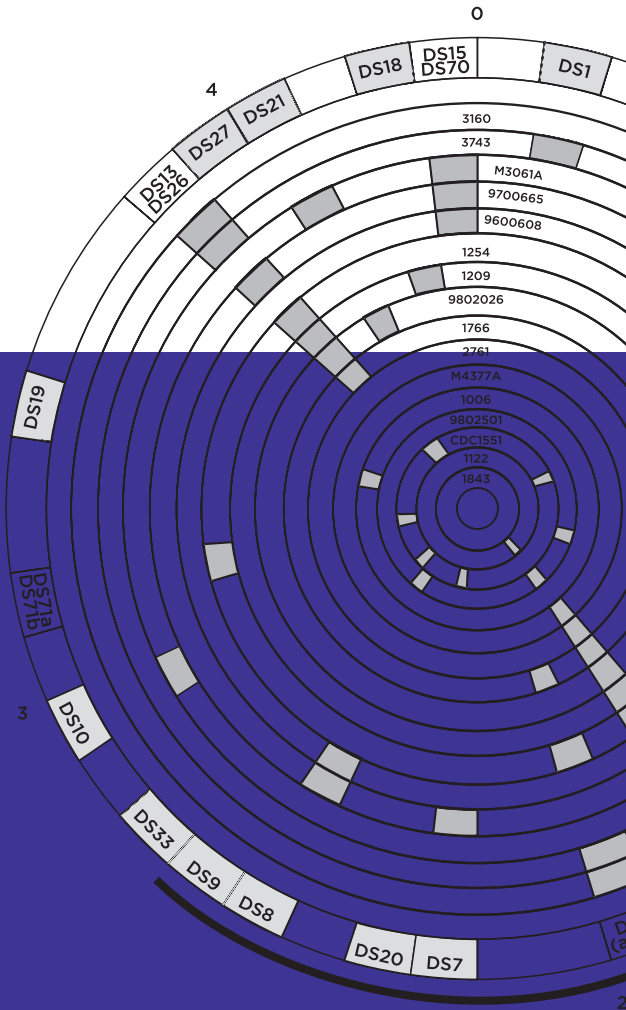
TAG
Treatment Action Group

Stop TB Partnership

TUBERCULOSIS RESEARCH
& DEVELOPMENT:

2010 Report on Tuberculosis Research Funding Trends, 2005–2009

2nd EDITION



MARCH 2011

TREATMENT ACTION GROUP

BY ELEONORA JIMÉNEZ SALAZAR

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BY ELEONORA JIMÉNEZ SALAZAR

EDITED BY MARK HARRINGTON, SCOTT MORGAN, AND JAVID SYED

DESIGN BY PASCALE WILLI

THIS REPORT IS DEDICATED TO

Susan Bacheller

(d. 18 October 2010)

Susan was TB Team Leader at USAID, a passionate fighter against TB, and a strong friend of the community.

> *"Susan was most supportive of [civil society] at the [Johannesburg Stop TB Coordinating Board meeting in October 2010]. She pushed to have us included on the selection panel [for the new executive secretary of the Stop TB Partnership] and assured us of support with [USAID] finances involved for this process. She really came out so strongly in support of communities at the last session of the board meeting.*
>
> *She will be missed and remembered as a great friend of the communities."*
>
> *—Blessi Kumar, Vice Chair of the Stop TB Partnership Coordinating Board, 22 October 2010*

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Executive Summary

The *2010 Report on Tuberculosis Research Funding Trends 2nd Edition* analyzes and tracks investments in tuberculosis (TB) research and development (R&D) from 2005 through 2009. This report updates the 1st edition released in November 2010 with new information from the German Federal Ministry of Education and Research (BMBF) and data from public private partnerships (PDPs) and research consortia for 2009.

In the first edition of this report, TAG reported $614 million was invested in TB R&D for 2009. After receiving revised funding data from our partners at G-FINDER, the BMBF funding increased from $260,000 to $5.3 million, moving the funder up in rank from #52 to #17. This new funding data, which went toward basic science ($2.9 million), TB vaccines ($1.4 million), TB drugs ($978,914), and operational research ($49,298), boosted TB R&D spending for 2009 from $614 million to $619 million.

For the past two years, TAG has partnered with the Stop TB Partnership (STBP) and Policy Cures' G-FINDER Project (formerly based at the George Institute), to document and measure global TB R&D investments against targets set by the STBP's *Global Plan to Stop TB: 2006-2015*. As a result of this collaborative effort, this report documents TB R&D investments from 94 funders—35 new funders plus 59 previously reporting organizations from 2008.

For 2009, donors reported investing $619 million in TB R&D, a $127.6 million increase over 2008 and a $261.7 million increase over 2005, the year TAG first began this resource tracking exercise.

Of the $619 million, $382.6 million (62%) came from the public sector, $125.1 million (20%) from the philanthropic sector, $111.4 million (18%) from the private sector, and $31.9 million from multilateral institutions. Despite continuing economic challenges in 2009, public sector funding increased by 44%, with several major funders including the NIH, the European Commission, the UK MRC, DfID, and USAID reporting double digit percentage increases over 2008 levels.

The private sector also witnessed an increase in spending (54%), reflecting the advancement of several new TB drug compounds through the clinical pipeline.

Among the six research categories examined in this report, TB drug development remains the research area receiving the greatest proportion of TB R&D investment (30% of the global total) at $189.3 million—a nine percent increase over 2008 spending. However,

the biggest funding increases were observed across basic science, applied/unspecified infrastructure, and operational research. Basic science funding grew 75% from $98.7 million to $172.9 million, capturing 28% of the global total compared to 20% in 2008. Applied/unspecified infrastructure funding increased 131% from $25 million to $57.9 million, and operational research grew 38% from $34.4 million to $47.4 million.

Vaccine funding remained virtually flat at $110.2 million and diagnostics funding fell back to 2007 levels by dropping 17% to $41.4 million, after growing steadily from 2005 to 2008.

Seven PDPs and research consortia spent $119.9 million on TB R&D in 2009, a 3% increase from 2008 spending levels and a 146% increase from 2005.

In October 2010, the STBP issued an update to the Global Plan 2006-2015 to allow for a mid-point course correction of funding targets and strategies to achieve the goals set out in the plan for the next five years. The updated Global Plan to Stop TB: 2011-2015 includes plans to scale up implementation of TB care and treatment programs, and accelerate research on new tools necessary to eliminate TB as a public health threat by 2050. The latest plan adjusts funding targets for diagnostics, drugs, and vaccines, and sets new targets for fundamental science and operational research, two research areas TAG advocated to be included since the plan was first launched in 2006. With the new and modified funding targets, the Global Plan's funding recommendation increased from $890 million to $2 billion annually, providing a more accurate picture of the funding needed to develop new and effective tools to prevent, diagnose, and treat TB.

While TB R&D spending grew 26% since 2008, the $619 million investment in 2009 represents only one-third of the $2 billion needed annually. To narrow the $1.4 billion funding gap, greater R&D investments from high-burden TB countries, particularly middle-income countries such as Brazil, China, India, the Russian Federation, and South Africa, will be crucial to eliminate TB as a public health threat by 2050.

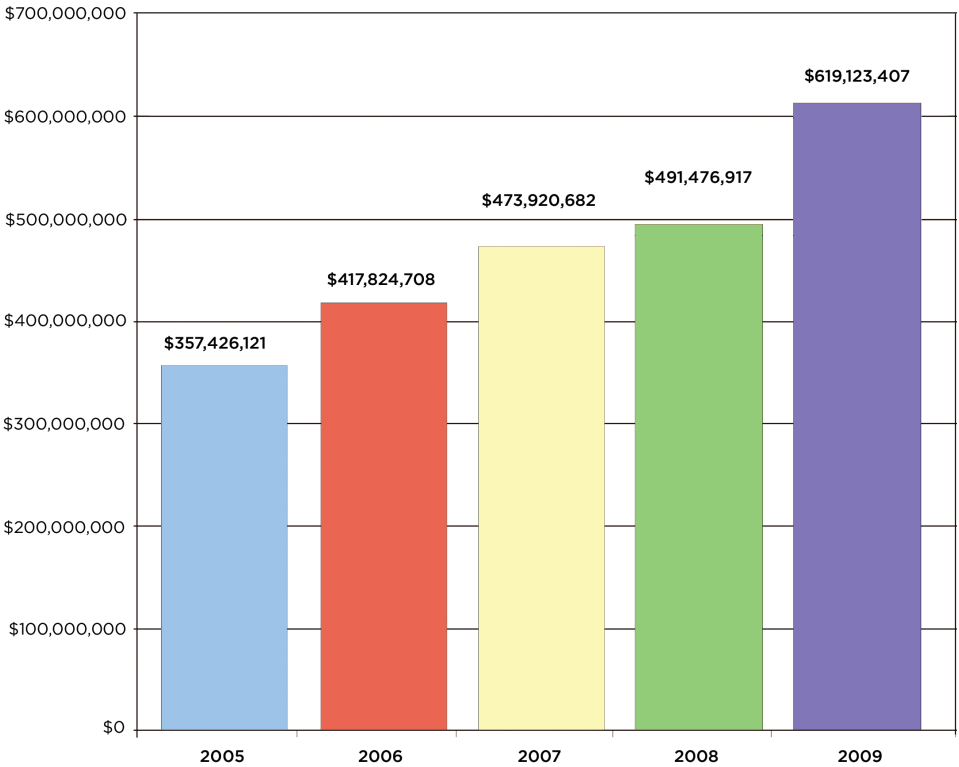
TABLE 1

2009 TB R&D Funders by Rank

2009 Rank	Institute	Total
1	US NIAID, NIH	$169,035,371
2	Bill & Melinda Gates Foundation (BMGF)	$114,389,144
3	Otsuka Pharmaceutical Co. Ltd (Otsuka)	$52,827,447
4	US Other Institutes & Centers, NIH	$36,870,364
5	European Commission: Research Directorate-General (EC)	$30,966,022
6	UK Medical Research Council (UK MRC)	$20,157,623
7	Company X	$20,071,322
8	US Centers for Disease Control (US CDC)	$18,452,382
9	UK Department for International Development (UK DfID)	$17,848,698
10	United States Agency for International Development (USAID)	$15,434,945
11	US NHLBI, NIH	$9,944,552
12	Statens Serum Institute (SSI)	$9,887,740
13	AstraZeneca	$8,911,694
14	The Wellcome Trust	$8,437,651
15	Dutch Ministry of Foreign Affairs—Directorate General of Development Cooperation (DGIS)	$8,276,185
16	Inserm—Institute of Infectious Diseases (Inserm)	$6,318,576
17	German Federal Ministry of Education and Research (BMBF)	$5,356,564
18	India (aggregate)	$4,767,764
19	Company Y	$4,022,000
20	UK Health Protection Agency: Centre for Emergency Preparedness and Response (UK HPA)	$3,763,682
21	Canadian Institutes of Health Research (CIHR)	$3,541,773
22	Pfizer	$3,490,868
23	Sequella	$3,000,700
24	Novartis	$2,962,447
25	German Research Foundation (DFG)	$2,930,102
26	Max Planck Society—Max Planck Institute for Infection Biology (MPIIB)	$2,900,000
27	Emergent Biosolutions	$2,851,000
28	Norway (aggregate)	$2,653,040
29	Agence Nationale de Recherche sur le SIDA (ANRS)	$2,448,609
30	Institut Pasteur	$2,252,023
31	China CDC National Tuberculosis Reference Laboratory (China CDC)	$2,152,653
32	Switzerland (aggregate)	$2,077,884
33	Eli Lilly and Company	$1,968,179
34	Sweden (aggregate)	$1,949,738
35	Australian National Health and Medical Research Council (Australia NHMRC)	$1,565,895
36	Brazil (aggregate)	$1,441,528
37	Irish Aid	$1,408,510
38	Consejo Nacional de Ciencia y Tecnologia (CONACYT)	$1,263,064
39	South African Department of Science and Technology (SA DST)	$1,156,320
40	PEPSICO	$1,153,583
41	Japan (aggregate)	$1,153,117
42	Colombian Department for Science, Technology and Innovation (Colciencias)	$785,247
43	Pan American Health Organisation (PAHO)	$657,760
45	Public Health Agency of Canada (PHAC)	$634,782
48	Damien Foundation	$430,028
50	South Africa Medical Research Council (SA MRC)	$372,611
52	Health Research Council of New Zealand (New Zealand HRC)	$332,923
53	Carlos III Health Institute	$328,183
56	UK Department of Health (UK DoH)	$166,298
58	Thrasher Research Fund	$143,451
59	The Colt Foundation	$117,012
64	Korea (aggregate)	$63,258
65	British Council	$49,697
66	UBS Optimus Foundation	$48,332
68	The Research Institute of Tuberculosis, Japan Anti-Tuberculosis Association (RIT/JATA)	$33,427
69	Global Fund to Fight AIDS, TB and Malaria (GFATM)	$31,935
72	Rockefeller Foundation	$24,000
	New Funders Under $500K	$2,843,706
	Grand Total	$619,123,407

FIGURE 1

Total TB R&D Funding: 2005–2009



1. Introduction

> ***"Universal access to existing TB diagnosis and treatment, and massively accelerated research to develop new and better tools are both urgently needed."***
>
> —Towards a Revolution in Tuberculosis Prevention, Care, and Treatment: Statement of Individuals from Communities Affected by Tuberculosis, 36th IUATLD World Congress on Lung Health, 19 October 2005, Paris

The world has not yet experienced the "revolution in tuberculosis prevention, care, and treatment" that a group of activists called for in October 2005 at the opening of the 36th Union World Conference on Lung Health in Paris, France (see Appendix 3). At that time the Stop TB Partnership (STBP) had just established its Community Task Force, and members of communities affected by tuberculosis (TB) had been elected to the partnership's working groups and Coordinating Board. It was the run-up to the launch of the *Global Plan to Stop TB: 2006–2015*, and there were strong debates about how ambitious the plan should be in its targets for scaled-up implementation of effective TB prevention, care, and treatment programs, as well as accelerated research on the new tools necessary for the elimination of TB as a public health threat by 2050.

