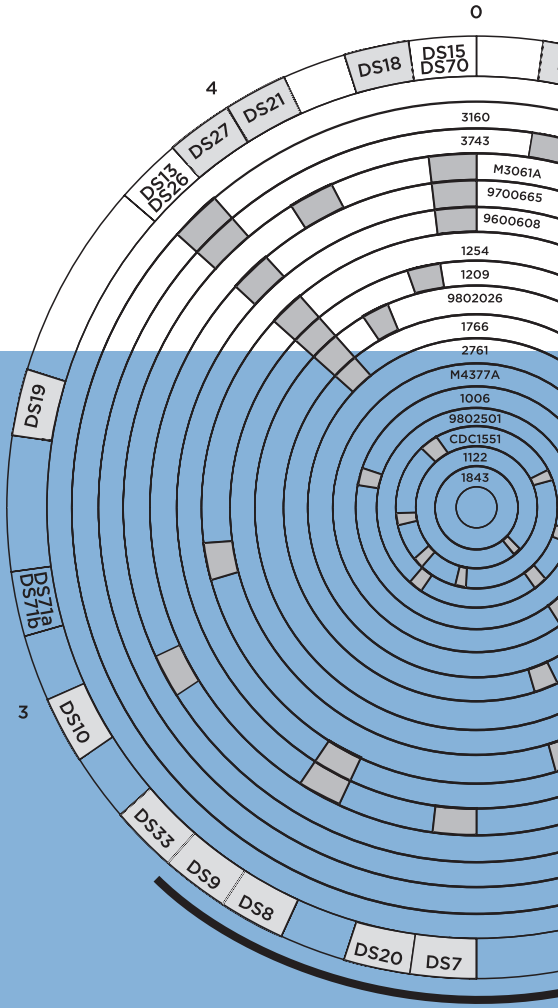
TAG
Treatment Action Group

Stop TB Partnership

TUBERCULOSIS RESEARCH
AND DEVELOPMENT:

2011 Report on Tuberculosis Research Funding Trends, 2005—2010

2ND EDITION



MARCH 2012

TREATMENT ACTION GROUP

BY ELEONORA JIMÉNEZ-LEVI

ACKNOWLEDGMENTS

TAG is grateful to all the participating TB R&D donors who made this report possible. A special thanks to Julie A. Cornell for assisting in all aspects of data gathering and report dissemination, and to the Bill & Melinda Gates Foundation and the Stop TB Partnership for supporting TAG's TB/HIV Project.

ABOUT TAG

Treatment Action Group is an independent AIDS research and policy think tank fighting for better treatment, a vaccine, and a cure for AIDS.

TAG works to ensure that all people with HIV receive lifesaving treatment, care, and information. We are science-based treatment activists working to expand and accelerate vital research and effective community engagement with research and policy institutions. TAG catalyzes open collective action by all affected communities, scientists, and policy makers to end AIDS.

TB/HIV PROJECT

Treatment Action Group's TB/HIV Project works to improve research, programs, and policy for people with TB and HIV.

Eleonora Jiménez-Levi is a senior researcher leading Treatment Action Group's resource-tracking efforts on original source funding for tuberculosis and HIV research. She holds a bachelor's degree in political science from Barnard College and a master of science from the Harvard School of Public Health. From 2004 to 2007, Eleonora managed the TB/HIV Monitoring and Advocacy Project at the Open Society Institute, where she partnered with TAG to help communities affected by TB and HIV advocate for better TB/HIV care and services.

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EDITED BY MARK HARRINGTON AND CHRISTIAN LIENHARDT

THIS REPORT IS DEDICATED TO:

Winstone Zulu

(1964-2011)

Winstone was in the vanguard of HIV activism. He was one of the first advocates to realize the huge challenge TB posed for people with HIV. He was not only a hero in the fight against AIDS, but a pioneer in bringing AIDS activism to the hitherto barren and civil society–free zone of tuberculosis prevention, treatment, and care.

Winstone worked tirelessly to change the world, at no small cost to his own health and well-being. His legacy is a stronger link between HIV and TB activists, but his inimitable calm and passionate voice of reason will be deeply missed.

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Executive Summary

While significant promise beckons in tuberculosis (TB) research and development (R&D), these advances are threatened by ongoing economic crises and lack of political will. On the hopeful side, the Stop TB Partnership published its comprehensive *International Roadmap for Tuberculosis Research*[1] and *Priorities in Operational Research to Improve Tuberculosis Care and Control*.[2] The South African–Zambian ZAMSTAR study reported a 22% decline in TB incidence in a high-TB/HIV-burden region of the world with a household case finding intervention.[3] The TB Alliance presented results of the first preliminary study of a novel combination treatment regimen and its impact on early bactericidal activity against TB.[4] In South Africa, the government rolled out a long-overdue comprehensive national strategy against both HIV and TB. In its first year, the country successfully tested almost 14 million people for HIV and 7 million for TB; 30% of the TB cases were identified with the new Xpert MTB/RIF test from Cepheid, introduced only in late 2010. This shows that with appropriate political leadership, effective new technology to combat TB can be rolled out quickly and effectively in high-burden countries. Finally, in early 2012 Otsuka filed for European Medicines Agency (EMA) approval for its new drug delamanid (OPC67683) for treatment of drug-resistant TB—the first new drug and new class of drugs submitted for regulatory approval in the past four decades.

This report is an update to the *Tuberculosis Research and Development 2011 Report on Tuberculosis Research Funding Trends, 2005–2010* released in October 2011. This second edition documents and analyzes investments in TB R&D from the baseline year 2005 through 2010 and offers new and revised funding data from the Canadian Institutes for Health Research; Company Y; the Global Fund to Fight AIDS, Tuberculosis, and Malaria; Pfizer; and the European Commission.

These donors reported investing an additional $13.4 million in TB R&D in 2010 to TAG, raising the global TB R&D total to $630.4 million—a 2% increase from 2009's $619.2 million investment and a 76% increase from the base year of 2005.

The revised data reported to TAG resulted in a 9% increase in diagnostics funding, from $44.6 million to $48.4 million; a 5% increase in operational research, from $58.1 million to $60.9 million; a 2% increase in basic science, from $126.7 million to $129 million; and a 2% increase in drug development, from $226.8 million to $230.5 million. Vaccines and infrastructure/unspecified research grew by less than 1%.

Though global investments for TB R&D grew slightly between 2009 and 2010, it was the smallest increase documented to date by TAG and represents only one-third of the $2 billion annual target required to eliminate TB by 2050. Public-sector funding fell 5%, from $395.3 million to $376.2 million, and philanthropic investments remained stable at $124 million. Private-sector funding grew 24%, from $100 million to $124.2 million, and multilateral funding increased from $0.5 million to $6 million.

In 2010, private-sector investments helped boost TB drug development—the largest funded research category, totaling $230.5 million, or 37% of the global total—as two new drugs are being or have already been submitted to regulatory authorities for accelerated approval. Basic science received $129 million—25% less than in 2009—making up 20% of all TB R&D funding. TB vaccines accounted for 12% of the global total, with $78.4 million—a 29% decline since 2009.

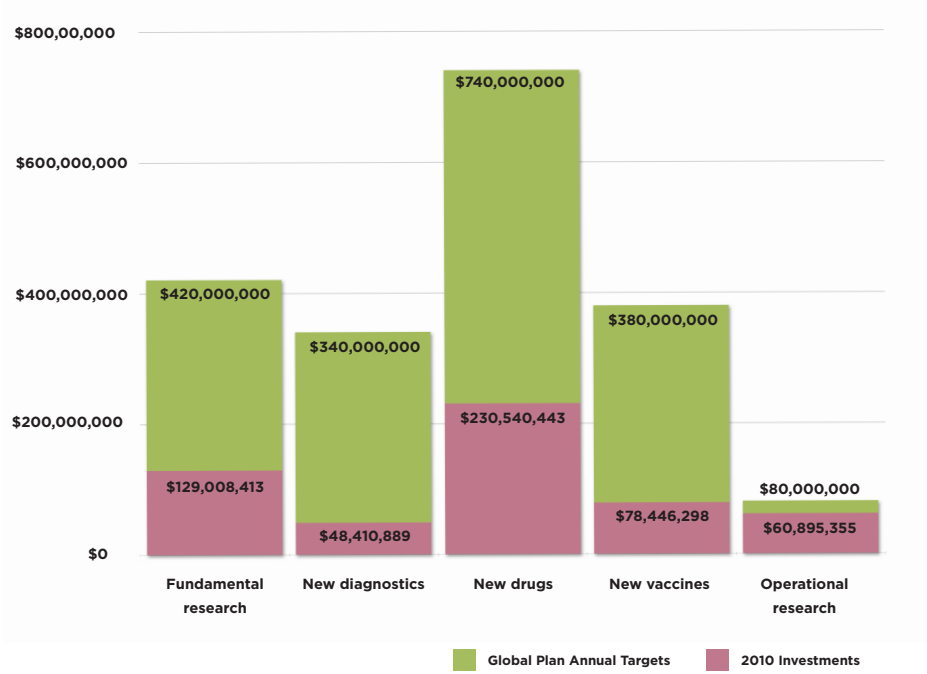
The infrastructure/unspecified category grew 47% to $83 million. Operational research and TB diagnostics rose 23% to $60.9 million and 24% to $48.4 million, respectively, since 2009. Measuring these totals in comparison to the *Global Plan* targets, the only category that came close to reaching the annual target was operational research (76% of the $80 million target); while the biggest percentage gap was seen in TB diagnostics (14% of the $340 million target; see Figure 1).

Eight product development partnerships and research consortia disbursed $116.6 million in TB R&D, a 12% decline from 2009 levels and a 140% increase since 2005.

In 2010, the U.S. National Institute of Allergy and Infectious Diseases (NIAID) continued to be the leading TB R&D funder. Despite reducing its funding in basic science and vaccines—two research areas in which investments fell 23% and 34%, respectively—NIAID remained the primary funder of basic science and TB diagnostics, and the second leading funder of TB drugs and vaccines. Overall, the U.S. National Institutes of Health (NIH) spent $224 million—36% of the R&D total—with American Recovery and Reinvestment Act stimulus funding supporting $35.3 million, or 16% of the NIH's 2010 investment.

FIGURE 1

Annual Global Plan Research Funding Targets vs. 2010 Investments

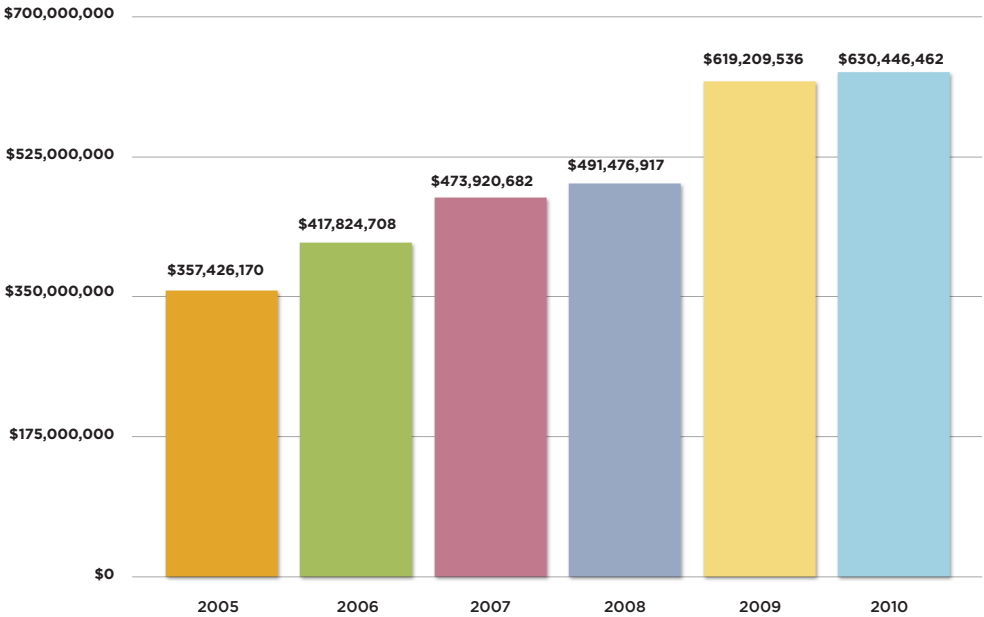


The Bill & Melinda Gates Foundation (BMGF) remained the second leading funder of TB—investing $115.3 million, or 18% of the global total—with the largest contributions directed at infrastructure/unspecified ($35.5 million), TB vaccines ($30.4 million), and TB drug development ($20.7 million).

Despite the exciting scientific advances described earlier, there is a great danger that lack of political will and insufficient resources will continue to hinder progress in TB research. Though the NIH is the world's largest funder of TB R&D, President Barack Obama's budget for 2013 proposes a first-ever flatlining of the NIH budget. Support for TB R&D from the BMGF is stable for the time being, and Otsuka continues to hold third place as it moves delamanid into phase III. The European Union, distracted by its economic woes, remains an unfocused donor to TB research and control. Fewer than 5% of people with drug-resistant TB are receiving treatment globally. It is unclear whether global normative bodies or national regulatory agencies are ready to deal with the challenges posed by a number of new drugs and regimens, which are under

FIGURE 2

Total TB R&D Funding: 2005—2010



study and moving forward toward approval. Many countries lack a regulatory framework even for compassionate use, let alone expanded access or accelerated approval. From the United States to the global south supplies of second-line TB drugs are inadequate, frequently interrupted, and hard to deliver on time where they are needed. Lastly, the ever-elusive TB point-of-care test remains only a distant hope.

