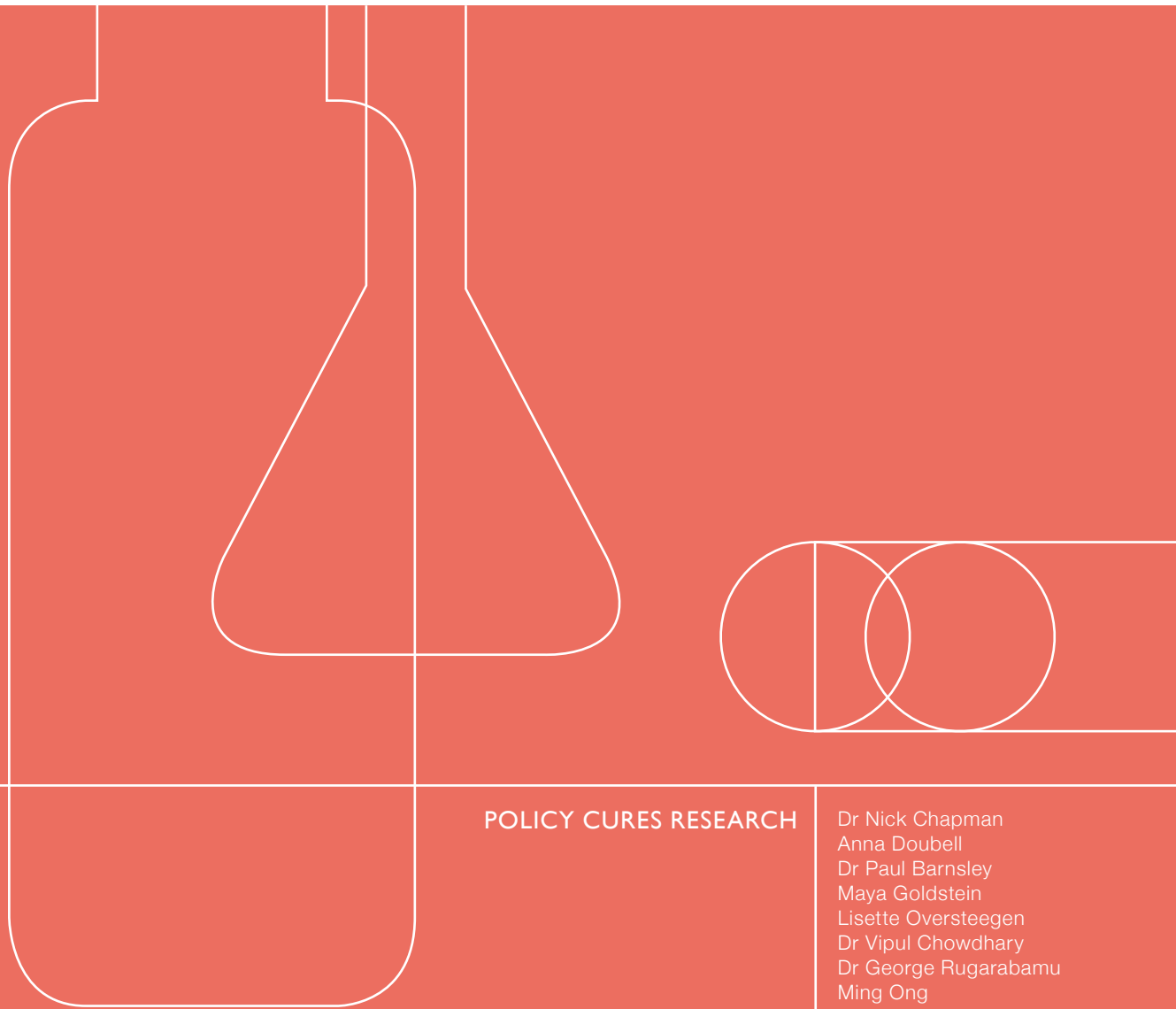G-FINDER | 2019

POLICY CURES RESEARCH.

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UNEVEN PROGRESS

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ACKNOWLEDGEMENTS

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GLOSSARY

ACT — Artemisinin-based combination therapy

Aggregate industry
Aggregate pharmaceutical and biotechnology companies

AIDS — Acquired immune deficiency syndrome

ALM — American Leprosy Missions

Australia - India SRF
Australia - India Strategic Research Fund

Australian NHF
Australian National Heart Foundation

Australian NHMRC
Australian National Health and Medical Research Council

Brazilian BNDES
Brazilian Development Bank

Brazilian DECIT
Brazilian Ministry of Health: Department of Science and Technology

Brazilian FAPEMIG
Brazilian Support Foundation for Research in the State of Minas Gerais

Brazilian FAPESP
Brazilian Support Foundation for Research in the State of São Paulo

Brazilian FINEP
Brazilian Innovation Agency

Canadian CIHR
Canadian Institutes of Health Research

Catalan DOH
Catalan Department of Health

CHAI — Clinton Health Access Initiative

CLTRF — Cebu Leprosy and Tuberculosis Research Foundation

CORDIS — Community Research and Development Information Service

DAA — Direct-acting antivirals

DAHW — German Leprosy and TB Relief Association

DALY — Disability-adjusted life year

DND*i* — Drugs for Neglected Diseases initiative

Dutch DGIS Dutch Ministry of Foreign Affairs - Directorate General of Development Cooperation

EAEC — Enteroaggregative *E. coli*

EC — European Commission – see the detailed discussion in the footnote to page 17

EDCTP — European and Developing Countries Clinical Trials Partnership

EID — Emerging infectious disease

EMA — European Medicines Agency

ETEC — Enterotoxigenic *E. coli*

FIND — Foundation for Innovative New Diagnostics

Flemish EWI Flemish Department of Economics, Science and Innovation

FP7 — The seventh Framework Programme for European Commission funding

French ANR French National Research Agency

French ANRS
French National Agency for Research on AIDS and Viral Hepatitis

French IRD French Research Institute for Development

FTE — Full-time equivalent

FY — Financial Year

Gates Foundation
Bill & Melinda Gates Foundation

Gavi Gavi, the Vaccine Alliance

GBD Global Burden of Disease Study

GDP Gross domestic product

German BMBF
German Federal Ministry of Education and Research

German DFG
German Research Foundation

G-FINDER Policy Cures Research's annual Global Funding of Innovation for Neglected Diseases study, including both the initial survey and the resulting report

GHIT fund Global Health Innovative Technology Fund

HBsAg Hepatitis B virus surface antigen

HBV Hepatitis B virus

HCV Hepatitis C virus

HIC 2018 World Bank listed high-income country

HIV Human immunodeficiency virus

IAVI International AIDS Vaccine Initiative

IDRI Infectious Disease Research Institute

IHME Institute for Health Metrics and Evaluation

IMI Innovative Medicines Initiative

IMPAACT network
International Maternal Pediatric Adolescent AIDS Clinical Trials Network

Indan DBT Indian Department of Biotechnology

Indian BIRAC
Indian Biotechnology Industry Research Assistance Council

Indian CSIR Indian Council of Scientific and Industrial Research

Indian ICMR Indian Council of Medical Research

Inserm French National Institute of Health and Medical Research

IPM International Partnership for Microbicides

IRS Indoor residual spraying

ISGlobal Barcelona Institute for Global Health

IVCC Innovative Vector Control Consortium

Japanese MHLW
Japanese Ministry of Health, Labour and Welfare

Japanese MOFA
Japanese Ministry of Foreign Affairs

LFA Lateral flow assays

LLIN Long-lasting insecticide treated bednets

LMIC 2018 World Bank listed low- and middle-income country

LRI Leprosy Research Initiative

mAb Monoclonal antibody

MDR-TB Multidrug-resistant tuberculosis

MIC 2018 World Bank listed middle-income country

MMV Medicines for Malaria Venture

MNC A multinational pharmaceutical company

MSF Médecins Sans Frontières

New Zealand HRC
Health Research Council of New Zealand

NSFC National Natural Science Foundation of China

NTS	Non-typhoidal *Salmonella enterica*
OWH	OneWorld Health
PCV	Pneumococcal conjugate vaccine
PDP	Product development partnership
PPP	Purchasing power parity
PrEP	Pre-exposure prophylaxis
R&D	Research and development
RDT	Rapid diagnostic tests
S&T Agency	A government agency with responsibilities which primarily centre on the advancement of science and technology
SBE	Snakebite envenoming
SME	A small pharmaceutical and biotechnology firm
South African DST	South African Department of Science and Technology
South African MRC	South African Medical Research Council
Spanish MAEUEC	Spanish Ministry of Foreign Affairs, European Union and Cooperation
Swedish SIDA	Swedish International Development Agency
Swiss SDC	Swiss Agency for Development and Cooperation
Swiss SNSF	Swiss National Science Foundation
TB	Tuberculosis
Thai GPO	Thailand Government Pharmaceutical Organisation
TLMI	The Leprosy Mission International
UK	United Kingdom

UK DFID	UK Department for International Development
UK DHSC	UK Department of Health and Social Care
UK MRC	UK Medical Research Council
US	United States
US CDC	US Centers for Disease Control and Prevention
US DOD	US Department of Defense
US FDA	US Food and Drug Administration
US NIAID	US National Institute of Allergy and Infectious Diseases
US NIH	US National Institutes of Health
USAID	US Agency for International Development
VCP	Vector control product
WHO	World Health Organization
WHO/TDR	World Health Organization Special Programme for Research and Training in Tropical Diseases
XDR-TB	Extensively drug-resistant tuberculosis

EXECUTIVE SUMMARY

The survey

Each year since 2007, the G-FINDER project has provided policy-makers, donors, researchers and industry with a comprehensive analysis of global investment into research and development (R&D) of new products to prevent, diagnose, control or cure neglected diseases in developing countries. It provides an up-to-date analysis of how R&D investments are being allocated across diseases and product types, funding trends over time, and where the potential gaps lie.

This is the twelfth annual G-FINDER report, providing new data on investments made in financial year 2018. In all, 262 organisations completed the survey for FY2018, which covered 36 neglected diseases and all relevant product types – drugs, vaccines, biologics, diagnostics, microbicides and vector control products (chemical and biological control agents, and reservoir targeted vaccines) – as well as basic research.

The 2018 survey added three new neglected diseases: hepatitis B, mycetoma and snakebite envenoming. It also removed the genotype restriction for hepatitis C, although restrictions to ensure that R&D is targeted at LMICs remain, and added vaccine R&D for leprosy. The therapeutic vaccine product category was expanded and relabelled as 'biologics', this category captures funding that was previously variously included under therapeutic vaccines, drugs and preventive vaccines.

Findings

Global funding for basic research and product development for neglected diseases reached a new record high of $4,055m in 2018, easily surpassing the previous year's record. The headline increase of $374m (up 10%) was partly due to improved reporting. After adjusting for changes in survey scope, participation and reporting, global funding for neglected disease R&D increased by $290m in 2018 (up 7.9%); this was both the largest real annual funding increase on record, and the first time ever that funding has grown for three consecutive years.

FUNDING BY DISEASE

As in previous years, HIV/AIDS, malaria and tuberculosis (TB) collectively received more than two-thirds ($2,799m, 69%) of all global funding for neglected disease R&D in 2018. This was the lowest share ever received by these three diseases in the history of the G-FINDER survey (albeit only by a very slim margin), in spite of increases in funding for all three: a $158m (12%) increase for HIV, due in large part to improved reporting from the US NIH, a $49m (7.7%) increase for TB and $18m (2.8%) for malaria.

Funding for diseases which received between 6% and 0.5% of global funding mostly rose or remained stable: funding increased significantly for hepatitis C (up $30m, 188%) and bacterial pneumonia & meningitis (up $16m, 21%), while *Salmonella* infections (up $4.8m, 5.7%) saw a smaller increase, with negligible funding changes for kinetoplastid diseases (down $2.4m, -1.6%), diarrhoeal diseases (up $1.4m, 0.8%) and helminth infections (down $0.9m, -1.0%). The largest drop in funding was once again for dengue (down $3.6m, -4.4%).

Funding for the six diseases with the lowest historical funding – leprosy, cryptococcal meningitis, Buruli ulcer, trachoma, leptospirosis, rheumatic fever – fell across-the-board, leaving them with their lowest-ever share of global funding.

Global funding for neglected disease R&D was the highest ever recorded

There was another substantial increase in non-disease-specific R&D investment. This category, which includes core funding of multi-disease R&D organisations, investments in platform technologies and multi-disease vector control products, and other R&D investment not allocated to a specific disease, accounted for 12% ($500m) of global funding in 2018. This was an increase of $100m (up 25%), headlined by an increase in core funding for multi-disease organisations (up $66m, 22%).

FUNDERS

Despite its record high level of investment ($2,599m), the public sector's share of total funding actually fell marginally, equalling its lowest ever level (64% of total funding) because of strong growth from the private sector. HIC governments once again provided the vast majority of public funding ($2,429m, 93%), with the remainder divided between multilateral organisations ($75m, 2.9%) and LMIC governments ($95m, 3.7%). The philanthropic sector provided almost a fifth of total funding ($760m, 19%), its largest contribution since 2008. Industry funding reached a record high of $694m (17% of total funding) of which multinational pharmaceutical companies provided the vast majority ($598m, 86%), with the remaining 14% ($96m) coming from small pharmaceutical and biotechnology firms.

Private sector funding rose sharply, focusing on clinical development

The US government was once again the largest public funder, providing nearly three-quarters ($1,779m, 71%) of all public funding in 2018. This was the largest contribution from the US government since 2009. The UK government provided $230m (9.2% of all public funding) – its largest ever contribution – followed by the EC with $134m (5.4%). For the second year running, each of these top three funders increased their investment. The largest increase came from the US (up $148m, 9.1%), although more than half of this increase was due to improved reporting from NIH. UK government funding increased by $32m (up 16%), driven by record-high funding from DHSC and DFID, while a smaller increase from the EC (up $8.9m, 7.1%) coincided with its largest ever disbursement to the EDCTP. Other notable increases came from the governments of Japan (up $15m, 82%), which has increased its funding for four years running, and Australia (up $11m, 44%). The largest decrease came from France (down $5.4m, -11%) – whose funding declined for the fifth year running – followed by the Netherlands (down $4.7m, -19%). Multilateral funding – almost entirely from Unitaid – increased by $22m (up 41%) to a record high of $75m. LMIC governments, in contrast, reduced their funding (by $7.9m, -7.6%) driven by lower funding from India (down $9.4m, -12%, after a record high in 2017) and South Africa (down $1.9m, -13%), offset slightly by a rebound in funding from Brazil (up $3.6m, 45%).

Philanthropic funding for neglected disease R&D totalled $760m in 2018, an increase of $43m (up 6.0%). While smaller than the funding increases from the public sector and industry, this took philanthropic funding to its highest level in a decade. The sector's share of total funding remained essentially unchanged at 19%. As in previous years, the Gates Foundation and the Wellcome Trust collectively provided the vast majority of philanthropic funding, jointly accounting for 93% of the total. Both organisations further increased their funding in 2018: the Gates Foundation (up $36m, 6.5%) to its highest level since 2009, and the Wellcome Trust (up $11m, 10%) to its highest level since 2012.

The private sector invested a total of $694m in neglected disease R&D in 2018, or 17% of global funding. This was significantly higher than 2017 (up $118m, 20%), and the largest ever investment by industry. Once again, the vast majority of this funding ($598m, 86%) came from multinational pharmaceutical companies (MNCs), with small pharmaceutical and biotechnology firms (SMEs) contributing the remainder ($96m, 14%). The strong growth from industry was exclusively driven by MNCs, whose investments increased by $132m (up 28%). SME investment fell for the first time in six years, though much of the apparent $14m (-12%) drop was due to survey non-participation.

More than half ($1,298m, 52%) of all HIC government and multilateral funding for neglected disease R&D was for basic & early-stage research, while just over a quarter ($685m, 27%) was explicitly directed to clinical development & post-registration studies – though this excludes the $137m (26%) directed to the clinical development-focused EDCTP. In contrast, an overwhelming majority of MNC investment was for clinical development & post-registration studies ($422m, 71%), with just 20% ($118m) for early-stage research, and the remainder not allocated to a specific R&D stage. MNC investment in clinical development increased considerably (up $140m, 50%) as products progressed through the pipeline, while their investment in early-stage research fell (down $15m, -12%). SMEs likewise devoted the overwhelming majority of their funding to clinical development & post-registration studies ($85m, 88%), more than two-thirds of which was for Phase II vaccine trials. Philanthropic funding was more balanced, with more than a third directed to basic & early-stage research ($278m, 37%), while clinical development & post-registration studies continued to receive around a quarter ($193m, 25%) and core funding accounting for a fifth ($149m, 20%).

FUNDING FLOWS

Organisations can invest in neglected disease R&D in two ways: by funding their own in-house research (internal investment/self-funding) or by giving grants to others (external investment). Almost three-quarters ($2,948m, 73%) of all funding for neglected disease basic research and product development in 2018 was given externally. Just under three-quarters ($2,147m, 73%) of this external funding was given directly to researchers and developers, $553m (19%) was channelled through PDPs, and the remainder ($248m, 8.4%) was given to other intermediaries. For the second year in a row there was a major increase in funding to intermediaries (up $55m, 28%), driven in 2018 by notable increases in funding to EDCTP and the GHIT Fund. Funding to PDPs also increased slightly (up $27m, 5.1%), while funding to researchers and developers reached its highest level ever (up $178m, 9.1%), though this left its share of total funding unchanged. There were notable increases in funding directly to researchers and developers from both philanthropic funders (up $19m, 4.1%) and public multilaterals (up $19m, 57%). Internal investments (self-funding) accounted for just over a quarter ($1,107m, 27%) of all funding for neglected disease R&D in 2018, rising by $115m (up 12%), entirely due to increased investment by industry.

DISCUSSION

Global funding for neglected disease R&D reached a new record high in 2018, on the back of three consecutive years of growth

Global funding for basic research and product development for neglected diseases topped the $4 billion mark for the first time in 2018, reaching a new record high of $4,055m. This was a real increase of $290m (up 7.9%) from the previous year's record high – the largest ever real increase in annual funding for neglected disease R&D, and the first time that funding has increased in three consecutive years.

A modest increase in funding from the philanthropic sector also (up $43m, 6.0%) took its funding to the highest level in a decade, but the real drivers of the funding growth in 2018 were governments and pharmaceutical companies. Public sector funding increased by $121m (up 5.1%), which was matched by a $118m increase in industry investment (up 20%). All of the increase in public sector funding came from HIC governments and multilaterals (up $128m, 5.6%), and all of the increase in industry investment came from MNCs (up a record $132m, 28%).

Investment by multinational pharmaceutical companies reached its highest ever level

Investment in neglected disease R&D by multinational pharmaceutical companies grew by more than a quarter in 2018. Not only did this take MNC investment in neglected disease R&D to a record high of $598m, it also meant that – for the first time ever – MNCs collectively invested more in neglected disease R&D in 2018 than the Bill & Melinda Gates Foundation. Nor is this impact only due to the aggregation of industry investment: if companies were listed individually, three of the top twelve funders of neglected disease R&D in 2018 would be MNCs, including the third and fourth largest.

Encouragingly, the increase in MNC investment was almost across the board, with investment increasing in all but one of the diseases in which MNCs are active. Also encouraging is that the 2018 increase was distributed more evenly than in the past; HIV, malaria and TB still accounted for three-quarters (74%) of all MNC investment, but nearly half (43%) of the growth in MNC investment went to diseases outside of the 'big three'.

The growth in industry investment contributed to a dramatic increase in funding for clinical development & post-registration studies

Funding for basic & early-stage research has historically dominated global funding for neglected disease R&D, and still received the largest share (43%) in 2018. But funding for clinical development & post-registration studies increased by $198m (up 16%) to a record high of $1,405m in 2018. If core funding to the European & Developing Countries Clinical Trials Partnership is included, the total increase in funding for clinical development & post-registration studies was even higher, totalling $238m. This growth was heavily driven by MNCs, with MNC investment in this area increasing by half (up $140m, 50%) to $422m, representing nearly three-quarters (71%) of all MNC investment in neglected disease R&D.

While the scale of the increase in funding for clinical development & post registration studies was unprecedented, the share of total global funding for neglected disease R&D going to clinical development & post registration studies has been trending upwards over the last 12 years.

Share of total funding by R&D stage 2007-2018
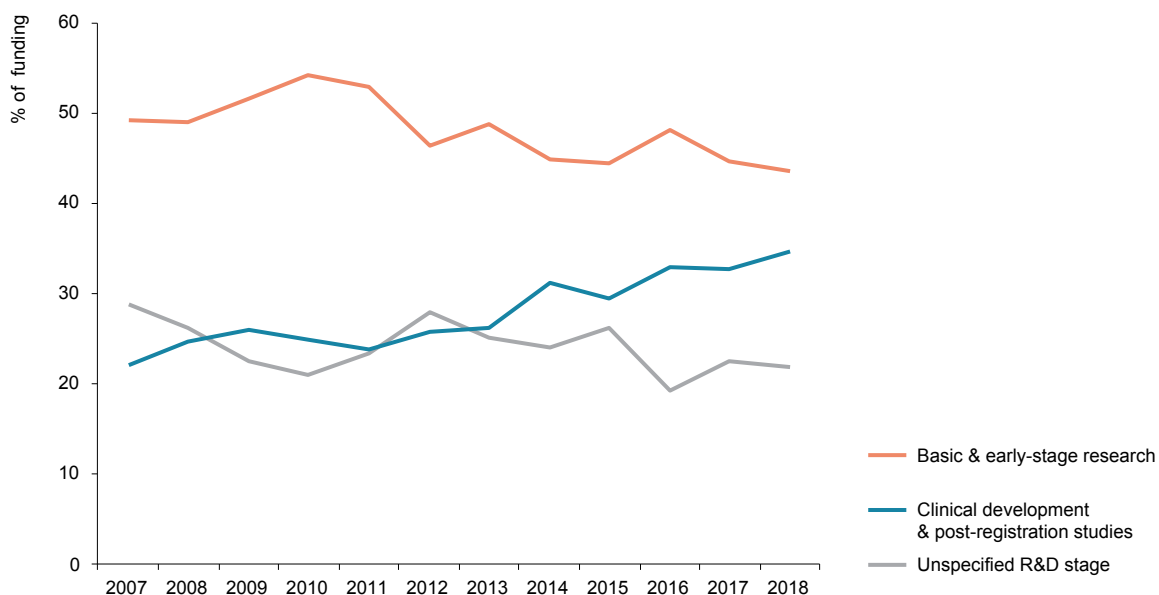
Legend:
- Basic & early-stage research
- Clinical development & post-registration studies
- Unspecified R&D stage

Progress remained encouraging outside of the traditional top funders of neglected disease R&D

Almost all of the biggest funders increased their investments, with record highs from the US and UK governments, as well as from MNCs, an increase from the European Commission to its second highest level ever, and funding from the Bill & Melinda Gates Foundation reaching its highest level in a decade.