Yet over the past five years the ground has been prepared for a renaissance in TB research and development (R&D). We do not yet have the tools to eliminate TB, but major developments are underway that promise to radically shorten the time to diagnose TB, have the potential to shorten TB treatment, and may lead to the discovery of an effective vaccine to prevent transmission of pulmonary TB.

In places where new molecular diagnostic tests can be made available, they hold the promise of diagnosing both smear-positive and smear-negative pulmonary TB within two hours rather than the three to twelve weeks it currently takes for the long-running TB "gold" standard of diagnosis, which is a culture test.

Back in 2005, no new class of drugs had been approved to treat TB since the 1970s. A group in Belgium provided a ray of hope by publishing in vitro data on a novel compound, TMC207, which acted on a new target and might be active against all forms of TB, both drug-sensitive and drug-resistant. By contrast, in 2010, at last four novel classes of drugs are in clinical trials to treat TB, and there is unprecedented interest in accelerating the development of novel TB combination regimens using innovative regulatory science. The U.S. Food and Drug Administration and the European Medicines Agency have each

provided new and evolving guidance, which may facilitate the approval of one or two new TB drugs in the coming 12 to 18 months. In 2010 the Critical Path to TB Drug Regimens (CPTR), founded by the Critical Path Institute, the Global Alliance for TB Drug Development (TB Alliance), and the Bill & Melinda Gates Foundation (BMGF), established a consortium involving academia, research institutions and funding agencies, pharmaceutical companies, and community activists, to collaborate on innovative research designs that may hasten the development of treatment-shortening regimens for both drug-sensitive and drug-resistant TB.

Coming up more slowly, but still with significant momentum, are a set of novel candidate TB vaccines, some of which may be ready for large-scale field trials in the coming five years.

Underpinning this surge of new activity has been a significant expansion of research investment in tuberculosis. At the launch of the Global Plan, the Treatment Action Group (TAG) began reporting the annual investment in TB R&D in mid-2006, using 2005 as a baseline year. Donors reported investing just $357 million in TB R&D in 2005. That figure rose to $417.8 million in 2006, $473.9 million in 2007, and $491.5 million in 2008 (see Figure 1).

TABLE 2

Summary of Changes in TB R&D Investment, 2005-2009 in USD

Year	Total TB R&D investment	Change over previous year ($)	Change over previous year ($)	Change over 2005 (%)	2005 (%)
2005	$357,426,121				
2006	$417,824,708	$60,398,587	16.9%	$60,398,587	16.9%
2007	$473,920,682	$56,095,974	13.4%	$116,494,561	32.6%
2008	$491,476,917	$17,556,235	3.7%	$134,050,796	37.5%
2009	$619,123,407	$127,646,490	26%	$261,697,286	73.2%

For 2009, donors reported investing $619 million in TB R&D, a dramatic increase of $127.6 million over 2008 and the greatest percentage increase (26%) since TAG began tracking TB R&D (see Table 2).

Despite the unfolding global economic crises, public sector investment in TB R&D rose by 44% ($117.6 million) over 2008. Among the top ten donors—who account for 80% of the global total—the NIH, the European Commission (EC), the UK Medical Research Council (UK MRC), the UK Department for International Development (DfID), and the United States Agency for International Development (USAID) all reported double-digit (or in the case of DfID, a triple-digit) percentage increases over 2008 levels.

The NIH alone reported a substantive increase of $74 million (52%), $27 million of which (19% of the total increase) was in awards made under the American Recovery and Reinvestment Act (ARRA) of 2009, the then incoming Obama administration's economic stimulus package.[2] There are some caveats with respect to the NIH data reporting methodology which are discussed further below.

Drug companies significantly increased their investment in clinical trials. Private sector investment rose by $39.4 million (54.7%), from $72 to $111.4 million. This reflects the advance of several new compounds into early stage clinical trials and of two novel drug classes into phase II trials.

Finally, due to the expanded donor reporting made available by G-FINDER, 35 new institutions reported TB R&D investments in 2009, contributing 2.3% of the total. Though these new institutions enable TAG and its partners to provide a more comprehensive tracking of TB R&D investments, 91% of total R&D funding continues to originate from the top 20 funders, which TAG has been tracking for the past five years.

The *Global Plan to Stop TB: 2006–2015* recommended that $8.9 billion be invested in TB R&D over the decade, or about $890 million per year. Over the past five years, sponsors invested almost $2.4 billion in TB R&D ($2,359,771,835), or more than half the $4.5 billion which Stop TB initially projected (though as noted previously the first reported year precedes the plan launch). Annual investment rose from $357.4 to $619 million or by 73% over those five years.

The new *Global Plan to Stop TB 2011–2015* issued in Johannesburg on 13 October 2010, reflects two changes sought by TAG since 2006. First, the plan explicitly includes target investments for fundamental science research (which includes basic science) and operational research. Despite their absence from the 2006 plan, TAG has tracked basic science and operational research since 2005. Second, the STBP modified the investment targets for TB diagnostics, drugs, and vaccines, by adjusting unit costs based on experience from the past five years. This new evidence-based and comprehensive TB research agenda sets the stage for further growth and maturation of the TB research renaissance.

TABLE 3

The Global Plan to Stop TB 2011–2015 at a glance and compared with *The Global Plan to Stop TB 2006–2015*

	GP: 2006-2015	Interim Increases	Revised GP: 2006–2015 totals	Cost per year (averaged over 10 years)	GP: 2011–2015	Cost per year (averaged over 5 years)
Implementation						
DOTS	$28,900,000,000		$28,900,000,000	$2,890,000,000	$22,600,000,000	$4,520,000,000
DR-TB	$5,800,000,000	$9,200,000,000	$15,000,000,000	$1,500,000,000	$7,100,000,000	$1,420,000,000
TB/HIV	$6,700,000,000		$6,700,000,000	$670,000,000	$2,800,000,000	$560,000,000
Lab strengthening**					$4,000,000,000	$800,000,000
ACSM*	$2,900,000,000		$2,900,000,000	$290,000,000		
Technical assistance**	$2,900,000,000		$2,900,000,000	$290,000,000	$400,000,000	$80,000,000
Implementation subtotal	$47,200,000,000	$9,200,000,000	$56,400,000,000	$5,640,000,000	$36,900,000,000	$7,380,000,000
Research & Development						
Fundamental research**					$2,100,000,000	$420,000,000
New diagnostics	$500,000,000	$1,000,000,000	$1,500,000,000	$150,000,000	$1,900,000,000	$380,000,000
New drugs	$4,800,000,000	$1,000,000,000	$5,800,000,000	$580,000,000	$3,700,000,000	$740,000,000
New vaccines	$3,600,000,000		$3,600,000,000	$360,000,000	$1,900,000,000	$380,000,000
Operational research**					$400,000,000	$80,000,000
R&D subtotal	$8,900,000,000	$2,000,000,000	$10,900,000,000	$1,090,000,000	$10,000,000,000	$2,000,000,000
Total: Implementation+R&D	**$56,100,000,000**	**$11,200,000,000**	**$67,300,000,000**	**$6,730,000,000**	**$46,900,000,000**	**$9,380,000,000**

* Not included in GP: 2011-2015
** Not included in GP: 2006-2015
Stop TB Partnership (2006, 2010)

Table 3 outlines original funding targets, interim increases done in 2007 after the development of a more comprehensive plan for multi-drug resistant/extensively drug-resistant TB in 2007, and updated funding targets for 2011-2015. Annual recommended investment in TB R&D increased from $890 million in the original *Global Plan* to $2 billion in the revised one. This includes the addition of $420 million annually in fundamental scientific research and $80 million in operational research, neither of which were included in the 2006 plan. In addition, the recommended annual investment in new TB diagnostics rose 153%, from $150 million to $380 million, reflecting the long path that lies ahead in the quest for a cheap, accurate, easy-to-use point-of-care (POC) diagnostic test. Recommended annual investment in new TB drugs rose from $580 million to $740 million reflecting evidence-based costing of clinical trials and accounting for inevitable product failures along the way. Recommended annual investment in new TB vaccines rose the least by $20 million from $360 million to $380 million, but this research area

is not as advanced as drugs or diagnostics and there is, as of yet, insufficient certainty to determine the rate and size of potential phase II–III trials that may become necessary over the next decade.

Five years after the call for a TB revolution, the TB community has a global plan and research funding targets that can yield promising new tools to prevent, diagnose, and treat TB. The challenge we face moving forward is galvanizing public, private, and philanthropic donors to invest $2 billion annually in TB R&D. To spark a sense of urgency and rely on continued financial support, we as activists, researchers, and policy makers must demonstrate to donors, the social and economic consequences caused by TB; translate the latest research findings in basic science, TB drugs, vaccines, and diagnostics; develop new ways to test, approve, and regulate multiple TB compounds; expand capacity of clinical trials; and evaluate and strengthen the delivery and uptake of these new TB tools at the country level. With adequate and sustainable funding, we can build on the current momentum to overcome the decades-long research and funding challenges to achieve a TB-free world by 2050.

1.1 Rationale

Tuberculosis claimed the lives of 1.82 million people in 2008. Globally, nearly 2 billion people are latently infected with *Mycobacterium tuberculosis* (MTB), and 9.4 million people develop active TB each year. Despite the disease burden and loss of life caused by TB, no new class of drugs have been approved for the treatment of the disease since the 1970s, while the only licensed vaccine for TB, Bacille Calmette Guérin (BCG), does not offer reliable protection from pulmonary TB for adolescents and adults and is no longer recommended for HIV-positive infants. Meanwhile, the most commonly used test for TB—sputum-smear microscopy—detects, at best, only half the cases of pulmonary disease and much less than that for children and people with HIV, where TB may not manifest in the lungs. Resources to develop new tools that protect against, detect, and treat people for TB are urgently needed. To determine research funding needs and measure progress over time, TAG is undertaking this resource-tracking effort to provide an evidence base that can be used by all stakeholders in TB research to advocate for increased resources for TB R&D.

1.2 Background

In 2006, the STBP launched the *Global Plan to Stop TB: 2006–2015*, a ten-year strategy outlining global targets for implementation of TB programs and for scaling up research on new tools. In that same year, TAG began a resource-tracking exercise to establish a baseline for TB R&D funding and document annual trends and progress against the

Global Plan targets. Among the most important recommendations from this report was the need to revise the *Global Plan* research targets to $2 billion annually in order to scale up research essential to eliminate TB as a public health threat by 2050.

On 13 October 2010 the STBP published the *Global Plan to Stop TB 2011–2015*, a revised strategy that sets more ambitious targets for universal access to effective TB prevention, diagnosis, and treatment for people with all forms of the disease—pulmonary and extrapulmonary; adult and pediatric; drug-sensitive and drug-resistant; HIV-negative and HIV-positive. The plan broadens and deepens the evidence base for recommended investments in R&D and the revised funding goals, now aligned with recommendations made by TAG since 2006, also include specific targets for fundamental research and operational research—two research areas that play a critical role in advancing the TB R&D agenda.

With five years of comprehensive data, TAG's report has become the benchmark for measuring global progress toward mobilizing the investment levels called for in the *Global Plan*. Data from this report is frequently cited among TB researchers and policy makers, presented at international conferences, and drawn on most recently in the new *Global Plan to Stop TB 2011–2015*.

1.3 Methodology

For the past two years, TAG has collaborated with the STBP and Policy Cures' G-FINDER Project (formerly based at the George Institute), to collect comprehensive data on global TB R&D investments. To streamline data collection and assure synergy of effort, Policy Cures led the data-collection process and surveyed funders on 2009 investments for TB R&D across all reported research areas, including operational research.

As a result of this collaborative effort, this report includes data provided by the G-FINDER Project on 90% (84) of the reporting funders. Funders who did not respond to the G-FINDER survey were contacted by TAG directly. Furthermore, wherever funding changed by more than 15% year over year, TAG approached the funding institution requesting more details to better understand the magnitude of the funding change. All data and information collated by TAG through this process were shared with G-FINDER unless the funder requested confidentiality.