TABLE 1.1

2010 TB R&D Funders by Rank

2010 Rank	Funding Organization	Funder Type	Total USD
1	US NIAID, NIH	P	$158,030,390
2	Bill & Melinda Gates Foundation (BMGF)	F	$115,259,533
3	Otsuka Pharmaceutical Co. Ltd (Otsuka)	C	$63,648,753
4	US Other NIH Institutes & Centers (US Other NIH ICs)	P	$52,363,574
5	European Commission: Research Directorate-General (EC)	P	$25,866,089
6	Company X	C	$20,645,794
7	US Centers for Disease Control (US CDC)	P	$19,865,178
8	United States Agency for International Development (USAID)	P-D	$19,791,027
9	UK Department for International Development (UK DfID)	P-D	$16,912,287
10	AstraZeneca	C	$14,023,381
11	US National Heart, Lung, & Blood Institute (US NHLBI, NIH)	P	$13,682,412
12	UK Medical Research Council (UR MRC)	P	$13,567,720
13	Institut Pasteur	P	$11,631,674
14	Wellcome Trust	F	$5,963,591
15	Novartis	C	$5,730,352
16	Canadian Institutes for Health Research (CIHR)	P	$4,445,356
17	Dutch Ministry of Foreign Affairs - Directorate General of Development Cooperation (DGIS)	P-D	$4,333,160
18	German Federal Ministry of Education and Research (BMBF)	P	$4,226,003
19	Company Y	C	$4,000,000
20	World Health Organization (WHO)	M	$3,650,090
21	US President's Emergency Plan for AIDS Relief (US PEPFAR)	P-D	$3,634,321
22	Sequella	C	$3,564,212
23	Pfizer	C	$3,533,561
24	Statens Serum Institut (SSI)	P	$3,452,820
25	UK Health Protection Agency National Institute for Health Research (UK HPA/NIHR)	P	$3,413,681
26	Max Planck Institute for Infection Biology (MPIIB)	P	$3,100,000
27	Sandoz	C	$3,000,000

P= Public Sector R&D Agency; C = Corporation/Private Sector; M= Multilateral; F=Foundation/Philanthropy; P-D= Public Sector Development Agency

TABLE 1.2

2010 TB R&D Funders by Rank (continued)

2010 Rank	Funding Organization	Funder Type	Total USD
28	Emergent Biosolutions	C	$2,791,239
29	Australian National Health and Medical Research Council (Australia NHMRC)	P	$2,549,818
30	The Global Fund to Fight AIDS, Tuberculosis, and Malaria (GFATM)	M	$2,310,000
31	Sweden (reported)	P	$2,034,384
32	India (reported)	P	$1,654,804
33	UBS Optimus Foundation	F	$1,625,000
34	Eli Lilly and Company	C	$1,500,000
35	UK Department of Health (UK DoH)	P	$1,499,860
36	Japan (reported)	P	$1,270,204
37	Irish Aid - Ireland Development Corporation	P-D	$1,221,470
38	PEPSICO	C	$1,153,583
39	Switzerland (reported)	P	$1,092,053
40	Korea (reported)	P	$1,008,200
41	South African Department of Science and Technology (South Africa DST)	P	$978,750
42	Agence Nationale de Recherche sur la SIDA (ANRS)	P	$974,075
43	Norway (reported)	P	$717,382
44	Brazil (reported)	P	$672,433
45	Damien Foundation	F	$476,448
46	Carlos III Health Institute	P	$460,556
47	US Food and Drug Administration (US FDA)	P	$400,000
58	Stanley Thomas Johnson Foundation	F	$138,851
63	World Health Organization (WHO): Stop TB Partnership	M	$62,500
65	Fondation Merieux	F	$61,243
71	Thrasher Research Fund	F	$30,625
	New Funders Under $500K		$2,428,023
	Grand Total		**$630,446,462**

P= Public Sector R&D Agency; C = Corporation/Private Sector; M= Multilateral; F=Foundation/Philanthropy; P-D= Public Sector Development Agency

1 Introduction

For the sixth year running, Treatment Action Group (TAG) publishes the latest data on global investments in tuberculosis (TB) research and development (R&D). The *2011 Report on Tuberculosis Research Funding Trends: 2005–2010*, second edition, provides six years of comprehensive spending data and measures investments in comparison to the funding targets defined by the original *Global Plan to Stop TB 2006–2015* and the most recently updated *2011–2015* version published last year. The report offers year-to-year data on the leading TB research funders and analyzes funding trends across six TB research categories and four donor sectors. Most important, the report examines the state of TB research funding and underscores the urgency of adequate and sustained funding to produce the powerful new tools the world needs to eliminate TB as a public health threat by 2050.

1.1 Rationale

TB, a disease caused by *Mycobacterium tuberculosis* (*M. tuberculosis*), claimed the lives of 1.45 million people and was responsible for 8.8 million new TB cases in 2010.[5] It is estimated that one-third of the world's population, or 2 billion people, are latently infected with TB but approximately 90% will never develop active TB disease. However, 10% of those with latent TB infection go on to develop active TB disease in their lifetime. The populations most at risk of developing active TB disease are children under the age of five and people who are malnourished and/or immune-compromised. In 2010, 1.1 million of the 8.8 million new TB cases and 0.35 million of the 1.45 million TB deaths were among people with HIV, making it the leading cause of death among people with HIV.[6]

As TB is curable, the ongoing disease burden and mortality rate is particularly inexcusable. For over 40 years no new class of TB drugs has been approved. The Bacille Calmette Guérin (BCG) vaccine, the only vaccine licensed for TB, protects against disseminated and meningeal TB, the worst forms of pediatric TB disease. Yet BCG cannot be administered to HIV-positive infants, as it can cause adverse effects, and offers no protection against the most common form of the disease—pulmonary TB. Between 2007 and 2010, the World Health Organization's Strategic and Technical Advisory Group approved eight new TB diagnostic technologies, yet none of them can be used as a point-of-care (POC) test in local health posts—where the majority of TB patients seek services.[7]

Resources to develop new tools to prevent, detect, and treat TB are urgently needed. The rise in TB rates associated with HIV in Africa and the multidrug-resistant TB (MDR-TB) epidemic affecting eastern Europe make the case for adequate and

sustainable funding even more compelling. Without a $2 billion annual investment in new TB diagnostic tools, vaccines, and drugs, the world will not be able to meet the Stop TB Partnership's goal of eliminating TB as a public health threat by 2050.[8]

1.2 Background

In 2006, the Stop TB Partnership published the *Global Plan to Stop TB 2006–2015*, a ten-year strategic plan that sets out to reduce the global TB burden by 2015 and eliminate it all together by 2050. The *Global Plan* outlines a road map and funding targets to scale up TB control programs and close the research gap on new TB tools. In October 2010, the Stop TB Partnership updated the strategy and set more ambitious implementation and funding targets to achieve the 2050 goal. In addition to revising the funding targets, the *Global Plan to Stop TB 2011–2015* introduced two new research components, fundamental science and operational research, which are critical to understanding fundamental TB science and evaluating the impact of TB control strategies in programmatic settings.

On the same year the Global Plan was launched, TAG embarked on a resource-tracking exercise to measure global progress in comparison to the *Global Plan's* research funding targets. The TB R&D reports established and tracked funding trends against a 2005 baseline. Data from these reports inform researchers, advocates, and policy makers about annual research investments, trends, and funding gaps that must be addressed if the world is to successfully eliminate TB disease.

Now in its sixth year, TAG's report is considered the point of reference for global TB R&D investment tracking. The report is used widely in the TB research community—most recently in the revision of the *2011–2015 Global Plan*.

The report also provided a key framework underlying the convening of the High-Level Meeting on TB Research by the Stop TB Partnership, held in Bellagio, Italy, in March 2011. For the first time, TB R&D donors met to share perspectives on their funding priorities and the needs of the field, providing an opportunity to better communicate and deepen their collaboration to eliminate TB. Lastly, in October 2011, Dr. Lucica Ditiu, executive secretary of the Stop TB Partnership, cited the report at a plenary speech of the 42nd Union World Conference on Lung Health titled "Hard Talk: Why We Need to Change the Way We Think and Speak TB!".

1.3 Methodology

In 2009 and 2010, TAG collaborated with Policy Cures' G-FINDER Project to collect and share TB R&D funding data and contacts. While the collaboration enjoyed the benefits of streamlining the data collection process, TAG and Policy Cures realized their respective projects differed in scope, methodology, and purpose, and therefore decided to undertake all aspects of data collection independently. Among the most important differences between TAG's TB resource tracking report and that of G-FINDER are:

- TAG's TB R&D report specifically measures global progress against the *Global Plan* funding targets and strategically advocates for increased resources to meet the $2 billion annual funding goal;
- TAG documents and tracks year-to-year funding for operational research;
- TAG's report offers disaggregated private sector data to track year-to-year funding trends and identify funding gaps; and
- TAG's report methodology and data build on six years of funding information—the most comprehensive TB funding data set publicly available.

For the 2011 report, in continued collaboration with the Stop TB Partnership, TAG surveyed 146 potential TB research funders. TAG generated original source funding data using an electronic survey asking funders to report disbursements supporting TB R&D in 2010. In addition to reporting funding awards, donors were asked to categorize awards using six predefined research categories: basic science, infrastructure/unspecified, diagnostics, drugs, vaccines, and operational research. Each category is designed to capture investments that will support or enhance scientific breakthroughs in new TB drugs, vaccines, and diagnostics. The following are descriptions of the research areas covered in this report:

- **Basic Science:** Undirected, investigator-initiated research that aims to uncover fundamental knowledge about *M. tuberculosis* and closely related organisms (e.g., *M. Africanum*, *M. bovis*, but not other mycobacterial species).
- **Infrastructure/Unspecified:** Research specific to TB that the donor or funder is 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, as well as latent and active TB).

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

- **Operational Research:** Research evaluating new and/or existing TB control tools and strategies to guide their effective implementation in program settings. Studies may include randomized trials, surveillance, and epidemiological and observational studies.

Of the 146 surveyed institutions, TAG collected data from 82 funders, including 19 new donors and 8 product development partnerships (PDPs) and research consortia. Unfortunately, 41 previously reporting institutions were not included in this year's report because they were either inactive or unresponsive. Though TAG attempted to collect data from all previously tracked funders, we prioritized our efforts to the top 30 funders from 2009 as they represented 97%, or $601 million, of the 2009 global total. From the 2009 top 30 list, TAG collected data from 28 funders—a 93% response rate. For a full listing of the 2010 nonrespondents and their past TB R&D investments please see pages 47–50.

Data collection for the US National Institutes of Health (NIH), the European and Developing Countries Clinical Trials Partnership (EDCTP, a clinical trials network funded by the European Commission's Sixth Framework Program through 2015), and the Swiss National Science Foundation (SNSF) did not follow the same methodology described above. Rather, TAG secured data from publically available databases such as the NIH Research Condition and Disease Category database (http://report.nih.gov/rcdc/categories/), and the EDCTP (http://www.edctp.org/Our-Work.180.0.html) and SNSF (http://www.projectdb.snf.ch/WebForms/Frameset.aspx) websites.

All non-U.S. currency funding data collected by TAG was converted to U.S. dollars using the 1 July 2010 currency exchange rate provided by the OANDA Corporation at http://www.oanda.com/currency/converter/.

Investment data were analyzed and reported by donor sector, research area, and the top ten funders of 2010. As in previous years, public-sector funding, including development agency spending, was aggregated for Brazil, India, Japan, Korea, Norway, Sweden, and Switzerland. New funders who invested $500,000 or less were also aggregated and labeled "New Funders under $500K." For a complete listing of the 2010 TB R&D funders, please visit www.treatmentactiongroup.org/tbrd2011.

1.4 Limitations of the Data

Resource tracking is not a perfect science. It involves analyzing and vetting data to ensure they are up to date and accurate. Several factors, however, hinder our ability to provide a comprehensive analysis. Some of the challenges experienced this year include:

- **Loss to follow up:** Forty-one previously reporting TB R&D donors did not provide 2010 data. Several of these institutions were new to TAG when TAG first started collaborating with the G-FINDER Project. TAG is committed to collecting more data for the 2012 report, particularly among donors who have historically invested $1 million or more to TB R&D. Despite this limitation, TAG was able to track 28 of the top 30 donors from last year, which accounted for 97% of the total global investment. For this reason, TAG feels confident that the majority of the global investments in TB R&D were tracked.

- **Changes in funding schemes:** Over the past year, TAG learned the UK Health Protection Agency (UK HPA) and South Africa's Department of Science and Technology (South Africa DST) funding schemes were restructured. The UK Department of Health—where UK HPA resides—introduced a new funding vehicle called the National Institute of Health Research. The vehicle requires public agencies, like UK HPA, to apply for a five-year award based on a peer review processes. South Africa DST also established a new entity, the Technology and Innovation Agency, to consolidate its R&D activities. These restructuring processes can alter investment levels, as it did for UK HPA and South Africa DST, making it challenging to track year-to-year funding.

- **Incomplete data:** Previously reporting organizations such as the Research Council of Norway, the National Research Foundation of Korea, and the Indian Council of Scientific and Industrial Research did not participate in this year's survey. However, TB R&D funding recipients did report to TAG that they received disbursements from these donors. Based on historical investment levels and missing or partial portfolios, TAG concluded that these donors' 2010 investments were incomplete.

