank and WHO.” What exactly is meant by “last several decades”? Has TB burden been “sustained,” and is this, and this alone, the causal reason for increased global coordination, as implied by “due to”? How to measure “global coordination” to assess if it is increasing? To avoid aphorisms, authors should critically review the words and phrasing used and their implications. Statements that are editorial or cannot be substantiated should be rephrased or eliminated. Precision is needed.

   We have edited the text as per advised to add greater precision to the paper.

2) Second, the authors should more fully attend to the World Bank’s relative position within global TB control as well as changes in global health more generally. When the World Bank began financing health projects at the end of the 1970s and into the 1980s, it did so in a moment of transition for global coordination for health. The valiant goals of “Health for All,” put forward by the primary health care movement and galvanized by the Alma Ata Declaration (1978), had to be scaled back given global economic downturn starting in the 1970s and leading into the 1980s. Such economic downturn resulted in decreased international aid, increased non-governmental actors in health, and structural adjustment programs that affected public services (including health). As the major director of such programs, World Bank was at the locus of restructuring of health. Conceptually, these changes marked a transition from “international” to “global” health paradigms.

For TB, major funding cuts during the 1970s and 1980s coincided with an increase burden after a period of decline following introduction of effective chemotherapies (along with increased wealth and other factors affecting TB epidemiology), the emergence of HIV-TB coinfections, and
increased cases of multidrug resistant TB. Renewed attention to TB galvanized by WHO Director Nakajima’s declaration of a “TB Global Emergency” coincided with World Bank’s Global Development report (both in 1993), which reported that TB was the most cost-effective disease control program, stemming largely from positive preliminary results from the large-scale implementation of the Union’s program in coordination with China MOH and WHO, which later was branded as DOTS by WHO and partners. At the time, TB burden remained high in China, and the focus on TB dovetailed with the much larger changes taking place following economic liberalization again starting in the late 1970s and early 1980s; World Bank had interests in China beyond TB.

- We have edited the layout of the text and now included a section called “The World Bank’s Historical Role in Global TB Control Policy” which summarises the World Bank’s political involvement in TB control. We have attempted to contextualise the policies of the World Bank with major historical events in TB control history. Please see this section for further details.

Additional Comments:
Consistency: World Bank vs. the Bank? Poverty-stricken countries vs low- and middle-income countries (LMICs)?
- Edited as per comment.

Citations: As much as possible, use primary sources for citations (e.g., Nakajima’s Global TB Emergency). Also, review citations in-text (seems like not all are appropriately connected to citations in Bibliography).
- Edited as per comment.

Introduction
Pg 3: WHO Global TB Report should be used as citation for first sentence. Also, it can be updated with most recent Global TB Report, out in September 2018.
- The citation has been updated to reflect the new Global TB report 2018.

Methods
Remove editorial comments from the Methods; should appear in Discussion.
- Editorial comments have been removed.

What was the criteria for differentiating the time periods? Post-hoc? Could this history be split up in a different way more closely following from the quantitative analysis?
- We have attempted to make the differentiation of the periods clearer to the reader by adding the following sentences to the Introduction: “We have identified four key periods in the World Bank’s involvement in TB control between 1986 and 2017 (Figure 1). These time periods are based on key historical eras in the World Bank’s political investment towards TB control. Using these periods, we discuss the political and financial commitments to TB projects by the World Bank.”

Pg 3: Consider adding a flow diagram to supplement to illustrate the results of literature review
- The methods have been updated to include a Google Scholar search. We have chosen to not include a flow diagram into the article to reduce the number of diagrams and tables within the text, as requested in an additional comment from the reviewer.

Results
Remove editorial comments from the Results; should appear in Discussion.
- Editorial comments have been removed and moved to Discussion.

Would be interesting to see the breakdown of what was funded, especially to support the author’s different time periods. Might also be interesting to show trends of the number of TB patients supported through World Bank-funded programs.
- No data existed for the number of TB patients supported within TB projects. We have undertaken additional work to examine themes supported within each TB-focused project. A summary of these can be found in the last paragraph of each ‘Period’ within the Results.
section. We have added additional analysis of this in the first section of the Discussion:

“Four national TB programmes, all adopting DOTS as the primary strategy for TB control, were created between 1995 and 2006 with financial assistance from World Bank TB-focused projects.”

Results miss many important events in TB history that happened over this time. Consider revising Results so it sticks more closely to describing quantitative analysis or providing a more detailed history of development of TB control over this time period.

- The World Bank political involvement has been moved to the Introduction to form a more cohesive and richer description of the political involvement of the Bank towards TB control.
  - Please see “The World Bank’s Historical Role in Global TB Control Policy”.

Pg 4-5: Much of the first 4 paragraphs should be in Background, not Results.
- Edited as per comment.

Pg 5: The first World TB Day was coordinated by the Union in 1982, celebrating the 100 year anniversary of Robert Koch’s isolation of Mycobacterium tuberculosis. I believe WHO started also celebrating World TB Day in the 1990s, prior to the 2000 event mentioned in text.
- Edited as per comment.