However, data collection for one of the leading TB funders—the NIH—followed a different data collection methodology (see section 1.4, "Limitations of the Data," below).

All funders who participated in the survey were asked to report on disbursements

supporting TB R&D for calendar year 2009, and based on the research projects and abstracts, TAG categorized the awards by the following research areas: basic science; applied/unspecified infrastructure; diagnostics; drugs; vaccines; and operational research. Each area is defined to capture funding grants dedicated to MTB and TB disease. Research on *M. avium* or *M. leprae* was not within the scope of this resource tracking, but *M. africanum* and *M. bovis* were included since they are part of the MTB lineage. The following is a brief description of the research areas:

- **Basic science**: undirected, investigator-initiated research to uncover fundamental knowledge about MTB, and closely related organisms (e.g., *M. Africanum*, *M. bovis*, but not other mycobacterial species).

- **Applied, preclinical, infrastructure, or otherwise unspecified**: research specific to TB that a donor or funder was unable to further categorize.

- **Diagnostics**: preclinical or clinical trials of diagnostic technologies and algorithms.

- **Drugs**: preclinical or clinical research on treatments and treatment strategies for TB disease (including prophylaxis, and latent and active TB).

- **Vaccines**: preclinical or clinical research on TB vaccines.

- **Operational research**: randomized controlled or prospective observational studies of existing interventions within routine program settings or targeted evaluation of new or existing interventions. Surveillance and epidemiological studies are also captured in this category.

TAG converted all non-U.S. currency data to U.S. dollars using the 1 July 2009 currency exchange rate at http://www.oanda.com/currency/converter/. TB R&D funding data were analyzed and reported by research area, country level, donor sector, and individual organization.

For 2009, TAG reports on the TB R&D investments of 94 institutions, including 35 new funders. Unfortunately, 13 previously reporting institutions were not tracked for this year because they were either inactive or unresponsive.

For the purposes of this report, public sector spending, including development agency spending, was aggregated by country. Participating countries include Brazil, India, Japan, Korea, Norway, Sweden, and Switzerland. Similarly, new funders who contributed USD $500,000 or less were aggregated and labeled “Funders under $500,000” for the print version of this report. For a full listing of TB funders, please see the online version of this report at www.treatmentactiongroup.org/TBRD2010.aspx.

To avoid double counting, disbursements made by product development partnership (PDPs) and research consortia such as the Aeras Global TB Vaccine Foundation and the Consortium to Respond Effectively to the AIDS/TB Epidemic (CREATE) were not included in the total figures because they are not original source funders but instead recipients of public, philanthropic, and private funds.

1.4 Limitations of the Data

During data analysis of NIH funding for TB, TAG became aware that some grants that were coded as TB in 2009 were not coded as TB in 2008 despite them clearly being TB grants. Similarly, multidisease grants (e.g., for TB and HIV) are fully attributed to TB and HIV instead of being divided proportionately between the appropriate diseases. This can also inflate the investment figures for a specific disease area. Thus, the jump in NIH funding for 2009 is partly an artifact of the still-maturing computerized database—the NIH Research Condition and Disease Categories (RCDC). For now, the RCDC database has the only publicly reported data that are available, forming the basis of NIH investment figures included in this report.

Prior to 2008, budget offices of the various NIH Institutes and Centers (ICs) provided TAG with categorized funding data directly. However, due to a change in the NIH reauthorization legislation (passed by Congress in 2006 but not fully coming into effect until 2008), the NIH implemented new restrictions on reporting of disease-specific funding levels.[4] While the bill did not specifically prohibit NIH staff from responding to public requests for grant-specific data, the NIH decided to rebuff such requests and instead develop the RCDC database—which tracks NIH investments in 218 specified disease and health conditions, including TB. The new system created significant anomalies compared against previously reported data (e.g., for 2007 the NIH ICs reported $166 million in TB R&D awards while the "sophisticated text data mining" capacity of the RCDC computer platform detected $188 million, an additional $22 million).

G-FINDER also highlighted some variations in the NIH reporting system. For example, the RCDC database may count an award in several categories (e.g., TB, TB vaccines, vaccines, biodefense); and when an award is given for research that covers several diseases (e.g., a genetic sequencing machine for microorganisms that is used to sequence HIV, malaria, and TB), the database may count the entire grant within each disease total rather than pro-rating for the respective diseases. This is not a serious problem for the TAG TB R&D report as we are not accounting for overall NIH spending on multiple diseases.

1.5 Corrections

Since the first edition of this report in November 2010, TAG received updated information on PDP disbursements. In 2009, TAG incorrectly reported how much funding Aeras, Foundation for Innovative New Diagnostics (FIND), and TBVAC spent on TB R&D by reporting the amount of funding received rather than the amount spent by the PDPs both on their internal and external research efforts. Figure 11 on page 31 reflects corrected disbursement data for these PDPs dating back to 2005. This report also tracks new data from the Tuberculosis Vaccine Initiative (TBVI), launched in 2008, and tracks R&D investment reported for the last year of TBVAC, a five-year project sponsored by the European Framework Program 6, which ended in 2009.

Lastly, TAG received revised funding data from G-FINDER for the German Federal Ministry of Education and Research (BMBF). The new funding, amounting to $5.3 million, supported basic science, drug development, and vaccine research, and increased the global total from $614 million to $619 million. All charts, graphs and tables reflect these changes.

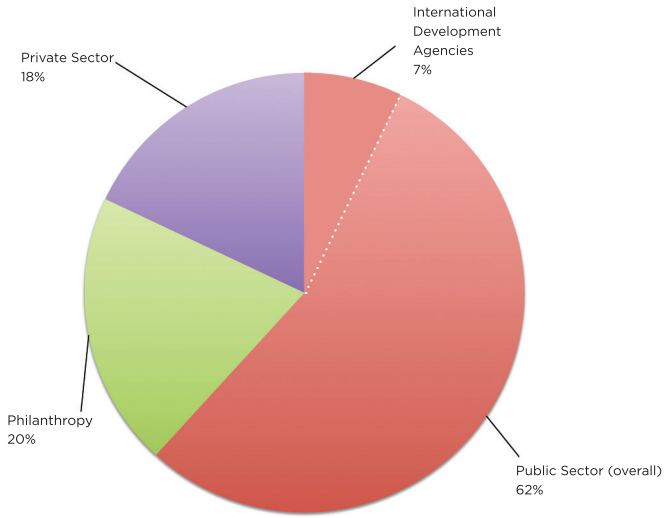
TAG welcomes additions, corrections and other suggestive changes to improve the accuracy of the reported data. Please contact Eleonora Jiménez at eleonora.jimenez@treatmentactiongroup.org if you have additional information to share.

2. Results

2.1 Donor Categories

FIGURE 2

TB R&D Funding by Donor Sector: 2009

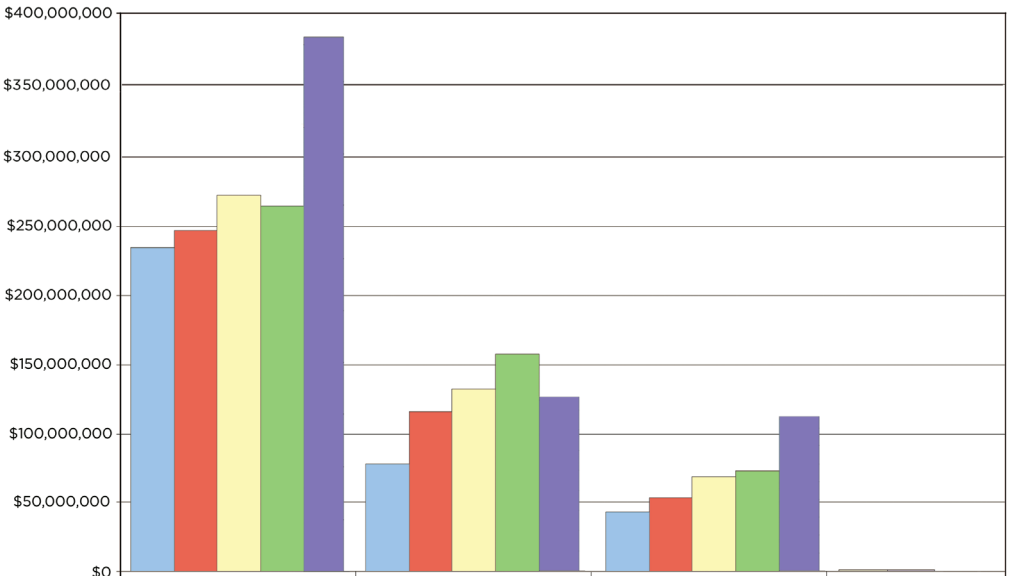


In 2009, TB R&D spending totaled $619 million—a 26% increase from 2008—marking the greatest funding increase in TB R&D since TAG began this resource tracking. Funding for TB R&D in 2009 was mainly financed by the top ten funders, with a total investment of $496 million, or 80% of all TB R&D funding. ARRA stimulus funds accounted for 4.4%. Seven of the newly reporting 35 investors provided $500,000 or more. In total, 35 new funders represented 2.3% of all TB R&D funding for 2009.

Across donor sectors, the 2009 funding increase can be largely attributed to public- and private-sector spending, which grew 44% and 55%, respectively since 2008 (see Figure 3). Public-sector support boosted funding for basic science, drugs, and vaccine research. Private-sector investments were primarily directed toward TB drug development. And for the first time since 2005, philanthropic investments fell by 19% from $154.5 million to $125.1 million.

FIGURE 3

Total TB R&D Funding by Donor Sector: 2005–2009

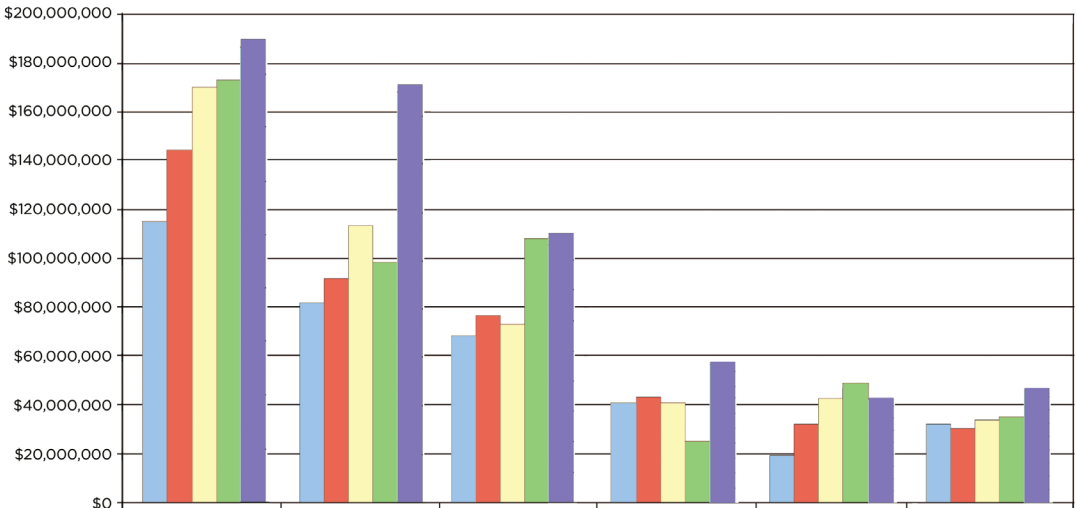


	Public	Philanthropy	Private	Multilateral
2005	$234,503,645	$78,178,708	$43,095,353	$1,648,083
2006	$246,862,858	$116,289,274	$53,138,347	$1,534,259
2007	$272,404,317	$132,326,981	$69,387,383	N/A
2008	$264,944,215	$154,513,987	$72,018,715	N/A
2009	$382,564,749	$125,120,349	$111,406,374	$31,935

Though the global economy remained weak in 2009, TB funding levels for drugs, basic science, operational research, and applied/unspecified infrastructure increased (see Figure 4). The NIH benefited from ARRA funding worth $26.8 million, with the NIH's National Institute of Allergy and Infectious Diseases (NIAID) receiving the largest share of stimulus funding. In 2010, ARRA funding continued to play a role in TB research at NIH, however, once it expires in 2011, TAG cautions NIH funding for TB research may drop.