1.5 Corrections

For the second edition of this report, TAG uncovered new and updated 2010 TB R&D investments from five donors totaling $13.4 million. Among the new data collected, TAG received funding information from the Canadian Institutes for Health Research (CIHR); Company Y; and the Global Fund to Fight AIDS, Tuberculosis, and Malaria

(GFATM). This new data resulted in CIHR ranking at #16, Company Y at #19, and the GFATM at #30 among the top 30 TB R&D donors. Year 2010 investments from Pfizer and the European Commission (EC) were corrected after TAG included full-time employee costs to Pfizer's company total and uncovered a 2010 basic science TB research award issued by the European Research Council (ERC)—an entity of the EC—under the Seventh Framework Program.

Table 2 summarizes the funding changes made to the 2010 TB R&D funding total.

Table 2

Summary of 2010 Data Corrections

2010 TB R&D Funding Institutions	Previously Reported Investment (in USD)	Corrected 2010 Data (in USD)
European Commission: Research Directorate-General (EC)	$25,381,045	$25,866,0890
Pfizer	$1,418,442	$3,533,561
Company Y	$0	$4,000,000
Canadian Institutes for Health Research (CIHR)	$0	$4,445,356
Global Fund to Fight AIDS, TB and Malaria (GFATM))	$0	$2,310,000
2010 TB R&D Funding Total	**$617,090,943**	**$630,446,462**

After correcting the information for the five donors outlined above, the total TB R&D investment for 2010 grew from $617,090,943 to $630,446,462. All charts, graphs, and tables herein reflect these changes.

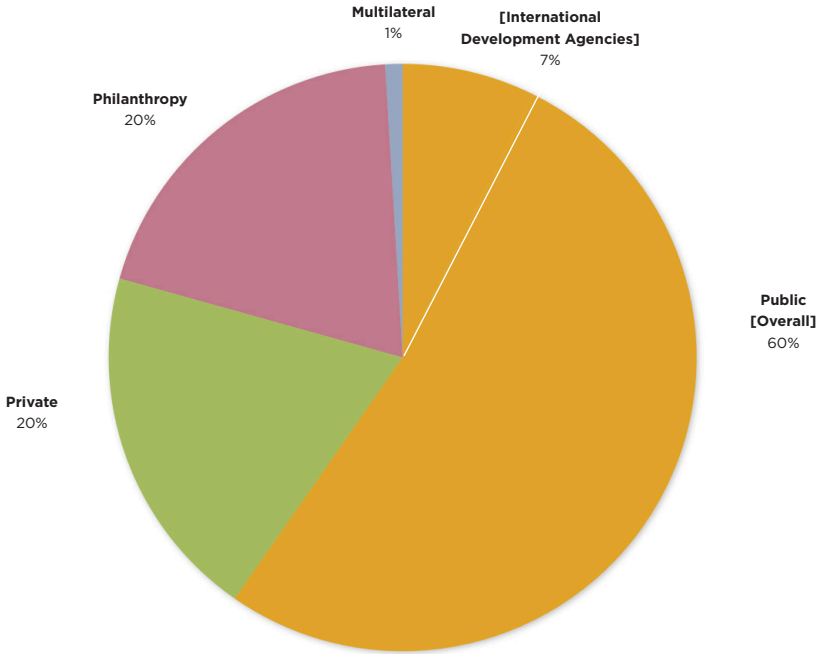
TAG strives to provide the most up-to-date information on TB R&D investments and welcomes additions, corrections, and other suggested changes to enhance the accuracy of this report. Please contact TAG at tbrdtracking@treatmentactiongroup.org if you have information or corrections to share.

2 Results

2.1 Donor Categories

FIGURE 3

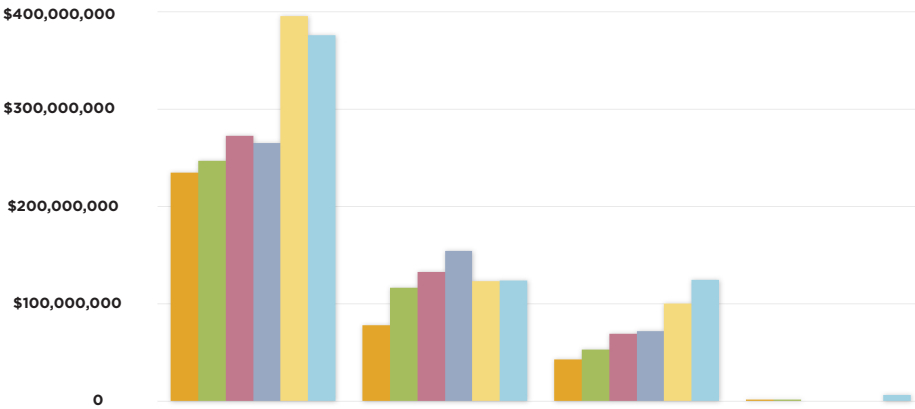
TB R&D Funding by Donor Sector: 2010
Total: $630,446,462



In 2010, 74 funders reported spending $630.4 million on TB R&D, a 2% increase from 2009 levels and the smallest growth ever documented by TAG since 2005. While global TB R&D funding grew faintly between 2009 and 2010, public-sector funding fell 5%, from $395.3 million to $376.2 million, and philanthropic investments remained stable at $124 million (see Figure 4). Private-sector funding grew 24% since 2009, making up 20% of total global spending and boosting TB drug development funding. Multilateral funding grew significantly in 2010 from $0.5 million to $6 million—largely due to improved resource tracking efforts, including new data from the GFATM.

FIGURE 4

Total TB R&D Funding by Donor Sector: 2005—2010



	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	$395,326,911	$123,383,703	$99,973,537	$525,385
2010	$376,199,816	$123,974,117	$124,249,938	$6,022,590

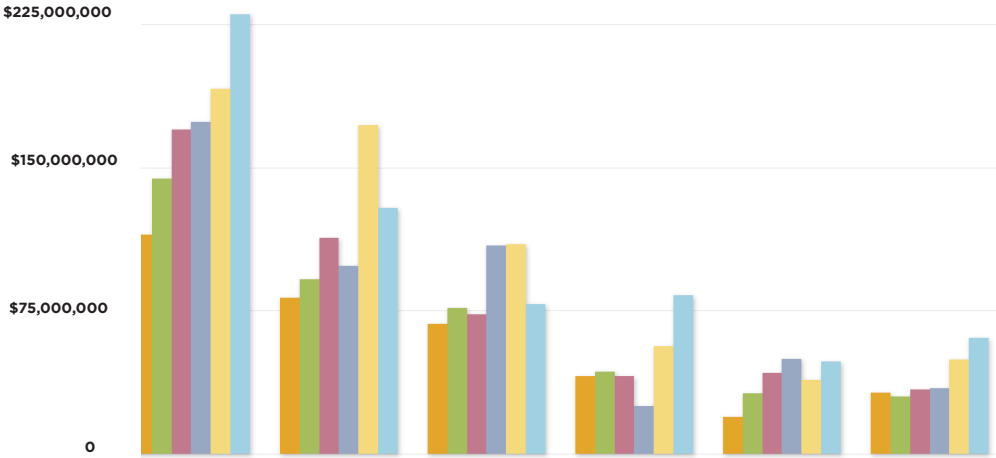
*** Includes funding from International Development Agencies**

Of the 74 funders included in this report, the top 10 TB R&D funders—which predominantly represent public and private funders—accounted for 80% of all TB R&D funding in 2010, with a total investment of $506.4 million.

Four of the six research sectors on which TAG reports—infrastructure/unspecified, TB drugs, operational research, and TB diagnostics—enjoyed increased funding in 2010 (see Figure 5). TB vaccines and basic science funding declined significantly.

FIGURE 5

Investments in TB R&D by Research Category: 2005—2010

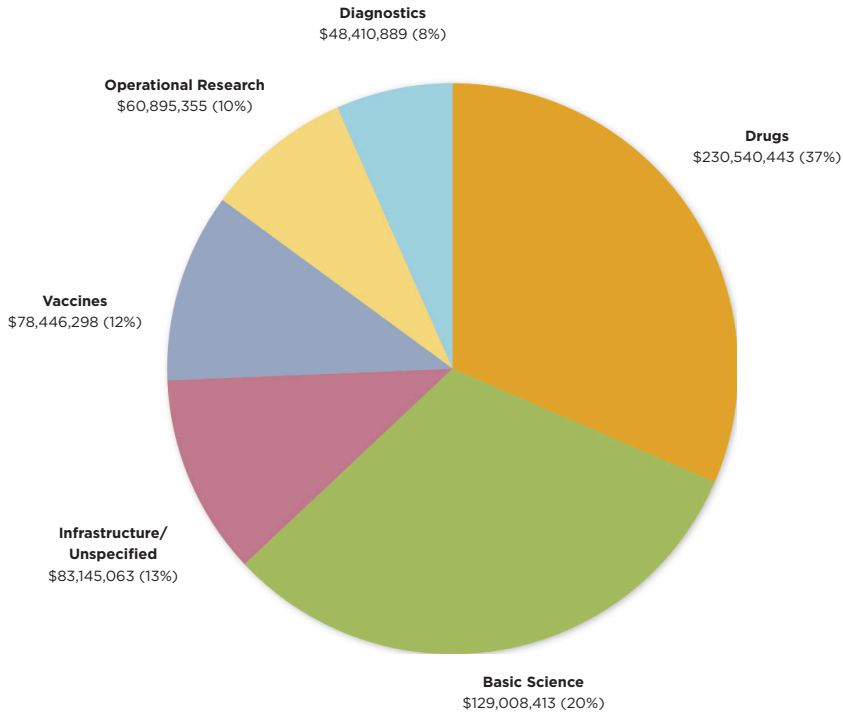


	Drugs	Basic Science	Vaccines	Infra structure/ Unspecified	Diagnostics	Operational Research
2005	$114,862,738	$81,892,167	$68,351,530	$40,741,527	$19,408,124	$32,170,084
2006	$144,336,532	$91,643,009	$76,555,111	$43,205,600	$31,890,329	$30,194,127
2007	$170,233,497	$113,325,202	$73,225,383	$40,734,199	$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	$191,483,304	$172,447,841	$110,133,485	$56,686,918	$38,921,229	$49,536,760
2010	$230,540,443	$129,008,413	$78,446,298	$83,145,063	$48,410,889	$60,895,355

2.2 Trends in TB Research by Category

FIGURE 6

TB R&D Investments by Research Category: 2010
Total: $630,446,462

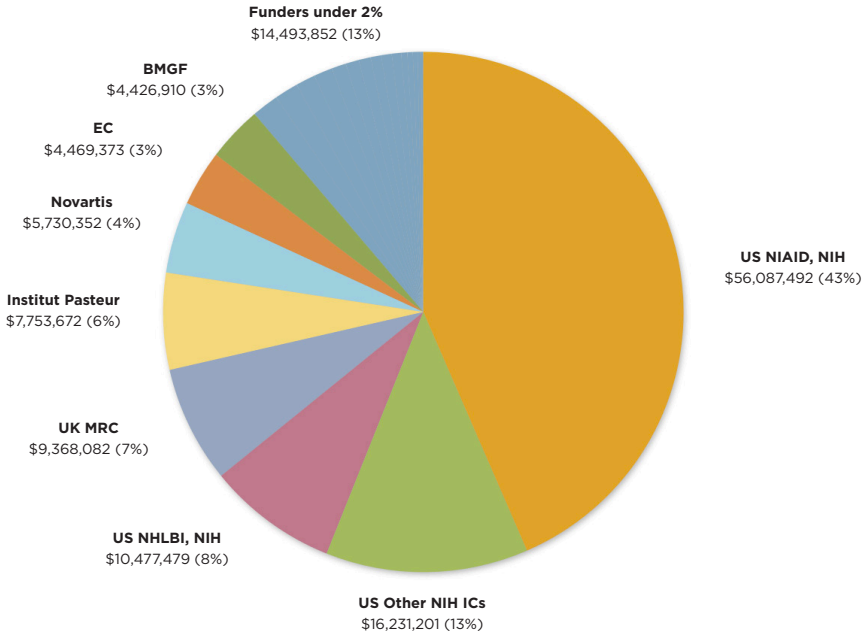


For the sixth consecutive year, TB drug development was the most well-funded research area, with $230.5 million in funding, a 20% increase since 2009 and 37% of the total global spend (see Figure 6). Basic science research received the second largest share of funding, with $129 million, and made up 20% of total global spending—a 25% decline from 2009 levels. TB vaccines funding fell 29%, from $110 million to $78.4 million (12% of the global total), and lagged behind the TB infrastructure/unspecified category, which grew 47% from $56.7 million to $83 million and accounted for 13% of the global total. Finally, operational research and TB diagnostics grew 23% and 24%, respectively, since 2009, claiming 10% and 8% of the global spending total.

Basic Science

FIGURE 7

Basic Science: $129,008,413



Funders with investments under 2%

Funder	Amount
Wellcome Trust	$2,159,208
BMBF	$1,900,599
Sweden (reported)	$1,566,878
MPIIB	$1,500,000
PEPSICO	$1,153,583
UK HPA/NIHR	$962,910
South Africa DST	$848,250
India (reported)	$845,402
Switzerland (reported)	$743,784
Australia NHMRC	$486,257
New Funders Under $500K	$442,500
Carlos III Health Institute	$372,965
WHO	$285,129
Pfizer Inc	$169,895

After experiencing a 75% funding surge from 2008 to 2009, basic science investments fell 25% in 2010, from $172.4 million to $129 million. The proportion of basic science funding relative to total TB R&D spending also declined from 28% to 20% between 2009 and 2010.