Funding by disease category 2007-2018
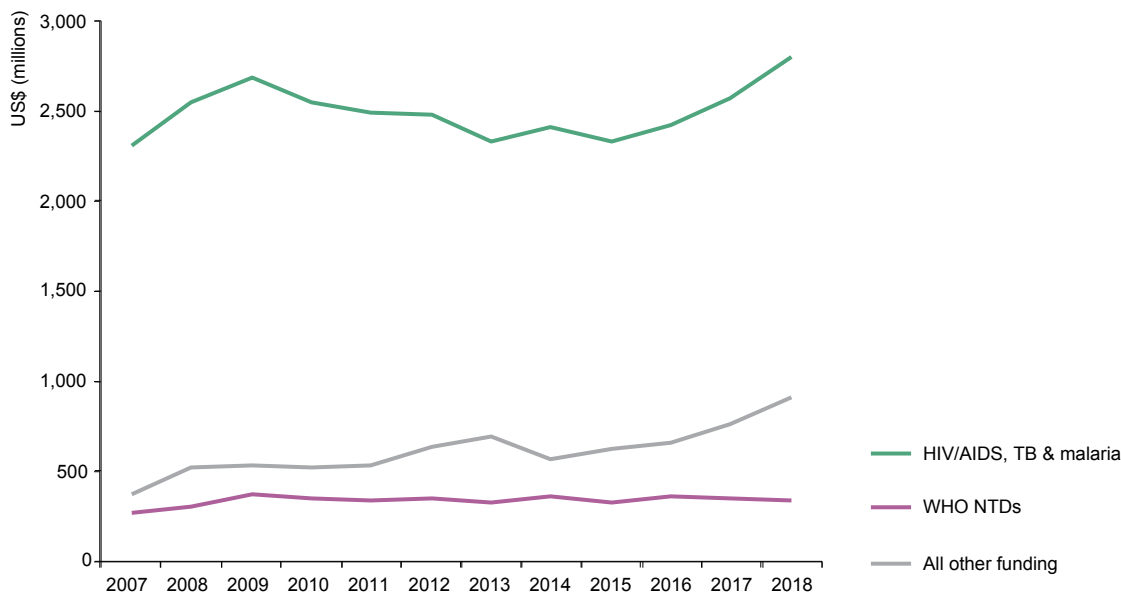
But there were also notable increases from smaller funders: 2018 saw record high levels of funding from the governments of Germany and Japan, as well as from Unitaid and Médecins Sans Frontières. Funding by the Brazilian government rebounded after a record low in 2017, and while funding from both the Indian and South African governments fell, this came after record highs in 2017.

Funding was lower from both LMIC governments (down $7.9m, -7.6%) and SMEs (down $14m, -12%), but this follows a long period of growth from both groups.

Not everything is trending upwards: funding for the WHO neglected tropical diseases has barely shifted over the last decade

Amidst the positive stories of widespread funding increases and record highs, there are still major areas of concern. One of these areas is the level of funding for WHO neglected tropical diseases (NTDs).

While funding for HIV/AIDS, TB and malaria has taken off in the last three years – along with funding for non-disease-specific R&D – funding for NTDs has been essentially flat for the past decade. In fact, it has gone backwards: funding for NTDs was nearly 10% lower in 2018 than it was in 2009, falling by $34m (-9.1%).

Industry investment in NTDs has actually been one of the few positive stories in this area. Investment in NTDs by MNCs in particular has grown steadily over the course of the last twelve years, increasing five-fold since 2007, while philanthropic funding for NTDs nearly halved over the same period. As a result, MNCs actually invested more in NTD R&D in 2018 than the philanthropic sector did.

However MNCs still only accounted for 16% of all funding for NTD R&D in 2018, meaning that funding for NTDs is heavily reliant on the public sector. This is particularly true for the least well funded diseases, many of which rely on just one or two public or philanthropic funders for the majority of their R&D funding. Of equal concern is the extremely small quantum of funding these diseases receive: there is little chance of meaningful progress in developing missing tools – especially drugs and vaccines – when total global investment in some of these diseases is just $2m annually.

INTRODUCTION

Background to the G-FINDER survey

Each year since 2007, the G-FINDER project has provided policy-makers, donors, researchers and industry with a comprehensive analysis of global investment into research and development (R&D) of new products to prevent, diagnose, control or cure neglected diseases in developing countries. It provides up-to-date analysis of how R&D investments are being allocated across diseases and product types, funding trends over time, and where the potential gaps lie.

G-FINDER is recognised as the gold standard in tracking and reporting global funding for neglected disease R&D. The World Health Organization (WHO) Expert Panel's Global Strategy and Plan of Action on Public Health, Innovation and Intellectual Property (GSPOA) includes a recommendation that Member States commit to providing information to G-FINDER, and G-FINDER has been included – as both a primary source and an indicator – in agenda items presented at the WHO Executive Board meeting and World Health Assembly.[1,2] G-FINDER is the primary source of neglected disease R&D funding data for both the WHO Global Observatory on Health R&D and Donor Tracker, and helps support the work of many other groups in the broader global health community.

This is the twelfth annual G-FINDER report; in addition to the previous eleven years of funding data, it reports on investments made in financial year (FY) 2018, referred to as 2018 in the text.

The survey scope

DEFINING NEGLECTED DISEASES AND PRODUCTS

The scope of the G-FINDER survey is determined in consultation with the G-FINDER Advisory Committee, which is made up of a broad cross-section of international experts in neglected diseases and product development (see Annexe 1 for the list of current Advisory Committee members). When defining the G-FINDER scope at the project's inception, and at each subsequent review, three criteria (see Figure 1) have been applied in order to establish a list of neglected diseases and products for which R&D would cease or wane if left to market forces.

Figure 1. Filter to determine G-FINDER neglected disease inclusions
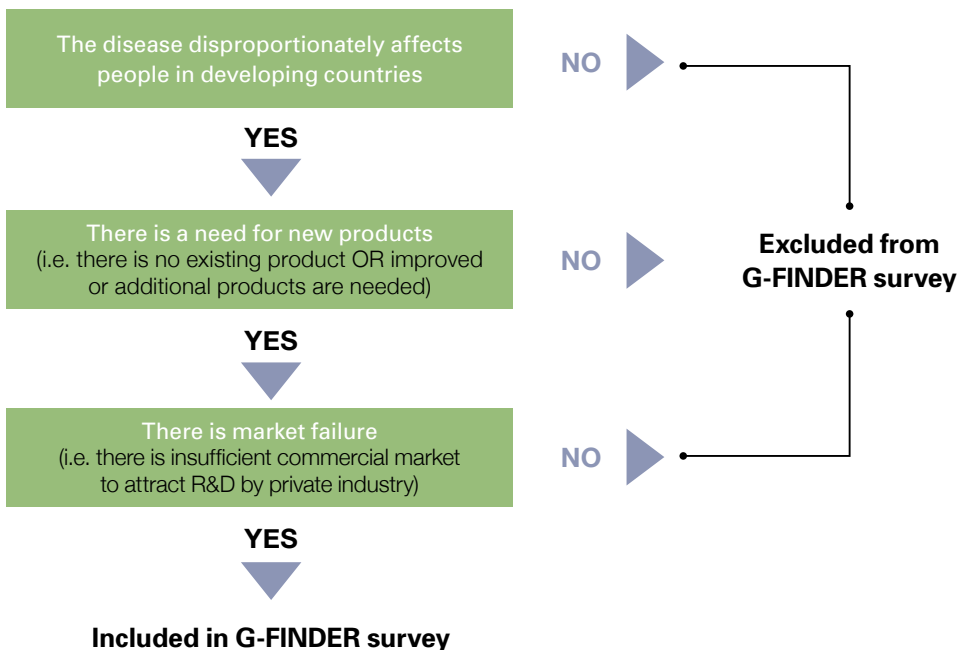
Many research activities that are extremely important for global health are excluded from G-FINDER because they are not related to the development of new tools for neglected diseases

Although basic research and all relevant product types – drugs, vaccines, biologics, diagnostics, microbicides and vector control products (chemical and biological control agents, and reservoir targeted vaccines) – were considered for inclusion in relation to every disease, not all areas are included in the G-FINDER scope for all diseases, and some are included only with restrictions. For example, pneumonia drugs are excluded because there is a sufficient commercial market; while pneumonia vaccine investments are only included if they meet G-FINDER requirements for strain, vaccine type and target age group.

Platform technologies (adjuvants, diagnostic platforms, and delivery devices for drugs or vaccines) and multi-disease vector control products are also included in the scope of G-FINDER. Platform technologies can potentially be applied to a range of neglected diseases and products, but have not yet been attached to a specific product for a specific disease. Multi-disease vector control products target vectors capable of transmitting several different diseases.

Investments that do not meet the G-FINDER scope are excluded from the results. This includes activities such as advocacy and behavioural research, which are critical to effecting change, but which are distinct from product development and fall outside the G-FINDER criteria.

A comprehensive explanation of all inclusions, exclusions and restrictions is outlined in the detailed G-FINDER R&D scope document, which is available online. A matrix summarising the neglected diseases, products and technologies included in this year's G-FINDER report is shown in Table 1.

TYPES OF RESEARCH INCLUDED

G-FINDER tracks investment in R&D to deliver new health technologies for neglected diseases, covering the spectrum from basic research to post-registration studies of new products. The main categories of research included are listed below, grouped under the two overarching categories that we often refer to in the body of the report

- Basic & early-stage research, including:
  - Basic research
  - Discovery and pre-clinical development
- Clinical or field development & post-registration studies, including:
  - Baseline epidemiology in preparation for product trials
  - Clinical development and field evaluation
  - Post-registration studies of new products, including Phase IV/pharmacovigilance, and operational research for diagnostics

A detailed explanation of what types of R&D activities are included in each of these categories, as well as specific inclusions and exclusions related to the G-FINDER scope, is provided in the G-FINDER neglected disease R&D scope document.

The purpose of G-FINDER is to track and analyse global investment in the research and development of new health technologies for neglected diseases. **G-FINDER does not, and is not intended to, capture investment in the entire spectrum of neglected disease research.** Many research activities that are extremely important for global health are excluded from G-FINDER because they are not related to the development of new tools for neglected diseases; this includes health systems and operations/implementation research (for example, research into health systems or policy issues, or research into the programmatic delivery of non-product interventions, or existing health technologies), and sociological, behavioural and epidemiological research not related to the development of new health technologies. We also exclude investment into non-pharmaceutical tools – such as untreated bed nets – or interventions – such as circumcision. General therapies such as painkillers or nutritional supplements are also excluded, as these investments cannot be ring-fenced to neglected disease treatment. Investment that is not research-related is similarly excluded: although we recognise the vital importance of activities such as health programme delivery, advocacy, routine disease surveillance programmes, community education and general capacity building to address neglected diseases, investment in these activities falls outside the scope of G-FINDER.

CHANGES TO THE G-FINDER R&D SCOPE FOR NEGLECTED DISEASES

Although maintaining a consistent scope is important in order to allow analysis of multi-year R&D funding trends, the scope of the G-FINDER survey is reviewed annually in consultation with the Advisory Committee.

In year two of the G-FINDER survey (FY2008), the typhoid and paratyphoid fever disease category was expanded to include non-typhoidal *Salmonella enterica* (NTS) and multiple *Salmonella* infections, while R&D for lymphatic filariasis diagnostics was added.

In FY2013 (the seventh survey year), the survey was expanded to include three additional diseases: cryptococcal meningitis, hepatitis C (genotype 4) and leptospirosis. Dengue vaccines were determined to no longer fit the criteria for inclusion in the G-FINDER survey given the emergence of a commercial market, and dengue vaccine R&D funding (including all previously reported investment) was removed from the survey. All other dengue product areas were retained.

In FY2014 (the eighth survey year), the hepatitis C category was expanded to capture investment in R&D for two additional genotypes (genotypes 5 and 6) that disproportionately affect people in developing countries.

In FY2016 (the tenth survey year), the bacterial pneumonia & meningitis category was expanded to explicitly include developing country-focused basic research for both *Streptococcus pneumoniae* (*S. pneumoniae*) and *Neisseria meningitides* (*N. meningiditis*). Developing country-specific research into therapeutic vaccines for HIV/AIDS was also added as a restricted category, reflecting emerging research into broadly neutralising anti-HIV antibodies (bNAbs) and their potential use in developing countries.

In FY2017 (the eleventh survey year), the G-FINDER report began to include the full value of funding that targets both neglected diseases *and* emerging diseases (EIDs). This new multi-disease category included core funding, platform technologies and vector control products aimed at vectors responsible for transmitting both EIDs and neglected diseases. 2017 also saw the inclusion of chemical vector control products for Chagas' disease, diagnostics for tapeworm infections and developing country-targeted insecticide-based tools for controlling outdoor transmission.

In FY2018, coverage of viral hepatitides was expanded to include basic research, drugs, biologics and diagnostics for hepatitis B, with restrictions to ensure that R&D is targeted at LMICs. The review of unmet need for hepatitis treatments in LMICs also lead to the removal of genotype restrictions on hepatitis C, meaning that all hepatitis C virus genotypes are now included within the G-FINDER scope, rather than only genotypes 4, 5 & 6 as had been the case since FY2014, although restrictions to ensure that R&D is targeted at LMICs remain.

Two additional diseases were also added to the G-FINDER scope in FY2018: mycetoma, for which basic research, drugs and diagnostics were included; and snakebite envenoming, for which basic research, drugs, biologics and diagnostics were included, with restrictions to ensure that R&D is targeted at LMICs. The scope for leprosy was also expanded to include vaccine development.

Finally, the therapeutic vaccine product category was expanded and renamed; now 'biologics', this category captures funding that was previously variously included under therapeutic vaccines, drugs and preventive vaccines depending on the disease scope, and has now been formally included for an increased number of diseases. Restrictions on the inclusion of biologic R&D for individual diseases are listed in the relevant disease chapters in this report, or are available in the G-FINDER methodology document, available online at **www.policycuresresearch.org/g-finder**.

HANDLING OF EMERGING INFECTIOUS DISEASES

In response to the 2014 West African Ebola epidemic, the G-FINDER survey scope was expanded for FY2014 (the eighth survey year) to capture investments in Ebola R&D for diagnostics, drugs and preventive vaccines, as well as basic research. For FY2015 (year nine), the survey scope was further expanded to include other African viral haemorrhagic fevers (VHFs). In addition to Ebola, this new category allowed respondents to also report R&D funding for Marburg and other African VHFs. In FY2016 (the tenth survey year), a separate scope definition was developed to identify investment in R&D for all priority emerging infectious diseases (EIDs) identified in the WHO R&D Blueprint for action to prevent epidemics, and previously reported Ebola and VHF funding was retrospectively removed from the G-FINDER neglected disease totals. In FY2018, funding data was gathered for the first time for chikungunya and emergent non-polio enteroviruses, which, while not listed in the WHO R&D Blueprint, were each considered for inclusion in 2018.

Although EID funding data continues to be collected alongside investments in R&D for neglected diseases – joined in 2018 by data on R&D funding for the sexual & reproductive health needs of LMIC populations – the analysis of this data will be reported separately. The only exception is investment in R&D that is applicable to both neglected and emerging infectious diseases, the full value of which will be included in both analyses, as described earlier.

Table 1. G-FINDER neglected diseases, products and technologies

Disease		Basic research	Drugs	Vaccines	Biologics	Diagnostics	Microbicides	Vector control products
HIV/AIDS		Restricted	Restricted	✓	Restricted	✓	✓	-
Tuberculosis		✓	✓	✓	✓	✓	-	-
Malaria	*P. falciparum*	✓	✓	✓	✓	✓	-	✓
	P. vivax	✓	✓	✓	✓	✓	-	✓
	Multiple / other malaria strains	✓	✓	✓	✓	✓	-	✓
Diarrhoeal diseases	Rotavirus	-	-	Restricted	-	-	-	-
	Cholera	✓	Restricted	✓	Restricted	✓	-	-
	Shigella	✓	Restricted	✓	Restricted	✓	-	-
	Cryptosporidiosis	✓	Restricted	✓	Restricted	✓	-	-
	Enterotoxigenic *E. coli* (ETEC)	-	-	✓	-	✓	-	-
	Enteroaggregative *E. coli* (EAEC)	-	-	✓	-	✓	-	-
	Giardiasis	-	-	-	-	✓	-	-
	Multiple diarrhoeal diseases	✓	Restricted	✓	Restricted	✓	-	-
Kinetoplastid diseases	Sleeping sickness (HAT)	✓	✓	✓	✓	✓	-	✓
	Leishmaniasis	✓	✓	✓	✓	✓	-	-
	Chagas' disease	✓	✓	✓	✓	✓	-	✓
	Multiple kinetoplastid diseases	✓	✓	✓	✓	✓	-	✓
Bacterial pneumonia & meningitis	*S. pneumoniae*	Restricted	-	Restricted	-	✓	-	-
	N. meningitidis	Restricted	-	Restricted	-	✓	-	-
	Both *S. pneumoniae* and *N. meningitidis*	Restricted	-	-	-	✓	-	-
***Salmonella* infections**	Typhoid and paratyphoid fever (*S.* Typhi, *S.* Paratyphi A)	✓	✓	✓	✓	✓	-	-
	Non-typhoidal *S. enterica* (NTS)	✓	✓	✓	✓	✓	-	-
	Multiple *Salmonella* infections	✓	✓	✓	✓	✓	-	-
Helminth infections (worms & flukes)	Schistosomiasis (bilharziasis)	✓	✓	✓	✓	✓	-	✓
	Onchocerciasis (river blindness)	✓	✓	✓	-	✓	-	✓
	Lymphatic filariasis (elephantiasis)	✓	✓	-	-	✓	-	✓
	Tapeworm (taeniasis / cysticercosis)	✓	✓	-	-	✓	-	✓
	Hookworm (ancylostomiasis & necatoriasis)	✓	✓	✓	-	-	-	-
	Whipworm (trichuriasis)	✓	✓	-	-	-	-	-
	Roundworm (ascariasis)	✓	✓	-	-	-	-	-
	Strongyloidiasis & other intestinal roundworms	✓	✓	✓	-	✓	-	-
	Multiple helminth infections	✓	✓	✓	-	✓	-	✓
Dengue		✓	✓	-	✓	✓	-	✓
Hepatitis C		-	Restricted	Restricted	-	✓	-	-
Leprosy		✓	✓	✓	✓	✓	-	-
Cryptococcal meningitis		-	✓	-	✓	-	-	-
Snakebite envenoming		Restricted	Restricted	-	Restricted	Restricted	-	-
Hepatitis B		Restricted	Restricted	-	Restricted	✓	-	-
Buruli ulcer		✓	✓	✓	-	✓	-	-
Trachoma		-	-	✓	-	✓	-	-
Leptospirosis		-	-	-	-	Restricted	-	-
Rheumatic fever		-	-	✓	-	-	-	-
Mycetoma		✓	✓	-	-	✓	-	-

Investment applicable to more than one neglected disease, or to both neglected and emerging infectious diseases					
Platform technologies				Multi-disease vector control products	Core funding of a multi-disease R&D organisation
General diagnostic platforms	Adjuvants and immunomodulators	Drug delivery technologies and devices	Vaccine delivery technologies and devices		
Restricted	Restricted	Restricted	Restricted	✓	✓

✓ denotes a category where a disease or product is included in the survey
Restricted   denotes a category where only some investments are eligible, as defined in the G-FINDER neglected disease R&D scope document

Survey methodology

Over the past twelve years, the G-FINDER survey has operated according to two key principles: capturing and analysing data in a manner that is consistent and comparable across all funders and diseases; and presenting funding data that is as close as possible to 'real' investment figures.

G-FINDER was originally designed as an online survey. An online survey platform was developed to capture grant data and is still used by the majority of survey participants. An offline grant-based reporting tool is also available. Investment from industry (pharmaceutical companies and biotechnology firms) in R&D is not grant-based, so a version of the reporting tool has been tailored for these participants. Instead of grants, companies enter the number of staff working on neglected disease programmes, their salaries, and direct project costs related to these programmes. Companies are required to exclude 'soft' expenditures, such as in-kind contributions and costs of capital.

For some organisations with very large datasets, the online survey and equivalent offline reporting tool are difficult to use. The G-FINDER team therefore uses publicly available databases to identify the relevant funding. For the Biomedical Advanced Research and Development Authority (BARDA), funding information is identified using the international and domestic 'Project Maps' retrieved from the Medical Countermeasures website. Information on funding from the US Department of Defense (DOD) is collected using the Defense Technical Information Center's 'DOD investment budget search' tool. Funding from the European Commission (EC)[1] is retrieved from the Community Research and Development Information Service (CORDIS) public database and the Innovative Medicines Initiative's (IMI) online project list. Supplementary data is provided by the EC. Information about R&D projects funded by Innovate UK is extracted from spreadsheets available on its website. For the first time this year, funding data for the National Natural Science Foundation of China was extracted from its public Chinese-language database. For the US National Institutes of Health (NIH), grants are collected using the Research Portfolio Online Reporting Tools (RePORTER) and the Research, Condition and Disease Categorization (RCDC) process. This year, the NIH provided its funding data for HIV/AIDS in a more granular format, allowing us to more accurately capture the scale of in-scope LMIC-targeted investment. The newly-identified funding included ongoing funding that had been excluded in prior years, meaning that part of the apparent increase in NIH funding seen in this year's report is artefactual; the effect of this change in reporting is quantified where relevant throughout the report.

All participating organisations are asked to only include disbursements (or receipts), rather than commitments made but not yet disbursed. In general, only primary grant data is accepted; the only exception is in the case of data collection collaborations between G-FINDER and other R&D funding surveys, such as the Resource Tracking for HIV Prevention Research & Development Working Group. Data from all sources is subject to verification using the same processes and inclusion criteria.

All grants are verified against the inclusion criteria. Cross-checking of reporting from funders and recipients is then conducted using automated reconciliation reports – which match investments reported as disbursed by funders with investments reported as received by intermediaries and product developers – followed by manual grant-level review. Any discrepancies are resolved by contacting both groups. For grants from the US NIH, funding data is supplemented and cross-referenced with information received from the Office of AIDS Research (OAR) and the National Institute of Allergy and Infectious Diseases (NIAID).