FIGURE 4

Investment in TB R&D by Research Category: 2005–2009



	Drugs	Basic Science	Vaccines	Applied/Unspecified	Diagnostics	Operational Research
2005	$114,862,738	$81,892,167	$68,351,530	$40,741,527	$19,408,124	$32,170,084
2006	$144,336,532	$91,643,009	$76,555,111	$43,205,600	$31,890,329	$30,194,127
2007	$170,233,497	$113,325,202	$73,225,383	$40,734,199	$42,435,113	$33,967,288
2008	$174,178,052	$98,728,019	$109,337,224	$25,032,930	$49,788,950	$34,411,742
2009	$189,309,332	$172,935,132	$110,214,465	$57,869,821	$41,399,434	$47,395,222

2.2 Trends in TB Research by Category

FIGURE 5

TB R&D Investment by Research Category: 2009
$619,123,407

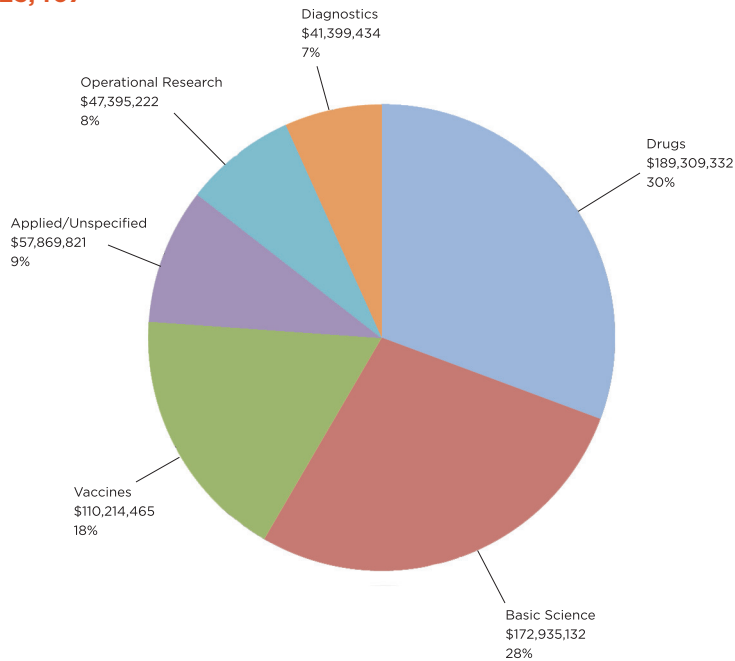


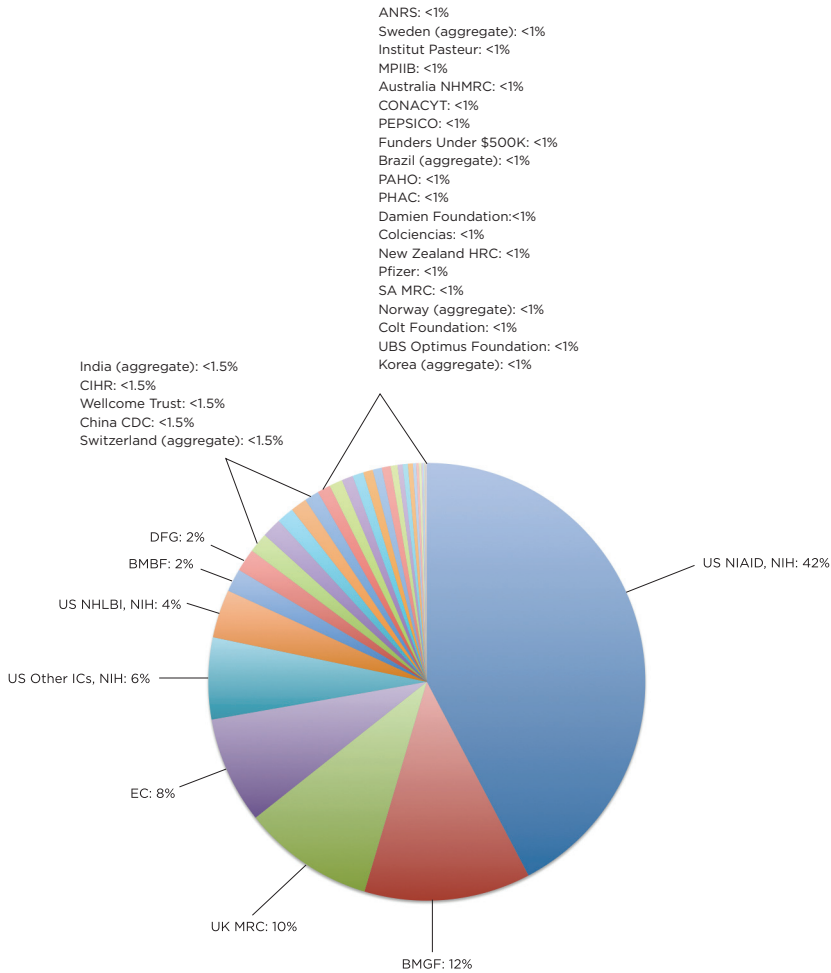
Figure 5 presents a funding overview of the six R&D areas for TB. As in years past, TB drugs accounted for the greatest proportion of TB R&D funding, at 30%. TB vaccines, which received the second largest proportion of funding in 2008, represented 18% of the total and was surpassed by basic science (28% of global total), because investments in vaccine development remained flat in 2009. Applied/unspecified infrastructure, and operational research corresponded to 9% and 8% of the global spending total, respectively. And lastly, the decline of TB diagnostics funding back to 2007 levels resulted in that research area receiving the smallest share of R&D funding at 7%.

A detailed analysis of the funding institutions that contributed to each of the research areas is described in the next section.

1. Basic Science

FIGURE 6

Basic Science: $172,935,132



A dedicated funding stream for basic science research is inextricably linked to the development of improved drugs, diagnostic tools, and vaccines for TB. Basic science research can uncover important information about pathogenesis, the development of latent TB infection to active TB disease, and host-pathogen interaction, which in turn helps researchers develop more innovative products to diagnose, prevent, and treat TB.

From 2008 to 2009, basic science research funding increased from 20% to 28% of total TB R&D investment. The actual amount of funding invested in TB basic science also increased by 75% from $98.7 million in 2008 to $172.9 million in 2009. The leading funder in this research area—NIAID—made up 42% of all basic science funding in 2009 (see Figure 6).

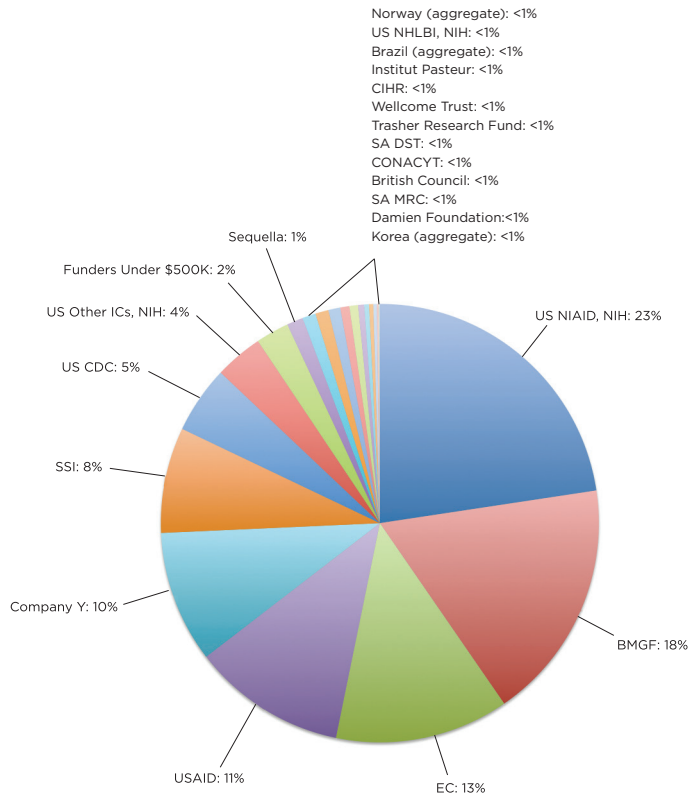
ARRA stimulus funding played a small but important role in increasing NIAID's contribution to basic science by providing an additional $10.8 million to the $62.2 million of the institute's spending—almost double last year's investment. The second largest funder was the Gates Foundation, which increased its investment by 617% in basic science from $2.9 million in 2008 to $21.3 million in 2009. The third largest funder, the UK MRC, increased its investment by 91%, spending $16.8 million in 2009 compared to $8.8 million in 2008. Together, NIAID, the Gates Foundation, and the UK MRC made up 64% of all TB basic science funding in 2009.

Under the new *Global Plan to Stop TB 2011–2015*, the STBP raised the profile of fundamental science research by including it as a new component in the *Global Plan* with its own funding target and objectives. According to the STBP, fundamental research is defined as basic, translational, clinical, and epidemiological science research necessary to produce more novel and effective TB drugs, diagnostics, and vaccines.[5] To advance fundamental science research, the *Global Plan* estimates an annual funding target of $420 million to meet the overall funding target of US$2.1 billion by 2015. As basic science research is primarily the domain of public research institutions, a majority of this funding will need to come from research institutions such as the NIH. However, as the *Global Plan* points out, emerging economies such as Brazil, the Russian Federation, India, and China have a significant role to play in increasing their contribution to basic science to address TB, which continues to present a significant public health challenge for their citizens.

2. TB Diagnostics

FIGURE 7

TB Diagnostics: $41,399,434



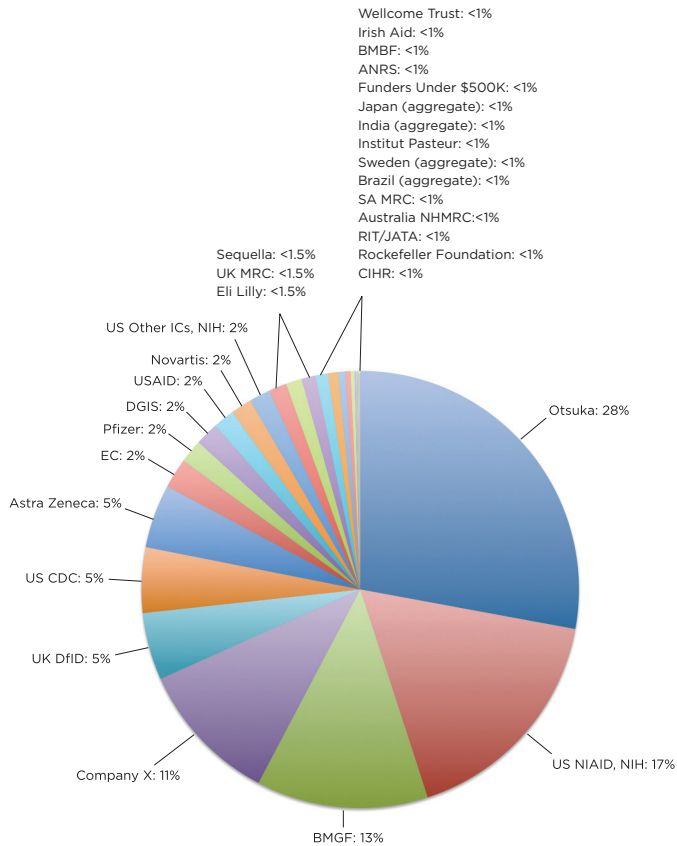
Despite the endorsement by the WHO (World Health Organization) of several new diagnostic technologies to better detect TB, there is still an urgent need to develop a point-of-care (POC) TB diagnostic test effective at the health post setting. The development of such a tool is largely dependent on advances in fundamental research to increase our understanding of the TB life cycle, activation from latent to active TB, and biomarkers that identify and characterize disease state and progression.[6]

After experiencing a steady rise in research funding, this year marks the first funding decline for TB diagnostics. In 2009, TB diagnostics funding experienced a 17% funding drop—the most significant funding decline of all the TB R&D areas. Funding for TB diagnostics in 2009 was a dismal $41.4 million (see Figure 7), and far below the *Global Plan 2011–2015* target of $380 million annually. In 2008, the Gates Foundation was the leading diagnostics funder, spending $24.6 million. However, in 2009, Gates funding dropped by 70% to $7.4 million, and NIAID became the primary TB diagnostics funder spending $9.4 million.

3. TB Drugs

FIGURE 8

TB Drugs: $189,309,332



For the fifth year in a row, TB drug development remained the most well-funded R&D research area, with funding at $189.3 million or 30% of all TB R&D spending in 2009. With 11 TB drugs under clinical investigation, the TB pipeline is the most active it's ever been. If study results are positive, one or two drugs may get accelerated or conditional approval for people with drug-resistant TB by the end of 2011-2012.

Since phase III TB drug trials will likely require large cohorts of several thousand study subjects to be followed for at least 12 months after they complete treatment, it is clear that current funding levels are not sufficient to move the 11 drug candidates through all phases of drug development. This is further complicated by the fact that there is insufficient clinical trial capacity to conduct registration quality trials that follow good clinical practice (GCP) standards.

The *Global Plan 2011–2015* target for TB drugs is set at $3.7 billion, with an average annual investment target of $700 million. However, the plan warns that the cost of building the capacity of sites to make them ready to conduct GCP-standard TB drug trials is a conservative estimate. To reach the new funding target for TB drug development, the existing funding level of $188.3 million must increase by $600 million in 2011 and $800 million by 2015. Furthermore, to meet the treatment needs of children, people with HIV and people with various forms of drug resistant TB, the *Global Plan* estimates 21 additional new drug candidates will have to be available in preclinical testing by 2015 to keep the drug pipeline robust.