In 2010, NIAID continued to be the leading funder of basic science, investing $56 million, which included $9.2 million from American Recovery and Reinvestment Act (ARRA) stimulus funding. Despite the additional ARRA funding—which made up 16% of NIAID's basic science investment—NIAID's contribution in 2010 was 23% less than 2009's $73 million.

Other NIH Institutes and Centers (Other NIH ICs) and the U.S. National Heart, Lung, and Blood Institute (NHLBI) increased their investments by 56%, making them the second and third leading funders in basic science in 2010. For other NIH ICs, the ARRA played a key role, providing $5.5 million, or 34%, of the institutes' basic science funding. For the NHLBI, ARRA funds sponsored only one grant worth $241,000. With ARRA stimulus funding set to expire at the end of 2011, TAG predicts funding for basic science will experience a steep decline in 2012 and disrupt important fundamental research needed to develop new TB tools.

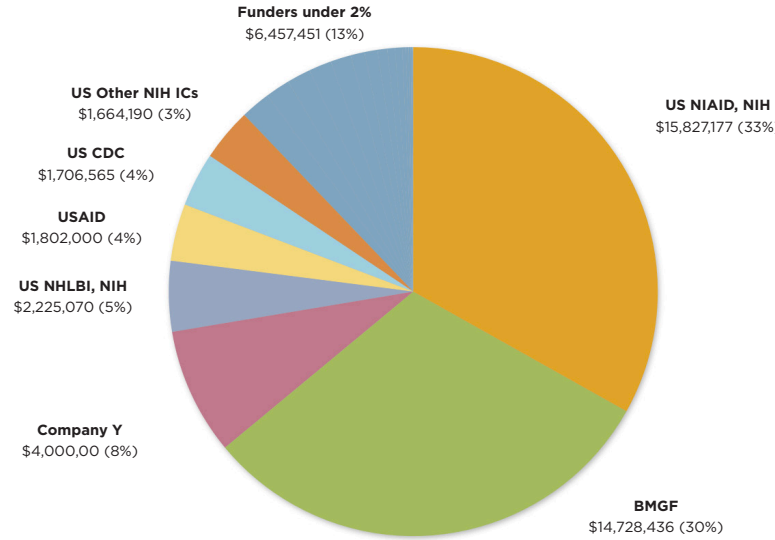
Of the 22 donors who invested in basic science in 2010, the BMGF downsized its investments by 80%, from $21.3 million to $4.4 million, and the UK Medical Research Council by 44%, from $16.8 million to $9.4 million.

Basic science is an important cornerstone in TB R&D research, as it reveals fundamental knowledge about *M. tuberculosis* that can accelerate the development of innovative technologies in drugs, diagnostics, and vaccine development. Therefore, the funding decline in basic science in 2010 is worrisome, since $129 million represents only 31% of the *Global Plan's* $420 million annual target.

TB Diagnostics

FIGURE 8

TB Diagnostics: $48,410,889



Funders with investments under 2%

Funder	Amount
DGIS	$939,030
UBS Optimus Foundation	$780,000
UK DfID	$749,930
Norway (reported)	$717,382
CIHR	$655,462
Institut Pasteur	$646,043
Wellcome Trust	$440,928
EC	$411,115
Brazil (reported)	$304,056
Sequella	$244,104
New Funders Under $500K	$221,832
UK MRC	$118,609
Stanley Thomas Johnson Foundation	$83,310
Damien Foundation	$71,032
BMBF	$31,601
Carlos III Health Institute	$29,642
Thrasher Research Fund	$13,375

In 2010, funding to support TB diagnostics research grew 25%, from $39 million to $48.4 million. Following a 22% funding decline between 2008 and 2009, the 2010 investment does not surpass 2008's $50 million investment—the highest amount recorded for TB diagnostics since this resource tracking began—and certainly does not come close to the *Global Plan's* $340 million annual target.

NIAID and the BMGF were the two largest contributors to TB diagnostics in 2010, providing 33% and 30% of the total, respectively. NIAID increased its TB diagnostics investment by 70%, from $9.4 million to $15.8 million, and the BMGF doubled its contribution from $7.4 million to $14.7 million.

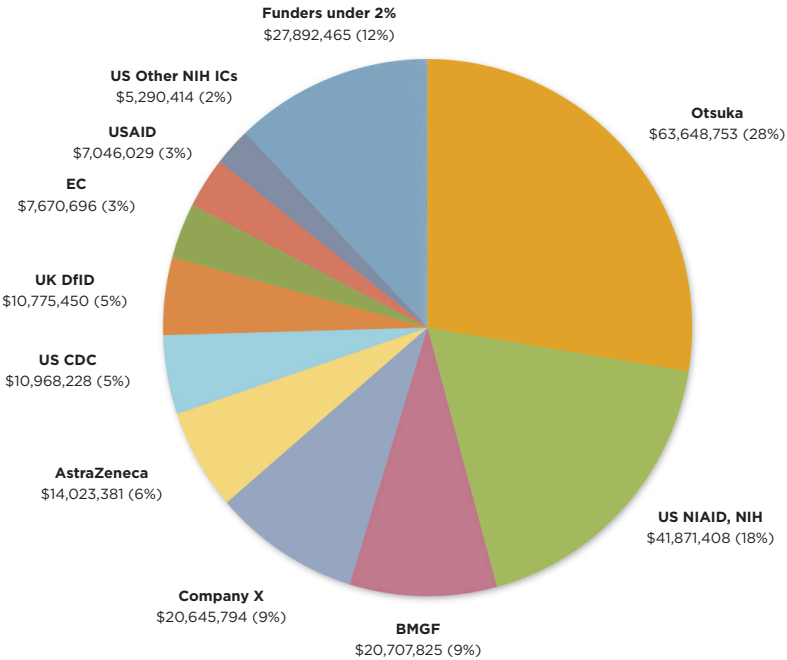
More resource mobilization is needed to develop a low-cost and effective POC diagnostic test that can be used in health post or community settings. The most recent diagnostic tool to be approved by the World Health Organization was the Xpert MTB/RIF assay; recommended in 2010, the test is designed to detect TB and confirm rifampicin resistance within two hours. Xpert MTB/RIF greatly reduces the time it takes to detect TB and initiate treatment, but can only be performed at the subdistrict level due to its cost, electricity, and equipment requirements.

To develop the urgently needed POC TB test, greater investment in basic science and biomarker discovery is necessary. In addition to funding, there is also a need for sample banks with well-characterized samples that include blood, urine, sputum, and other relevant specimens. These sample banks need to be operated efficiently and have a clear open-access policy to facilitate the identification and validation of biomarkers. The BMGF has made this one of its priority areas and in 2011 announced a $12 million Grand Challenges Biomarkers Grant Opportunity to support research that detects TB in low-resource settings by validating host and/or pathogen biomarkers.[9]

TB Drugs

FIGURE 9

TB Drugs: $230,540,443



Funders with investments under 2%

Funder	Amount
Pfizer Inc	$3,363,666
Sequella	$3,320,108
WHO	$3,261,920
Sandoz	$3,000,000
Institut Pasteur	$2,919,059
UK MRC	$2,172,823
CIHR	$1,602,780
Eli Lilly	$1,500,000
Irish Aid	$1,221,470
Korea (reported)	$1,000,000
ANRS	$974,075
Australia NHMRC	$611,802
DGIS	$500,560

Funder	Amount
BMBF	$474,044
New Funders Under $500K	$446,500
US FDA	$400,000
Sweden (reported)	$318,307
UBS Optimus Foundation	$304,200
Wellcome Trust	$256,475
WHO: Stop TB Partnership	$62,500
Switzerland (reported)	$59,769
Carlos III Health Institute	$57,949
Stanley Thomas Johnson Foundation	$55,540
Thrasher Research Fund	$8,917

In 2010, 34 donors invested $230.5 million in TB drug development, or 37% of all TB R&D investment. The 20% funding growth from $191.5 million to $230.5 million reflects the rise in clinical activity of novel and second-generation drug compounds moving through the private-sector pipeline.

Several ongoing trials are using existing TB drugs to reduce treatment duration, improve treatment outcomes, and lessen side effects, while six new compounds, including three new classes, are being developed to treat drug-resistant and drug-sensitive forms of TB.[10]

One of the new class of drugs is Otsuka's delamanid (also known as OPC-67683)—an oral therapeutic for the treatment of MDR-TB. Clinical research on delamanid is presently in phase III, with Otsuka sponsoring all the costs of the trial. In 2010, Otsuka invested $63.6 million on delamanid—a 21% increase from 2009 levels—making it the leading funder of TB drug development (at 28% of all TB drug spending). A significant portion of this investment was spent on scaling up clinical trial capacity to carry out registration quality trials that meet good clinical practice standards. While carrying out phase III, Otsuka filed for regulatory approval for delamanid with the European Medicines Agency (EMA) in early 2012 and anticipates a decision by the end of the year.

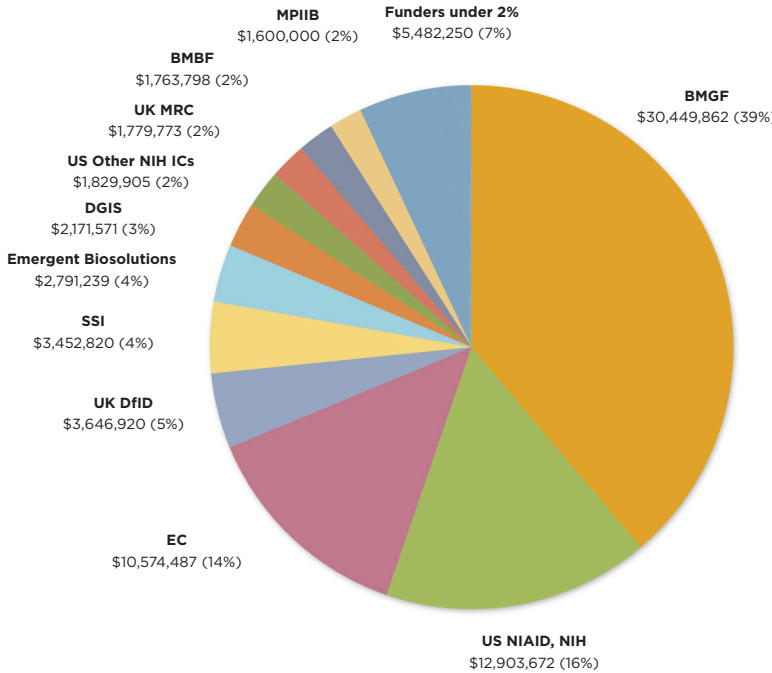
The second leading funder for TB drugs in 2010 was NIAID, investing $41.9 million—a 29% increase since 2009—across a range of translational and clinical research. For a second year in a row the BMGF placed third in TB drug development, spending $20.7 million—a 14% reduction from 2009's $24 million.

Though TB drug development continues to receive the greatest share of funding, it only reached 31% of the $740 million annual *Global Plan* target in 2010. In addition to closing the $509.5 million funding gap, more guidance on regulatory approval requirements is needed to ensure that new drugs and regimens are developed and approved expeditiously. The Critical Path to TB Drug Regimen Initiative, a broad collaboration comprised of drug developers, regulatory bodies, civil society advocates, academics, and research funders, is working to clarify a regulatory pathway that can use new validated-study endpoints to allow for shorter TB drug trials without compromising the safety or efficacy of the new regimens.

TB Vaccines

FIGURE 10

TB Vaccines: $78,446,298



Funders with investments under 2%

Funder	Amount
UK DoH	$1,499,860
UK HPA/NIHR	$1,171,391
New Funders Under $500K	$1,054,943
Australia NHMRC	$535,797
CIHR	$433,165
Institut Pasteur	$312,899
Wellcome Trust	$183,818
South Africa DST	$130,500
Fondation Merieux	$61,243
Sweden (reported)	$51,448
US NHLBI, NIH	$30,653
Thrasher Research Fund	$8,333
Korea (reported)	$8,200

After experiencing no growth in 2009, the TB vaccines category suffered a 29% funding drop, from $110 million to $78.4 million in 2010—the steepest decline ever recorded for vaccines research since 2005. Though five of the top ten R&D funders invested in vaccines, they each reduced their investments from as little as 4% to as much as 45% compared to 2009 investment levels.

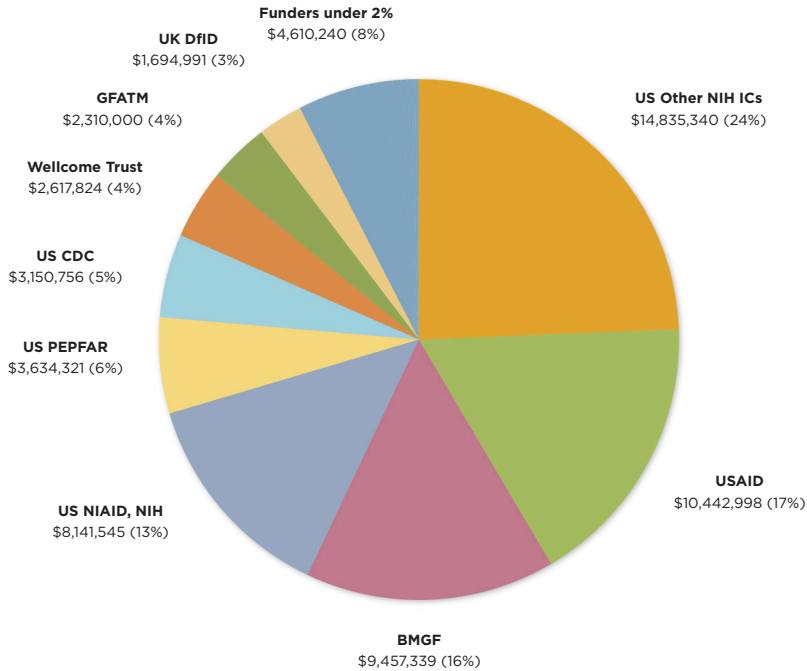
Investments from the two leading vaccine donors, the BMGF and NIAID, fell 36% and 34%, respectively. The largest TB vaccine grant issued by the BMGF in 2010 (worth $28.7 million) was awarded to the Aeras Global TB Vaccine Foundation as part of their five-year $200 million grant to develop and license an improved vaccine against TB for use in high-burden countries.