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[1] The term 'EC' used here and throughout the report refers to funding from the European Union budget that is managed by the European Commission or related European Union partnerships and initiatives, such as the European & Developing Countries Clinical Trials Partnership (EDCTP) and Innovative Medicines Initiative (IMI).

Industry figures are reviewed against industry portfolio information held by Policy Cures Research and against full-time equivalent (FTE) and direct costs provided by other companies. Costs that fall outside the expected range, for example, above average FTE costs for clinical staff, are queried with the company and corrected.

UNSPECIFIED FUNDING

Around 1.5% ($63m) of funding was reported to the survey as 'unspecified', usually for multi-disease programmes where funds could not easily be apportioned by disease. A proportion of funding for some diseases was also 'unspecified', for instance, when funders reported a grant for research into tuberculosis (TB) basic research and drugs without apportioning funding to product categories. This means that reported funding for some diseases and products will be slightly lower than actual funding, with the difference being included as 'unspecified' funding.

A further 8.9% ($363m) of global funding was given as core funding to R&D organisations that work in multiple disease areas, for example, the European & Developing Countries Clinical Trials Partnership (EDCTP) and the Foundation for Innovative New Diagnostics (FIND). As this funding could not be accurately allocated by disease it was reported as unallocated core funding. In cases where grants to a multi-disease organisation were earmarked for a specific disease or product, they were included under the specific disease-product area.

DATA AGGREGATION

All pharmaceutical industry funding data is aggregated and anonymised for confidentiality purposes. Rather than being attributed to individual companies, pharmaceutical company investment is instead reported according to the type of company, with a distinction made between multinational pharmaceutical companies (MNCs) and small pharmaceutical and biotechnology firms (SMEs).

INFLATION ADJUSTMENTS

Funding data is adjusted for inflation and converted to US dollars (US$) to eliminate artefactual effects caused by inflation and exchange rate fluctuations, allowing accurate comparison of annual changes. Due to these adjustments, historical G-FINDER data in tables and figures in this report will differ from data in previous G-FINDER reports. All funding data in this report is in 2018 US$.

LIMITATIONS

While the survey methodology has been refined over the past decade, there are limitations to the data presented, including survey non-completion, time lags in the funding process, an inability to disaggregate some investments, and non-comparable or missing data. Please see the G-FINDER methodology document, available online at www.policycuresresearch.org/g-finder, for a more in-depth discussion of these limitations.

Reading the G-FINDER report

STRUCTURE

The G-FINDER report is structured in four main parts: 1) analysis of funding by neglected disease; 2) analysis of neglected disease funders; 3) analysis of funding flows; and 4) discussion of key findings.

YEARS

Throughout the text, references to years, other than survey years, are to financial years.

YEAR-ON-YEAR CHANGES

To avoid reporting on artefactual variations related to survey participation, year-on-year funding analysis was previously based only on funding reported by organisations that had participated in every year of the survey.

G-FINDER is now in its twelfth year, and survey participation from the major funders has stabilised. Therefore annual changes mentioned in the FY2018 report are based on funding reported by all survey participants. In instances where changes were materially influenced by survey participation, an explanation has been provided.

COUNTRY GROUPINGS

For brevity, we use the terms 'LMICs' and 'developing countries' to denote low- and middle-income countries, and 'HICs' to denote high-income countries, as defined by the World Bank.[3]

MEASURING THE BURDEN OF NEGLECTED DISEASE

Estimating the burden of disease is a complex process, and estimates may differ substantially between sources depending on the data and methodology used. This report presents disease burden estimates from the Institute for Health Metrics and Evaluation's (IHME) Global Burden of Disease Study 2017 (GBD 2017).[4] Estimates of deaths and disability-adjusted life years (DALYs) in LMICs from GBD 2017 are presented by disease where available, while estimates of the burden of cryptococcal meningitis and leptospirosis are instead sourced from peer reviewed studies.[5,6] Some estimates may differ from those published in previous G-FINDER reports due to changes in methodology.[7]

Pathogen-specific diagnosis for diarrhoeal diseases, and bacterial pneumonia & meningitis is challenging, complicating attempts to estimate their disease burden. The diarrhoeal disease group in GBD 2017 includes diseases outside the scope of G-FINDER, and does not include estimates for giardiasis. Therefore, estimates of deaths and DALYs for the diarrhoeal disease group have been calculated by subtracting pathogens identified by aetiology as out of scope from the GBD 2017 diarrhoeal disease grouping 'by cause' totals. Calculating the burden of bacterial pneumonia & meningitis is complicated by the inclusion of an 'Other meningitis' aetiology category which is not disaggregated to a level where it can be established what proportion of the burden falls within the scope of G-FINDER. Estimates of deaths and DALYs for bacterial pneumonia & meningitis presented in this report include 'Other meningitis', and may therefore include some burden of disease caused by pathogens outside the scope of G-FINDER. For helminth infections (worms & flukes), burden estimates do not include estimates for strongyloidiasis.

Subject to these limitations, Table 2 shows the estimated number of DALYs and mortality caused by each G-FINDER neglected disease.

Table 2. LMIC deaths and DALYs by disease^

Disease	Deaths	DALYs
HIV/AIDS	938,891	53,567,471
Tuberculosis	1,167,623	44,666,899
Malaria	619,685	45,005,406
Diarrhoeal diseases	1,157,938	54,608,364
Kinetoplastid diseases	16,641	1,076,053
Bacterial pneumonia & meningitis	1,220,742	64,535,085
Salmonella infections	193,943	14,023,086
Helminth infections (worms & flukes)	12,765	7,512,706
Dengue	40,407	2,910,652
Hepatitis C	449,333	12,743,817
Leprosy	-	31,397
Cryptococcal meningitis~	181,100	
Snakebite envenoming		
Hepatitis B	741,267	23,752,066
Buruli ulcer		
Trachoma	-	301,761
Leptospirosis*	58,900	2,900,000
Rheumatic fever	245,372	8,814,192
Mycetoma		

^ All disease burden estimates cited are from IHME's 2017 Global Disease Burden study, unless otherwise cited.

        No commonly accepted disease burden estimation available.

~ Rajasingham et al. 2017

* Torgerson et al. 2015

The latest G-FINDER survey

The twelfth G-FINDER survey was open for a six-week period from May to June 2019. Intensive follow-up and support for key participants led to a total of 12,361 recorded entries in the database for financial year 2018.

PARTICIPANTS

G-FINDER is primarily focused on funding, and therefore the emphasis is on surveying funding organisations. A total of 262 organisations participated in the G-FINDER survey in 2019, reporting on behalf of 271 organisations. 128 of the 262 direct participants were funders. A wide range of funding intermediaries, product development partnerships (PDPs), and researchers and developers who received funding also participated. Data from funding recipients was used to collect data on investments from funders who did not participate in the survey; to better understand how and where R&D investments were made; to track funding flows through the system; to prevent double counting; and to verify reported data.

Participants originated from 40 countries. Organisations included:

- Public, private and philanthropic funders from 21 HICs
- The EC
- Public funders from eight MICs (Brazil, China, Colombia, India, Mexico, Nigeria, Thailand and South Africa)
- Private sector funders from 15 countries, including two MICs (Colombia and India)
- Academic organisations from seven MICs (Costa Rica, India, Kenya, Morocco, Thailand, the Philippines and Tunisia), and one LIC (Benin)

Table 3. Disease and product R&D funding 2018 (US$ millions)

Disease or R&D area	Basic research	Drugs	Vaccines	Biologics	Diagnostics	Microbicides	Vector control products	Unspecified	Total
HIV/AIDS	205.06	212.53	757.03	40.07	68.23	140.09		27.72	1,450.73
Tuberculosis	184.30	359.48	64.90	4.56	62.72			8.64	684.60
Malaria	162.95	252.49	156.15	1.61	27.00		55.67	7.55	663.42
P. falciparum	76.58	88.78	122.91	-	4.70		19.53	3.93	316.44
P. vivax	14.01	28.64	9.65	-	1.47		0.29	0.02	54.08
Multiple / other malaria strains	72.36	135.07	23.60	1.61	20.82		35.84	3.60	292.90
Diarrhoeal diseases	38.66	16.51	106.08	0.57	6.79			2.67	171.29
Rotavirus			53.63					1.07	54.69
Cholera	24.63	0.57	7.71	-	1.07			-	33.99
Shigella	5.40	1.07	22.77	-	0.81			0.92	30.98
Cryptosporidiosis	5.37	10.28	0.89	-	0.17			0.34	17.05
Enterotoxigenic *E. coli* (ETEC)			10.59		0.18			0.19	10.96
Enteroaggregative *E. coli* (EAEC)			0.23		-			0.15	0.38
Giardiasis					<0.01			-	<0.01
Multiple diarrhoeal diseases	3.26	4.59	10.26	0.57	4.55			-	23.23
Kinetoplastid diseases	53.88	86.08	3.68	0.05	4.20		0.04	1.44	149.38
Sleeping sickness (HAT)	22.89	26.28	-	-	1.36		-	0.11	50.63
Leishmaniasis	20.74	12.42	3.65	0.03	1.06			0.97	38.87
Chagas' disease	7.78	11.31	0.02	0.02	1.75		0.04	0.03	20.95
Multiple kinetoplastid diseases	2.47	36.08	0.01	-	0.03		-	0.34	38.92
Bacterial pneumonia & meningitis	7.32		82.07		1.23			1.87	92.50
S. pneumoniae	4.71		70.93		0.38			-	76.01
N. meningitidis	2.47		11.14		0.41			1.87	15.90
Both *S. pneumoniae* and *N. meningitidis*	0.14				0.45			-	0.59
***Salmonella* infections**	42.32	5.93	38.65	0.09	2.57			-	89.56
Typhoid and paratyphoid fever (*S.* Typhi, *S.* Paratyphi A)	25.06	4.19	36.00	0.09	2.35			-	67.70
Non-typhoidal *S. enterica* (NTS)	6.60	-	0.40	-	-			-	7.00
Multiple *Salmonella* infections	10.66	1.74	2.25	-	0.22			-	14.86
Helminth infections (worms & flukes)	33.49	39.83	5.07	0.64	5.40		0.69	3.54	88.67
Schistosomiasis (bilharziasis)	11.52	5.08	3.26	0.64	1.51		0.47	1.29	23.76
Onchocerciasis (river blindness)	1.08	11.81	0.71		1.57		0.02	-	15.18
Lymphatic filariasis (elephantiasis)	4.86	7.48			0.32		0.02	2.18	14.85
Tapeworm (taeniasis / cysticercosis)	2.63	1.31			1.28		0.19	-	5.41
Hookworm (ancylostomiasis & necatoriasis)	1.23	0.56	0.86					-	2.65
Whipworm (trichuriasis)	1.81	0.39						-	2.20
Roundworm (ascariasis)	1.53	0.16						-	1.69
Strongyloidiasis & other intestinal roundworms	1.02	0.01	<0.01		0.04			-	1.07
Multiple helminth infections	7.81	13.04	0.24		0.69		-	0.07	21.84
Dengue	38.38	22.79		1.30	6.72		8.28	2.32	79.79

Disease or R&D area	Basic research	Drugs	Vaccines	Biologics	Diagnostics	Microbicides	Vector control products	Unspecified	Total
Hepatitis C		41.56	0.40		3.52			0.14	45.62
Leprosy	7.09	1.09	0.48	-	1.49			0.09	10.25
Cryptococcal meningitis		7.67		-				-	7.67
Snakebite envenoming	3.43	1.35		1.38	0.42			0.02	6.61
Hepatitis B	1.91	0.57		-	0.76			2.48	5.73
Buruli ulcer	2.29	0.88			0.11			-	3.29
Trachoma			1.97		0.11			-	2.09
Leptospirosis					1.67			-	1.67
Rheumatic fever			1.65					-	1.65
Mycetoma	0.17	<0.01			-			0.72	0.88
Platform technologies									42.95
General diagnostic platforms									16.52
Adjuvants and immunomodulators									15.91
Vaccine delivery technologies and devices									8.45
Drug delivery technologies and devices									2.07
Multi-disease vector control products									31.31
Core funding of a multi-disease R&D organisation									362.79
Unspecified disease									62.59
Total R&D funding									4,055.03

\- No reported funding

▨ Category not included in G-FINDER

FUNDING BY DISEASE

Global funding for basic research and product development for neglected diseases in 2018 was $4,055m, replacing 2017's total as the highest ever recorded by the G-FINDER survey. Funding grew by another $374m (up 10%), the largest increase in both absolute and proportional terms since 2008, ushering in a third consecutive year of R&D funding growth for the first time in G-FINDER history.

Only a small portion ($14m) of the overall increase was due to the inclusion of three new diseases – snakebite envenoming, mycetoma, and hepatitis B – and leprosy vaccine R&D in the G-FINDER scope, and this was entirely offset by the net effect of changes in survey participation. There was, however, a $93m increase due to more granular reporting of HIV/AIDS R&D funding by the US NIH, which meant that several ongoing NIH projects were included in 2018 that had been considered out of scope in previous years.

After adjusting for changes in survey participation and reporting, global funding for neglected disease R&D increased by $290m in 2018 (up 7.9%), representing the largest real annual funding increase on record.

Figure 2. **Total R&D funding for neglected diseases 2007-2018**
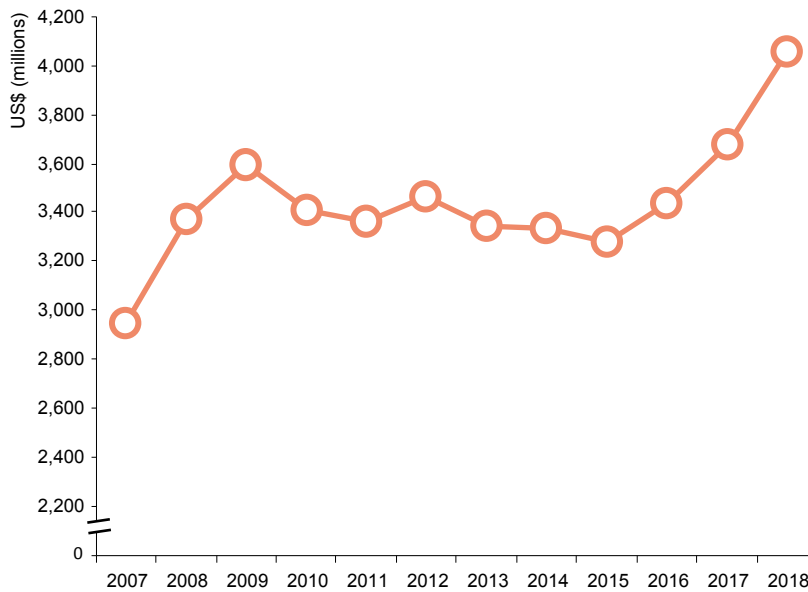
Neglected diseases fall into three distinct funding tiers: those that received more than 6% of global funding in 2018 fall into the top tier; those that received between 0.5% and 6% of total funding make up the second tier, while diseases in the third tier each receive less than 0.5%.

Three diseases – HIV/AIDS, TB and malaria – each received more than 6% of global funding, placing them in the top funding tier, and collectively accounting for $2,799m, or 69% of global funding. This was the lowest share ever received by these three diseases in the history of the G-FINDER survey, in spite of increases in funding for all three: a $158m (12%) increase for HIV/AIDS, $49m (7.7%) for TB and $18m (2.8%) for malaria.

Table 4. R&D funding by disease 2009-2018^

Disease or R&D area	US$ (millions)										2018 % of total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
HIV/AIDS	1,380	1,302	1,261	1,289	1,175	1,187	1,127	1,202	1,293	1,451	36
Tuberculosis	629	654	606	579	592	607	610	611	635	685	17
Malaria	676	600	622	614	569	613	598	613	645	663	16
Diarrhoeal diseases	215	188	177	179	211	186	171	159	170	171	4.2
Kinetoplastid diseases	183	165	146	149	134	159	133	148	152	149	3.7
Bacterial pneumonia & meningitis	79	108	113	116	109	80	99	98	77	92	2.3
Salmonella infections	46	51	51	61	69	70	73	97	85	90	2.2
Helminth infections (worms & flukes)	92	85	91	96	93	96	80	76	90	89	2.2
Dengue	85	73	83	79	72	87	95	116	83	80	2.0
Hepatitis C					50	48	36	30	16	46	1.1
Leprosy	12	11	9.4	16	14	11	12	12	13	10	0.3
Cryptococcal meningitis					3.2	5.9	5.4	5.9	11	7.7	0.2
Snakebite envenoming										6.6	0.2
Hepatitis B										5.7	0.1
Buruli ulcer	2.0	5.9	6.2	6.5	6.9	4.0	2.0	3.0	4.4	3.3	0.1
Trachoma	1.4	3.6	6.1	2.2	2.3	1.4	1.2	2.3	2.8	2.1	0.1
Leptospirosis					0.4	1.4	1.4	2.5	3.3	1.7	0.0
Rheumatic fever	3.6	2.1	0.9	1.0	0.9	1.4	2.3	1.3	1.7	1.7	0.0
Mycetoma										0.9	0.0
Platform technologies	26	32	19	53	47	24	38	54	33	43	1.1
General diagnostic platforms	10	11	11	18	18	10	17	18	11	17	0.4
Adjuvants and immunomodulators	5.9	11	6.1	30	23	9.0	13	18	14	16	0.4
Vaccine delivery technologies and devices	9.2	6.5	2.0	0.9	4.7	2.4	4.9	14	2.2	8.4	0.2
Drug delivery technologies and devices	0.2	3.7	-	4.4	1.8	2.6	3.7	3.3	6.6	2.1	0.1
Multi-disease vector control products									26	31	0.8
Core funding of a multi-disease R&D organisation	76	78	94	112	122	112	149	168	297	363	8.9
Unspecified disease	89	58	80	117	78	41	47	39	43	63	1.5
Total	3,595	3,416	3,364	3,469	3,348	3,337	3,282	3,437	3,681	4,055	100

Hepatitis C, cryptococcal meningitis and leptospirosis were added to G-FINDER in 2013. Multi-disease vector control products were added in 2017. Mycetoma, snakebite envenoming and hepatitis B were added in 2018.

^ Please note that some of the diseases listed are actually groups of diseases, such as the diarrhoeal illnesses and helminth infections. This reflects common practice and also the shared nature of research in some areas. For example, Streptococcus *pneumoniae* R&D is often targeted at both pneumonia and meningitis.

- No reported funding

Diseases in the second tier of R&D funding were dengue, diarrhoeal diseases, kinetoplastid diseases, helminth infections, *Salmonella* infections, bacterial pneumonia & meningitis, and hepatitis C, which returned to the second tier in 2018, having dropped below 0.5% of global funding in 2017. Collectively, diseases in the second funding tier for 2018 received a little under 18% of total funding ($717m), a slight reduction in share compared to 2017, despite funding for these diseases increasing by $45m. Funding increased significantly for hepatitis C (up $30m, 188%) and bacterial pneumonia & meningitis (up $16m, 21%), while *Salmonella* infections (up $4.8m, 5.7%) saw a smaller increase. The largest drop in funding was for dengue (down $3.6m, -4.4%), with negligible funding changes for kinetoplastid diseases (down $2.4m, -1.6%), diarrhoeal diseases (up $1.4m, 0.8%) and helminth infections (down $0.9m, -1.0%).

Diseases that received less than 0.5% of global funding in 2018 were leprosy, cryptococcal meningitis, Buruli ulcer, trachoma, leptospirosis, rheumatic fever and the three newly-included diseases: snakebite envenoming, mycetoma and hepatitis B. These nine diseases collectively accounted for just 1.0% of global funding in 2018. This share was unchanged from 2017 due to the inclusion of the three new diseases; funding in fact fell for all six existing diseases, with the largest decreases for cryptococcal meningitis (down $3.4m, -31%) and leprosy (down $2.3m, -19%).

Figure 3. **Funding distribution 2007-2018^**
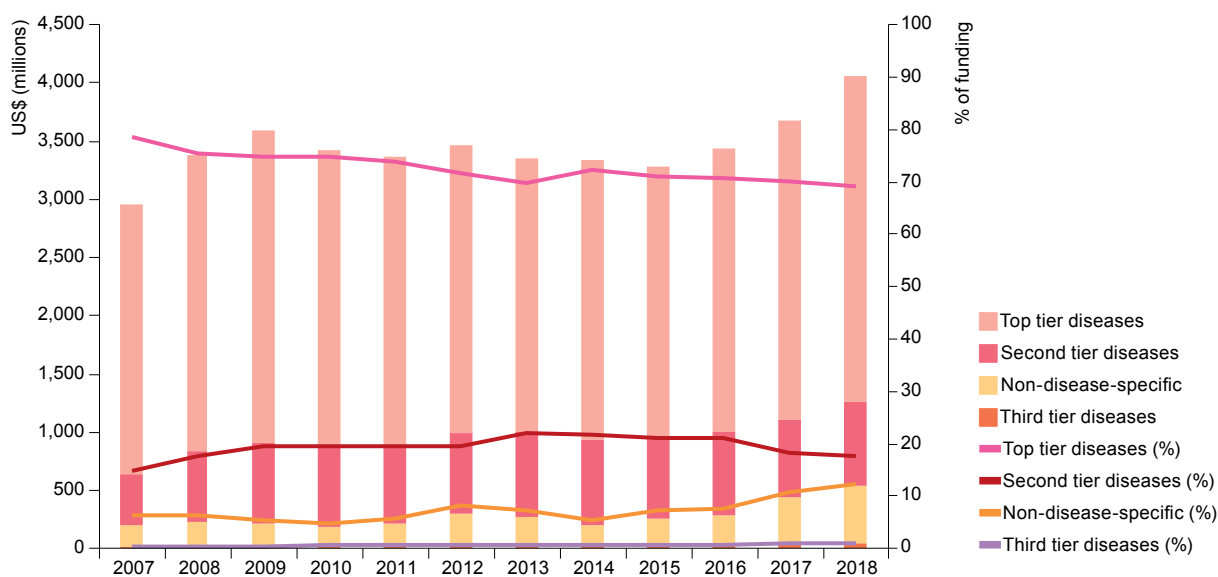
^ Pre - 2018 figures reflect the tiers diseases were allocated to in 2018, not the allocation in each prior year.