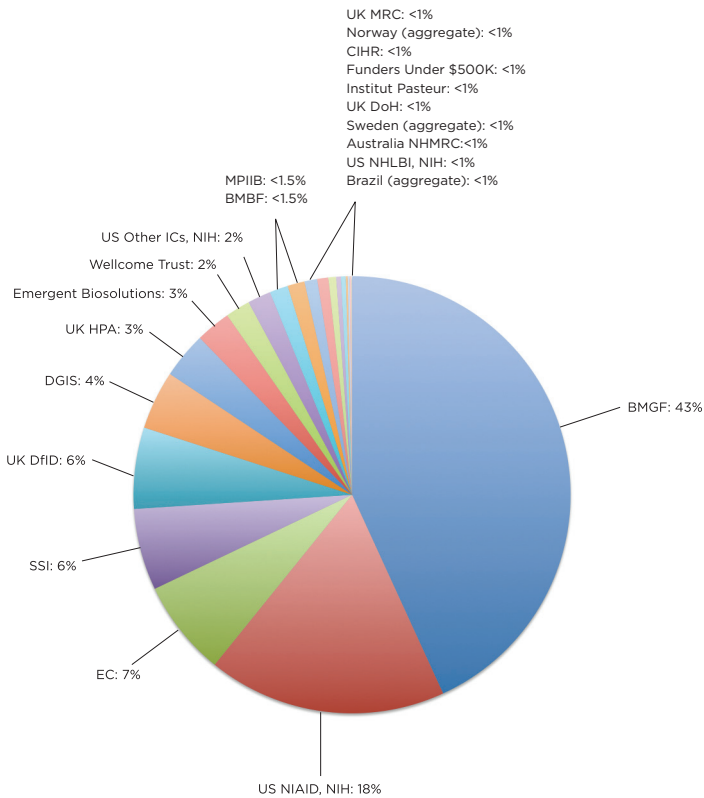
After being the third leading investor for TB drugs in 2008 with $32 million, Otsuka reported the largest TB drug development investment in 2009 with $52.8 million. With phase II trials of OPC-67683 underway, Otsuka is on the path to securing accelerated regulatory approval within two years, pending favorable study outcomes.[7] Otsuka's investment in TB drugs is currently the largest investment in this category, demonstrating the tremendous costs needed to conduct regulatory quality clinical trials for just one chemical entity. To ensure reliable clinical study outcomes, funding for OPC-67683 will likely include a substantial investment toward enhancing clinical trial capacity, which will benefit future TB drug development efforts.

The US NIAID's investment of $32.4 million (see Figure 8) for its broad and comprehensive portfolio of translational and clinical research in TB drug development placed just above the Gates Foundation which reduced its funding by 35% in 2009 after being the leading funder of TB drug development in 2008.

4. TB Vaccines

FIGURE 9

TB Vaccines: $110,214,465



Greater funding for TB vaccines is essential. The *Global Plan* cautions that without an effective vaccine, the goal to reduce TB incidence to one case per million by 2050 will not be met.[8] In other words, scale up of other interventions will not meet the goal of eliminating TB as a global health threat if greater investments are not made in both basic science and targeted vaccine research.

In 2009, TB vaccine spending remained virtually flat at $110.2 million after growing by 33% in 2008. The Gates Foundation remained the lead funder in this research area, though its contribution, compared to last year, declined by $19.3 million due to the foundation's uneven payment schedule for multi-year awards. For instance, in 2007, the Gates Foundation awarded the Aeras Global TB Vaccine Foundation a $200 million award for a five-year project, disbursing the first award of $63 million (94% of the foundation's vaccine spending) in 2008—the first full year of the grant. Now in its second year, Aeras received $43 million or 91% of the foundation's vaccine spending, to continue the development and licensing of an improved vaccine against TB for use in high-burden countries.

Vaccine funding levels from NIAID, the second largest funder, remained flat at $19.5 million (see Figure 9).

The funding targets for new vaccine development in the updated *Global Plan 2011-2015* estimate $1.9 billion will be needed by 2015 to expand clinical trial capacity and manufacturing while also maintaining a strong pipeline of new vaccine candidates. The updated funding target does not include costs of BCG program implementation that were formerly included in the vaccines R&D cost projections of the *Global Plan 2006–2015*. Though the annual funding target for vaccine R&D grew only by $20 million in the *Global Plan 2011–2015*, the removal of BCG program expenses makes the revised annual funding target of $380 million a more accurate reflection of TB vaccine-related research costs for 2011–2015.

Annual TB vaccine funding must reach $250 million in 2011 and nearly $440 million in 2015 in order to develop and introduce a vaccine effective against all forms of TB and across all age groups and among people with HIV.

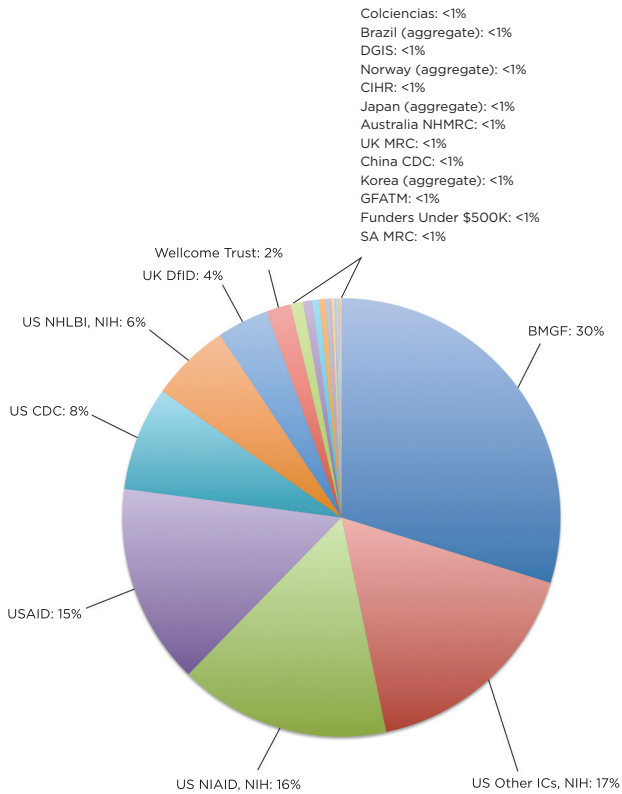
5. Operational Research

Operational research is critical for evaluating current and new TB control tools and strategies to guide their effective implementation in programmatic settings. With the growing recognition of the importance of operational research, the STBP included operational research as a new component of R&D in the revised *Global Plan*, setting a target of $400 million by 2015. This funding target will allow for better monitoring of existing interventions and development of locally driven solutions and ideas to improve access to and delivery of TB care.

In 2009, operational research funding for TB grew from $34.4 to $47.4 million—a 38% increase. Again this year, the Gates Foundation was the top funder, representing 30% of all operational research funding. The NIH and USAID also contributed to this growth by doubling their funding investments from 2008 levels (see Figure 10).

FIGURE 10

Operational Research: $47,395,222



2.3 Product Development Partnerships & Research Consortia

Product development partnerships (PDPs) are non-profit institutions that bring together public, philanthropic, and private sector partners and resources to accelerate research for neglected global diseases. PDPs, as well as research consortia and clinical trials networks, are not original source funders but rather receive and disburse funding to develop new tools to address neglected diseases such as TB.

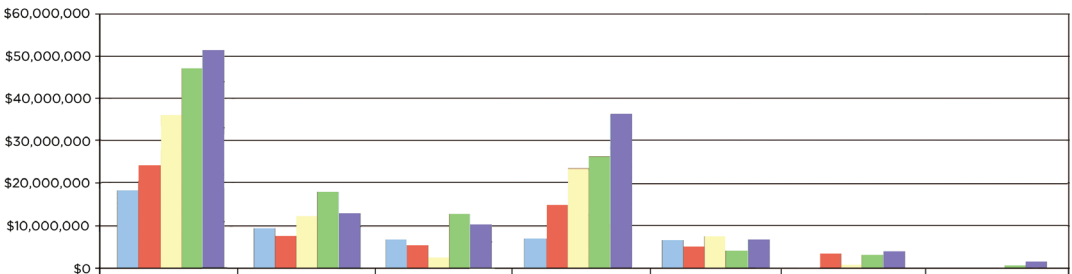
In 2009, PDPs spent $119.9 million in TB R&D, a 3% increase from 2008 spending and a 146% increase since 2005.

Since the first edition of this report in November 2010, TAG received updated information on TB R&D expenditures from Aeras, FIND, TB Alliance, TBVAC, and TBVI. In 2009, TAG incorrectly reported how much funding Aeras, FIND, and TBVAC spent on TB R&D by reporting the amount of funding received rather than the amount disbursed. Figure 11 reflects corrected disbursement data for these PDPs.

This report also tracks new disbursement data from TBVI, a non-profit foundation launched in 2008 that facilitates the development of new TB vaccines, and includes the final year of reporting for TBVAC, a five-year project sponsored by the European Framework Program 6 to establish an academic-industrial consortium responsible for moving TB vaccine candidates from preclinical to phase I clinical trials in Europe and Africa.

FIGURE 11

TB R&D PDPs and Research Consortia: 2005–2009



	Aeras	CREATE	FIND	TB Alliance	TBVAC	TDR	TBVI
2005	$18,580,139	$10,000,000	$6,778,239	$7,874,983	$5,445,450	N/A	N/A
2006	$25,923,809	$8,298,826	$5,492,942	$14,808,362	$4,451,895	$2,995,748	N/A
2007	$37,704,051	$12,375,000	$1,145,409	$22,885,734	$6,091,335	$453,382	N/A
2008	$48,679,266	$18,493,585	$14,177,202	$26,885,734	$3,944,425	$3,817,352	$339,741
2009	$50,792,515	$12,786,985	$9,975,320	$35,643,490	$5,634,040	$4,243,264	$841,333

2.4 Top Ten Funders of TB R&D in 2009

In 2009, the top ten funders invested $496 million in TB R&D. Two funders—the NIAID, a component of the U.S. NIH, and the Gates Foundation—invested over $100 million for each of the last four years. Eight funders invested over $10 million in 2009—two companies (Otsuka and "Company X") and six public sector institutions—other Institutes and Centers at the U.S. NIH, the European Commission (EC), the UK Medical Research Council (MRC), the UK Department for International Development (DfID), the U.S. Centers for Disease Control and Prevention (US CDC), and the US Agency for International Development (USAID). Ninety-four funders reported data in 2009. Some of these have been aggregated; for example TAG aggregated data for Brazil, India, Japan, Norway, Switzerland, and Sweden, all of which invested more than $1 million but less than $5 million in 2009.

1. The U.S. National Institute of Allergy and Infectious Diseases (NIAID) of the National Institutes of Health (NIH)

In 2009 the NIH NIAID—as in 2006, 2006, and 2007—provided the largest sum of TB biomedical research funding globaly. NIAID reported 330 grants, 102 of them new in 2009. In total, $148.9 million was disbursed in regular awards and $20 million in ARRA grants. Two-thirds of the ARRA grants were new, and one-third were supplements to existing awards.

NIAID funded 42% ($73 of $173 million) of the world's basic research on TB. In total, $27.3 million went to infrastructure or other applied/unspecified TB research. A gravely insufficient $9.4 million (23% of all diagnostics research) gave it first place in TB diagnostics R&D, but some of the NIAID basic and applied awards are likely to lead at least indirectly to new biomarkers and, potentially, diagnostics. In drug development, NIAID support followed that of Otsuka ($32.4 million vs. $52.8 million, 17% vs. 28%) with both organizations supporting complementary approaches. NIAID support for TB vaccines was lower than funding by the Gates Foundation and supported complementary R&D enabling activities ($19.5 vs. $47.6M, 18% vs. 43%). Finally, NIAID's support of operational research, in line with its core mission, was modest at $7.4M (15%), compared to the other NIH institutes and centers ($8M, 17%), and the Gates Foundation ($14M, 30%).

The prospects for continuing growth in NIAID's investment in TB R&D are good. The institute's director, Dr. Anthony S. Fauci, is keen to catalyze a transformative research agenda to bring TB research into the 21st century and set the stage for the elimination of the disease. As he told the Pacific Health Summit in June 2009, "[W]e have had decades of relative neglect given the extent of the problem. There is much catching up to do and this will require a sustained effort."

Dr. Fauci said NIAID is "exploring the possibility" of using the existing and extensive HIV clinical trials networks for other infectious diseases, including TB. "That could provide an extraordinary boost for the clinical trials for TB," he noted. Since then, NIAID has embarked on a process of expanding the mandate of its clinical trials networks.

There are limitations to the potential growth of NIAID's support for TB research, however. The entire NIH budget is likely to drop in fiscal year 2011 with the expiry of the extra $20 billion in ARRA stimulus funds that enriched the institutes in 2009–2011. The return of NIH budgets to pre-ARRA levels is likely to place serious stress on new and emerging areas of priority investment, including TB.