The 2010 $78.4 million TB vaccine investment is woefully inadequate and falls $301.5 million short of the *Global Plan's* $380 million target. Funding for vaccine research has never been more urgent. Ten new vaccine candidates presently in clinical trials will not be able to move along the pipeline if there is no adequate and sustainable funding—especially funding to scale-up infrastructure to conduct these complex later-stage trials.[11]

Operational Research

FIGURE 11

Operational Research: $60,895,355



Funders with investments under 2%

Funder	Amount
EC	$728,987
Australia NHMRC	$725,102
DGIS	$721,999
UBS Optimus Foundation	$540,800
CIHR	$508,063
Damien Foundation	$405,416
Switzerland (reported)	$288,500
New Funders Under $500K	$262,249
Brazil (reported)	$153,165
UK MRC	$128,433
WHO	$99,526
India (reported)	$48,000

Funding to support operational research in 2010 grew 23%, from $49.5 million to $60.9 million. Unlike in past years, this year's new leading funder of operational research was the NIH's other ICs with a $14.8 million investment, followed by the U.S. Agency for International Development's $10.4 million contribution.

The BMGF—which historically funded operational research the most—decreased its investment by 33%, from $14.1 million to $9.5 million, making it the third leading funder of operational research.

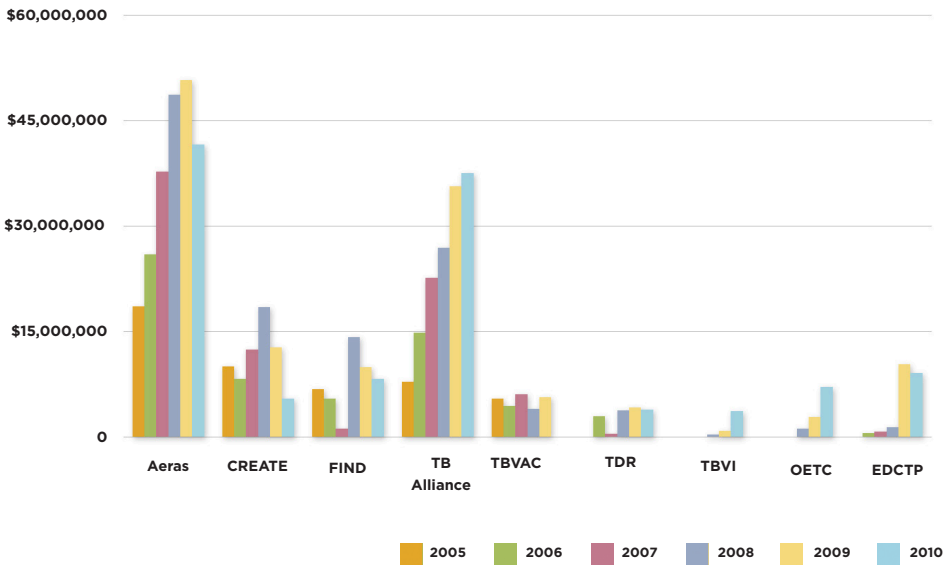
In 2010, the GFATM reported investing $2.3 million on program-based operational TB research—the first time TAG has been able to track GFATM's contribution. Tracking of the GFATM's investment data, which is difficult to collect and consolidate, is a first step in documenting the important role GFATM plays in supporting national TB programs and other Global Fund principal recipients in their efforts to evaluate existing TB control strategies and new tools in programmatic settings.

As outlined in the *Global Plan*, operational research is key for producing the evidence that lays the groundwork for improving current strategies and introducing new tools. Of the five research areas, the 2010 investment in operational research came the closest to meeting the annual target, reaching 76% of the $80 million target. This is excellent progress in a much needed research area that is involved in ensuring better access to people who need quality TB care as well as best uptake of new tools and strategies to diagnose, treat, and prevent TB efficiently. To promote and support this further, the Stop TB Partnership, in collaboration with the WHO Stop TB Department and the GFATM, developed a document titled *Priorities in Operational Research to Improve Tuberculosis Care and Control*. This document describes the priority areas in which knowledge gaps hamper optimal implementation of TB control activities and, for each of these areas, provides a list of the critical questions that must be addressed together with a synopsis of suitable study designs and methods required to respond to these questions.

Product Development Partnerships and Research Consortia

FIGURE 12

TB R&D PDPs and Research Consortia: 2005—2010



	Aeras	CREATE	FIND	TB Alliance	TBVAC	TDR	TBVI	OETC	EDCTP
	$18,580,139	$10,000,000	$6,778,239	$7,874,983	$5,445,450	N/A	N/A	N/A	N/A
	$25,923,809	$8,298,826	$5,492,942	$14,808,362	$4,451,895	$2,995,748	N/A	N/A	$580,039
	$37,704,051	$12,375,000	$1,145,409	$22,624,182	$6,091,335	$453,382	N/A	N/A	$805,625
	$48,679,266	$18,493,585	$14,177,202	$26,885,734	$3,944,425	$3,817,352	$339,741	$1,196,000	$1,416,064
	$50,792,515	$12,786,985	$9,975,320	$35,643,490	$5,634,040	$4,243,264	$841,333	$2,851,000	$10,343,479
	$41,572,980	$5,410,545	$8,212,896	$37,538,794	Concluded	$3,900,000	$3,700,914	$7,142,159	$9,081,799

Product development partnerships (PDPs) and research consortia play a vital role in accelerating TB drug, diagnostic, and vaccine development by bringing together public, private, and philanthropic donors to share resources and research knowledge. Since PDPs are nonprofit institutions and recipients of public, private, and philanthropic funding, they are not considered original source funders and thus their disbursements are not counted toward the global TB R&D investment total.

In 2010, eight PDPs and research consortia disbursed $116.6 million in TB R&D, a 12% decline from 2009 and a 140% increase since 2005. The 2010 data includes new disbursement data from OETC and the EDCTP, a clinical trials network funded by the European Commission's Sixth Framework Program through 2015.[12]

CREATE, a research consortium funded by BMGF, experienced the largest funding decline when it began winding down its three TB/HIV operational research studies in 2010. The ten-year project is set to conclude in 2012.

Top Ten Funders in TB R&D in 2010

In 2010, 74 donors reported spending $630.4 million in TB R&D. The top ten funders contributed $506.4 million, or 80% of total global spending. NIAID and the BMGF continued to invest the largest sums—over $100 million each—and represent 55% of the $506.4 million investment from the top ten donors. This year, TAG observed increases in private-sector investments toward TB drugs, with three companies making the top ten list (Otsuka, Company X, and AstraZeneca)—an encouraging sign for TB drug and regimen development.

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

In 2010, NIAID granted 320 awards worth $158 million to TB R&D. Though this amount represents the largest TB R&D investment of 2010, NIAID's funding was 7% lower than in 2009, with ARRA stimulus funding making up 13%, or $20.3 million, of NIAID's 2010 investment.

Despite reducing its funding in basic science and vaccines—two research areas in which investments fell 23% and 34%, respectively—NIAID remained the primary funder of basic science and TB diagnostics, and the second leading funder of TB drugs and vaccines in 2010. Funding for TB diagnostics climbed 70%, from $9.4 million to $15.8 million, as did TB drugs, from $32.4 million to $41.9 million. Such increases are part of NIAID's 2009 NIH Challenge Grants in Health and Science Research program, calling for research to address important challenges in biomedical and behavioral research. This program, funded by the ARRA stimulus package for fiscal years 2009–2010, focused on clinical research to develop diagnostics and drugs for MDR-TB or extensively drug-resistant TB (XDR-TB) in order to meet the urgent demand for improved technologies that prevent, detect, and treat MDR- and XDR-TB.[13]

Since 2009, ARRA stimulus funds have catalyzed important research to address the most urgent challenges in health research, and the TB field—particularly basic science—has benefitted greatly from that support (see Table 3).

Table 3

2009—2010 ARRA TB Funding

	ARRA 2009 Spending	% of Total	ARRA 2010 Spending	% of Total	% change from 2009 to 2010
Basic Science	$12,819,004	47.9%	$14,886,114	42.1%	16.1%
Infrastructure/Unspecified	$3,536,292	13.2%	$6,644,829	18.8%	87.9%
Diagnostics	$662,987	2.5%	$3,916,366	11.1%	490.7%
Drugs	$4,763,420	17.8%	$6,916,605	19.6%	45.2%
Vaccines	$3,851,879	14.4%	$2,201,443	6.2%	-42.8%
Operational Research	$1,151,480	4.3%	$764,526	2.2%	-33.6%
TOTAL	**$26,785,062**		**$35,329,883**		**31.9%**

As TAG suggested in the 2010 report, NIH funding is gravely threatened by U.S. budget cuts. The expiration of the ARRA stimulus package in 2011 and President Obama's 2013 budget proposal—which recommends flatlining the NIH budget—present potentially catastrophic effects on the future ability to control and eliminate TB (see Table 4).

Table 4

2005—2010 NIH Funding for Select Infectious Diseases (in USD millions)

	2005	2006	2007	2008	2009*	2010*
HIV/AIDS	$2,921	$2,902	$2,906	$2,928	$3,338	$3,407
Smallpox	$187	$149	$142	$94	$98	$97
Anthrax	$183	$150	$160	$134	$115	$130
Tuberculosis	$158	$150	$188	$142	$216	$224
Malaria	$104	$98	$112	$142	$121	$148

* Includes ARRA stimulus funds

NIH Estimates of Funding for Various Research, Condition, and Disease Categories (RCDC)
Accessed 9 Septemb

2. The Bill & Melinda Gates Foundation (BMGF)

As the second largest investor in TB R&D, the BMGF has made important contributions to TB basic science, drug, diagnostics, vaccine development, and operational research. The foundation's short-term TB priorities are to develop new drug regimens that are safe and effective and reduce the duration of TB treatment, and to improve molecular diagnostics for TB. Its long-term strategy includes the development of a preventive vaccine effective against all forms of TB as well as research to produce the much-needed POC diagnostic test for use in health post and community settings.

While the foundation's investment remained stable at $115.3 million in 2010, investments in basic science, vaccines, TB drugs, and operational research declined. Funding for TB drugs dropped 14%, from $24 million to $20.7 million; funding for operational research dropped 33%, from $14 million to $9.5 million; and funding for TB vaccines fell 36%, from $47.6 million to $30.4 million. The sharpest drop was observed in basic science, with a 79% decline, from $21.3 million to $4.4 million. Infrastructure/unspecified R&D rose from $0 to $35.5 million, and TB diagnostics from $7.4 million to $14.7 million.

3. Otsuka Pharmaceutical Company

Otsuka is a Japanese-based company recruiting study participants for a phase III study of delamanid (OPC-67683), a nitroimidazole compound, for the treatment of MDR-TB. For a third consecutive year Otsuka ranked third among the top ten funders list in 2010, investing $63.6 million in TB drug development.

Delamanid is currently in the early stages of phase III, and pending favorable study outcomes, may qualify for accelerated regulatory approval with the EMA by the end of 2012. Otsuka is committed to the full development of this anti-TB drug but warns that lack of clear regulatory guidance could become a major roadblock to the development of delamanid—which is one of two new class TB drugs to be developed in 50 years. Another notable and more immediate concern as the drug enters complex late-stage trials is the lack of adequate laboratory capacity for diagnosing MDR-TB.

4. Other NIH Institutes and Centers (Other NIH ICs)

Since TAG first embarked on this resource-tracking exercise in 2005, the report has published data on two NIH institutes—NIAID and the NHLBI—and the remaining 25 NIH research institutes have been aggregated into the "US other NIH Institutes and Centers" category. In addition to AstraZeneca—a top ten funder that reported a 57% increase in 2010—the other NIH ICs also witnessed a notable 42% increase in TB R&D investments, from $36.9 million in 2009 to $52.4 million.

As a result of increased investment, other NIH ICs funding for basic science ($16.2 million), operational research ($14.8 million), and TB drug development ($5.3 million) grew by 56%, 85%, and 81%, respectively. TB vaccines funding remained flat at $1.8 million.

Of the $52.4 million budget, $14.8 million of ARRA funding made up 28% of the other NIH ICs budget and supported 32 of the 198 awards issued in 2010.

5. The European Commission (EC)

The EC is comprised of several research funding programs, such as the EC's Sixth and Seventh Framework Programs, the Directorate-General's Research and Innovation Division, and the ERC.

For 2010, the EC reported low-budget figures because many projects that began in 2009 are expected to receive their second installments in 2011. Based on the best available data, the EC invested a total of $25.9 million in TB R&D in 2010—with 41% supporting vaccine research ($10.6 million). The EC's TB research priorities include research to develop new diagnostics, therapies, and preventive tools ranging from basic molecular research to preclinical tests. The EC is particularly interested in TB research that addresses MDR-TB.

6. Company X

Company X is a private company studying new TB therapy. Between 2009 and 2010, Company X's investments grew 3%, from $20.1 million to $20.6 million.