The slight reductions in funding share for diseases in the first and second funding tier despite robust growth in absolute terms were a result of the continued growth of non-disease-specific R&D investment, which includes core funding of multi-disease R&D organisations, investments in platform technologies and multi-disease vector control products, and other R&D investment that cannot be allocated to a specific disease. The share of non-disease-specific investment exceeded 12% in 2018, up from 11% in 2017 and 7.6% in 2016. This was an increase of $100m over 2017 (up 25%), driven by across-the-board growth in non-disease-specific funding, headlined by an increase in core funding for multi-disease organisations (up $66m, 22%).

HIV/AIDS

The Human Immunodeficiency Virus (HIV) attacks and destroys CD4 cells in the human immune system. Without treatment, HIV-infected individuals gradually become more susceptible to other diseases, and eventually develop Acquired Immunodeficiency Syndrome (AIDS); people with AIDS often die from opportunistic infections like TB or cryptococcal meningitis, or cancers like Kaposi's sarcoma.

There is currently no vaccine against HIV, and the rapid mutation of the virus poses a significant challenge to vaccine development. To date no vaccine candidate has proved able to match even the 31% efficacy achieved in the 2009 RV144 Thai Phase III clinical trials.[8] There are currently three large HIV vaccine efficacy trials underway: HVTN 706, a global Phase III HIV vaccine efficacy trial of mosaic immunogens;[9] HVTN 705, a Phase IIb trial of Janssen's prime-boost-based regimen;[10] and HVTN 702, a Phase IIb/III trial investigating a modified version of the RV144 vaccine regimen.[11] Several other candidates are currently in Phase I and II trials, including NIAID's broadly neutralising anti-HIV antibody (bNAb) candidate, VRC01, which is in Phase IIb.[12]

The therapeutic vaccines category was relabelled this year to capture biologic R&D spending previously categorised in this area or under drugs and preventive vaccines. bNAb-based approaches – designed to control HIV infection by boosting the body's natural immunity – are also being investigated for immunotherapy, including VRC01LS/10-1074, a dual long-acting bNAb currently in Phase II.[13] Plasmid and viral vectored DNA vaccines are also among the therapeutic vaccine candidates currently in Phase I and II clinical trials.[14–16]

Commercially-driven R&D of antiretroviral drugs is excluded from the G-FINDER scope; only R&D targeting the needs of developing countries (such as paediatric formulations or long-acting injectable drugs for PrEP) is included. The Drugs for Neglected Diseases initiative (DNDi), in partnership with Cipla, is developing Quadrimune, a taste-masked and heat-stable fixed-dose formulation containing four WHO-recommended antiretrovirals.[17] It is currently under review by the US FDA and, if approved, will be the world's first HIV/AIDS treatment designed specifically for infants and young children.[18] One long-acting injectable PrEP candidate, cabotegravir, is in Phase IIb/III and III trials,[19] while the long-acting injectable treatment regimen cabotegravir/rilpivirine, is under review by the US FDA following Phase III trials.[20]

Microbicides are preventive tools designed to block transmission of HIV through the vaginal or rectal mucosa. The International Partnership for Microbicides' (IPM) monthly dapivirine ring has completed Phase III trials, and is currently undergoing review by the European Medicines Agency.[21]

Current methods for early diagnosis are often not adapted to, or suitable for, developing countries, especially early infant diagnosis. There is progress towards robust, rapid point-of-care diagnostics, culminating in the recent WHO prequalification of several promising candidates. These include early infant diagnostic tests (Alere's q HIV-1/2 Detect and Cepheid's Xpert HIV-1 Qual assay), an assay for viral load monitoring (Hologic's Aptima HIV-1 Quant Assay) and the first true point-of-care molecular test for resource limited settings (Abbott's m-PIMA HIV-1/2 VL).[22–24]

$1.45 BILLION
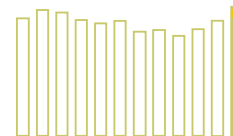
TOTAL SPEND ON HIV/AIDS R&D IN 2018

36%
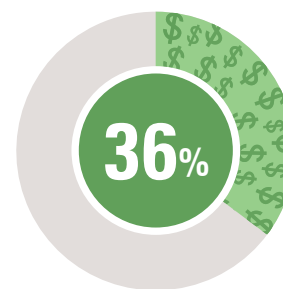
OF GLOBAL R&D FUNDING

54M DALYS
938,891 DEATHS
IN 2017

BASIC RESEARCH	RESTRICTED
DRUGS	RESTRICTED
VACCINES	IN SCOPE
BIOLOGICS	RESTRICTED
DIAGNOSTICS	IN SCOPE
VCPs	OUT OF SCOPE
MICROBICIDES	IN SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Global funding for HIV/AIDS basic research and product development in 2018 was $1,451m. This was by far the most of any neglected disease, and represented 36% of all neglected disease R&D investment in 2018. The bulk of the $158m (12%) headline increase from 2017 was the result of additional funding from the US NIH (up $135m, 18%). However, more than half of the US NIH increase (around $90m) was the result of better reporting of NIH HIV/AIDS project funding, which allowed us to identify additional in-scope investment; this means that some ongoing NIH projects included for 2018 had been wholly or partly excluded from previous years' funding totals. The effects of this change in reporting are particularly strong in relation to basic research and vaccine funding – accounting for all or most of their respective increases – though it had a significant impact across all product categories. If we correct for the effects of this year's broader inclusion criteria, the actual change in overall HIV/AIDS R&D funding was a more modest increase of $64m (up 5.0%), though still resulting in the third-largest annual investment in HIV/AIDS R&D ever recorded by G-FINDER, and the largest since 2009.

As in previous years, more than half of HIV/AIDS R&D funding was for vaccines ($757m, 52%), although this was the lowest share of funding for vaccine R&D ever recorded. This reflects the scale of the increase in drug R&D funding in 2018 (up $56m, 36%) rather than any decrease in funding for vaccines, which actually grew by more than $50m. Funding for R&D of drugs designed to meet LMIC needs accounted for 15% ($213m) of all funding, surpassing the amount and share of LMIC-focused HIV/AIDS basic research ($205m, 14%) for the first time in the history of G-FINDER. Microbicide R&D received less than ten percent of total funding ($140m, 9.7%) for the first time. Diagnostic R&D ($68m, 4.7%) received its highest ever amount and share. Biologics – a category introduced this year to include biologic funding previously categorised variously under therapeutic vaccines, preventive vaccines and drugs – received relatively little funding ($40m, 2.8%) in comparison to other product categories within HIV/AIDS, though this was still by far the most funding for biologic R&D of any neglected disease.

Funding increased for drug R&D for the second consecutive year (up $56m, 36%), with almost all of this increase coming from two sources: the US NIH (up $31m, 62%) and industry (up $16m, 21%). More than half (57%) of the apparent US NIH increase was due to better reporting, with the remainder reflecting $12m of additional funding for the HIV Prevention Trials Network's long-acting Pre-Exposure Prophylaxis (PrEP) clinical trials, including, most notably, the start of a Phase III clinical trial of the long-acting injectable cabotegravir in sub-Saharan Africa. A further $8.3m of additional funding was for the IMPAACT network, targeting new drug formulations for HIV-infected children and pregnant women. Industry committed an additional $16m (up 21%), driven by the beginning of a Phase III clinical trial of a long-acting injectable treatment regimen, cabotegravir/rilpivirine. Vaccine R&D funding likewise increased significantly (up $52m, 7.3%), on the back of record high funding from industry (up $40m, 58%), reflecting, in part, funding for the start of a Phase IIb clinical trial of the Ad26.Mos4.HIV/Clade C gp140 vaccine candidate in sub-Saharan Africa. The majority (78%) of US NIH increase in vaccine R&D funding (up $33m, 7.5%) was due to better reporting, while the rest reflected growth across the research spectrum – from funding of intramural discovery and pre-clinical R&D to late-stage clinical trials conducted by the HIV Vaccine Trials Network. The bulk of the increase in funding for LMIC-focused biologic R&D was genuine (up $16m, 67%), reflecting additional US NIH funding aimed at moving the VRC01 broadly neutralising antibody and its derivatives along the R&D pipeline. Funding for diagnostics also grew in 2018 (up $15m, 29%) to its highest ever level, following three consecutive years of funding increases: for the second year in a row, this year's increase was driven by increased funding from Unitaid (up $13m, 48%), mostly going to the Elizabeth Glaser Paediatric AIDS Foundation and UNICEF for the pilot implementation of early infant diagnostics.

Funding for microbicides decreased (down $13m, -8.4%), driven by reduced funding from USAID (down $12m, -33%). Following a small increase in 2017, the drop in funding in 2018 continued the downward trend of microbicide funding since its peak in 2008. Essentially all of the apparent increase in basic research funding in 2018 is a reflection of better reporting of US NIH data; basic research funding actually decreased (down $9.8m, -5.6%) if the change in NIH reporting is accounted for, following falls in consistently-measured NIH funding and from most other top funders.

Figure 4. HIV/AIDS R&D funding by product type 2009-2018
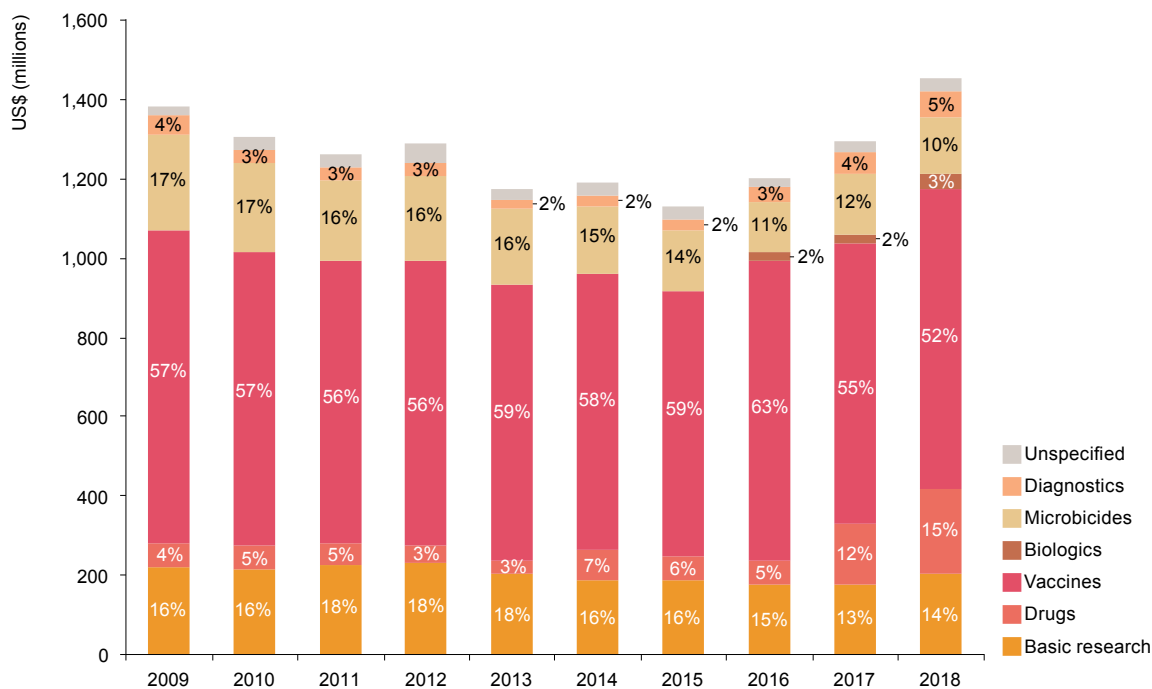
For the second consecutive year, more HIV/AIDS R&D funding went to clinical development & post-registration studies ($731m, 50%) than basic & early-stage research ($619m, 43%), with clinical development receiving half of all funding for the first time. The remainder ($101m, 7.0%) was not allocated to a specific product or R&D stage. Funding for clinical development & post-registration studies increased by $119m (up 19%); this reflects the advanced state of the HIV/AIDS R&D pipeline, with several ongoing late-stage clinical trials for vaccines, drugs, and microbicides, as well as operational research for diagnostics.

The top 12 funders remained unchanged from the previous year, and together provided almost all of the funding (98%) for HIV/AIDS R&D in 2018. The top 3 funders collectively provided the vast majority of total funding ($1,230m, 85%; the highest proportion ever recorded): the US NIH with $891m (61% of the total), industry $206m (14%), and the Gates Foundation $133m (9.2%).

Half of the top 12 funders increased their investment in 2018, most notably the US NIH, although as noted, two-thirds of its $135m (18%) increase (around $90m) was due to improved reporting. Industry investment also reached a record high (up $52m, 34%), recording its fifth consecutive year of growth, driven in 2018 by a ramp-up in clinical development for HIV drugs and vaccines. Unitaid funding increased by $18m (up 51%), reflecting a further increase in spending on early infant diagnostics. Smaller increases came from the German BMBF (up $3.4m, 47%), the UK DFID (up $2.1m, 20%), and French ANRS (up $1.2m, 16%). Funding from the Gates Foundation fell slightly (down $8.3m, -5.9%), with increased funding for vaccine R&D (up $5.1m, 5.2%; to its highest level ever recorded) offset by reductions in funding across all other products (collectively down $13m, -31%). The largest decrease was from US DOD (down $14m, -40%) due to the expiry of a Congressional Special Interest project. USAID funding also decreased (down $11m, -17%), mainly due to lower funding for microbicide development, with its funding to CONRAD falling to the lowest level ever recorded. Other decreases came from the Dutch DGIS (down $5.9m, -49%) and Inserm (down $4.4m, -41%).

Table 5. HIV/AIDS R&D funders 2018

Funder	US$ (millions)										2018 % of total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
US NIH	876	831	804	819	737	761	750	781	756	891	61
Aggregate industry	41	34	26	24	17	49	59	89	154	206	14
Gates Foundation	146	146	136	134	131	119	116	137	141	133	9.2
USAID	84	84	80	78	71	63	62	50	64	53	3.7
Unitaid	-	-	-	-	0.7	7.4	5.7	4.8	35	52	3.6
US DOD	42	39	52	56	60	67	30	37	34	21	1.4
EC	29	21	22	16	18	14	13	18	16	14	1.0
UK DFID	35	18	15	19	6.5	10	1.4	5.6	11	13	0.9
German BMBF	-	2.6	1.0	1.7	2.3	2.1	4.1	6.5	7.3	11	0.7
French ANRS	12	11	9.8	11	12	4.6	4.6	5.3	7.3	8.5	0.6
Inserm	13	14	14	14	13	12	12	11	11	6.4	0.4
Dutch DGIS	7.4	4.0	6.2	4.0	8.0	6.6	1.4	9.8	12	6.1	0.4
Subtotal of top 12^	1,305	1,227	1,188	1,209	1,101	1,138	1,082	1,165	1,249	1,415	98
Disease total	1,380	1,302	1,261	1,289	1,175	1,187	1,127	1,202	1,293	1,451	100

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.
- No reported funding

Just over three-quarters of all HIV/AIDS funding came from public funders ($1,107m, 76%). HICs accounted for the vast majority of public sector funding ($1,045m, 94%), with most coming from the US NIH ($891m, 85% of HIC funding). The remaining quarter of HIV/AIDS R&D funding in 2018 was provided by industry ($206m, 14%), the vast majority of which ($199m, 96%) was from MNCs; and the philanthropic sector ($137m, 9.5%).

The largest real increase in HIV/AIDS R&D investment came from the private sector (up $52m, 34%), continuing its rapid and sustained growth since reaching a low of $17m in 2013. Most (80%) of the apparent increase in public sector funding in 2018 was due to improved reporting of US NIH funding data; if the effects of changes to NIH reporting are accounted for, public funding increased only slightly (up $23m, 2.3%). Without the genuine and reported increases from the US NIH, public funding for HIV/AIDS would actually have fallen slightly, in large part due to significant reductions from the US DOD and USAID. Philanthropic sector funding was lower (down $11m, -7.3%) in 2018, marking two consecutive years of decreasing funding.

Figure 5. HIV/AIDS R&D funding by sector 2018

Private (MNCs) 14%
Private (SMEs) 0.5%
Philanthropic 9%
Public (LMICs) 0.5%
Public (multilaterals) 4%
Public (HICs) 72%
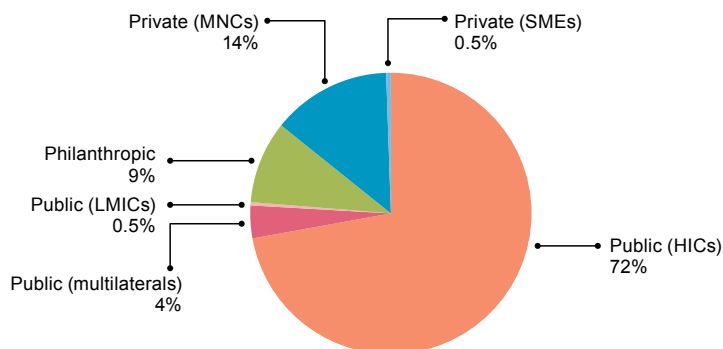
TUBERCULOSIS

Tuberculosis (TB), caused by *Mycobacterium tuberculosis*, is an airborne disease that most commonly affects the lungs, and is the leading cause of death of any single infectious pathogen. Almost a quarter of the world's population is estimated to be infected, but most TB cases are latent and non-infectious; around 5-15% will progress to active TB if left untreated. Active TB usually causes coughing, fever and weight loss, and is highly infectious. TB is especially dangerous for people with low immunity, and is a leading cause of death among people with HIV/AIDS. There is also growing resistance to existing treatments.

Current TB drug regimens are complex and can require up to two years of daily treatment, leading to poor compliance, drug resistance and treatment failure. New drugs are needed that can shorten the duration of treatment, are effective not only against drug-sensitive TB but also against multidrug-resistant (MDR-TB) and extensively drug-resistant TB (XDR-TB), are suitable for all age groups, are safe to use in conjunction with HIV treatments, and can be used in new treatment paradigms, including treatment of latent TB and MDR-TB prophylaxis.
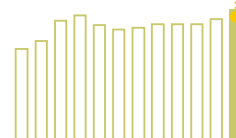
The world's first fixed-dose combination treatment specifically designed for children, HRZ/HR, received WHO prequalification in 2017 and has since been rolled out in over 80 countries,[25] while in 2019 the FDA approved the all-oral, once daily BPaL regimen (including the novel drug pretomanid in combination with bedaquiline and linezolid), which promises to dramatically shorten the duration of treatment for XDR-TB and treatment-tolerant or non-responsive MDR-TB.[26] TB Alliance is also preparing clinical trials for paediatric formulations of pretomanid.[27] There are several ongoing Phase III trials of various regimens for the treatment of drug resistant TB based on new and approved drugs, including NeXT, SimpliciTB, TB PRACTECAL and endTB;[28] and a further Phase III clinical trial (PHOENIx MDR-TB) evaluating the effectiveness of prophylactic delamanid in protecting household contacts from contracting MDR-TB.[29] There are also two Phase III trials (SimpliciTB and TBTC Study 31) currently examining shorter duration regimens for drug-sensitive TB.[30]

The existing TB vaccine (BCG) provides limited protection against pulmonary disease in adults. A vaccine which provides protection against all forms of TB in all age groups is needed.[31] Results from two recent TB vaccine efficacy trials were mixed: M72/AS01E showed an efficacy of 54% among TB-infected adults, and even higher levels in participants 25 years of age or younger,[32] while H4:IC31 showed no statistically significant protection.[33] A recombinant vaccine, VPM1002, has completed Phase II trials to assess safety and immunogenicity in neonates (including those exposed to HIV), and is in Phase II/III trials for prevention of TB recurrence in adults.[33] Therapeutic vaccines (which now fall under the expanded 'biologics' category in this year's G-FINDER report), are a potential tool to simplify and shorten TB treatment; at least one such candidate (RUTI) targeting MDR-TB is currently in Phase II clinical trials.[34]

There is a need for more effective and appropriate point-of-care TB tests, tests to diagnose TB in children, and tests for drug resistance and susceptibility.[33] Cepheid's next generation molecular test, Xpert MTB/RIF Ultra, showed significantly better performance than its predecessor, and the WHO is expected to provide a policy update on its use.[35] Two new types of diagnostic technology – genotypic drug resistance testing and centralised high-throughput testing platforms – are currently under development.[33]

$685 MILLION

TOTAL SPEND ON TUBERCULOSIS R&D IN 2018

17%
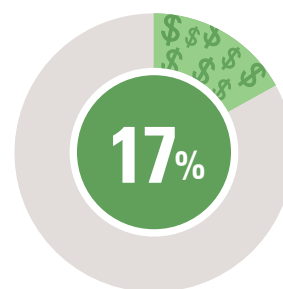
OF GLOBAL R&D FUNDING

45M DALYS 1,167,623 DEATHS IN 2017
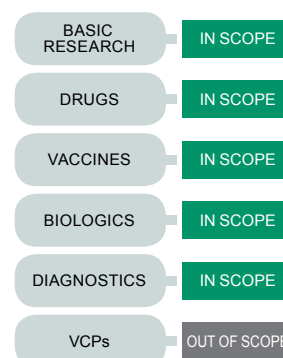
BASIC RESEARCH	IN SCOPE
DRUGS	IN SCOPE
VACCINES	IN SCOPE
BIOLOGICS	IN SCOPE
DIAGNOSTICS	IN SCOPE
VCPs	OUT OF SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Global funding for basic research and product development for TB in 2018 was $685m, making it the second-highest funded neglected disease, narrowly ahead of malaria for the first time since 2015. Funding increased for the sixth consecutive year (up $49m, 7.7%) taking TB investment to the highest level ever recorded by G-FINDER, and marking the largest increase in annual funding since 2009.

For the first time, investment in just one product, drugs, made up over half of total TB investment with $359m (53%). Funding for basic research ($184m, 27%) received the next largest share, followed by vaccine R&D ($65m, 9.5% – its lowest share ever recorded), diagnostics ($63m, 9.2%) and biologics ($4.6m, 0.7%).

Investment in drug R&D increased by more than $63m (21%) from last year's record, surpassing the $300m mark for the first time. Just under half of the overall increase was contributed by the Gates Foundation, which increased its investment by more than two-thirds (up $29m, 67%). This increase was largely due to a combination of new funding for industry (up $12m, 240%) to support clinical trials of a promising new candidate and increased funding to TB Alliance (up $9.7m, 55%). Increased funding for TB drug R&D from UK DFID (up $11m, 90%) was similarly driven by increased funding to TB Alliance. Other notable increases came from industry (up $8.5m, 11%), US NIH (up $8.4m, 9.8%) and the Indian ICMR (up $6.9m, 625%).