TABLE 4

2005-2009 NIH Funding for Select Infectious Diseases (in millions)

	2005	2006	2007	2008	2009*
HIV/AIDS	2,921	2,902	2,906	2,928	3,338
Smallpox	187	149	142	94	98
Anthrax	183	150	160	134	115
Tuberculosis	158	150	188	142	216
Malaria	104	98	112	142	121

* Includes ARRA stimulus funds
NIH RCDC, 1 February 2011, http://report.nih.gov/rcdc/categories/

2. The Bill and Melinda Gates Foundation

After being the largest funder of TB R&D in 2008, the Gates Foundation returned to being second largest in 2009 as it was in 2005-2007. Compared to the $148 million investment in 2008, the foundation's funding for TB R&D in 2009 decreased by 23%, to $114 million.

In 2009 as in 2008, the largest investment of the Gates Foundation was directed at TB vaccine development. Vaccines, diagnostics, drugs, and operational research all got reduced amounts of funding in 2009 when compared to 2008, due to uneven funding disbursements for multi-year awards. Vaccines research fell from $67 million to $48 million; diagnostics went down from $24.6 million to $7.3 million; drug research declined from $37 million to $24 million, and operational research went from $16.3 million to $14.1 million. Basic science is the only research area that experienced an increase in 2009 compared to 2008. This increase was substantial, from $3 million in 2008 to $21.3 million in 2009.

The Gates Foundation's largest investments in 2009 were targeted at PDPs. The three largest disbursements were $43 million to Aeras Global TB Vaccine Foundation, $19 million to the TB Alliance, and $7 million to FIND.

3. Otsuka Pharmaceutical

As the third ranked investor in TB R&D in 2009, Otsuka held its 2008 position. This Japanese company has been developing the drug OPC-67683 for treatment of MDR-TB and completed enrolling its phase II studies in Asia, Egypt, Europe, South America, and the United States.

Otsuka's investment increased by 66% over 2008, from $31.7 million to $52.8 million. All of its funding is targeted at drug development. To address the lack of sufficient clinical research trial site capacity to conduct registration quality trials, Otsuka had to invest a substantial amount to build capacity at the sites where it carried out its clinical trials. This is a substantial investment that other TB product developers and their funders, especially drug and vaccine developers, will also have to budget for as their products move through the development pipeline. However, Otsuka's investment in site and laboratory development is likely to leave a beneficial legacy in many places which had not previously carried out rigorous clinical trials meeting GCP standards.

4. Other NIH Institutes and Centers

For the past five years, TAG has examined two NIH institutes and centers (ICs)—NIAID and the National Heart, Lung, and Blood Institute individually (NHLBI, 10th largest funder in 2008 and 11th largest in 2009)—while all other NIH TB-related grants to a variety of ICs are aggregated. In 2009, the other NIH ICs invested $36.9 million in TB R&D, with relatively large amounts (over $8 million), invested in basic science, applied/unspecified infrastructure, and operational research, while smaller amounts were targeted toward product development for new diagnostics ($1.5 million), drugs ($2.9 million), and vaccines ($1.9 million).

5. The European Commission (EC)

The EC Research-Directorate General oversees a broad portfolio of research programs including several that collectively make the EC the 5th largest global investor in TB R&D in 2009, at $30.9 million. In 2009, basic science grew from $8.6 million to 13.6 million, and TB diagnostics doubled from $2.8 million to $5.3 million. Conversely, TB drugs, vaccines, and operational research fell by $3.2 million, $1 million, and $45,281, respectively.

It is unknown what effect the ongoing austerity fever prevalent in European circles will have on future trends in TB R&D investment in the European Union.

6. The United Kingdom Medical Research Council (UK MRC)

Despite the economic meltdown, in 2009 the UK MRC—historically the cynosure of TB drug development from the historic streptomycin trial in the late 1940s to the validation in the 1970s of the current standard directly observed therapy short-course (DOTS) first-line TB regimen now in worldwide use—was able to increase its investment in TB R&D by 34%, from $15 million in 2008 to $20.1 million. The UK MRC made important contributions, primarily to basic science research, by doubling its spending from $8.8 million to $16.8 million. TB vaccines also benefited from a 42% funding increase, though TB drugs, diagnostics, and operational research all dropped by 50% or more from 2008 funding levels. The UK coalition government recently decided to freeze the MRC budget for the next four years, which will lead to a 10% decline in real terms when adjusted for inflation.[10]

7. Company X

"Company X" ascended from the ninth largest funder in 2008 to the seventh in 2009 by increasing its investments 89%, from $10.6 to $20 million. "Company X" continues to focus on TB drug development.

8. The U.S. Centers for Disease Control and Prevention (CDC)

The CDC did not obtain noticeable benefit from the 2009 stimulus act. Instead, its TB R&D spending fell by 3%, from 2008's $19.1 million (6th ranking) to 2009's $18.5 million (8th ranking). TB drugs represented the greatest share of CDC funding across all the research areas, at $9.1 million. The most important and sizable sections of the CDC's TB R&D portfolio include the recently recompeted TB Trials Consortium (TBTC), which awarded new ten-year contracts in mid-2009, and the TB Epidemiology Studies Consortium (TBESC), which will be recompeted in 2011. The TBTC and TBESC make up 85% of CDC's TB R&D investments. For far too long, the CDC has had to do too much with too little and its vital expertise and experience is underutilized in the global fight against TB.

9. The United Kingdom's Department for International Development (DfID)

Rounding out the top ten funders of TB R&D in 2009 were the DfID, and USAID. Despite deep budget cuts, the UK has committed to protecting its meritorious investments in global development. In 2009, DfID increased its investment in TB R&D by a whopping 220% percent, making it the ninth largest funder. In 2008, it spent just $5.6 million on TB research, while in 2009 it spent $17.8 million. TB drug development received half the funds, at $9.4 million, and operational research got $1.8 million. In 2009, the DfID expanded from its traditional investment areas (e.g., TB drugs and operational research) and spent $6.6 million on TB vaccines.

10. United States Agency for International Development (USAID)

USAID's investment in TB research rose from $10.9 million in 2008 to $15.4 million in 2009, a 41% increase. Part of this increase is reflected in the new reporting by USAID of country-specific research programs in Bangladesh ($1.3 million), Brazil ($710,000), Cambodia ($600,000), Georgia ($17,500), India ($1.1 million), Indonesia ($450,000), Malawi ($157,599), Namibia ($280,000), the Philippines ($60,000), South Africa ($800,000), Tanzania ($118,000), and Uganda ($265,000). These country-specific investments in implementation and operational research are important in validating the use of new TB diagnostics and drugs in real-world settings. In line with USAID's mission, operational research received the greatest investment by USAID at $7 million, while $4.7 million went to diagnostics, $3 million to drugs, and $730,000 to applied/unspecified infrastructure.

3. Conclusions & Recommendations

3.1 Conclusions

In 2009, TB R&D funding increased by $127.6 million over 2008, the largest funding increase since TAG's resource tracking began. At $619 million, however, the investment is not sufficient to meet the *Global Plan 2011–2015* targets of an average of $1.8 billion per year, which is close to the $2 billion annual investment that TAG estimates is needed to eliminate TB as a public health threat.

To realistically achieve the annual $2 billion funding target, greater R&D investments from high-burden TB countries, and especially middle-income countries such as Brazil, China, India, the Russian Federation, and South Africa—where TB exacts a high toll despite anemic research investments and high disease burden—will be crucial.

Greater coordination as well as more funding is needed to address the critical bottlenecks that are impeding the development and testing of new tools. Collaboration is urgently needed to identify and validate surrogate biomarkers to accurately diagnose various forms of TB. With several promising TB drug candidates in the pipeline, increased research trial capacity, candidate biomarkers, and innovative regulatory science will be essential to ensure that new drug candidates are studied together to develop the needed TB drug regimen changes. Efforts such as the CPTR are critical to reduce the time it takes to get TB drug candidates and other tools from discovery phase to regulatory approval.

3.2 Recommendations

> *We should look to transform the field of TB research. . . . It's not just taking an incremental approach to developing another drug and another diagnostic tool. TB is an ancient disease, but we need to understand it in modern terms, and we need to use modern technology to ask questions that were never addressed in the first place. We need to understand TB as a disease of the whole organism, namely, the patient.*
>
> *—Dr. Anthony S. Fauci*[11]

Innovation and financing is critical to reaching the goal of TB elimination. Without new tools, the vision of TB care, control, and ultimate eradication will not be met. Though the world has not yet experienced a "revolution in tuberculosis prevention, care, and treatment," the TB community now has a global plan and research-funding targets that can yield promising new tools to prevent, diagnose, and treat TB. The challenge we face moving the revolution forward is galvanizing public, private, and philanthropic donors to invest $2 billion annually in TB R&D. To spark a sense of urgency and rely on continued financial support, we as activists, researchers, and policy makers must demonstrate to donors the social and economic consequences caused by TB; translate the latest research findings in basic science, TB drugs, vaccines, and diagnostics; develop new ways to test, approve, and regulate multiple TB compounds; expand capacity of clinical trials; and evaluate and strengthen the delivery and uptake of these new TB tools at the country level. With adequate and sustainable funding, we can revolutionize the TB research field and build on the current momentum to overcome the decades-long research and funding challenges to achieve a TB-free world by 2050.

Appendix 1: 2009 and 2008 Top Reporting TB R&D Funders

TABLE 5 2009 and 2008 Top Reporting TB R&D Funders Above $500,000
And Funders that TAG Has Tracked in Previous Years

2009 Rank	2008 Rank	Institute	Type of Funder
1	2	US NIAID, NIH	F
2	1	Bill & Melinda Gates Foundation (BMGF)	P
3	3	Otsuka Pharmaceutical Co. Ltd (Otsuka)	C
4	5	US Other Institutes & Centers, NIH	P
5	4	European Commission: Research Directorate-General (EC)	P
6	7	UK Medical Research Council (UK MRC)	P
7	9	Company X	C
8	6	US Centers for Disease Control (US CDC)	P
9	14	UK Department for International Development (UK DfID)	P-D
10	8	United States Agency for International Development (USAID)	P-D
11	10	US NHLBI, NIH	P
12	22	Statens Serum Institute (SSI)	C
13	11	AstraZeneca	C
14	15	The Wellcome Trust	F
15	17	Dutch Ministry of Foreign Affairs—Directorate General of Development Cooperation (DGIS)	P-D
16	38	Inserm—Institute of Infectious Diseases (Inserm)	P
17	43	German Federal Ministry of Education and Research (BMBF)	P
18	19	India (aggregate)	P
19	24	Company Y	C
20	21	UK Health Protection Agency: Centre for Emergency Preparedness and Response (UK HPA)	P
21	20	Canadian Institutes of Health Research (CIHR)	P
22		Pfizer	C
23	16	Sequella	C
24	12	Novartis	C
25		German Research Foundation (DFG)	P
26	23	Max Planck Society—Max Planck Institute for Infection Biology (MPIIB)	P
27	31	Emergent Biosolutions	C
28	39	Norway (aggregate)	P
29	25	Agence Nationale de Recherche sur le SIDA (ANRS)	P
30	13	Institut Pasteur	P
31	50	China CDC National Tuberculosis Reference Laboratory (China CDC)	P
32		Switzerland (aggregate)	P
33	28	Eli Lilly and Company	C
34	27	Sweden (aggregate)	P
35		Australian National Health and Medical Research Council (Australia NHMRC)	P
36	18	Brazil (aggregate)	P
37	30	Irish Aid	P-D
38	29	Consejo Nacional de Ciencia y Tecnologia (CONACYT)	P
39	35	South African Department of Science and Technology (SA DST)	P
40		PEPSICO	C
41		Japan (aggregate)	P
42		Colombian Department for Science, Technology and Innovation (Colciencias)	P
43		Pan American Health Organisation (PAHO)	P-D
45	34	Public Health Agency of Canada (PHAC)	P
48	37	Damien Foundation	F
50	47	South Africa Medical Research Council (SA MRC)	P
52	40	Health Research Council of New Zealand (New Zealand HRC)	P
53	41	Carlos III Health Institute	P
56	51	UK Department of Health (UK DoH)	P
58	48	Thrasher Research Fund	F
59	56	The Colt Foundation	F
64	33	Korea (aggregated)	P
65	55	British Council	P
66	52	UBS Optimus Foundation	F
68	42	The Research Institute of Tuberculosis, Japan Anti-Tuberculosis Association (RIT/JATA)	P
69		Global Fund to Fight AIDS, TB and Malaria (GFATM)	P-D
72		Rockefeller Foundation	F
		New Funders Under $500K	
		Grand Total	

P = Public sector R&D agency, P-D = Public sector development agency,
F = Foundation/philanthropy, C= Corporate/private sector