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

With an 8% investment increase, from $18.5 million to $19.9 million, the CDC was the seventh largest TB R&D funder. The CDC supports TB R&D through the TB Trials Consortium and the TB Epidemiological Studies Consortium, which make up over 85% of the organization's external funding for TB research. Both consortia are funded for ten years and focus on TB diagnostics, clinical management, prevention, and strengthening scientific research capacity. In 2010, the TB drugs category received the largest share of CDC funding (55%), followed by infrastructure/unspecified (20%), and operational research (16%). While the CDC is interested in TB vaccine R&D, it did not invest in TB vaccine development in 2010.

8. The U.S. Agency for International Development (USAID)

In 2010, USAID funding for TB R&D grew for the fourth consecutive year. Annual US-AID investment between 2009 and 2010 rose 28%, to $19.8 million, with the majority

of the funding going toward operational research ($10.4 million) and TB drug development ($7 million).

USAID's top TB priorities are the development of new TB drugs and diagnostics, as well as improving the delivery of TB/HIV care and the performance and accessibility of directly observed treatment–short course in programmatic settings.

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

In 2010, TB investment on the part of the UK DfID fell 5.2%. TB vaccine funding declined 45%, from $6.6 million to $3.6 million. Operational research funding fell by 6%. Investment in TB drugs grew 14%, from $9.4 million to $10.7 million. The UK DfID made modest new contributions to infrastructure/unspecified and TB diagnostics research. Its largest investments—in TB drugs and TB vaccines—reflect the agency's commitment to supporting the development and scale-up of new and affordable tools for populations most affected by TB. As part of its long-term strategy, the UK DfID is beginning to include new diagnostics research for TB among people with HIV as a priority area.

10. AstraZeneca

AstraZeneca is a pharmaceutical company with a TB research center based in Bangalore, India, that is expanding its research portfolio to deliver new TB drug candidates for clinical development. The most advanced compound is AZD5847, which entered phase I testing in December 2009 after it showed favorable results in preclinical studies against MDR-TB.

In 2010, AstraZeneca's investment in TB drugs rose 57%, from $8.9 million to $14 million, placing it among the top ten funders for the very first time. Pending favorable study outcomes from its phase I trial, AstraZeneca will partner with external organizations to further AZD5847's clinical development.

Such partnerships are already happening. In May 2010, AstraZeneca and the Global TB Alliance formed a research collaboration aimed at advancing TB drug discovery and development by sharing resources in a joint portfolio.[14] And most recently, in March 2011, AstraZeneca joined a new research consortium, More Medicines for Tuberculosis—a European Commission Sixth Framework Program funding venture—made up of 25 partners to introduce 10 to 20 compounds into the clinical pipeline and develop 2 to 3 TB drugs to be used in a new regimen.[15,16]

3. Conclusions & Recommendations

3.1 Conclusions

The TB R&D 2011 Report on Tuberculosis Research Funding Trends, 2005-2010, second edition, finds that investments in TB research witnessed a 76% increase over 2005 levels, but only minimal growth (2%) since 2009 (see Table 5). Seventy-four funders invested $630.4 million across six research areas to support scientific breakthroughs in TB drugs, vaccines, and diagnostics—only one-third of the annual $2 billion global need.

Table 5

Summary of Changes in TB R&D Investments, 2005—2010, in USD

Year	Total TB R&D Investment	Change Over Previous Year ($)	Change Over Previous Year (%)	Change Over 2005 ($)	Change Over 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	$619,209,536	$127,732,619	26.0%	$261,783,415	73.2%
2010	$630,446,462	$11,236,926	1.8%	$273,020,341	76.4%

TB drug development received $230.5 million—the greatest share of funding in 2010—but it only accounted for 31% of the annual $740 million *Global Plan* target. In addition to TB drugs, investments in infrastructure/unspecified, operational research, and TB diagnostics all grew since 2009. However, funding for basic science and vaccines fell 25% and 29%, respectively.

Of the six research categories, the only one that came close to reaching the *Global Plan* target was operational research (76% of the $80 million target), while the biggest percentage gap was seen in TB diagnostics (14% of the $340 million target).

While global TB R&D funding grew a mere 2% in 2010, public-sector funding fell 5%, from $395.3 million to $376.2 million, and philanthropic investments remained stable at $124 million. Private-sector funding grew 24%, from $100 million to $124.2 million, and multilateral funding also increased from $0.5 million to $6 million.

Increased investments from the private sector in 2010 offer an encouraging sign about improved clinical drug pipeline activity and the prospects of Otsuka's drug candidate, delamanid, achieving accelerated regulatory approval for treatment of MDR-TB this year.

In 2010, NIAID continued to be the leading TB R&D funder. However, with the expiration of the ARRA package in 2011 and President Obama's 2013 budget proposal, NIH funding for TB is likely to decline. Now more than ever, increased investments from middle-income countries are necessary to close the $1.4 billion gap in TB R&D funding.

3.2 Recommendations

Scientific progress in TB R&D is beginning to speed up after half a decade of increasing investment. Two new drugs are being or have already been submitted to regulatory authorities this year for accelerated approval. In earlier testing are some innovative combination regimens to treat both drug-sensitive and drug-resistant TB. A TB POC test and better drug susceptibility testing are still urgently needed. Meanwhile, new approaches to TB vaccine discovery are being applied. The armamentarium of new candidate TB drugs, diagnostics, and vaccines is fuller than it has been in half a century. To protect this progress from eroding, there is an urgent need for emerging economies to scale up their investments and for donors and implementers to increase their collaboration.

In this respect, the Research Movement of the Stop TB Partnership developed the *International Roadmap for Tuberculosis Research*, which describes the key priorities and critical questions to be addressed in the areas of fundamental research, diagnostics, drugs, vaccines, operational, public health, and epidemiological research in order to meet the Stop TB Partnership's goals.[17] The *Roadmap* encompasses the continuum of TB research and is designed to reinvigorate and promote research worldwide, from the laboratory to the bedside of a person affected by the disease. It is proposed as

a vehicle and framework upon which transformational and outcome-oriented focus areas can be constructed for better TB research internationally toward elimination of the disease.

In addition to recommending a $1.4 billion investment increase to close the funding gap, TAG documented four key recommendations from TB research donors and recipients—including the EC, Otsuka, the BMGF, the Max Planck Institute for Infection Biology, the CDC, and the Global TB Alliance—that could help accelerate the TB R&D agenda:

1. Greater investment in basic science to gain fundamental knowledge of the TB infection process and inform drug, diagnostics, and vaccine development processes to prevent and/or treat TB. The biomarker discovery work is critical to discover and validate biomarkers to be used as study endpoints to reduce the length and cost of TB drug trials and modernize regulatory science for TB. Biomarkers for a TB POC test could also revolutionize TB care.

2. Support of efficient and open access sample banks that house well-characterized samples of blood, urine, sputum, and other relevant specimens to facilitate the identification and validation of biomarkers.

3. Increased funding to enhance clinical trial capacity for all stages of TB drug and vaccine trials.

4. More guidance on regulatory approval requirements clarifying the use of new validated study endpoints to allow for shorter TB drug trials.

Only by close coordination among these players and a strong advocacy network will the world achieve the scientific breakthroughs needed to eliminate TB by 2050 and prevent the loss of the nearly 1.45 million lives that TB claims annually.

Appendix 1

Table 6.1

2010 and 2009 Top Reporting TB R&D Funders

2010 Rank	2009 Rank	FUNDING ORGANISATION	FUNDER TYPE
1	1	US NIAID, NIH	P
2	2	Bill & Melinda Gates Foundation (BMGF)	F
3	3	Otsuka Pharmaceutical	C
4	5	US Other NIH Institutes & Centers (US Other NIH ICs)	P
5	4	European Commission: Research Directorate-General (EC)	P
6	7	Company X	C
7	8	US Centers for Disease Control (US CDC)	P
8	10	United States Agency for International Development (USAID)	P-D
9	9	UK Department for International Development (UK DfID)	P-D
10	12	AstraZeneca	C
11	11	US NHLBI, NIH	P
12	6	UK Medical Research Council (UK MRC)	P
13	29	Institut Pasteur	P
14	15	Wellcome Trust	F
15	23	Novartis	C
16	21	Canadian Institutes for Health Research (CIHR)	P
17	13	Dutch Ministry of Foreign Affairs - Directorate General of Development Cooperation (DGIS)	P-D
18	16	German Federal Ministry of Education and Research (BMBF)	P
19	19	Company Y	C
20	84	World Health Organization (WHO)	M
21		US President's Emergency Plan for AIDS Relief (US PEPFAR)	P-D
22	22	Sequella	C
23	23	Pfizer Inc	C
24	20	Statens Serum Institut (SSI)	P
25	19	UK Health Protection Agency/National Institute for Health Research (UK HPA/NIHR)	P
26	25	Max Planck Institute for Infection Biology (MPIIB)	P
27		Sandoz	C

TOTAL USD	Basic Science	Infrastructure/ Unspecified	Diagnostics	Drugs	Vaccines	Operational Research
$158,030,390	$56,087,492	$23,199,096	$15,827,177	$41,871,408	$12,903,672	$8,141,545
$115,259,533	$4,426,910	$35,489,161	$14,728,436	$20,707,825	$30,449,862	$9,457,339
$63,648,753	$0	$0	$0	$63,648,753	$0	$0
$52,363,574	$16,231,201	$12,512,524	$1,664,190	$5,290,414	$1,829,905	$14,835,340
$25,866,089	$4,469,373	$2,011,431	$411,115	$7,670,696	$10,574,487	$728,987
$20,645,794	$0	$0	$0	$20,645,794	$0	$0
$19,865,178	$0	$4,039,629	$1,706,565	$10,968,228	$0	$3,150,756
$19,791,027	$0	$500,000	$1,802,000	$7,046,029	$0	$10,442,998
$16,912,287	$0	$44,996	$749,930	$10,775,450	$3,646,920	$1,694,991
$14,023,381	$0	$0	$0	$14,023,381	$0	$0
$13,682,412	$10,447,479	$979,210	$2,225,070	$0	$30,653	$0
$13,567,720	$9,368,082	$0	$118,609	$2,172,823	$1,779,773	$128,433
$11,631,674	$7,753,672	$0	$646,043	$2,919,059	$312,899	$0
$5,963,591	$2,159,208	$305,338	$440,928	$256,475	$183,818	$2,617,824
$5,730,352	$5,730,352	$0	$0	$0	$0	$0
$4,445,356	$1,056,492	$189,394	$655,462	$1,602,780	$433,165	$508,063
$4,333,160	$0	$0	$939,030	$500,560	$2,171,571	$721,999
$4,226,003	$1,900,599	$55,960	$31,601	$474,044	$1,763,798	$0
$4,000,000	$0	$0	$4,000,000	$0	$0	$0
$3,650,090	$285,129	$3,516	$0	$3,261,920	$0	$99,526
$3,634,321	$0	$0	$0	$0	$0	$3,634,321
$3,564,212	$0	$0	$244,104	$3,320,108	$0	$0
$3,533,561	$169,895	$0	$0	$3,363,666	$0	$0
$3,452,820	$0	$0	$0	$0	$3,452,820	$0
$3,413,681	$962,910	$1,279,381	$0	$0	$1,171,391	$0
$3,100,000	$1,500,000	$0	$0	$0	$1,600,000	$0
$3,000,000	$0	$0	$0	$3,000,000	$0	$0

P = Public Sector R&D Agency P-D = Public Sector Development Agency
F = Foundation/Philanthropy C = Corporation/Private Sector M = Multilateral

Appendix 1 (continued)

Table 6.2

2010 and 2009 Top Reporting TB R&D Funders (continued)

2010 Rank	2009 Rank	FUNDING ORGANISATION	FUNDER TYPE
28	26	Emergent Biosolutions	C
29	34	Australian National Health and Medical Research Council (Australia NHMRC)	P
30	69	The Global Fund to Fight AIDS, Tuberculosis, and Malaria (GFATM)	M
31	33	Sweden (reported)	P
32	17	India (reported)	P
33	40	UBS Optimus Foundation	F
34	32	Eli Lilly and Company	C
35	63	UK Department of Health (UK DoH)	P
36	43	Japan (reported)	P
37	36	Irish Aid - Ireland Development Corporation	P-D
38	42	PEPSICO	C
39	44	Switzerland (reported)	P
40	68	Korea (reported)	P
41	41	South African Department of Science and Technology (DST)	P
42	28	Agence Nationale de Recherche sur la SIDA (ANRS)	P
43	27	Norway (reported)	P
44	35	Brazil (reported)	P
45	51	Damien Foundation	F
46	57	Carlos III Health Institute	P
47	53	US Food and Drug Administration (US FDA)	P
58	55	Stanley Thomas Johnson Foundation	F
63	49	World Health Organization (WHO): Stop TB Partnership	M
65	73	Fondation Merieux	F
71	66	Thrasher Research Fund	F
		New Funders Under $500K	
		Grand Total	