Despite the overall growth in TB R&D, investment in vaccines fell to an all-time low, declining for the fourth consecutive year (down $12m, -15%). An increase from the US NIH (up $11m, 81%) was not enough to offset reduced investment from industry (down $9.3m, -60%), the Gates Foundation (down $5.4m, -20%) and a number of other public funders, with the winding down of Aeras' activities in 2018 a key factor behind reductions from the Gates Foundation and DFID. Investment in diagnostic R&D also fell (down $6.7m, -9.6%), although this drop was largely due to changes in survey participation by industry. Investment in biologics, a new category which also captures funding historically allocated to therapeutic vaccines, was overwhelmingly funded by the US NIH (92% of the total) and decreased slightly in 2018 (down $0.4m, -7.7%).

Figure 6. **TB R&D funding by product type 2009-2018**
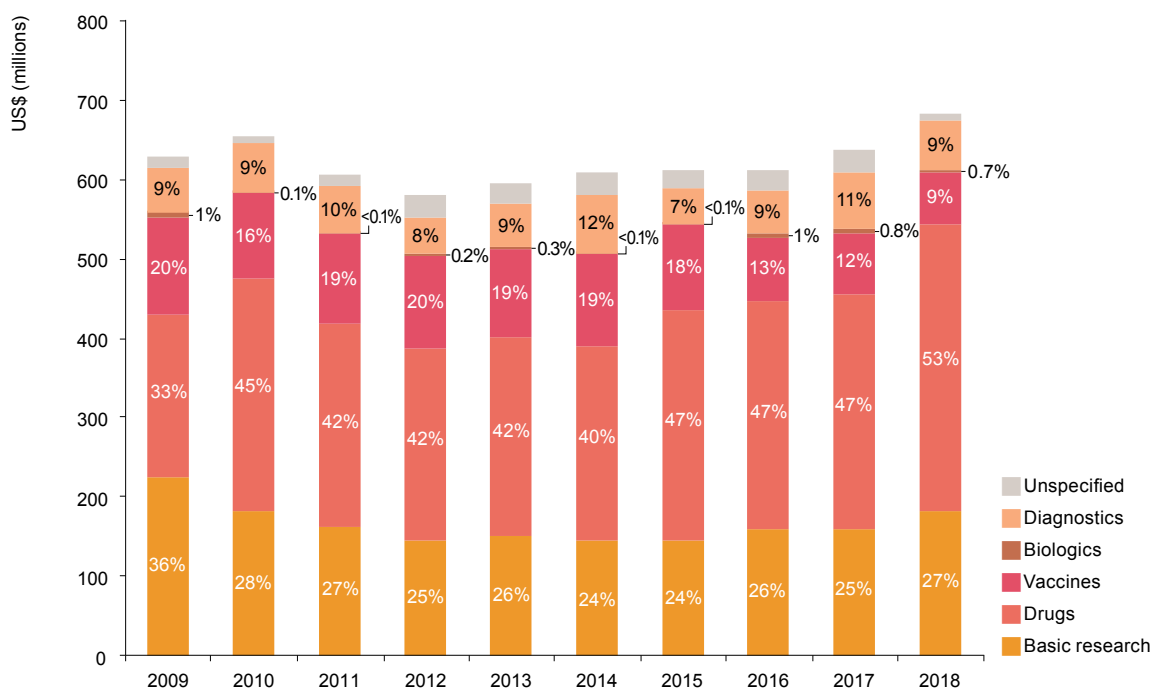
Basic research funding was the only other area to receive increased funding (up $24m, 15%) in 2018. Just under half of the increase came from the US NIH (up $11m, 9.2%), nearly all of which went to the US Department of Agriculture (USDA) for prospective observational research studies (RePORT) in India and South Africa. Most of the remaining growth was due to Indian ICMR funding for basic research (up $8.0m, 965%); however this was due to more detailed reporting of grants which would previously have been categorised as 'unspecified', rather than an overall increase in basic research funding.

More than half ($371m, 54%) of all TB R&D funding in 2018 was for basic & early-stage research with a further 31% ($214m) for clinical development & post-registration studies. The remaining 15% ($100m) was not allocated to a product or R&D stage.

The distribution of funding varies a great deal between products. Just under two-thirds (63%) of vaccine R&D funding went to discovery & pre-clinical research, whereas nearly half (49%) of all drug R&D funding was invested in clinical development & post-registration studies. This reflects the status of their respective pipelines, with an absence of late-stage vaccine candidates on the one hand, and advanced trials for drugs like pretomanid, which was registered in 2019, on the other.

Funding for both basic & early-stage research and clinical development & post-registration studies increased at similar rates, but the drivers behind the changes were different. The increase in funding for basic & early-stage research (up $31m, 9.2%) could be almost entirely attributed to the US NIH, which increased its funding for early-stage drug and vaccine R&D (collectively up $22m, 49%) and basic research (up $11m, 9.2%). In contrast, the increase in funding for clinical development & post-registration studies (up $21m, 11%) came largely from industry and the Gates Foundation, who increased their collective investment in clinical & post-registration studies of new TB drugs by $32m (up 65%), while reducing their investment in clinical development of vaccines (down $15m, -63%).

The top 12 funders accounted for 90% ($618m) of all TB R&D funding in 2018, with the top three funders – the US NIH, Gates Foundation and industry – collectively providing nearly three-quarters ($485m, 71%). Both these proportions are slightly higher than in 2017, mainly as a result of the large increases in funding from the US NIH and the Gates Foundation. Although the gap between the US NIH and the second-largest funder was smaller than in 2017, funding from the US NIH was still more than double that of the Gates Foundation.

The 2018 increase in TB R&D funding was mostly due to large increases from HIC public funders and the Gates Foundation. Funding from the Gates Foundation (up $21m, 23%) bounced back to 2012 levels after three years of declining funding, as a result of new funding to industry to support clinical trials and additional support to TB Alliance. A number of public funders from HICs reported increased funding at or near their historic highs, including the US NIH (up $31m, 13%), UK DFID (up $9.5m, 67%) and USAID (up $4.1m, 34%). After increasing its investment in 2017 for the first time since 2011, industry funding dropped again (down $7.2m, -6.9%), falling to the second-lowest amount ever recorded by the G-FINDER survey. This comes as a result of further decline in industry investment in vaccine R&D (down $9.3m, -60%), taking it to its lowest level ever, as well as a reported reduction in diagnostics investment (down $6.6m, -61%) which was mostly due to changes in survey participation. These decreases completely overwhelmed the smaller increase in industry investment in drug R&D (up $8.5m, 11%). The EC (down $5.7m, -32%) was responsible for the only other notable decrease in funding, resulting from the conclusion of projects under the seventh Framework Programme (FP7), including TBVAC2020.

The public sector provided just under two-thirds ($448m, 65%) of all funding for TB R&D in 2018, with the remainder coming from the philanthropic ($138m, 20%) and private sectors ($97m, 14%). As in previous years, the vast majority of public funding was contributed by HICs ($405m, 90%) with the rest coming from LMICs ($30m, 6.8%) and multilateral organisations ($13m, 2.9%). MNCs provided the majority of private sector funding ($91m, 93%) with SMEs accounting for just $6.5m (6.7%); this was the lowest share of TB R&D funding from SMEs since 2013, but was potentially skewed by the nonparticipation of a major 2017 funder.

Table 6. Top TB R&D funders 2018

Funder	US$ (millions)										2018 % of total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
US NIH	202	193	187	195	181	204	212	222	244	274	40
Gates Foundation	119	125	105	111	137	144	138	105	92	113	16
Aggregate industry	141	176	169	146	120	111	109	100	105	97	14
UK DFID	16	20	11	1.5	13	14	12	7.9	14	24	3.5
Indian ICMR	2.3	3.7	3.8	7.4	8.9	8.8	8.5	13	19	19	2.8
USAID	10	10	10	11	9.3	14	14	17	12	16	2.4
German BMBF	5.1	4.4	4.1	5.2	5.2	6.3	7.1	10	17	16	2.3
US CDC	18	11	10	0.0	0.0	16	9.5	8.9	15	15	2.1
Unitaid	0.0	0.0	0.0	0.4	2.1	0.5	6.4	34	12	13	1.8
EC	31	24	20	12	20	16	27	22	18	12	1.7
Wellcome Trust	7.6	12	11	12	13	12	10	9.1	9.3	10	1.5
Gates Ventures									5.5	9.0	1.3
Subtotal of top 12^	578	606	554	526	531	559	561	557	565	618	90
Disease total	629	654	606	579	592	607	610	611	635	685	100

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.
- No reported funding
▨ Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

The largest increase came from the public sector, with an increase in funding of $31m (up 7.5%), almost entirely from HICs (up $30m, 7.9%), while funding from LMICs (up $0.8m, 2.8%) and multilaterals (up $0.6m, 5.0%) was largely steady. Philanthropic sector funding increased by just over a fifth (up $25m, 22%), primarily from the Gates Foundation (up $21m, 23%). Private sector investment decreased (down $7.2m, -6.9%) due to sharply lower investment by SMEs (down $8.2m, -56%), partly related to survey participation. MNC investment remained stable (up $1.1m, 1.2%).

Figure 7. TB R&D funding by sector 2018

Private (SMEs) 1%
Other 0.1%
Private (MNCs) 13%
Philanthropic 20%
Public (HICs) 59%
Public (LMICs) 4%
Public (multilaterals) 2%
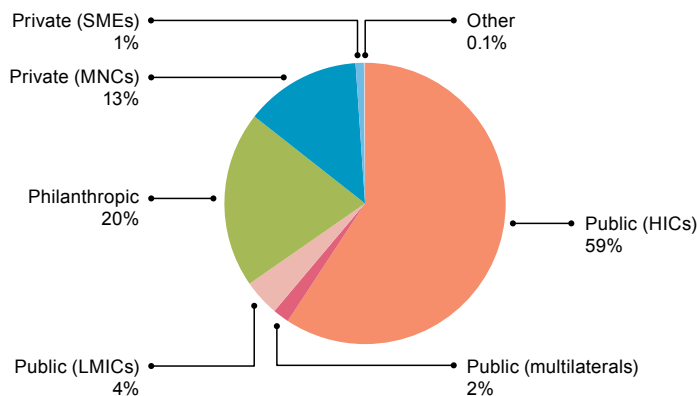
MALARIA

Malaria is a parasitic disease transmitted through the bite of an infected female *Anopheles* mosquito. The two most common types of malaria are caused by *Plasmodium falciparum* and *Plasmodium vivax*. Left untreated, malaria can cause severe illness and death. Children and pregnant women are among the most vulnerable, with more than 70% of all malaria deaths occurring in children under five years of age.[36]

The most advanced malaria vaccine candidate, RTS,S, commenced large-scale pilot implementation in 2019 in Malawi, Ghana and Kenya under the auspices of the WHO-coordinated Malaria Vaccine Implementation Programme.[37] There remains a need for new vaccines which have greater efficacy; provide protection against both *P. falciparum* and *P. vivax*; and can block transmission.[38] The next most advanced vaccine candidate, Sanaria's PfSPZ, is now in Phase II trials.[39]

Eleven new malaria drugs have been approved since 2007,[40] including tafenoquine, a single-dose treatment for relapsing *P. vivax* malaria approved in 2018, and two paediatric artemisinin-based combination therapy (ACT) formulations.[41,42] New drugs are still needed in response to emerging resistance to ACTs, and to meet the goal of a single-dose cure. Several promising novel drugs are in late-stage development, including artefenomel/ferroquine and ganaplacide/lumefantrine.[43] Both candidates are undergoing Phase IIb trials for safety, efficacy and their potential as a single-encounter radical cure.[43] Biologics were included in scope for the first time this year, with monoclonal antibodies (mAbs) being investigated as a new approach for malaria prophylaxis, treatment or blocking transmission. At least one transmission blocking biologic, mAb TB31F, is currently in pre-clinical development.[44]

Cheap, sensitive rapid diagnostic tests (RDTs) exist, although heat stability can be an issue.[45] The emergence of parasites with deletions in the *pfhrp2/3* gene – which codes for the most common RDT target for detecting P. *falciparum* – is concerning.[46] Improved, more sensitive diagnostics are needed to identify non-*falciparum* species, distinguish malaria from other febrile illnesses, detect asymptomatic cases, and diagnose G6PD enzyme deficiency.[45] PATH's RDT to diagnose G6PD deficiency is currently in late-stage development,[47] while Alere's Malaria Ag P.f, a new generation highly-sensitive RDT which can detect asymptomatic infections, was prequalified in 2019.[48]

Next-generation vector control products are urgently needed in response to emerging pyrethroid resistance. Novel non-pyrethroid-based products that received WHO prequalification in 2017 include Sumitomo's SumiShield 50WG, a clothianidin indoor residual spray (IRS) formulation and BASF's Interceptor G2, a chlorfenapyr-based, dual-ingredient long-lasting insecticide-treated bed net (LLIN).[49] Chemical control products in development include Sylando 240SC – a chlorfenapyr-based IRS formulation – currently undergoing final phases of WHO prequalification review,[50] and Olyset Duo – a dual LLIN with permethrin plus pyriproxyfen – which recently completed field evaluations.[51] Vector manipulation approaches to reduce mosquito populations or block parasite transmission are also being investigated, with field experiments of CRISPR/Cas9-based gene drive approaches starting this year in Burkina Faso.[52–54] New approaches to vector control are being explored, including use of ivermectin mass drug administrations for malaria transmission control,[55] as well as spatial repellents and insecticide-treated baits.[56]

$663 MILLION
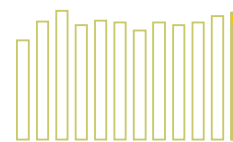
TOTAL SPEND ON MALARIA R&D IN 2018

16%

OF GLOBAL R&D FUNDING

**45M DALYS
619,685 DEATHS**
IN 2017

BASIC RESEARCH	IN SCOPE
DRUGS	IN SCOPE
VACCINES	IN SCOPE
BIOLOGICS	IN SCOPE
DIAGNOSTICS	IN SCOPE
VCPs	IN SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

A total of $663m was invested in malaria basic research and product development globally in 2018. This was only a modest increase from the previous year (up $18m, 2.8%), but marked the third consecutive year of increasing funding, and the largest annual investment in malaria R&D since its peak of $676m in 2009. Despite this, malaria was the third-highest funded neglected disease in 2018, after tuberculosis – funding for which grew even more sharply.

The largest share of malaria R&D funding went to drugs ($252m, 38%), followed by roughly equal shares to basic research ($163m, 25%) and vaccines ($156m, 24%). Essentially all of the remaining malaria funding went to vector control products ($56m, 8.4%)^ and diagnostics ($27m, 4.1%). R&D for biologics – a product category included for the first time in this year's G-FINDER report – received just $1.6m (0.2%), almost exclusively from the US Department of Defence (DOD).

Funding for malaria drug R&D increased by $25m (up 11%) to the highest level ever recorded in G-FINDER, driven by increased industry investment in several Phase II trials of new chemical entities with potential for single-exposure radical cure. Vector control product funding also increased significantly (up $21m, 60%), mainly due to cyclical grant funding from the Gates Foundation to both the Innovative Vector Control Consortium (IVCC; up $8.5m, with no disbursement in 2017) and the Foundation for the National Institutes of Health (FNIH; up $3.4m, from a low base), as well as a new $3.5m grant to industry for biological vector control product R&D. Basic research funding increased by $20m (up 14%), although a little over half of this increase was due to improved reporting by the Indian ICMR (whose reported basic research funding increased by $12m, having previously been reported as unspecified); further increases came from the Australian NHMRC (up $5.6m, 217%), and the US NIH (up $3.9m, 4.6%). Funding for vaccine R&D decreased (down $25m, -14%) due to lower investment from industry, reflecting a pipeline which saw no new candidates advance from or enter late-stage clinical trials, and pilot implementation studies for RTS,S not commencing until 2019. Diagnostic R&D was the only other product area to receive lower funding in 2018 (down $4.3m, -14%), driven by both the Gates Foundation (down $1.9m, -20%) and Gates Ventures (down $1.9m, -19%).

Figure 8. Malaria R&D funding by product type 2009-2018
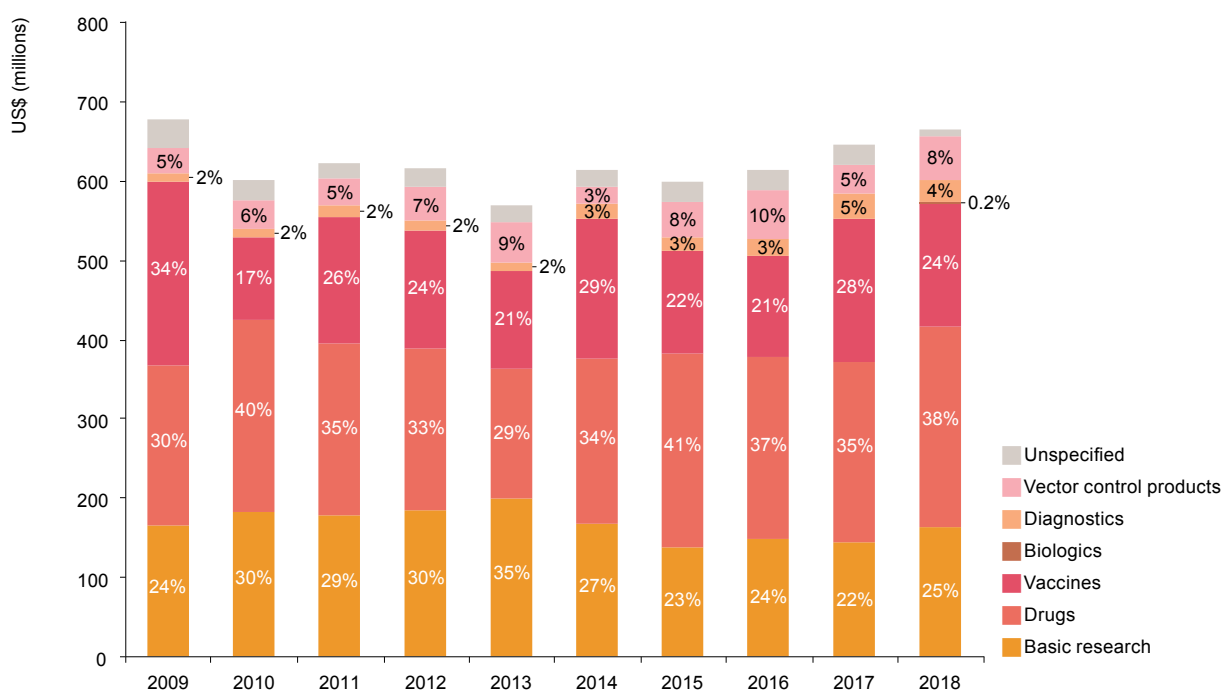
^ Overall private sector funding is under-reported as one company was unable to provide data in time to be included in the G-FINDER analysis. The organisation, an MNC, invested $3.8m in R&D for malaria chemical vector control products in 2018.

More than half ($352m, 53%) of all malaria R&D funding in 2018 was for basic & early-stage research; a further 27% ($176m) went to clinical development & post-registration studies. The remaining 20% ($135m) was not allocated to a specific product or R&D stage, mostly consisting of core funding to product development partnerships (PDPs). Funding for clinical development of drugs and vaccines focused on Phase II clinical trials, accounting for 60% of drug clinical development funding and 34% for vaccines; this reflects the support of several ongoing and new Phase II trials for new chemical entities as well as next generation malaria vaccines and additional clinical trials for RTS,S fractional dose schedules. Most other drug clinical development funding went to Phase III clinical trials (30% of the total), with Phase I receiving very little (3.4%). Vaccines, in contrast, saw nearly a quarter (23%) of their funding go to Phase I clinical trials, with Phase III vaccine trials accounting for only 2.9% of total clinical development funding.

Funding for basic & early-stage research increased sharply (up $52m, 18%) in 2018, driven by the doubling of industry investment in drug discovery and pre-clinical development (up $21m, 99%) as well as higher public sector funding for basic research (up $20m, 17%). There was lower investment in clinical development & post-registration studies in 2018 (down $21m, -11%), which returned to 2016 levels due to a reduction in investment in vaccine clinical trials (down $26m, -33%). This is a reflection of the state of the pipeline, with no new vaccine candidates advancing from or entering late-stage clinical trials in 2018. The fall in vaccine trial funding was somewhat offset by the combined effects of a near doubling of investment in field development for vector control products (up $9.7m, 96%), primarily due to funding to IVCC from UK DFID and Unitaid, as well as increased investment in drug clinical trials (up $7.9m, 8.9%) primarily from industry.

The top 12 funders accounted for 92% ($608m) of all malaria R&D funding in 2018, with this proportion largely unchanged from 2017. The top 3 funders – the US NIH, industry and the Gates Foundation – collectively contributed over two-thirds of total funding ($455m, 69%).

Six of the top 12 funders increased their investment in 2018. The largest increase was from the Gates Foundation (up $20m, 18%), largely reflecting cyclical funding for vector control products (up $15m, 94%), as well as increased funding for drugs (up $4.3m, 12%), which grew slightly despite a third consecutive year of reduced funding to its largest recipient, Medicines for Malaria Venture (MMV), which reflected a peak in supplementary grants in 2015 and the postponement of some scheduled funding until 2019. Industry also increased investment in 2018 (up $16m, 11%) to the highest level ever recorded in G-FINDER, eclipsing its previous (2015) peak following increased investment in support of multiple drug candidates undergoing Phase II clinical trials; this rise in industry's drug funding was more than enough to offset for a major drop in its vaccine R&D investment (down $21m, -34%), which returned to normal levels following a spike in 2017. The Australian NHMRC (up $5.5m, 119%) re-entered the top 12 funders list for the first time since 2014. Funding also increased from USAID (up $5.2m, 46%; to its highest level ever recorded), US DOD (up $3.8m, 13%) and the Wellcome Trust (up $1.6m, 10%). Of the six top 12 funders that decreased their funding, the US NIH and three UK funders (DFID, MRC and DHSC) had the largest decreases: US NIH funding dropped for the first time since 2013 (down $5.3m, -3.0%), driven by lower funding for vaccine R&D (down $7.9m, -15%); UK DFID decreased its funding by $5.3m (-14%), from its historic high in 2017; the drop in 2018 was due to lower funding to MMV (down $13m, -43%) offset somewhat by a doubling in funding to IVCC (up $5.8m, 106%); funding from the UK MRC fell by $4.4m (-33%) following a small increase in the previous year, and the UK DHSC (down $3.8m, -37%) dropped out of the top 12 malaria funders due to lower funding to MMV and EDCTP, after a large disbursement in the previous year as part of its new stream of official development assistance funding.