Total USD	Basic Science	Applied/ Unspecified	Diagnostics	Drugs	Vaccines	Operational
169,035,371	73,140,091	27,293,582	9,361,880	32,381,974	19,468,579	7,389,265
114,389,144	21,304,192	0	7,360,482	24,018,908	47,569,104	14,136,458
52,827,447	0	0	0	52,827,447	0	0
36,870,364	10,430,947	12,130,385	1,473,395	2,926,614	1,902,414	8,006,609
30,966,022	13,664,314	0	5,309,638	4,172,476	7,819,594	0
20,157,623	16,816,002	0	0	2,237,593	1,036,364	67,663
20,071,322	0	0	0	20,071,322	0	0
18,452,382	0	3,608,051	2,055,702	9,148,883	0	3,639,746
17,848,698	0	0	0	9,419,779	6,626,200	1,802,719
15,434,945	0	730,000	4,700,000	3,000,000	0	7,004,945
9,944,552	6,166,156	557,886	405,223	0	29,864	2,785,423
9,887,740	0	0	3,225,488	0	6,662,252	0
8,911,694	0	0	0	8,911,694	0	0
8,437,651	2,190,913	1,428,935	189,508	1,758,837	2,012,274	857,183
8,276,185	0	0	0	3,242,977	4,788,652	244,555
6,318,576	0	6,318,576	0	0	0	0
5,356,564	2,936,743	49,298	0	978,914	1,391,608	0
4,767,764	2,535,803	2,083,838	0	148,123	0	0
4,022,000	0	0	4,022,000	0	0	0
3,763,682	0	0	0	0	3,763,682	0
3,541,773	2,515,033	0	261,788	10,802	626,512	127,638
3,490,868	200,000	0	0	3,290,868	0	0
3,000,700	0	0	500,337	2,500,363	0	0
2,962,447	0	0	0	2,962,447	0	0
2,930,102	2,930,102	0	0	0	0	0
2,900,000	1,400,000	0	0	0	1,500,000	0
2,851,000	0	0	0	0	2,851,000	0
2,653,040	134,519	967,273	406,795	0	913,560	230,893
2,448,609	1,692,697	0	0	755,912	0	0
2,252,023	1,464,745	0	280,086	123,540	383,651	0
2,152,653	2,086,845	0	0	0	0	65,808
2,077,884	1,847,011	230,873	0	0	0	0
1,968,179	0	0	0	1,968,179	0	0
1,949,738	1,682,930	0	0	116,964	149,844	0
1,565,895	1,239,660	58,962	0	56,268	137,468	73,536
1,441,528	665,733	0	361,478	74,127	25,494	314,697
1,408,510	0	0	0	1,408,510	0	0
1,263,064	1,155,535	0	107,530	0	0	0
1,156,320	0	1,027,840	128,480	0	0	0
1,153,583	1,153,583	0	0	0	0	0
1,153,117	0	911,541	0	152,050	0	89,526
785,247	345,459	0	0	0	0	439,788
657,760	657,760	0	0	0	0	0
634,782	634,782	0	0	0	0	0
430,028	416,871	0	13,157	0	0	0
372,611	161,551	120,301	16,702	56,287	0	17,769
332,923	332,923	0	0	0	0	0
328,183	0	328,183	0	0	0	0
166,298	0	0	0	0	166,298	0
143,451	0	0	143,451	0	0	0
117,012	117,012	0	0	0	0	0
63,258	11,700	0	11,700	0	0	39,858
49,697	0	0	49,697	0	0	0
48,332	48,332	0	0	0	0	0
33,427	0	0	0	33,427	0	0
31,935	0	0	0	0	0	31,935
24,000	0	0	0	24,000	0	0
2,843,706	855,190	24,297	1,014,917	530,045	390,050	29,206
$619,123,407	**$172,935,132**	**$57,869,821**	**$41,399,434**	**$189,309,332**	**$110,214,465**	**$47,395,222**

Appendix 2: Top TB R&D Funders: 2005–2009

FIGURE 12

TB R&D Funders Ranked 1-10 That Invested Above $500,000 USD And Funders That TAG Has Tracked In Previous Years: 2005–2009

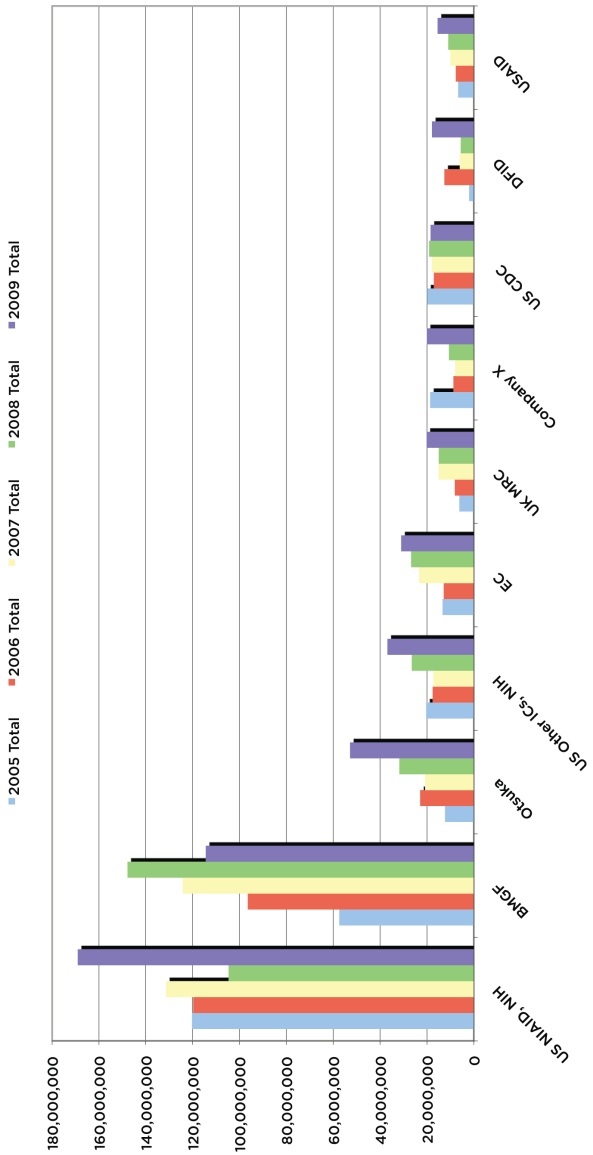


FIGURE 13

TB R&D Funders Ranked 11-23 That Invested Above $500,000 USD And Funders That TAG Has Tracked In Previous Years: 2005–2009

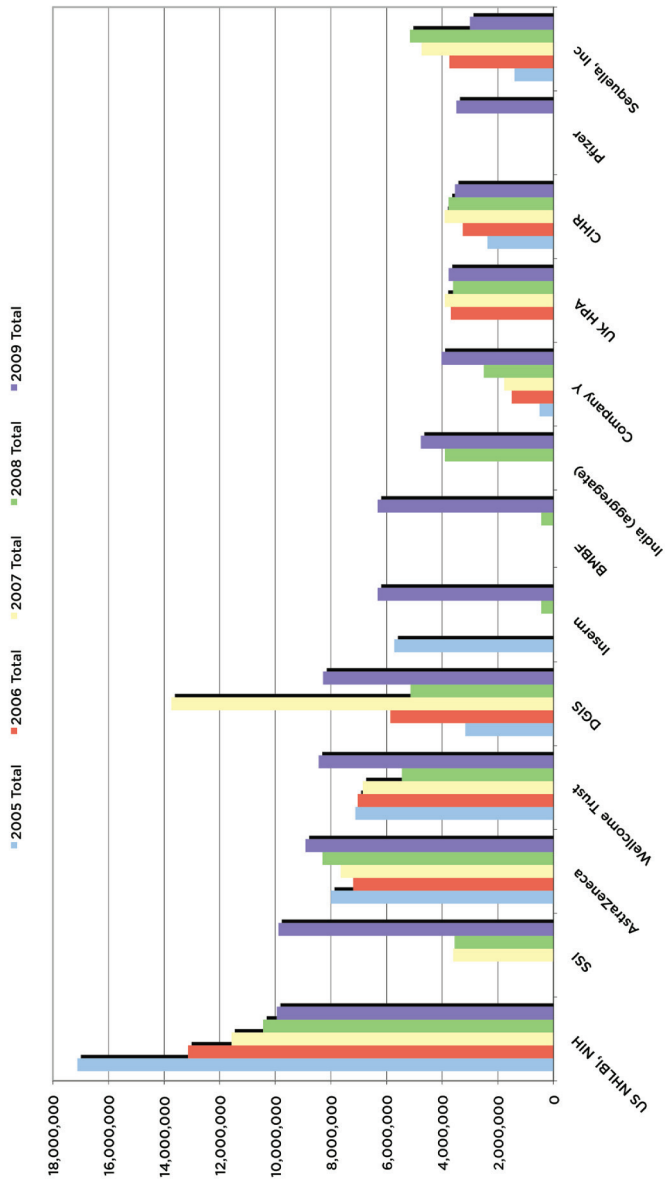


FIGURE 14

TB R&D Funders Ranked 24-34 That Invested Above $500,000 USD And Funders That TAG Has Tracked In Previous Years: 2005–2009

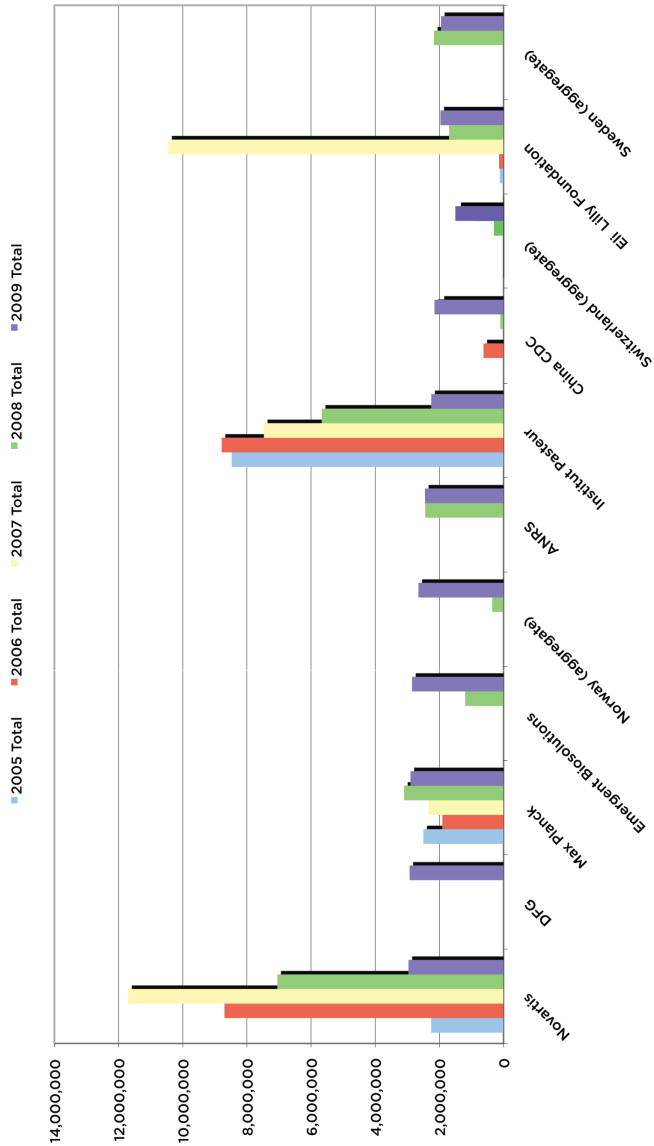


FIGURE 15

TB R&D Funders Ranked 35-44 That Invested Above $500,000 USD And Funders That TAG Has Tracked In Previous Years: 2005–2009

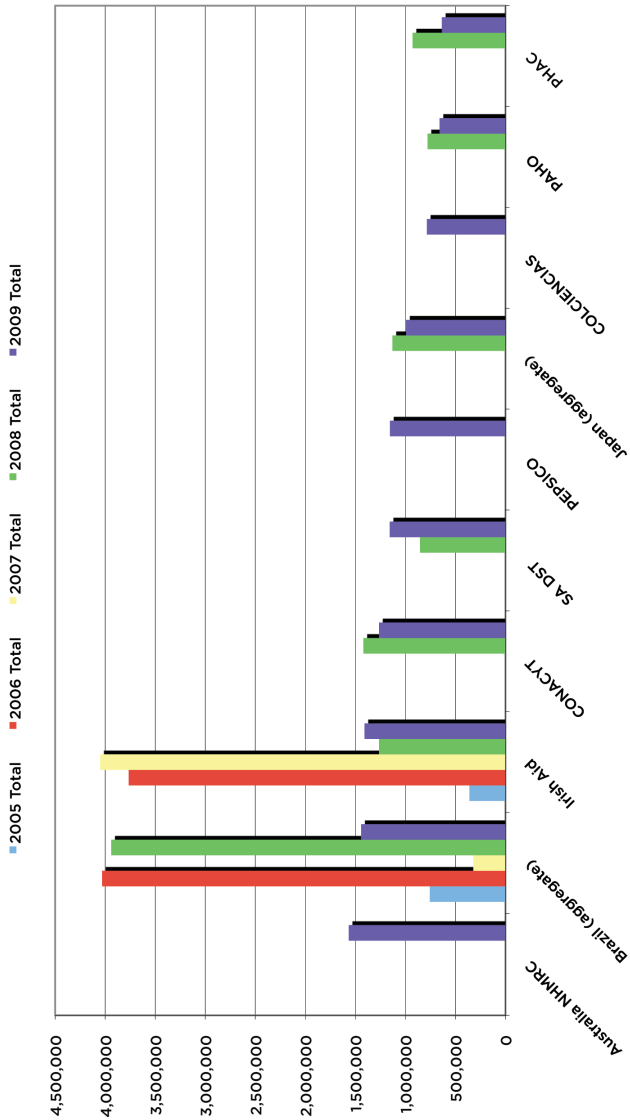


FIGURE 16

TB R&D Funders Less Than $500,000 USD That TAG Has Tracked In Previous Years: 2005–2009