TOTAL USD	Basic Science	Infrastructure/ Unspecified	Diagnostics	Drugs	Vaccines	Operational Research
$2,791,239	$0	$0	$0	$0	$2,791,239	$0
$2,549,818	$486,257	$190,859	$0	$611,802	$535,797	$725,102
$2,310,000	$0	$0	$0	$0	$0	$2,310,000
$2,034,384	$1,566,878	$97,751	$0	$318,307	$51,448	$0
$1,654,804	$845,402	$761,401	$0	$0	$0	$48,000
$1,625,000	$0	$0	$780,000	$304,200	$0	$540,800
$1,500,000	$0	$0	$0	$1,500,000	$0	$0
$1,499,860	$0	$0	$0	$0	$1,499,860	$0
$1,270,204	$0	$1,270,204	$0	$0	$0	$0
$1,221,470	$0	$0	$0	$1,221,470	$0	$0
$1,153,583	$1,153,583	$0	$0	$0	$0	$0
$1,092,053	$743,784	$0	$0	$59,769	$0	$288,500
$1,008,200	$0	$0	$0	$1,000,000	$8,200	$0
$978,750	$848,250	$0	$0	$0	$130,500	$0
$974,075	$0	$0	$0	$974,075	$0	$0
$717,382	$0	$0	$717,382	$0	$0	$0
$672,433	$0	$215,212	$304,056	$0	$0	$153,165
$476,448	$0	$0	$71,032	$0	$0	$405,416
$460,556	$372,965	$0	$29,642	$57,949	$0	$0
$400,000	$0	$0	$0	$400,000	$0	$0
$138,851	$0	$0	$83,310	$55,540	$0	$0
$62,500	$0	$0	$0	$62,500	$0	$0
$61,243	$0	$0	$0	$0	$61,243	$0
$30,625	$0	$0	$13,375	$8,917	$8,333	$0
$2,428,023	$442,500	$0	$221,832	$446,500	$1,054,943	$262,249
$630,446,462	**$129,008,413**	**$83,145,063**	**$48,410,889**	**$230,540,443**	**$78,446,298**	**$60,895,355**

P = Public Sector R&D Agency P-D = Public Sector Development Agency
F = Foundation/Philanthropy C = Corporation/Private Sector M = Multilateral

Appendix 2

FIGURE 13

TB R&D Funders Ranked 1—10 That Invested Above $500,000 USD & Funders That TAG Has Tracked in Previous Years: 2005—2010

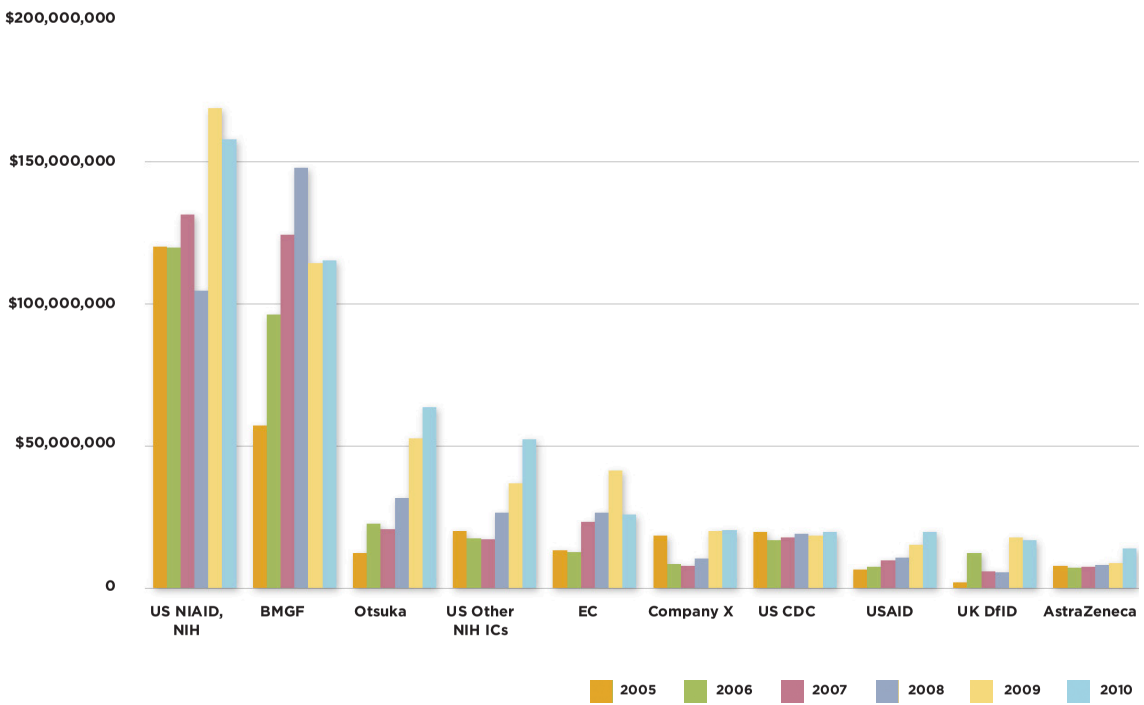


FIGURE 14

TB R&D Funders Ranked 11—20 That Invested Above $500,000 USD & Funders That TAG Has Tracked in Previous Years: 2005—2010

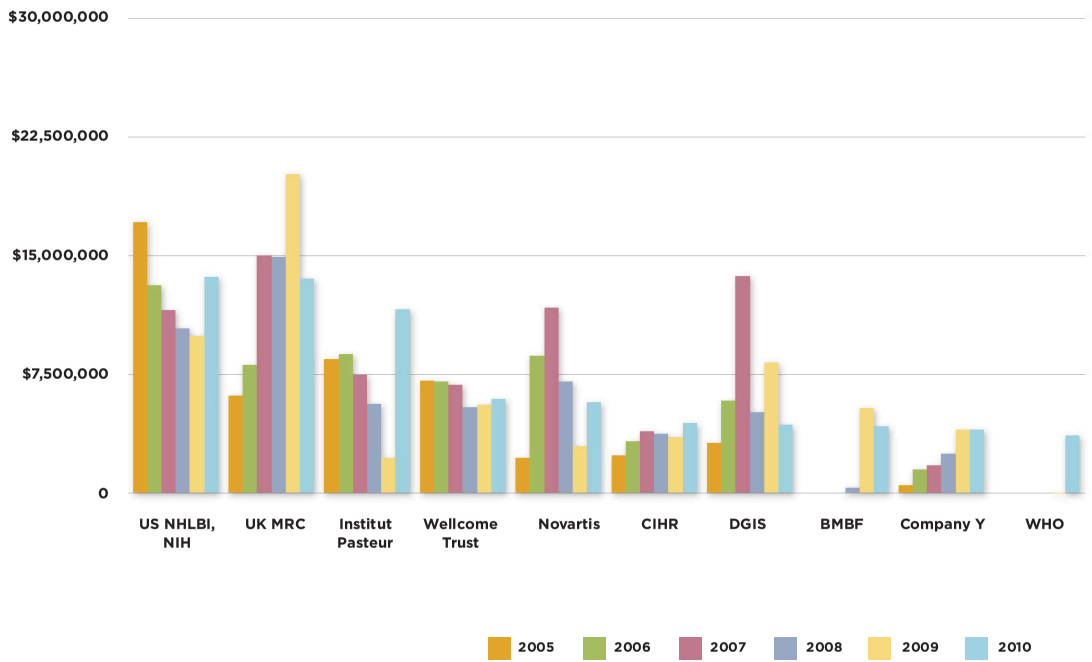


FIGURE 15

TB R&D Funders Ranked 21—30 That Invested Above $500,000 USD & Funders That TAG Has Tracked in Previous Years: 2005—2010

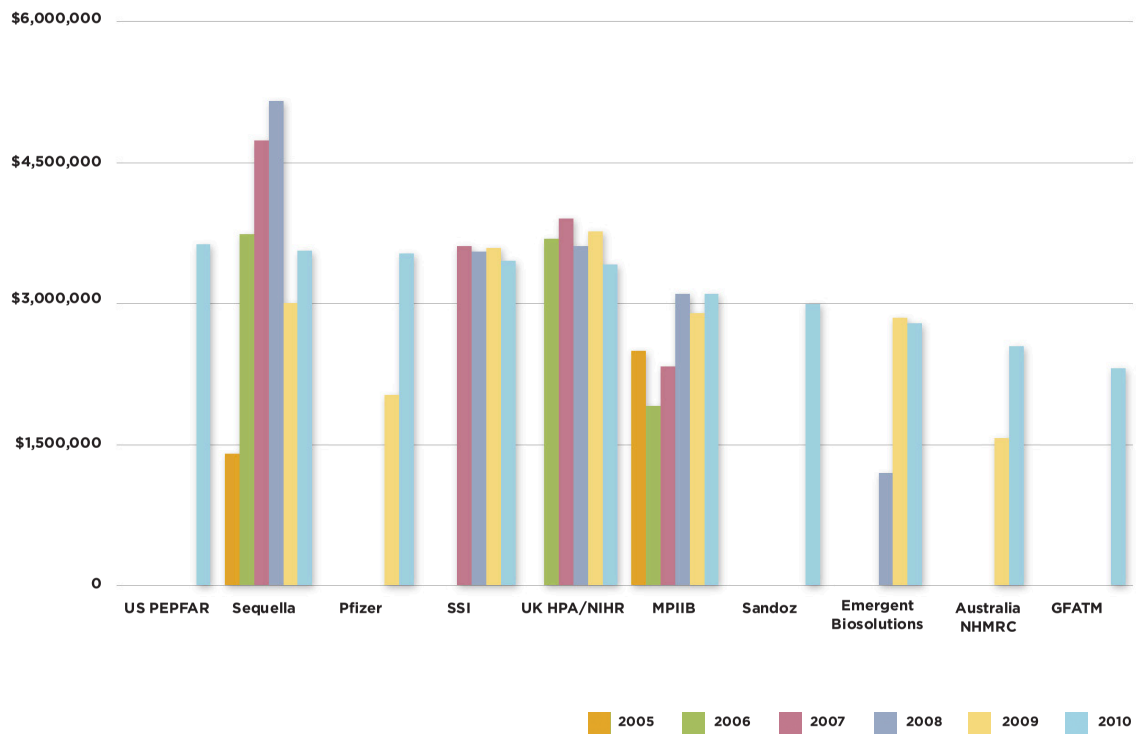


FIGURE 16

TB R&D Funders Ranked 31—41 That Invested Above $500,000 USD & Funders That TAG Has Tracked in Previous Years: 2005—2010

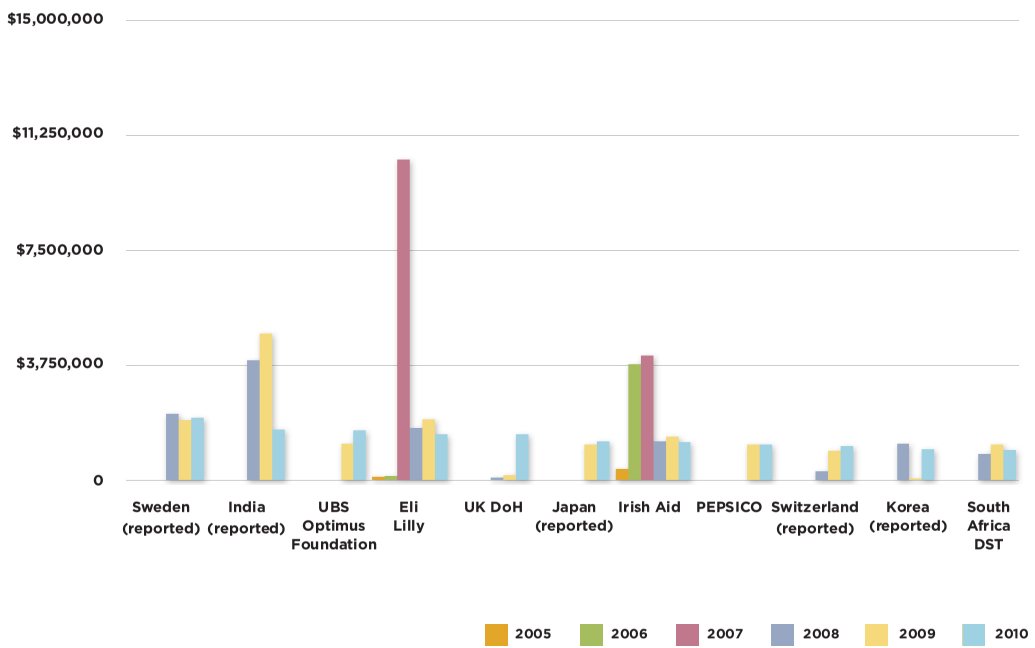


FIGURE 17

TB R&D Funders Ranked 42—71 That Invested Less Than $500,000 USD & Funders That TAG Has Tracked in Previous Years: 2005—2010