The public sector provided more than half ($353m, 53%) of all malaria R&D funding in 2018, as it has in each of the previous eight years. Remaining funding was split evenly between private sector ($158m, 24%) and the philanthropic sector ($152m, 23%). This was a record high investment by industry, and marked the fourth year in a row that its contribution was equal to or larger than that of the philanthropic sector. Public funding was dominated by HIC governments ($328m, 93% of public sector funding), with the US NIH remaining by far the largest funder ($171m, 52% of HIC government funding). MNCs continued to contribute the vast majority ($153m, 97%) of industry funding, with SMEs providing the remaining 3.3% ($5.2m).

Table 7. Top malaria R&D funders 2018

Funder	US$ (millions) 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
US NIH	142	163	150	186	151	161	167	173	176	171	26
Aggregate industry	103	123	99	113	81	126	151	146	142	158	24
Gates Foundation	223	108	178	146	138	156	126	131	106	126	19
US DOD	46	28	22	11	24	20	31	30	29	33	5.0
UK DFID	3.3	21	18	5.9	26	19	17	13	38	33	4.9
USAID	10	11	9.5	12	6.9	5.8	2.1	14	11	17	2.5
Wellcome Trust	25	30	28	28	25	23	17	15	15	17	2.5
Indian ICMR	7.5	5.4	5.4	7.2	8.1	7.5	8.3	9.6	15	15	2.2
EC	25	25	23	16	23	23	15	9.6	12	12	1.8
Australian NHMRC	12	11	13	16	12	11	3.5	3.6	4.6	10	1.5
UK MRC	18	20	18	16	16	14	8.5	11	13	9.1	1.4
Gates Ventures									10	8.1	1.2
Subtotal of top 12^	625	554	569	564	521	575	562	566	580	608	92
Disease total	676	600	622	614	569	613	598	613	645	663	100

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.
 Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

The overall increase in funding for malaria R&D was driven in equal parts by the philanthropic sector (up $17m, 12%, after a record low in 2017), and industry (up $16m, 11%); funding from the public sector fell by $14m (-3.8%), but still remained well above its historical average. The increase in industry investment came entirely from MNCs (up $16m, 11%) with funding from SMEs essentially steady (down $0.1m, -2.0%). The drop in public sector funding came from both HICs (down $14m, -4.2%) and LMICs (down $0.9m, -4.4%), which outweighed an increase in multilateral funding (up $1.1m, 29%).

Figure 9. Malaria R&D funding by sector 2018

Private (SMEs) 0.8%
Private (MNCs) 23%
Philanthropic 23%
Public (LMICs) 3%
Public (multilaterals) 0.8%
Public (HICs) 49%
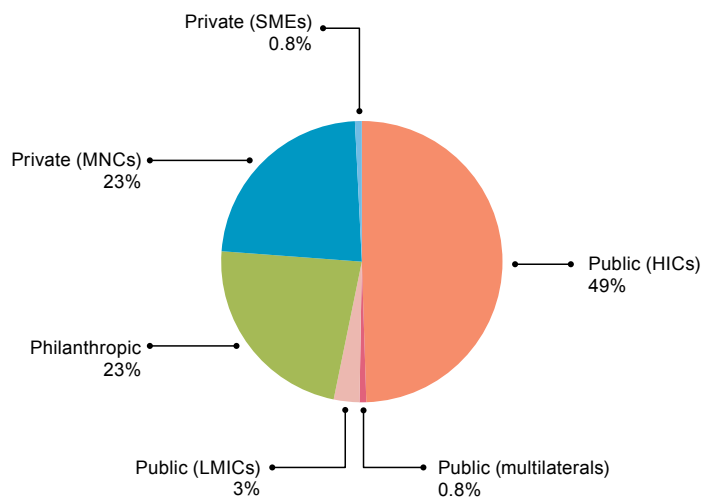
DIARRHOEAL DISEASES

Diarrhoeal diseases are a group of illnesses caused by viruses, bacteria and protozoan parasites that spread through contaminated food or water. Without treatment, diarrhoeal diseases can cause severe illness and death. Children under the age of five and immunocompromised individuals are most at risk. Rotavirus is the leading cause of severe diarrhoeal disease in young children worldwide, causing fever, vomiting and watery diarrhoea. Other diarrhoeal diseases include enteroaggregative *E. coli* (EAEC) and enterotoxigenic *E. coli* (ETEC), both of which can also cause fever and watery diarrhoea. For some people, cholera (caused by *Vibrio cholerae*) is asymptomatic but for others, infection can lead to severe diarrhoea and vomiting, and even kill within hours if left untreated. Shigellosis, caused by the *Shigella* bacterium, is highly contagious. Giardiasis is caused by the *Giardia* protozoan parasite found in soil, food and water contaminated by faeces. *Cryptosporidium* is a protozoan parasite that can survive in soil, food and water, causing cryptosporidiosis primarily in people who work with animals or live in overcrowded settings.

Current vaccines against diarrhoeal diseases are sometimes ineffective and not always suitable for infants. New bivalent and multivalent vaccines that are suitable for infants and that have long durations of protection are needed for most diarrhoeal diseases. Paxvax's Vaxchora, a cholera vaccine, received US FDA approval in 2016 for use in adults travelling to cholera-affected areas.[57] While it is currently being evaluated for use in children over two years of age, it has not been approved for, or tested in, endemic areas. There are currently four WHO prequalified rotavirus vaccines, with ROTASIIL receiving prequalification in September 2018.[58,59] As of late 2018, 101 countries had introduced a rotavirus vaccine as part of their routine immunisation schedule.[60] However these current-generation live attenuated oral vaccines are not optimally effective in high-burden settings, and coverage is lower than with comparable injectable vaccines on the routine schedule.[61] The next generation of rotavirus vaccine candidates are non-replicating parenteral vaccines, the most advanced of which – NRRV (P2-VP8) – is in Phase III trials.[62] Several vaccine candidates for other diarrhoeal diseases are in Phase II trials, including ETVAX to address ETEC; and GSK3536852A and Flexyn2a for *Shigella*.[63–65] A combined *Shigella* and ETEC vaccine candidate, ShigETEC, is also in pre-clinical development.[66]

Oral rehydration therapy in conjunction with zinc supplementation is the mainstay of diarrhoeal disease management in LMICs, but supportive therapy alone is not sufficient in all types of diarrhoea. Safe, effective and affordable pathogen-specific drugs are needed to target *V. cholerae*, *Cryptosporidium*, and *Shigella*. The current therapeutic pipeline of both small molecule drugs and biologics for these pathogens is in the early stages of development, with no candidates in clinical development.[67–70] New rapid diagnostic tests capable of distinguishing between different diarrhoeal diseases are also required, however there are currently no late-stage candidates in the diagnostic pipeline.

$171 MILLION

TOTAL SPEND ON DIARRHOEAL DISEASE R&D IN 2018

4%

OF GLOBAL R&D FUNDING
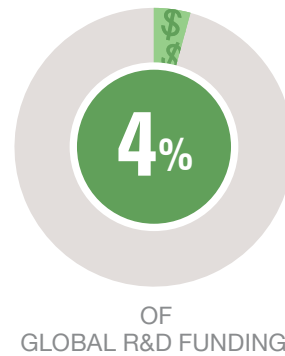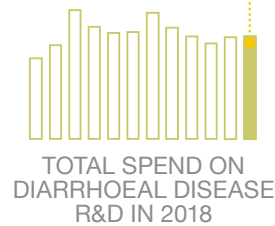
55M DALY
1,157,938 DEATHS
IN 2017

	Rotavirus	Shigella Cholera Cryptosporidiosis	ETEC EAEC	Giardiasis	Multiple diarrhoeal diseases
BASIC RESEARCH	OUT OF SCOPE	IN SCOPE	OUT OF SCOPE	OUT OF SCOPE	IN SCOPE
DRUGS	OUT OF SCOPE	RESTRICTED	OUT OF SCOPE	OUT OF SCOPE	RESTRICTED
VACCINES	RESTRICTED	IN SCOPE	IN SCOPE	OUT OF SCOPE	IN SCOPE
BIOLOGICS	OUT OF SCOPE	RESTRICTED	OUT OF SCOPE	OUT OF SCOPE	RESTRICTED
DIAGNOSTICS	OUT OF SCOPE	IN SCOPE	IN SCOPE	IN SCOPE	IN SCOPE
VCPs	OUT OF SCOPE	OUT OF SCOPE	OUT OF SCOPE	OUT OF SCOPE	OUT OF SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Diarrhoeal diseases received $171m in basic research and product development funding in 2018. Investment remained steady (up $1.4m, 0.8%), at a level well below its peak of $215m in 2009.

The largest share of diarrhoeal disease R&D funding once again went to rotavirus ($55m, 32%), followed by cholera ($34m, 20%), Shigella ($31m, 18%), multiple diarrhoeal diseases ($23m, 14%) and cryptosporidiosis ($17m, 10%). The remaining diarrhoeal diseases collectively received only 6.6% ($11m) of all diarrhoeal disease funding, their smallest share since 2014.

The stable overall funding for diarrhoeal diseases masks several changes in funding for individual pathogens. The largest increase was for rotavirus (up $7.2m, 15%), and was the first significant increase in rotavirus R&D investment since 2013 – driven by an increase in rotavirus vaccine R&D investment by industry (up $13m, 89%) related to the commencement of an LMIC-specific vaccine trial for registration purposes. The only other notable increase in funding was for cholera (up $4.5m, 15%), which placed it ahead of Shigella for the first time since 2015. However both this increase and the corresponding drop in funding for multiple diarrhoeal diseases (down $4.1m, -15%) were due to improved pathogen-specific reporting of intramural funding from the Indian ICMR. Funding for all other diarrhoeal diseases either fell or remained steady, with the largest decreases being for Shigella (down $3.1m, -9.0%) and ETEC (down $2.3m, -17%).

The three diarrhoeal diseases for which all relevant product areas are in scope (cholera, Shigella, cryptosporidiosis) display markedly different funding profiles. Funding for cholera was focused on basic research ($25m, 72%), with less than a quarter going to vaccines ($7.7m, 23%). The inverse was true for Shigella: almost three-quarters of its funding was for vaccines ($23m, 74%), and less than a fifth was for basic research ($5.4m, 17%). For cryptosporidiosis, nearly two-thirds of all funding ($10m, 60%) was for drug development, with most of the remainder going to basic research ($5.4m, 31%). A little under half of all funding for multiple diarrhoeal diseases was for vaccine R&D ($10m, 44%), almost all of which was funding from the Gates Foundation to PATH to support the advancement of vaccine candidates against Shigella and ETEC. Most of the remaining funding for multiple diarrhoeal diseases was split relatively evenly between drugs ($4.6m, 20%), diagnostics ($4.6m, 20%) and basic research ($3.3m, 14%). Multiple diarrhoeal diseases was also the only category to report any funding for biologics ($0.6m, 2.4% of its total).

Funding for vaccine R&D increased for the second consecutive year (up $9.0m, 9.2%). The increase was due largely to growth in industry investment in rotavirus R&D (up $13m, 89%) – partially offset by decreased funding for ETEC (down $2.6m, -19%) and smaller decreases across several other diseases. Funding for drug R&D remained largely stable (up $0.7m, 4.4%), after having doubled the previous year. Funding for diagnostic R&D decreased for the second consecutive year (down $1.4m, -18%) – after an all-time high of $12m in 2016 – with the decreases concentrated in funding for multiple diarrhoeal diseases (down $1.1m, -20%). Funding for basic research remained steady (up $0.2m, 0.4%), although this was only the case due to a substantial increase in basic research funding for cholera (up $5.2m, 27%), which was primarily due to more granular reporting from the Indian ICMR. Basic research investment in other pathogens fell sharply, with the largest decreases in funding for multiple diarrhoeal diseases (down $3.4m, -51%) and Shigella (down $2.4m, -31%).

Table 8. Diarrhoeal disease R&D funding 2018 (US$ millions)^

Disease	Basic research	Drugs	Vaccines	Biologics	Diagnostics	Unspecified	Total	%
Rotavirus			54	-		1.1	**55**	32
Cholera	25	0.6	7.7	-	1.1	-	**34**	20
Shigella	5.4	1.1	23	-	0.8	0.9	**31**	18
Cryptosporidiosis	5.4	10	0.9	-	0.2	0.3	**17**	10
Enterotoxigenic *E. coli* (ETEC)			11		0.2	0.2	**11**	6.4
Enteroaggregative *E. coli* (EAEC)			0.2		-	0.2	**0.4**	0.2
Giardiasis					<0.1	-	**<0.1**	<0.1
Multiple diarrhoeal diseases	3.3	4.6	10	0.6	4.6	-	**23**	14
Total	**39**	**17**	**106**	**0.6**	**6.8**	**2.7**	**171**	**100**

^ Please note that there were strict eligibility conditions on drug and vaccine investments for some diarrhoeal disease products to avoid inclusion of overlapping commercial activity. Due to this, total funding between product categories cannot be reasonably compared.
- No reported funding
▒ Category not included in G-FINDER

Funding for diarrhoeal diseases remained focused on basic & early-stage research ($101m, 59% of all funding for diarrhoeal disease R&D). A further third went to clinical development & post-registration studies ($57m, 33%), with $14m (8.0%) not allocated to a specific product or R&D stage. Funding for several diarrhoeal diseases were particularly focused on basic & early-stage research, which accounted for 95% of all funding for cryptosporidiosis and 90% of funding for cholera. The inverse was true of rotavirus, where nearly three-quarters (71%) of all funding was for clinical development & post-registration studies – reflecting the relative maturity of its vaccine pipeline. Funding for *Shigella* shifted from focusing heavily on basic & early-stage research in 2017 (80% of its funding) to a more even distribution, with roughly half of total investment going to basic & early-stage research (52%), and a third (29%) to clinical development – its largest ever share for clinical development, reflecting the progression of an industry vaccine candidate.

Funding for diarrhoeal disease R&D remained highly concentrated in 2018, with the top three funders – industry, the US NIH and the Gates Foundation – providing 80% ($137m) of total funding.

Unlike in 2017, when 10 of the top 12 funders increased their investment in diarrhoeal disease R&D, 2018 saw widespread but modest decreases in funding from smaller funders both inside and outside the top 12, which offset larger increases from a handful of top funders. The largest of these increases came from industry (up $12m, 32%), making it the top funder of diarrhoeal disease R&D for the first time – reflecting a large increase in industry rotavirus vaccine investment (up $13m, 89%) related to the commencement of an LMIC-specific trial in support of product registration. Other significant increases came from the US NIH (up $3.7m, 9.0%), largely driven by an increase in its funding for cholera R&D (up $2.7m, 14%), and UK DFID (up $3.6m, 88%), focused on rotavirus vaccines and drugs for multiple diarrhoeal diseases. The only other increases among the top funders came from the EC (up $1.0m, 47%), and a new funding stream from the Indian BIRAC ($1.0m) for cholera vaccine R&D. These increases were offset by mostly modest reductions in funding from a large number of organisations, with only the Gates Foundation (down $4.0m, -8.4%) reporting a drop in funding of more than $2.0m.

Public sector funding accounted for a little under half ($75m, 44%) of all funding for diarrhoeal disease R&D, with HICs providing the vast majority ($68m, 91% of public sector investment). This picture was essentially unchanged from the preceding year; however there was a shift in the balance of the remaining funding, which in 2018 was split evenly between industry and the philanthropic sector ($48m, 28% each). This was a record high share for industry, and the first time it had matched the contribution of the philanthropic sector. Industry funding continued its shift back towards investment from MNCs, which provided 84% ($40m) of 2018 industry investment, up from a low of 47% in 2016.

Table 9. Top diarrhoeal disease R&D funders 2018

| Funder | US$ (millions) | | | | | | | | | | 2018 % of total |
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
Aggregate industry	44	36	30	32	47	42	36	32	37	48	28
US NIH	76	63	65	59	51	47	40	40	41	45	26
Gates Foundation	57	55	38	42	55	44	43	50	48	44	26
UK DFID	2.5	4.7	2.7	-	3.3	8.8	5.0	3.7	4.1	7.7	4.5
US DOD	13	7.2	5.9	9.0	10	10	7.5	6.1	8.5	7.2	4.2
Indian ICMR	4.1	5.1	3.1	2.9	5.1	4.9	5.5	5.2	7.2	5.5	3.2
EC	0.6	0.8	2.9	3.0	3.4	3.4	3.3	0.6	2.1	3.1	1.8
Institut Pasteur	5.3	4.3	4.4	4.1	4.1	4.1	3.9	4.3	4.3	2.3	1.4
MSF					-	-	1.5	4.9	2.7	1.9	1.1
Wellcome Trust	0.3	0.4	0.4	3.9	3.0	4.9	4.1	2.8	3.4	1.7	1.0
Indian BIRAC								<0.1	-	1.0	0.6
Inserm	1.5	1.7	8.8	9.2	14	12	12	1.1	1.4	0.9	0.5
Subtotal of top 12^	210	182	170	173	205	183	165	154	162	168	98
Disease total	215	188	177	179	211	186	171	159	170	171	100

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.
- No reported funding
◻ Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

The only increase in funding came from the private sector (up $12m, 32%); for the second consecutive year this was driven by a significant increase in MNC investment (up $13m, 48%) offset by a drop in investment by SMEs, although this drop (down $1.4m, -15%) was smaller than the previous year's. Public funding remained steady (down $0.4m, -0.6%) after a significant increase in 2017, with the slight drop in funding coming entirely from LMIC public funders (down $0.7m, -9.1%). Philanthropic sector funding fell substantially (down $9.8m, -17%), with lower funding from all philanthropic funders – particularly the Gates Foundation, Gavi and the Wellcome Trust.

Figure 10. Diarrhoeal disease R&D funding by sector 2018

Private (SMEs) 5%
Private (MNCs) 24%
Philanthropic 28%
Public (HICs) 40%
Public (LMICs) 4%
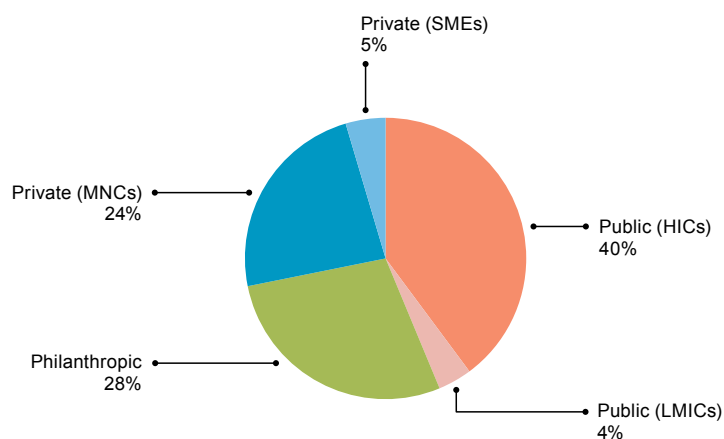
KINETOPLASTIDS

Kinetoplastid infections include three diseases: leishmaniasis; Chagas' disease (also known as American trypanosomiasis); and sleeping sickness (human African trypanosomiasis). Leishmaniasis – caused by *Leishmania* parasites and spread by phlebotomine sand flies – has three forms: visceral (the most severe form, often fatal without treatment); cutaneous (the most common); and mucocutaneous. Chagas' disease – caused by *Trypanosoma cruzi* and predominantly spread by the blood-sucking triatomine bug – has two stages. Symptoms in the acute stage are often mild or absent, resulting in under-diagnosis. Left untreated, infected individuals will progress to the chronic second stage, and 20-30% will develop life-threatening complications.[71] Sleeping sickness is caused by the parasite *Trypanosoma brucei* and spread by tsetse flies. It also has two stages, with early-stage disease symptoms difficult to distinguish from other viral illnesses. In late-stage disease, the parasite infects the brain and central nervous system, causing confusion and – without treatment – coma and death.

Leishmaniasis needs a preventive vaccine; biologic treatments; improved, preferably oral, drug formulations; and diagnostic tests for general disease diagnosis, cure, and a specific test for post-kala-azar dermal leishmaniasis (PKDL). Two visceral leishmaniasis candidates – a vaccine and a biologic therapy – are in active clinical development.[72,73] Three novel leishmaniasis drugs being developed by GSK and DND*i* have entered Phase I trials;[74–76] while a topical formulation of an existing drug (amphotericin B) is in clinical trials for the treatment of cutaneous leishmaniasis.[77] Diagnostics for resource-limited settings in development include: VL Sero K-SeT (in late-stage development) for rapid monitoring of cure and diagnosis of PKDL;[78] a VL ELISA test (in late-stage development);[79] and a LAMP-based test for visceral and cutaneous leishmaniasis currently undergoing demonstration studies.[79,80]

Chagas' disease needs a preventive vaccine; biologic treatments; safer, more effective drugs suitable for children and effective against the chronic form of the disease; and diagnostics that can reliably detect chronic disease and monitor treatment. All Chagas' disease vaccine and biological therapeutic candidates are in the pre-clinical stage or earlier.[81] A paediatric benznidazole formulation has been approved in Brazil, the US and Argentina, while a combination of benznidazole and fosravuconazole has completed Phase II trials, showing effectiveness as a two-week treatment course.[18,82] A Phase II trial of short-course and low-dose regimens of fexinidazole is ongoing in Spain.[83] Several new diagnostic tools to detect congenital Chagas' disease are in development, including two immunoassays in early-stage development and two LAMP-based molecular tests in late-stage development.[84–88]

Fexinidazole, the first all-oral treatment active against both stages of sleeping sickness, was registered in 2019 in the DRC, following the 2018 EMA positive scientific opinion.[89] It could potentially replace the current nifurtimox-eflornithine combination injectable treatments with an all-oral treatment which can be completed in just ten days. A second oral treatment, acoziborole, is in Phase II/III clinical trials.[18] There is little active research into sleeping sickness vaccines or biologics, with no candidates currently in the pipeline. Two point-of-care serological tests are in late-stage development: Coris BioConcept's second generation HAT RDT and ITM Antwerp's iELISA.[84]

$149 MILLION
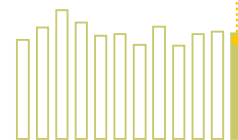
TOTAL SPEND ON KINETOPLASTID R&D IN 2018

4%
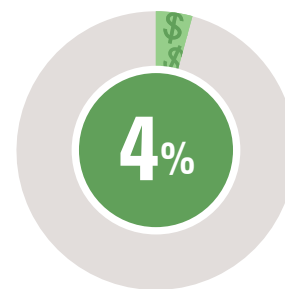
OF GLOBAL R&D FUNDING

1.1M DALYS
16,641 DEATHS
IN 2017

	Leishmaniasis	**Sleeping sickness (HAT)** **Chagas' disease** **Multiple kinetoplastid diseases**
BASIC RESEARCH	IN SCOPE	IN SCOPE
DRUGS	IN SCOPE	IN SCOPE
VACCINES	IN SCOPE	IN SCOPE
BIOLOGICS	IN SCOPE	IN SCOPE
DIAGNOSTICS	IN SCOPE	IN SCOPE
VCPs	OUT OF SCOPE	IN SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Global funding for basic research and product development for kinetoplastid diseases in 2018 was $149m. This was a slight decrease from the previous year (down $2.4m, -1.6%), bringing investment back to 2016 levels.