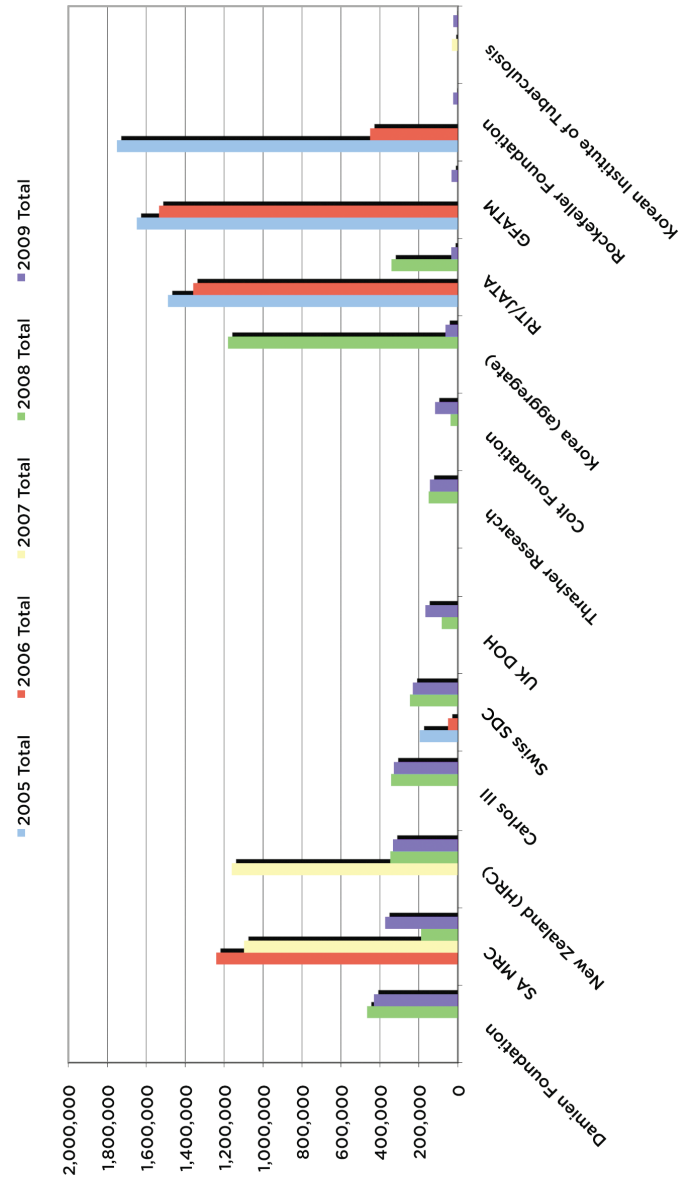
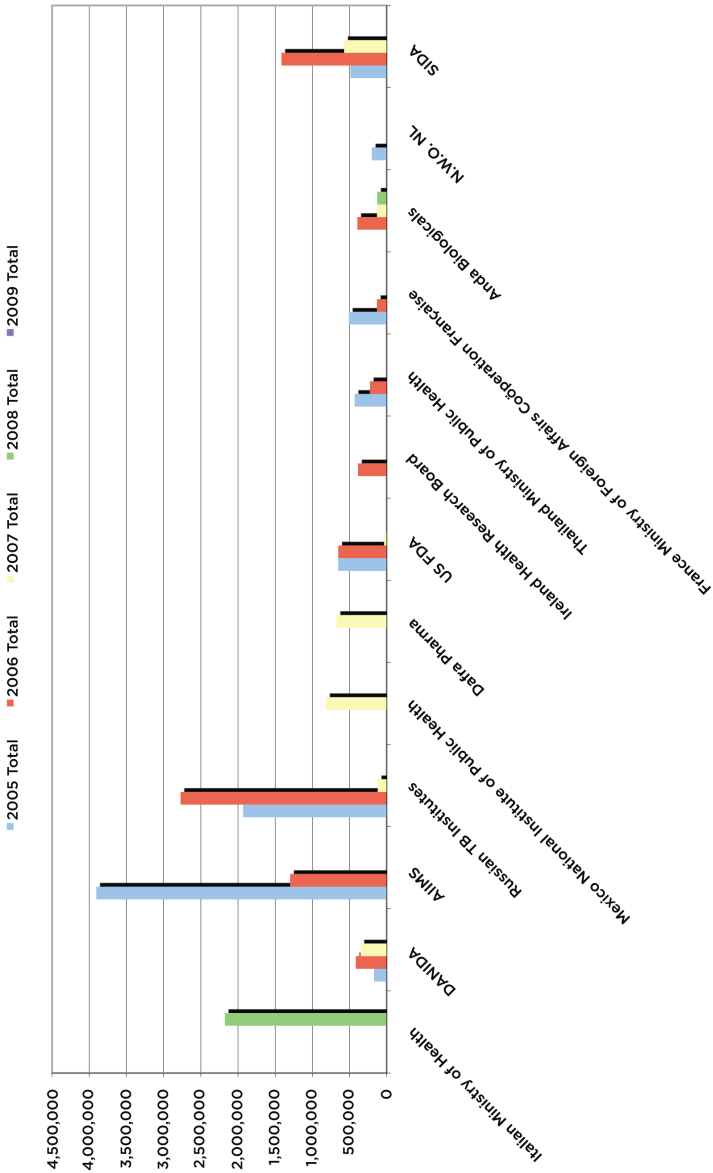


FIGURE 17

TB R&D Funders Inactive or Unresponsive in 2009



Appendix 3:

Toward a Revolution in Tuberculosis (TB) Prevention, Care and Treatment: Statement of Individuals from Communities Affected by Tuberculosis (TB)

36th IUATLD World Congress on Lung Health
19 October 2005
Paris, France

We are individuals from communities affected by the worldwide pandemic of tuberculosis (TB). We have seen the unnecessary suffering and death that TB causes, amplified by the overlapping HIV/AIDS pandemic. Up to two billion people worldwide are infected with the bacteria which causes TB. Each year, eight million people develop TB disease and two million die from it. Yet TB is preventable, treatable, and curable. The suffering and death it causes are unnecessary and unacceptable.

No one should die of a curable disease because of poverty or underfunded health systems. Human rights, public health, and social justice approaches all demand a better global response to stopping TB.

Universal access to existing TB diagnosis and treatment, and massively accelerated research to develop new and better tools are both urgently needed.

We can reduce the suffering caused by TB to 80 million people over the next ten years, prevent 20 million unnecessary deaths, and accelerate the day when tuberculosis—one of humanity's most ancient diseases—is finally stopped.

What has been lacking is the political will, the scientific determination, and the popular support.

We call upon leaders, governments, and all sectors of society to take the following steps:

1. **Recognize the importance of community participation in TB control efforts.** People living with TB must be at the center of all TB awareness, prevention, care and treatment programs. Their rights and dignity must be respected. People living with TB have the right to participate fully in all organizations concerned with their care, at all levels including governance, planning, implementation, and evaluation of TB research, prevention, care, treatment, and advocacy programs.

2. Increase investment to support community participation. Community activism is essential to ensure the growth and sustainability of TB control programs. Massively increased resources are needed to support community mobilization, awareness, education, literacy, and participation in TB control programs worldwide by people living with or most vulnerable to TB.

3. Ensure expanded access to TB treatment. All people with active TB—not just those with sputum smear positive pulmonary TB—must be promptly and properly diagnosed, treated, and cured. This includes those with smear negative pulmonary TB, extrapulmonary TB, pediatric TB, HIV-related TB and multi-drug resistant (MDR) TB.

4. Provide TB services to vulnerable populations. All affected communities must have full access to TB prevention, care and treatment, including women, children, homeless people, the unemployed, the uninsured, the incarcerated, populations regardless of immigration status, drug users, people living with HIV, and those with other life-threatening diseases.

5. Incorporate TB program expansion into stronger health systems. TB control programs should be expanded in the context of strengthening health systems.

6. Provide universal access to high-quality TB services. TB preventive measures, diagnosis, treatment, and cure must be made universally accessible, available, and free at the point of use to persons being screened or treated for TB, including those with multi-drug resistant (MDR) TB or with TB/HIV.

7. Expand use of existing TB prevention methods. More emphasis is needed on use of existing tools to reduce TB transmission and treat latent infection, including administrative measures to reduce transmission in confined settings and isoniazid preventive therapy in people at high risk of progression to active TB, including those with TB/HIV.

8. Scale up research on new tools to stop TB. Massively accelerated and greatly increased research funding is needed for new tools to prevent, diagnose, treat, and cure TB. Funding for this research should come from all countries from both public and private sectors. Community activism is needed to secure full funding of and community involvement in all stages of this research.

9. Disseminate existing TB diagnostics and develop new ones. New diagnostic tests to accurately diagnose TB—pulmonary and extrapulmonary, drug-sensitive and drug-resistant, adult and pediatric, and HIV-negative and HIV-positive—are urgently needed.

These tests must be usable where the vast majority of people with TB get their care, in district hospitals, private providers, and health centers. Optimally, these point-of care assays must be rapid, require little technical training, not require electricity or refrigeration, able to withstand high heat and humidity, and be affordable for all public health systems. Currently available diagnostic such as culture and drug susceptibility testing (DST) must be made much more broadly available in resource-poor settings to increase the ability to diagnose smear-negative, extrapulmonary, pediatric, and drug-resistant TB.

10. Develop shorter TB cures. New drugs and combination treatment regimens for TB are urgently needed which will fully cure over 95% of drug-sensitive and drug-resistant cases of TB within two months. These drugs must be affordable, available, safe, and effective especially for persons infected with MDR-TB or TB/HIV.

11. Discover new TB vaccines. New vaccines for TB are needed which will prevent TB infection or disease in over 75% of those vaccinated without side effects, ideally in a single dose given once a lifetime.

12. Stopping TB is a job for everyone. Governments around the world must commit the full resources, leadership, and long-term effort necessary to make TB a disease of the past. We call for strong, vocal, and persistent commitment by political leaders and systems worldwide, and by all sectors of society and community, to provide the resources needed to make TB a disease of the past.

For the past ten years, governments around the world have stated their commitment to stop TB. Now is the time to intensify this commitment by turning declarations into deeds, promises into programs.

Community activism and advocacy are essential to ensure the growth and sustainability of TB programs. We commit to redouble our efforts to mobilize communities to respond to the TB epidemic by increasing our efforts in education, information dissemination, advocacy, support, and participation. We call for the same commitment from all with the power to help make the future one free of TB.

*Online Link: http://www.treatmentactiongroup.org/publication.aspx

Endnotes

1. Andries K, Verhasselt P, Guillemont J, et al. (2005), A diarylquinoline drug active on the ATP-synthase of Mycobacterium tuberculosis. Science 307 (5707): 223–27.

2. NIH. Estimates of Funding for Various Research, Condition, and Disease Categories (RCDC). Research, Condition, and Disease Categorization Process Website. Table Published: February 1, 2010; http//report.nih.gov/rcdc/categories/.

3. H.R.6164—National Institutes of Health Reform Act of 2006 (Enrolled Bill [Final as Passed Both House and Senate] Section 402B. SEC. 402B. ELECTRONIC CODING OF GRANTS AND ACTIVITIES. "The Secretary, acting through the Director of NIH , shall establish an electronic system to uniformly code research grants and activities of the Office of the Director and of all the national research institutes and national centers. The electronic system shall be searchable by a variety of codes, such as the type of research grant, the research entity managing the grant, and the public health area of interest. When permissible, the Secretary, acting through the Director of NIH , shall provide information on relevant literature and patents that are associated with research activities of the National Institutes of Health."—http://www.thomas.gov/cgi-bin/query/D?c109:3:./temp/~mdbsVc1DKn

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6. Treatment Action Group. 2009 Report on Tuberculosis Research Funding Trends, 2005-2008, 2nd ed. New York: Treatment Action Group, 2010

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