Discussion

Pg 8: The DOTS-Plus Strategy was spearheaded by WHO with partners; World Bank did not publish this guidance. Please check your citation.
- Edited as per comment.

Figures/Tables

Print these out in black and white to ensure that Figures/Tables retain important shading/formatting. E.g., Figure 1 cannot differentiate between shades.
- Consider selecting the 3-4 main figures and tables, and putting the rest as supplements.
- Edited as per comment.

Competing Interests: None
accommodating ‘donor-led’ financing: the authors argue that such trends in health financing may erode support for the cross-cutting, long-term interventions that are increasingly needed in TB control today.

This is, to my knowledge, the first time this evidence has been collected and quantified in a systematic way. The manuscript is well-written: however, I have the following comments for clarification and improvement.

Main comments
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-- From results in Figure 2, the authors conclude that TB-related projects have become more TB-focused over time. However, with all the volatility in this figure, it would be helpful to clarify precisely how these trends have been judged. The dashed line on figure 2 suggests that the authors have conducted a least-squares fit over time (see also minor comment below). Does the conclusion follow from this line? If so, it is important to address how much this apparent trend is driven by the spikes in 2001 (with the launch of the Partnership), and in 2016 - that is, because of specific events, rather than any secular trend. Indeed, the authors may consider dropping the line altogether, and instead simply adding a column to table 1 to show the overall increases in each period - which would tell the story just as well.

-- The discussion identifies the growing use of trust funds by WB, a trend that seems rather important in understanding Figure 2. However, the reader is left with only a partial view, as Figure 2 (and much of the manuscript) concentrates on core funding. What is really needed is an idea of the contribution from trust funds, relative to core funding. It would help to either: present this proportion over time, or (in case this data is not available), add further discussion to describe the evidence for the importance of these vehicles.

-- The discussion would benefit from a fuller description of the limitations of this analysis. For example, the search strategy focuses on projects naming TB as a theme. To what extent could it miss out on other WB core funding that may nonetheless have important implications for TB (for example, on projects aimed at health systems strengthening)? Other limitations might address the scope of the analysis, for example.

Other comments:
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p.4, “Tuberculosis was among the primary causes of death…” This is background rather than results, and would be better placed in the introduction. Also in this paragraph, reference to the ‘adoption of antibiotics’ could be dropped - for today’s HICs, the bulk of 20th-century reductions in TB burden occurred prior to the discovery of streptomycin in the 1940s.

p.5 onwards: Results refer repeatedly to ‘TB-focused’ projects, which I assume are WB projects identifying TB as a theme (regardless of the proportion of funds for TB?). Please define this term in the Methods.

p.7, “While the global incidence of TB has been declining, the infection still inflicts…” Replace ‘infection’ by ‘disease’ to avoid confusion with latent TB infection, which by itself has no known cost in DALYs. Similarly for p.3, “The cost of infection..."

Figure 2 can be a little hard to interpret, for the reasons described above: presumably the volatility arises because the figure plots commitments by year of approval, rather than actual disbursements over time. If the latter data is available, it would be helpful to see these plotted too, perhaps as a supporting
Also relating to figure 2, it would be helpful to describe what the dashed line represents (e.g. line-of-best-fit?), in the figure caption. Alternatively, authors may consider dropping this line, in place of horizontal dashed lines, showing the average proportion in each period.

Fig.10 illustrates the emergence of GFATM as a leading source of funding: in the discussion this is associated with funding priorities being more donor-led. However, we know that health systems strengthening is now also a strategic priority for GFATM. Some acknowledgement to this effect could be helpful.

Supporting information: Suggests there’s no need for figure A2, as figure A1 already depicts the relative amounts in the stacked bars.

There are a few typos in the main text, including p.2, “Selected articled...” and p.12, “…reduce countries' the ability...”

In showing the value of total commitments over time, were these adjusted for dollar value in a given year? Either way, it would be helpful to clarify.

Is the work clearly and accurately presented and does it cite the current literature? Yes

Is the study design appropriate and is the work technically sound? Yes

Are sufficient details of methods and analysis provided to allow replication by others? Partly

If applicable, is the statistical analysis and its interpretation appropriate? Not applicable

Are all the source data underlying the results available to ensure full reproducibility? Partly

Are the conclusions drawn adequately supported by the results? Partly

**Competing Interests:** No competing interests were disclosed.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.
We would like to thank Dr Arinaminpathy for his detailed feedback and constructive ideas to improve this paper. We have edited the results and discussion sections to reflect the changes suggested regarding Figure 2 and also added additional discussion regarding the potential effects of trust fund financing upon TB control programmes financed by the World Bank. We believe that the comments from Dr Arinaminpathy have provided us the foundation for a richer discussion within this paper.

This analysis addresses important and topical questions in global health. The authors quantify World Bank (WB) support for TB projects over the last three decades, and they set these trends in the context of development assistance from other organisations, including the Global Fund.