Sleeping sickness received the largest share of kinetoplastid funding ($51m, 34%) for the first time since 2014, on the back of three consecutive years of funding growth. R&D targeting multiple kinetoplastid diseases ($39m, 26%) and leishmaniasis ($39m, 26%) each received just over a quarter of total funding; this was the smallest share of funding ever for leishmaniasis. Chagas' disease received the remaining $21m (14%).

Although overall funding remained relatively stable, there were some notable changes in pathogen-specific investment. Funding for sleeping sickness increased by just under a third (up $12m, 30%), driven by historically-high levels of drug investment from industry (up $8.8m, 239%) and the Wellcome Trust (up $3.6m, from a low base). The increase in funding for Chagas' disease investment (up $3.0m, 17%), was also driven by increased investment in drug R&D (up $6.9m, 155%), offsetting a drop in funding for Chagas' basic research (down $3.7m, -32%).

Funding increases for sleeping sickness and Chagas' weren't enough to overcome the decreases in funding for multiple kinetoplastids and leishmaniasis. The drop in funding for multiple kinetoplastids (down $11m, -22%) was driven by reduced investment in drug R&D from industry (down $7.1m, -63%), as a result of a discovery portfolio for multiple kinetoplastids advancing to the development of specific candidates for both leishmaniasis (up $3.7m, 153%) and Chagas' disease (up $3.3m, from a low base). While this development contributed to the overall increase in Chagas' R&D funding, it did not prevent an overall drop in funding for leishmaniasis (down $6.4m, -14%), driven by a near-halving of both non-industry funding for leishmaniasis drug R&D (down $5.7m, -47%), and overall leishmaniasis funding from the Indian ICMR (down $2.7m, -45%), following its record-high investment in 2017.

As in previous years, funding for kinetoplastid diseases was heavily concentrated in drug R&D ($86m, 58%) and basic research ($54m, 36%), with the share of funding for drug R&D reaching the highest level ever recorded. The small amount of remaining funding was mostly shared between diagnostics ($4.2m, 2.8%) and vaccines ($3.7m, 2.5%). Biologics and vector control products each received less than 0.1% of all funding (<$0.1m).

Table 10. **Kinetoplastid disease R&D funding 2018 (US$ millions)**

Disease	Basic research	Drugs	Vaccines	Biologics	Diagnostics	Vector control products	Unspecified	Total	%
Sleeping sickness (HAT)	23	26	-	-	1.4	-	0.1	51	34
Leishmaniasis	21	12	3.7	<0.1	1.1		1.0	39	26
Chagas' disease	7.8	11	<0.1	<0.1	1.8	<0.1	<0.1	21	14
Multiple kinetoplastid diseases	2.5	36	<0.1	-	<0.1	-	0.3	39	26
Total	54	86	3.7	<0.1	4.2	<0.1	1.4	149	100

- No reported funding
▇ Category not included in G-FINDER

The only notable increase in funding was for drug R&D (up $4.9m, 6.0%), as a result of record-high industry investment (up $8.7m, 51%) and the Mundo Sano Foundation's $1.8m grant to DND*i* for paediatric benznidazole to treat Chagas', which offset a drop in public sector funding (down $4.9m, -9.2%). Funding for basic research (up $0.5m, 1.0%), vaccines (down $0.2m, -5.6%) and diagnostics (up <$0.1m, 0.4%) all remained essentially steady, while funding for biologics and vector control products remains too low to meaningfully comment on changes. R&D funding that wasn't assigned to a specific category fell significantly (down $7.5m, 84%), although this was partially a reflection of more granular funding from the Indian ICMR.

Just under two-thirds of all funding for kinetoplastid diseases went to basic & early-stage research ($94m, 63%), while 13% ($20m) was invested in clinical development & post-registration studies. The remaining quarter ($35m, 24%) was not allocated to a specific product or R&D stage.

The focus on basic & early-stage research was common to all three pathogens – 82% for Chagas' disease, 81% for leishmaniasis and 73% for sleeping sickness – reflecting an R&D pipeline with very few clinical development candidates. Most of the unspecified funding was for multiple kinetoplastid disease R&D (accounting for 85% of unspecified funding), $29m of which was funding for DND*i* from several public funders, most notably the UK DFID.

Funding for clinical development & post-registration studies increased by over a third (up $5.6m, 39%), driven by funding to support the approval of fexinidazole. Basic & early-stage research funding remained essentially stable (down $1.3m, -1.4%).

The top 12 funders accounted for 88% of all R&D funding for kinetoplastid diseases in 2018. This was in line with previous years, however the top three funders alone – the US NIH, industry and UK DFID – provided nearly two-thirds ($90m, 60%) of all funding, up from 56% in 2017.

The only significant increase in kinetoplastid R&D funding for 2018 came from industry (up $8.6m, 50%), taking industry investment to its highest level ever recorded, and serving as the primary reason that global funding for kinetoplastid R&D was relatively stable in 2018. Smaller increases came from the Wellcome Trust (up $1.2m, 13%) and the Dutch DGIS (up $0.5m, 14%), while an increase of just $0.3m (12%) was enough for French IRD to enter the top 12 in 2018.

All of the other top funders of kinetoplastid R&D remained stable or reduced their investment in 2018, with five of them reporting decreases of more than $2.0m. The largest decreases came from ICMR (down $2.7m, -45%) and US DOD (down $2.7m, -54%), both of which were specific to leishmaniasis. EC funding was also lower in 2018 (down $2.5m, -42%) as a result of multiple projects coming to an end under the seventh Framework Programme (FP7). Gates Foundation funding fell by just under a quarter (down $2.4m, -23%) due to reduced funding for leishmaniasis basic research. The US NIH also reduced investment into kinetoplastid R&D (down $2.1m, -4.8%) mainly due to a drop in Chagas' funding, while the German DFG fell out of the top 12 after a $1.4m drop (-49%) split across all disease areas.

Table 11. Top kinetoplastid disease R&D funders 2018

Funder	US$ (millions)										2018 % of total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
US NIH	65	69	58	56	49	44	38	42	44	42	28
Aggregate industry	4.8	11	14	19	17	19	21	15	17	26	17
UK DFID	8.3	8.6	9.2	9.7	8.7	13	13	14	23	22	15
Wellcome Trust	11	8.4	9.3	12	10	13	13	13	9.5	11	7.2
Gates Foundation	44	24	13	9.7	9.5	20	2.9	14	10	8.0	5.3
Dutch DGIS	-	1.3	4.0	2.5	4.9	4.0	0.9	4.9	3.8	4.4	2.9
EC	10	9.1	7.5	6.2	4.1	12	15	13	6.0	3.4	2.3
Indian ICMR	0.1	2.2	4.0	3.6	5.2	4.5	3.1	3.5	6.0	3.3	2.2
UK MRC	2.2	2.4	2.1	1.5	2.2	3.0	2.4	3.2	3.1	3.2	2.1
German BMBF	-	-	0.9	5.8	4.4	5.8	3.4	1.8	3.2	2.8	1.9
French IRD								2.8	2.4	2.7	1.8
US DOD	5.6	1.2	1.0	0.6	-	-	3.5	2.9	4.9	2.2	1.5
Subtotal of top 12^	166	150	130	135	120	146	120	131	134	131	88
Disease total	183	165	146	149	134	159	133	148	152	149	100

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.

- No reported funding

▨ Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

The public sector provided just over two-thirds ($105m, 70%) of all kinetoplastid R&D funding in 2018. Nearly all of this was from HICs ($98m, 94% of total public funding), with LMICs accounting for the remainder ($6.4m, 6.1%). The private sector accounted for a record-high share of funding ($26m, 17%), essentially all of which was provided by MNCs ($26m, 99.8%). Remaining funding came from the philanthropic sector ($19m, 13%).

Private sector investment increased by half in 2018 (up $8.6m, 50% – the largest increase from industry ever recorded), all of which was contributed by MNCs (up $8.7m, 51%) while funding from SMEs fell marginally (down $0.1m, -63%), albeit for the fourth consecutive year. Public funding decreased (down $9.6m, -8.4%) as a result of reductions from both HICs (down $6.9m, -6.6%) and LMICs (down $2.7m, -30%). Funding from philanthropic funders also fell (down $1.4m, -7.0%) for the second year in a row.

Figure 11. Kinetoplastid R&D funding by sector 2018

Private (MNCs) 17%
Philanthropic 13%
Public (LMICs) 4%
Public (HICs) 66%
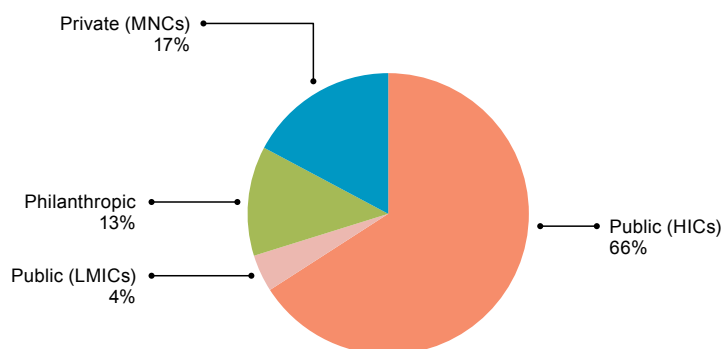
BACTERIAL PNEUMONIA & MENINGITIS

Pneumonia is an infection of the lungs that is transmitted when infected individuals cough or sneeze. Symptoms include coughing, fever, chest pain and shortness of breath. The illness can be deadly, especially for young children and elderly patients. Although pneumonia can be caused by a range of pathogens, pneumococcal pneumonia caused by the bacterium *Streptococcus pneumoniae* is by far the most common in developing countries.

Bacterial meningitis is an infection of the fluid that surrounds the brain and spinal cord, most commonly caused by *S. pneumoniae* or *Neisseria meningitidis*. Symptoms of bacterial meningitis can include severe headaches, fever, chills, a stiff neck, nausea and vomiting, sensitivity to light, and an altered mental state. Bacterial meningitis is also often transmitted from person to person through coughing or sneezing. Even with early diagnosis and treatment, 5-10% of infected individuals die within 48 hours of showing symptoms.[90]

Pneumococcal conjugate vaccines (PCVs) are highly effective and widely used in high-income countries, but until recently, the most common PCVs did not offer protection against serotypes most prevalent in developing countries.[91] The WHO-prequalified PCV10 and PCV13 vaccines, which offer broader protection, have been rolled out in developing countries with positive results.[91,92] However, PCVs are expensive to make and do not protect against all pneumococcal serotypes.[91,92] Gains from PCVs with limited serotype coverage may be threatened by serotype replacement of vaccine-cleared serotypes with non-vaccine serotypes. New vaccines are needed that are more affordable, while still providing specific protection for children against all serotypes, or those predominant in developing countries. Non-conjugate protein- and whole-cell-based vaccines are two potential approaches, offering broad protection and cheaper manufacture; however Sanofi's trivalent vaccine candidate PPrV and PATH's whole-cell candidate PATH-wSP are the only non-PCV candidates currently in active clinical development.[93] An affordable 10-valent PCV (PNEUMOSIL) was WHO prequalified in December 2019.[236]

Historically, most epidemic and endemic bacterial meningitis in the meningitis belt of sub-Saharan Africa has been caused by serogroup A meningococci. MenAfriVac, a 50c-per-dose monovalent conjugate meningitis A vaccine developed by the Meningitis Vaccine Project, has been rolled out across the meningitis belt since 2010, with much success. An infant version of MenAfriVac was prequalified by the WHO in early 2015. But as rates of meningitis A have fallen, other serogroups have become increasingly prominent. Two multivalent conjugate vaccines are currently available, but, at between $12 and $40 per dose, are too expensive for developing countries.[94] There is an ongoing need for cheaper polyvalent conjugate vaccines, with one candidate – PATH and SII's pentavalent meningococcal conjugate vaccine (A, C, Y, W-135, X) – entering Phase III trials in August 2019.[95] Diagnostics are also needed, including an RDT for use at the peripheral level that can detect serogroups to guide vaccine response, as well as multi-pathogen point-of-care tests for use at either peripheral or hospital levels to guide case management in both epidemic and endemic settings.[96] BioSpeedia's MeningoSpeed RDT is currently undergoing clinical evaluations for the detection of serogroups A, C, W, Y, X.[97]

$92.5 MILLION
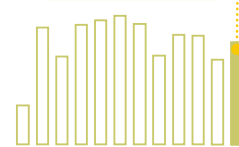
TOTAL SPEND ON BACTERIAL PNEUMONIA & MENINGITIS R&D IN 2018

2%
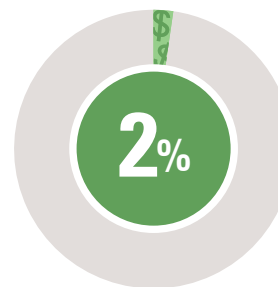
OF GLOBAL R&D FUNDING

65M DALYS
1,220,742 DEATHS
IN 2017

	S. pneumoniae *N. meningitidis*	Both *S.* *pneumoniae* and *N. meningitidis*
BASIC RESEARCH	RESTRICTED	RESTRICTED
DRUGS	OUT OF SCOPE	OUT OF SCOPE
VACCINES	RESTRICTED	OUT OF SCOPE
BIOLOGICS	OUT OF SCOPE	OUT OF SCOPE
DIAGNOSTICS	IN SCOPE	IN SCOPE
VCPs	OUT OF SCOPE	OUT OF SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Global funding for basic research and product development for bacterial pneumonia & meningitis in 2018 was $92m. This was an increase of $16m (21%) over 2017, reversing much of the previous year's decline.

For the second year in a row, more than 80% of all funding for bacterial pneumonia & meningitis R&D was for *S. pneumoniae* ($76m, 82%), with basically all of the remainder going to *N. meningitidis* ($16m, 17%). Funding for research targeting both bacteria was negligible ($0.6m, 0.6% of total funding).

Funding for both pathogens increased in 2018. The increase for *S. pneumoniae* (up $12m, 18%) was driven by the Gates Foundation (up $8.0m, 40%) and industry (up $3.9m, 12%), which offset a near halving of funding from Gavi (down $2.3m, -46%), while the increase for *N. meningitidis* (up $4.9m, 45%) was primarily due to a seven-fold increase in funding from the UK DFID (up $5.3m, 598%).

Vaccines received the vast majority of all funding in 2018 ($82m, 89%). This was the largest ever share for vaccine R&D, though still significantly below its 2012 peak in absolute terms. Conversely, funding levels for both basic research ($7.3m, 7.9% of the total) and diagnostics ($1.2m, 1.3%) were at or near their record lows.

The growth in overall funding for bacterial pneumonia & meningitis R&D in 2018 was almost entirely due to increased funding for vaccine R&D (up $15m, 22%), with proportionally similar increases across both pathogens. Pneumococcal vaccine R&D investment jumped by 21% (up $13m), driven by increases from the Gates Foundation (up $9.3m, 52%) and industry (up $3.9m, 12%) for clinical development & post-registration studies, which offset a drop in funding from Gavi (down $2.3m, -46%). Meningococcal vaccine R&D funding increased by 24% (up $2.2m), primarily due to the spike in UK DFID funding to PATH (up $5.3m, 598%) for development of the pentavalent meningococcal conjugate vaccine (A, C, Y, W-135, X). Diagnostics funding fell by just under a third (down $0.6m, -31%) due to small decreases in funding from the Gates Foundation (down $0.5m, -60%) and the US NIH (down $0.3m, -50%), while basic research funding remained relatively stable (down $0.1m, -2.0%).

Figure 12. Bacterial pneumonia & meningitis R&D funding by product type 2009-2018
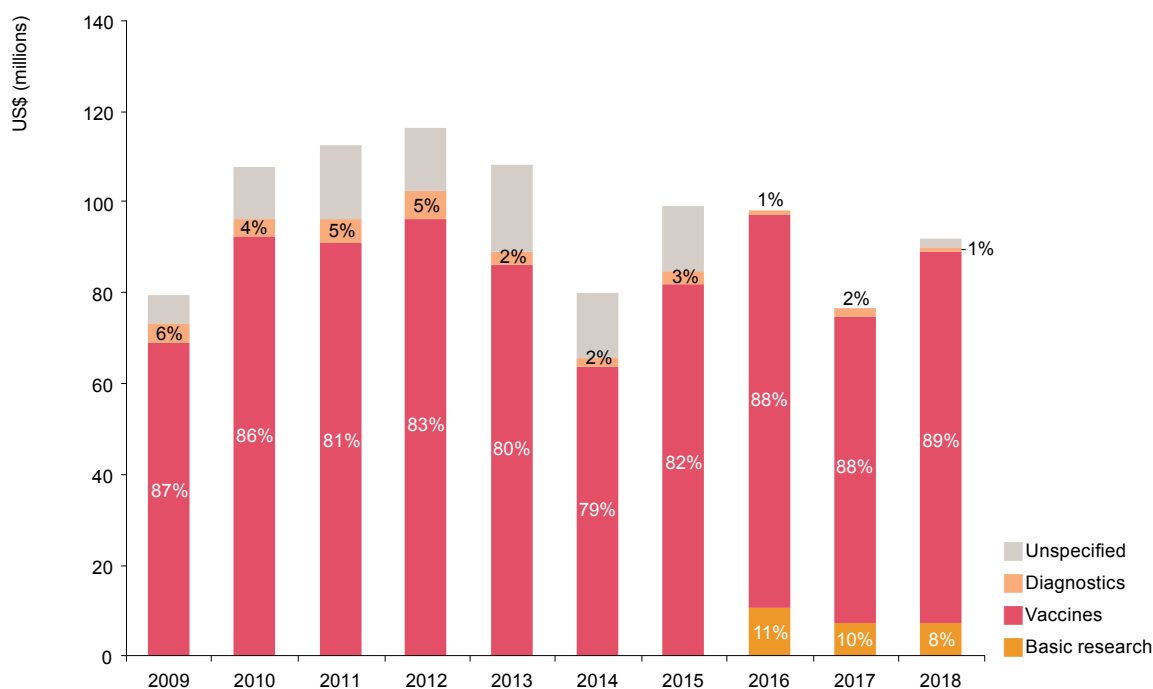
Most bacterial pneumonia & meningitis R&D funding went to clinical development & post-registration studies ($75m, 82%), with only $15m (16%) for basic & early-stage research. This split is influenced by scope restrictions on basic research and vaccine R&D in the G-FINDER survey, but marks the highest proportion of funding ever allocated to clinical development & post-registration studies, following a $13m (22%) increase driven by increased funding for late-stage *S. pneumoniae* vaccine development (up $11m, 21%).

Funding for bacterial pneumonia & meningitis was once again dominated by industry ($41m, 45%) and the Gates Foundation ($31m, 33%), which together provided over three-quarters ($72m, 78%) of all funding in 2018.

The overall increase in funding was mostly due to the Gates Foundation (up $5.6m, 22%), UK DFID (up $5.3m, 598%) and industry (up $4.7m, 13%) increasing their vaccine R&D investment. Two first time funders of bacterial pneumonia & meningitis – the UK NIHR and the Indian BIRAC – entered the top 12, as did the South African MRC. The largest decrease in funding came from Gavi (down $2.3m, -46%), followed by Institut Pasteur (down $1.2m, -61%, after a record-high investment in 2017).

A little under half of all bacterial pneumonia & meningitis investment came from industry ($41m, 45%). A further third came from the philanthropic sector ($34m, 36%), with only 19% ($17m) coming from the public sector. The overwhelming majority of industry investment was from SMEs ($38m, 90% of industry funding), almost all of which was from India-based companies. This was in contrast to public funding, the vast majority of which came from HICs ($16m, 91%), with only $1.6m (9.2%) provided by LMICs.

Table 12. Top bacterial pneumonia & meningitis R&D funders 2018

Funder / US$ (millions)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
Aggregate industry	38	35	41	44	52	52	39	59	37	41	45
Gates Foundation	26	48	41	46	15	5.7	35	20	25	31	33
UK DFID	-	-	-	0.1	0.8	1.9	-	3.0	0.9	6.1	6.7
German DFG	0.6	0.6	-	0.4	2.7	2.9	1.8	2.4	2.5	2.8	3.0
Gavi		2.6		5.7	12		6.7	4.9	5.0	2.7	2.9
US NIH	4.5	11	17	9.2	6.8	2.3	1.3	3.5	2.3	2.3	2.5
UK NIHR										1.9	2.0
Indian BIRAC								-	-	1.2	1.3
UK MRC	1.9	0.9	0.6	0.3	0.6	0.5	0.8	1.8	1.1	0.9	0.9
Institut Pasteur	0.3	0.4	0.8	0.5	0.3	0.3	0.5	0.7	1.9	0.8	0.8
Australian NHMRC	1.6	1.1	1.2	0.9	0.4	-	-	-	0.2	0.7	0.8
South African MRC	-	-	-	<0.1	<0.1	-	-	-	-	0.3	0.3
Subtotal of top 12^	78	105	112	116	108	80	99	98	76	92	99
Disease total	79	108	113	116	109	80	99	98	77	92	100

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.
- No reported funding
▓ Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

All three sectors increased their investment in 2018: the public sector by $8.2m (up 89%), industry by $4.7m (up 13%), and the philanthropic sector by $3.0m (up 9.7%). Despite the near doubling of public sector funding, bacterial pneumonia & meningitis recorded the second-lowest public sector share of investment of any of the G-FINDER neglected diseases, ahead of only hepatitis C.