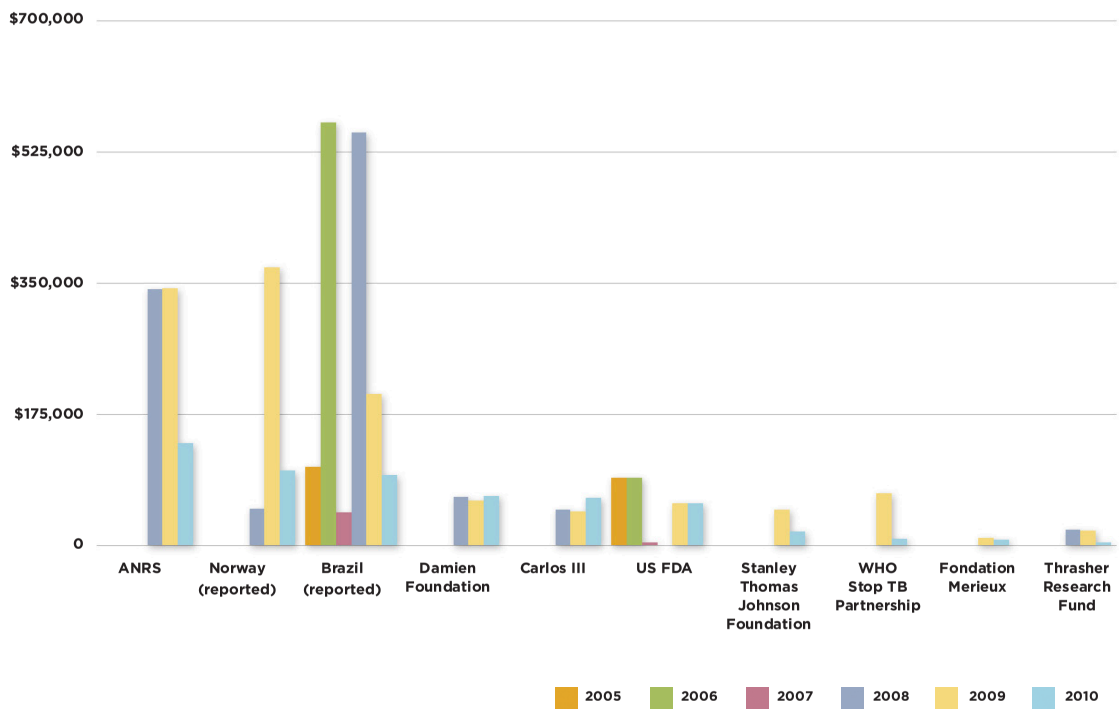


FIGURE 18

TB R&D Funders Inactive or Unresponsive in 2010, 1—10

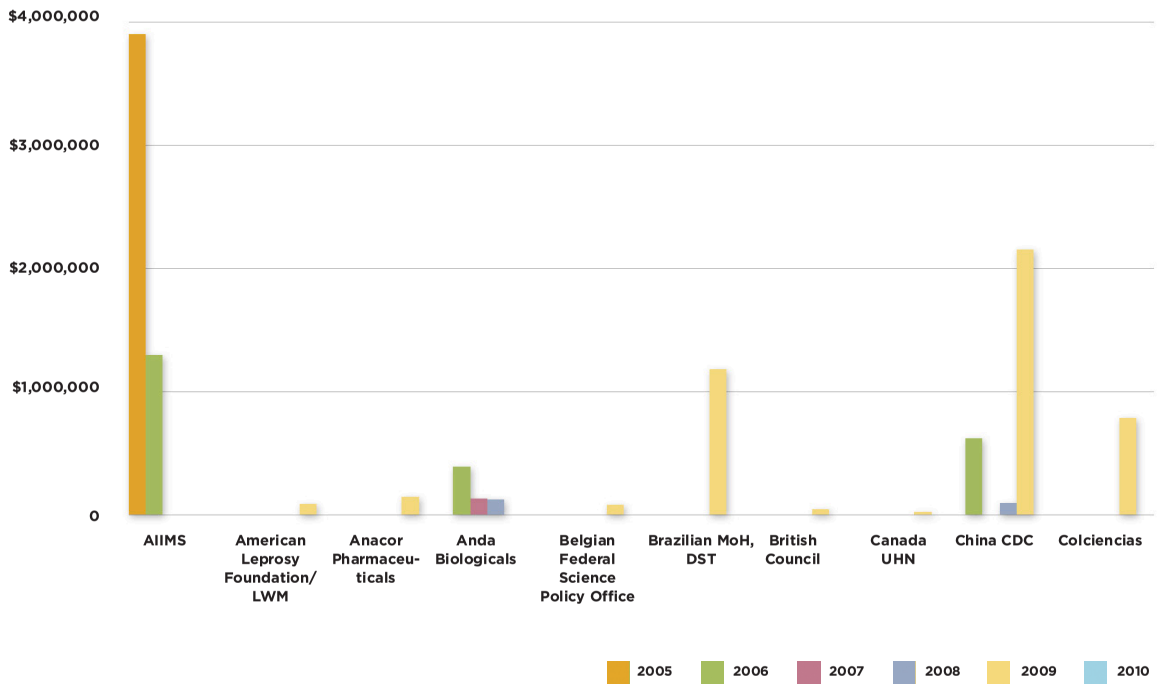


FIGURE 19

TB R&D Funders Inactive or Unresponsive in 2010, 11—20

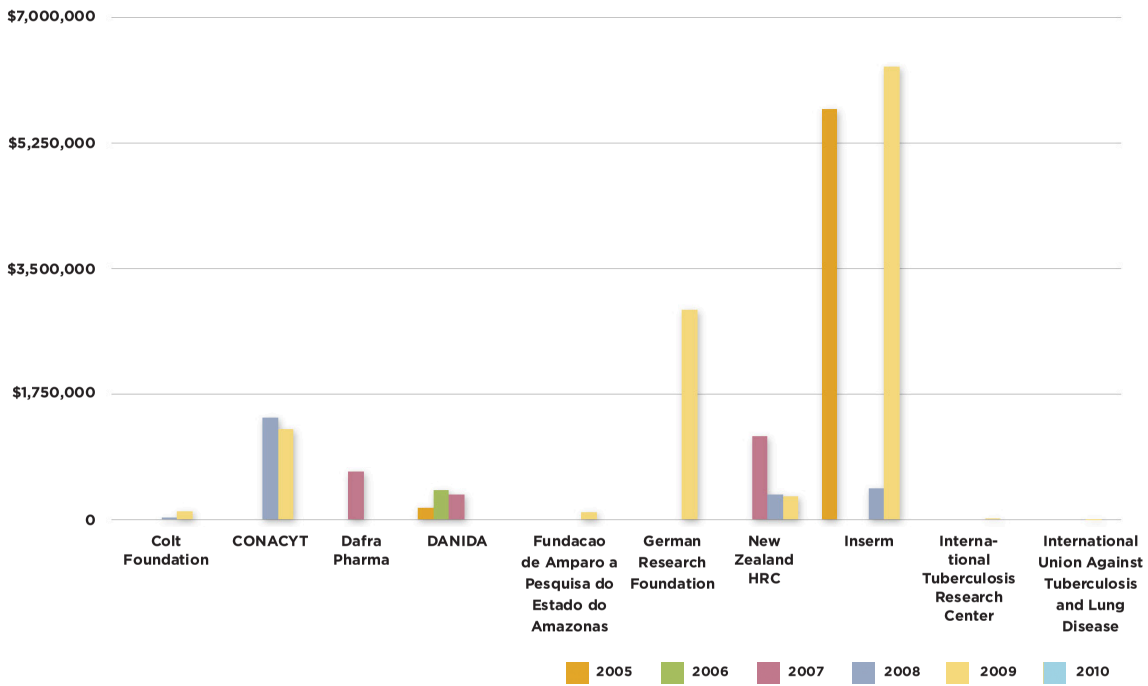


FIGURE 20

TB R&D Funders Inactive or Unresponsive in 2010, 21—30

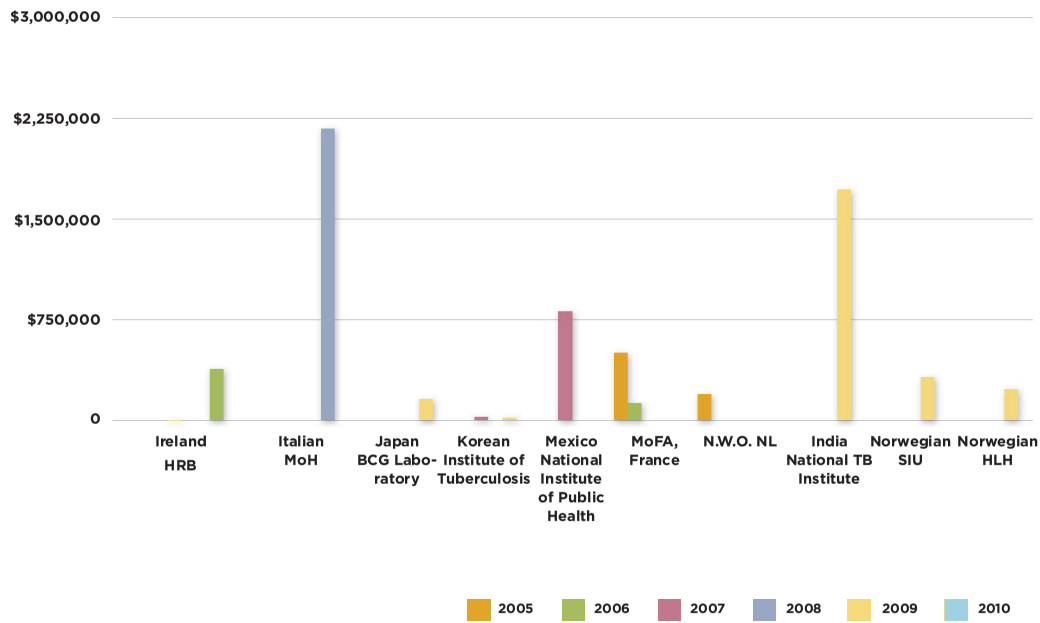
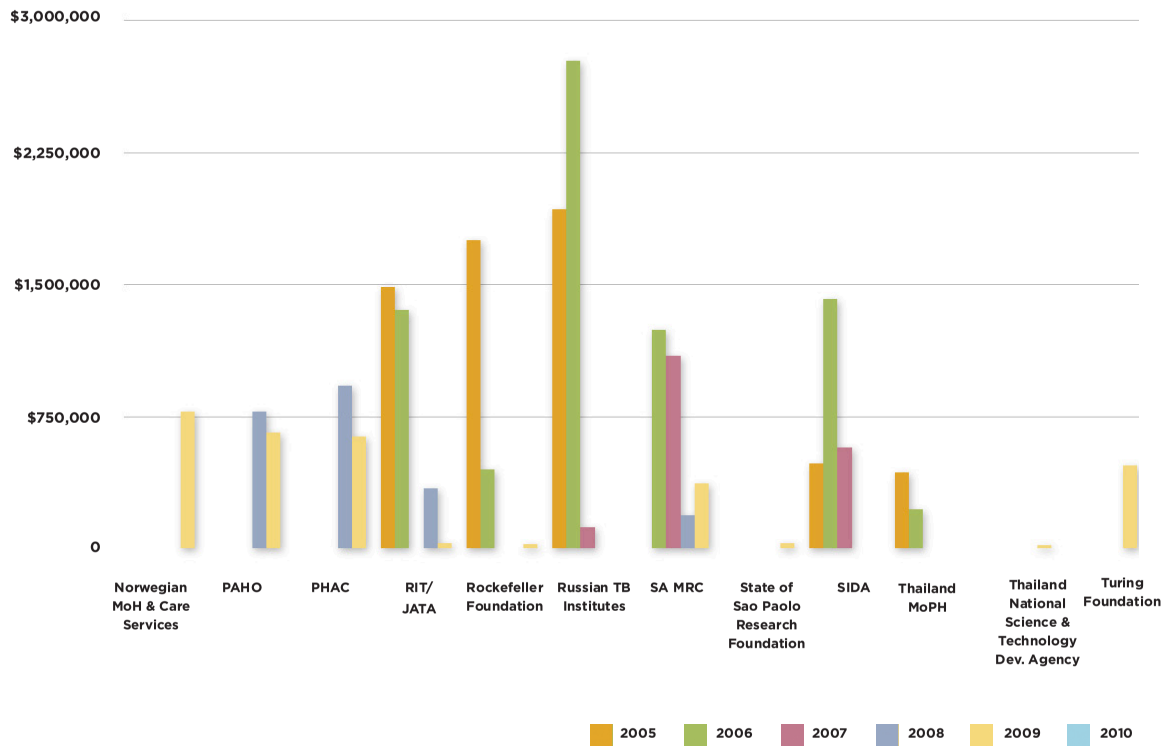


FIGURE 21

TB R&D Funders Inactive or Unresponsive in 2010, 31—42



Endnotes

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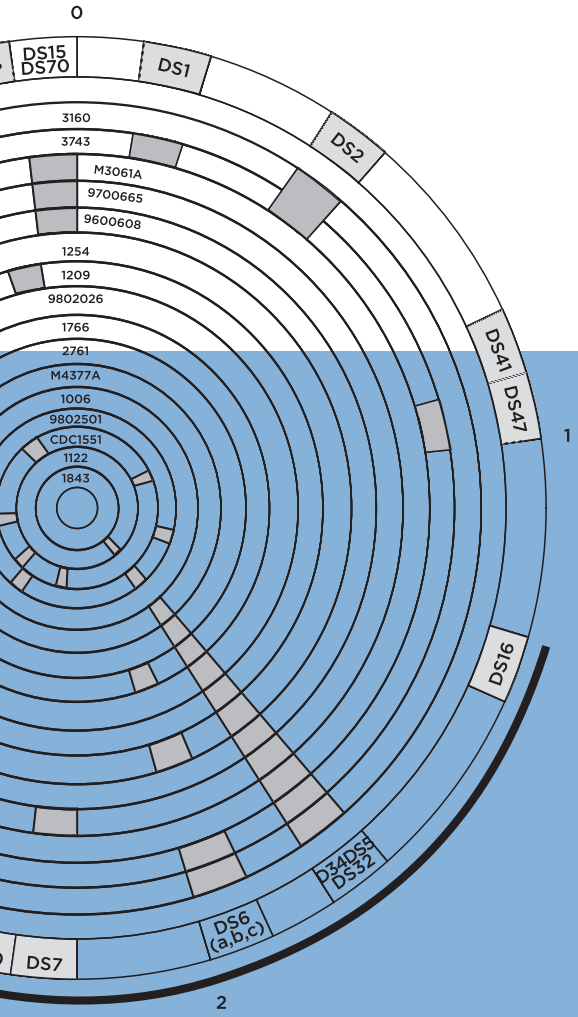

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