The authors conclude that: (i) TB-related projects funded by the World Bank have become more TB-focused over the study period, (ii) overall WB funding for TB has declined steadily since 2001, and (iii) These recent declines are reflective of a general move towards trust funds and other mechanisms accommodating 'donor-led' financing: the authors argue that such trends in health financing may erode support for the cross-cutting, long-term interventions that are increasingly needed in TB control today.

This is, to my knowledge, the first time this evidence has been collected and quantified in a systematic way. The manuscript is well-written: however, I have the following comments for clarification and improvement.

Main comments
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1) From results in Figure 2, the authors conclude that TB-related projects have become more TB-focused over time. However, with all the volatility in this figure, it would be helpful to clarify precisely how these trends have been judged. The dashed line on figure 2 suggests that the authors have conducted a least-squares fit over time (see also minor comment below). Does the conclusion follow from this line? If so, it is important to address how much this apparent trend is driven by the spikes in 2001 (with the launch of the Partnership), and in 2016 - that is, because of specific events, rather than any secular trend. Indeed, the authors may consider dropping the line altogether, and instead simply adding a column to table 1 to show the overall increases in each period - which would tell the story just as well.

- A new column has been added to table 1 which shows the “Proportion of Project Funding Committed to TB (%).” This has been reflected in Figure 2 through the use of the dashed horizontal lines in each period.

2) The discussion identifies the growing use of trust funds by WB, a trend that seems rather important in understanding Figure 2. However, the reader is left with only a partial view, as Figure 2 (and much of the manuscript) concentrates on core funding. What is really needed is an idea of the contribution from trust funds, relative to core funding. It would help to either: present this proportion over time, or (in case this data is not available), add further discussion to describe the evidence for the importance of these vehicles.

- Further discussion as to the extent and potential implications of trust fund financing has been added to the discussion. This has been added to the discussion under “Substitutive Development Assistance from the Global Fund, NGOs, and Foundations” and “TB Financing Patterns Reflect the Global Burden of Disease”. We have also noted in the limitations that this study was unable to quantify the extent of trust fund financing for TB control at the World Bank, however this may be an area of further study that would overall provide a richer understanding of the World Bank’s influence within TB control.
3) The discussion would benefit from a fuller description of the limitations of this analysis. For example, the search strategy focuses on projects naming TB as a theme. To what extent could it miss out on other WB core funding that may nonetheless have important implications for TB (for example, on projects aimed at health systems strengthening)? Other limitations might address the scope of the analysis, for example.

- Please see ‘Limitations’ section in Discussion.

Other comments:

p.4, “Tuberculosis was among the primary causes of death…” This is background rather than results, and would be better placed in the introduction. Also in this paragraph, reference to the ‘adoption of antibiotics’ could be dropped - for today’s HICs, the bulk of 20th-century reductions in TB burden occurred prior to the discovery of streptomycin in the 1940s.

- Removed as per comment.

p.5 onwards: Results refer repeatedly to ‘TB-focused’ projects, which I assume are WB projects identifying TB as a theme (regardless of the proportion of funds for TB?). Please define this term in the Methods.

- Added to Methods: “We refer to World Bank projects with funding allocated towards the ‘tuberculosis’ theme as ‘TB-focused’ within the text.”

p.7, “While the global incidence of TB has been declining, the infection still inflicts…” Replace ‘infection’ by ‘disease’ to avoid confusion with latent TB infection, which by itself has no known cost in DALYs. Similarly for p.3, “The cost of infection…”

- Edited as per comment.

Figure 2 can be a little hard to interpret, for the reasons described above: presumably the volatility arises because the figure plots commitments by year of approval, rather than actual disbursements over time. If the latter data is available, it would be helpful to see these plotted too, perhaps as a supporting information figure.

- No data regarding the actual disbursement towards TB per year is given in the project documents therefore in the legend for Figure 2 we have acknowledged the volatility: “Volatility arises within the data due to total projects commitments being allocated to the year of the project approval date.”

Also relating to figure 2, it would be helpful to describe what the dashed line represents (e.g. line-of-best-fit?), in the figure caption. Alternatively, authors may consider dropping this line, in place of horizontal dashed lines, showing the average proportion in each period.

- Figure 2, Line of best fit has been removed and replaced with data found in Table 1 (last column) regarding “Proportion of Project Funding Committed to TB (%)

Supporting information: Suggests there’s no need for figure A2, as figure A1 already depicts the relative amounts in the stacked bars.

- Removed as per comment.

There are a few typos in the main text, including p.2, “Selected articulated…” and p.12, “…reduce countries’ the ability…”

- Edited as per comment.

In showing the value of total commitments over time, were these adjusted for dollar value in a given year? Either way, it would be helpful to clarify.

- Comment added in Methods: “All figures used in analysis are the gross dollar amount quoted in the project ICR or ISR. The dollar values were not adjusted for inflation.”

**Competing Interests:** None