Figure 13. Bacterial pneumonia & meningitis R&D funding by sector 2018

Public (HICs) 17%
Public (LMICs) 2%
Philanthropic 36%
Private (MNCs) 4%
Private (SMEs) 41%
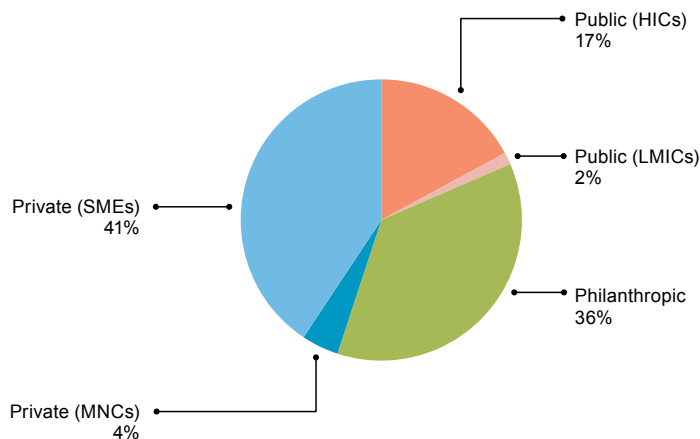
SALMONELLA INFECTIONS

Salmonella infections are a group of diseases caused by the *Salmonella enterica* bacteria, and transmitted through contaminated food or drink. These include: typhoid (caused by *Salmonella* Typhi); paratyphoid fever (caused by *Salmonella* Paratyphi A, B or C) – collectively referred to as enteric fever; and thousands of non-typhoidal serotypes, referred to as non-typhoidal *Salmonella* (NTS). Enteric fevers affect only humans, while NTS affects both humans and animals.

Salmonella infections are more common where there is dirty water and poor sanitation or hygiene. Symptoms can include fever, malaise, headache, constipation or diarrhoea, and an enlarged spleen and liver. Occasionally rose-coloured spots appear on the chest. In the case of typhoid fever, a small proportion of people can recover but still carry and spread the bacteria for as long as a year after infection. Diagnosis of *Salmonella* infections may require a blood, stool or bone marrow sample.

Medicines exist to treat enteric fever; however data from endemic regions show antimicrobial resistance linked to *S.* Typhi H58 clade is increasing, including the first ever reported outbreak of ceftriaxone-resistant *S.* Typhi in Pakistan in 2016.[98] Therefore, there is a need for more efficacious drugs, including ones suitable for children. There are currently three safe and effective typhoid vaccines available, with the latest to receive WHO prequalification being the world's first typhoid conjugate vaccine (TCV), Typbar TCV.[99] The WHO recommends TCVs as the preferred vaccine in high-burden countries[100] and Gavi funding for the introduction of this vaccine has been available for eligible countries since April 2018,[101] with Zimbabwe as the first beneficiary.[102] Given the threat of antibiotic resistance,[103] biologic R&D remains a need and was included in the G-FINDER scope for the first time this year. Pathogen-specific antibody-based therapeutics, such as monoclonal antibodies (targeting the typhoid toxin) and bacteriophages, are also being considered as an alternative modality for the treatment of typhoid fever.[103,104]

Paratyphoid fever is an increasingly common cause of enteric fever throughout Asia, but there are no registered vaccines specifically targeting it,[105] nor any bivalent vaccines that target both typhoid and paratyphoid fever.[106] There are at least two vaccine candidates targeting serovar Paratyphi A currently in clinical development: a glycoconjugate vaccine candidate O:2-TT (Phase II) and a live oral vaccine strain CVD 1902 (Phase I).[105,107,108]

There is no vaccine available for NTS, and treatment with antibiotics is only recommended for high-risk individuals such as young children, elderly people and immunocompromised patients. Several NTS vaccine candidates are in development, although they are all in the pre-clinical stage or earlier, including two candidates already set to transition to early clinical development: iNTS-GMMA, and the trivalent typhoid/iNTS glycoconjugate vaccine formulation (*S.* Enteritidis COPS:FliC/*S.* Typhimurium COPS:FliC/Typbar-TCV).[109–111]

$89.6 MILLION

TOTAL SPEND ON SALMONELLA R&D IN 2018

2%

OF GLOBAL R&D FUNDING
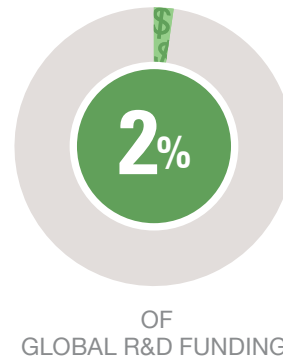
14M DALYS
193,943 DEATHS
IN 2017
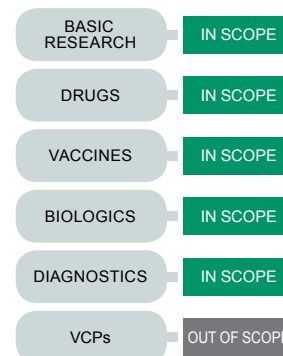
BASIC RESEARCH	IN SCOPE
DRUGS	IN SCOPE
VACCINES	IN SCOPE
BIOLOGICS	IN SCOPE
DIAGNOSTICS	IN SCOPE
VCPs	OUT OF SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Global funding for basic research and product development for *Salmonella* infections in 2018 was $90m. Funding increased by $4.8m (up 5.7%), continuing the long term trend of steady funding growth. There has only ever been one material decrease in annual funding for *Salmonella* R&D since the start of the G-FINDER survey – in 2017, following a record increase the preceding year – and funding has nearly doubled since 2009.

The division of funding for *Salmonella* infections has remained relatively unchanged since 2012. Over three-quarters of all *Salmonella* R&D funding in 2018 was for typhoid and paratyphoid fever ($68m, 76%), with multiple *Salmonella* infections receiving $15m (17%) and non-typhoidal *Salmonella* (NTS) just $7.0m (7.8%). Funding increased for both typhoid and paratyphoid fever (up $2.8m, 4.3%, after a large decrease the previous year) and NTS (up $1.9m, 36%). Funding for multiple *Salmonella* infections remained stable (up $0.2m, 1.0%).

The vast majority of funding for *Salmonella* R&D in 2018 was split between basic research ($42m, 47%) and vaccine R&D ($39m, 43%). The remaining funding was for drug ($5.9m, 6.6%) and diagnostic ($2.6m, 2.9%) R&D, with almost no funding reported for biologics in 2018 (<$0.1m, 0.1%). The overall concentration of funding on typhoid and paratyphoid fever was reflected across all product-focused R&D; basic research was the only area in which NTS accounted for more than 2.0% of funding (receiving 16% of all funding for *Salmonella* basic research).

The overall increase in funding for *Salmonella* R&D was driven by higher funding for vaccines (up $2.9m, 8.0%) and drugs (up $1.8m, 44%). Primarily driven by increased funding from the US NIH, these increases largely reversed the 2017 fall in vaccine funding and pushed *Salmonella* drug investment to its highest ever level. Funding for basic research also increased (up $1.0m, 2.4%), while funding for diagnostic R&D fell (down $0.6m, -18%).

Table 13. **Salmonella R&D funding 2018 (US$ millions)**

Disease	Basic research	Drugs	Vaccines	Biologics	Diagnostics	Unspecified	Total	%
Typhoid and paratyphoid fever (*S.* Typhi, *S.* Paratyphi A)	25	4.2	36	<0.1	2.4	-	68	76
Non-typhoidal *S. enterica* (NTS)	6.6	-	0.4	-	-	-	7.0	7.8
Multiple *Salmonella* infections	11	1.7	2.2	-	0.2	-	15	17
Total	42	5.9	39	<0.1	2.6	-	90	100

- No reported funding

As in 2017, almost two-thirds of all *Salmonella* R&D funding was for basic & early-stage research ($54m, 60%), with the majority of the remainder going to clinical development & post-registration studies ($32m, 36%). Vaccine R&D was the lone product area with a focus on clinical development ($32m, 82% of all vaccine funding), with diagnostics the only other area to receive any clinical development funding ($0.4m, 15% of diagnostic funding). Clinical development funding for *Salmonella* was once again concentrated in typhoid and paratyphoid fever R&D, which received 98% of all funding for clinical development & post-registration studies ($32m) – reflecting its more mature R&D pipeline.

Table 14. Top Salmonella R&D funders 2018

Funder	US$ (millions) 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
US NIH	31	33	27	36	34	32	30	41	32	35	39
Aggregate industry	4.1	3.5	5.3	4.7	11	17	15	26	24	26	29
Gates Foundation	2.0	4.0	4.7	5.6	10	7.3	13	13	16	16	17
Wellcome Trust	1.8	2.6	4.5	5.2	4.8	3.8	3.4	3.0	2.5	2.4	2.7
UK MRC	0.8	0.7	1.5	1.2	1.4	1.9	2.3	2.1	1.8	2.4	2.7
German DFG	0.6	1.3	1.3	1.0	1.4	2.0	0.4	1.9	1.7	2.2	2.4
Indian ICMR	-	<0.1	0.4	<0.1	0.5	0.4	<0.1	<0.1	<0.1	1.5	1.6
EC	1.2	0.9	0.5	0.2	-	<0.1	<0.1	0.2	0.6	0.9	1.0
Institut Pasteur	1.6	1.5	2.5	1.5	1.8	2.1	1.9	2.1	1.9	0.7	0.8
Canadian CIHR	-	-	-	-	-	-	-	-	0.6	0.6	0.7
Chilean FONDECYT		<0.1	0.8	0.7	0.7	0.7	0.6	0.5	0.5	0.5	0.5
Swiss SNSF		-	0.8	0.7	-	0.8	0.5	0.6	0.7	0.4	0.4
Subtotal of top 12^	46	50	50	60	68	69	72	95	83	88	99
Disease total	46	51	51	61	69	70	73	97	85	90	100

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.

- No reported funding

███ Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

The top 12 funders contributed almost all funding for *Salmonella* R&D globally ($88m, 99%), with the top three funders – the US NIH, industry and the Gates Foundation – collectively accounting for 86% ($77m); this was the largest share from the top three since 2008. The ranking of the top three funders has remained unchanged since 2013, with little movement among the remaining top 12 funders in 2018.

Seven of the top 12 funders increased their investment in 2018. The largest increase came from the US NIH (up $3.6m, 11%), and was spread across drugs, vaccines and diagnostics. This was followed by an increase from industry (up $1.7m, 6.9%) for typhoid and paratyphoid vaccine clinical development, while the Indian ICMR (up $1.4m, from a low base) appeared in the top 12 for the first time since 2014 due to an increase in intramural funding for basic research. The most significant decrease came from the Institut Pasteur (down $1.2m, -63%), which drove the overall drop in funding for diagnostic R&D.

The public sector accounted for a narrow majority ($46m, 51%) of global funding for *Salmonella* R&D; industry provided just under a third ($26m, 29%), and the philanthropic sector the remaining fifth ($18m, 20%). The vast majority of public funding came from HICs ($44m, 96% of all public funding), with LMICs providing only $1.8m (3.9%). In contrast, LMIC-based SMEs were responsible for the vast majority of industry funding ($24m, 94% of industry funding); accounting for 27% of total funding for *Salmonella* R&D – the second-highest share of SME funding for any G-FINDER disease group, behind only bacterial pneumonia & meningitis.

The overall increase in funding for *Salmonella* R&D was driven by increased investment from both the public (up $3.4m, 8.1%) and private sectors (up $1.7m, 6.9%) – with philanthropic sector funding remaining relatively stable (down $0.3m, -1.5%). The increase in private sector funding was entirely driven by increased investment by SMEs (up $2.3m, 10%); investment by MNCs fell for the third consecutive year (down $0.6m, -28%), to the lowest level recorded since 2008. Despite accounting for just a fraction of total public sector funding, a ten-fold increase in funding from LMICs (up $1.6m, 1100%) was responsible for almost half of the public funding increase, while a proportionally smaller increase from HIC public funders (up $1.8m, 4.3%) provided the remainder.

Figure 14. **Salmonella R&D funding by sector 2018**
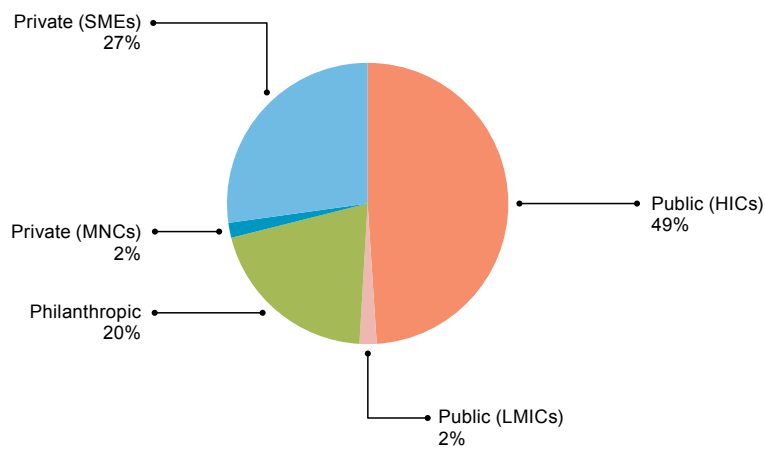
HELMINTH INFECTIONS (WORMS AND FLUKES)

Helminths are parasitic worms and flukes that can cause disease in humans. The most common mode of transmission to humans is through ingesting or coming into contact with contaminated food, water, or soil. Helminth infections transmitted in this manner include ancylostomiasis and necatoriasis (hookworm), ascariasis (roundworm), trichuriasis (whipworm) and strongyloidiasis (intestinal roundworms) – collectively referred to as soil-transmitted helminths – as well as taeniasis/cysticercosis (tapeworm) and schistosomiasis (bilharziasis, also known as snail fever). Other helminth infections are transmitted by bites of blood-sucking arthropods: these include lymphatic filariasis, which is transmitted by mosquitoes, and river blindness (onchocerciasis), which is transmitted by the black fly.

Adult worms can reside in the intestines and other organs, causing malnutrition and impaired cognitive development (hookworms), or progressive damage to the bladder, ureter and kidneys (schistosomiasis). Onchocerciasis is a major cause of blindness in many African and some Latin American countries, while lymphatic filariasis can cause painful, disfiguring swelling of the scrotum (hydrocele) and limbs (elephantiasis).

With no vaccines, disease control efforts rely on mass drug administration.[112] Variable drug efficacy and the need to control transmission mean that treatment programmes must continue for many years, increasing the risk of drug resistance.[113] New and more effective drugs are needed for many helminth infections, as are paediatric formulations of existing drugs. Current diagnostic products for detection of some helminths are outdated or complex; new and effective diagnostics that can measure infection intensity and detect drug resistance are needed.[113]

In 2018, the US FDA approved moxidectin, the first new onchocerciasis treatment in 20 years. Candidates in clinical development include oxfendazole and emodepside for onchocerciasis (both in Phase I),[114,115] tribendimidine for hookworm (Phase II),[116] an orodispersible praziquantel tablet for schistosomiasis in children (Phase III) and TylAMac for filarial diseases (Phase I).[117–119] Among the schistosomiasis vaccines in development are Sm14, which has completed a Phase IIa trial,[120,121] and Sm-TSP-2, which recently commenced Phase I/II trials in Uganda.[122] Therapeutic vaccines and antibody immunotherapy against adult worms, included in the G-FINDER scope under the heading of 'biologics' for the first time this year, are also being explored for schistosomiasis. Sm-p80, the only schistosomiasis vaccine with promising therapeutic potential, has completed pre-clinical evaluation and is currently in preparation for human clinical trials.[123,124] Two candidate vaccines against human hookworm infection are in clinical development. Na-GST-1 – the most advanced candidate – entered Phase II clinical trials in 2018 using a controlled human hookworm infection model.[120] All of the current vaccine candidates against onchocerciasis are in pre-clinical development.[125]

There are several diagnostic tests in development for helminth infections, including the SD BIOLINE Oncho/LF IgG4 biplex rapid test – a dual detection point-of-care test for onchocerciasis and lymphatic filariasis currently in field evaluation[126] – and the UCP-LF CAA assay to diagnose schistosomiasis in low-prevalence settings, which is in clinical development.[127] A lateral flow point-of-care test from the US CDC that can simultaneously detect taeniasis and neurocysticercosis is currently undergoing field evaluation in Tanzania and Zambia.[128]

$88.7 MILLION
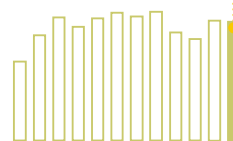
TOTAL SPEND ON HELMINTH R&D IN 2018

2%

OF GLOBAL R&D FUNDING

**7.5M DALYS
12,765 DEATHS**
IN 2017

	Onchocerciasis (river blindness) / Multiple helminth infections	Tapeworm (taeniasis / cysticercosis) / Lymphatic filariasis (elephantiasis)	Hookworm (ancylostomiasis & necatoriasis)	Whipworm (trichuriasis) / Roundworm (ascariasis)	Strongyloidiasis & other intestinal roundworms	Schistosomiasis (bilharziasis)
BASIC RESEARCH	IN SCOPE	IN SCOPE	IN SCOPE	IN SCOPE	IN SCOPE	IN SCOPE
DRUGS	IN SCOPE	IN SCOPE	IN SCOPE	IN SCOPE	IN SCOPE	IN SCOPE
VACCINES	IN SCOPE	OUT OF SCOPE	IN SCOPE	OUT OF SCOPE	IN SCOPE	IN SCOPE
BIOLOGICS	OUT OF SCOPE	OUT OF SCOPE	OUT OF SCOPE	OUT OF SCOPE	OUT OF SCOPE	IN SCOPE
DIAGNOSTICS	IN SCOPE	IN SCOPE	OUT OF SCOPE	OUT OF SCOPE	IN SCOPE	IN SCOPE
VCPs	IN SCOPE	IN SCOPE	OUT OF SCOPE	OUT OF SCOPE	OUT OF SCOPE	IN SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Global funding for basic research and product development for helminth infections in 2018 was $89m. Funding was essentially steady (down $0.9m, -1.0%), following a substantial increase in 2017.

Nearly two-thirds (61%) of all funding for helminth infection R&D in 2018 was invested in just four diseases: schistosomiasis ($24m, 27%), onchocerciasis ($15m, 17%), lymphatic filariasis ($15m, 17%) and tapeworm ($5.4m, 6.1%). The four other helminth infections included in the G-FINDER survey each received less than $3.0m, while the remaining 25% of funding ($22m) went to R&D targeting multiple helminth infections.

Only three helminth infections saw increased R&D funding in 2018. The largest increase was for onchocerciasis (up $2.9m, 24%), driven by increased investment in drug R&D (up $2.4m, 25%). This was followed by whipworm (up $1.0m, 86%), driven by increased US NIH funding (up $1.0m, 250%) for basic research and drug R&D, while the slight increase in funding for roundworm (up $0.4m, 30%) was attributable to $0.5m in new funding from the German DFG for basic research (after no reported funding in this area since 2011). Funding was lower for all other helminth infections, with the largest decreases seen in multiple helminths, hookworm and schistosomiasis. Funding for multiple helminth infection R&D decreased by $1.5m (-6.3%), driven by a $2.1m (-34%) decrease from the US NIH. Investment for hookworm fell by $1.4m (-35%), due to decreased funding for vaccines by the EC (down $1.3m, -100%) following the conclusion of the seventh Framework Programme (FP7) HOOKVAC project. Schistosomiasis funding fell by $1.0m, (-3.9%) – driven by decreases from the US NIH (down $1.4m, -8.7%) and Inserm (down $1.4m, -87%), partially offset by a resumption in funding by the German DFG ($1.1m, after reporting no funding in 2017). Smaller decreases were seen in lymphatic filariasis (down $0.8m, -5.1%), strongyloidiasis & other intestinal roundworms (down $0.4m, -26%), and tapeworm (down $0.2m, -2.8%).

Most helminth infection R&D funding was split between drug development ($40m, 45% of total funding) – both its largest amount and highest proportion of funding ever – and basic research ($33m, 38%), partly because these are the only products included in scope for all helminth infections. All other product areas received significantly smaller shares: 6.1% for diagnostics ($5.4m), 5.7% for vaccines ($5.1m), and 0.8% for vector control products ($0.7m). Biologics was introduced as a new product category for schistosomiasis and received $0.6m (0.7% of total funding).

Stable overall funding masked changes at the product level. The largest change was for vaccine R&D, which saw funding halve (down $4.9m, -49%) due to decreases from two funders: the US NIH (down $3.2m, -53%) and the EC (down $1.7m, -88%). Funding for drug R&D increased by $3.4m (9.4%) on the back of increased investment by a number of funders, led by industry (up $1.9m, 15%), while funding for diagnostics doubled (up $2.9m, 113%), mainly due to increases from the US NIH (up $1.0m, 123%) and the Gates Foundation (up $1.0m, 146%). Basic research funding remained stable (up $0.4m, 1.2%), partly due to improved reporting by the Indian ICMR (with $1.4m in basic research funding in 2018, previously reported as unspecified) offsetting a decrease from the US NIH (down $2.4m, -10%). Biologics was introduced as a new product category for schistosomiasis in 2018, with only the US NIH reporting funding, totalling $0.6m.

Table 15. Helminth R&D funding 2018 (US$ millions)

Disease	Basic research	Drugs	Vaccines	Biologics	Diagnostics	Vector control products	Unspecified	Total	%
Schistosomiasis (bilharziasis)	12	5.1	3.3	0.6	1.5	0.5	1.3	24	27
Onchocerciasis (river blindness)	1.1	12	0.7		1.6	<0.1	-	15	17
Lymphatic filariasis (elephantiasis)	4.9	7.5			0.3	<0.1	2.2	15	17
Tapeworm (taeniasis / cysticercosis)	2.6	1.3			1.3	0.2	-	5.4	6.1
Hookworm (ancylostomiasis & necatoriasis)	1.2	0.6	0.9				-	2.6	3.0
Whipworm (trichuriasis)	1.8	0.4					-	2.2	2.5
Roundworm (ascariasis)	1.5	0.2					-	1.7	1.9
Strongyloidiasis & other intestinal roundworms	1.0	<0.1	<0.1		<0.1		-	1.1	1.2
Multiple helminth infections	7.8	13	0.2		0.7	-	<0.1	22	25
Total	33	40	5.1	0.6	5.4	0.7	3.5	89	100

- No reported funding

Category not included in G-FINDER

More than two-thirds of all funding for helminth R&D in 2018 was for basic & early-stage research ($60m, 67%), and over a quarter went to clinical development & post-registration studies ($25m, 28%). The remaining funding ($4.2m, 4.7%) was not allocated to a specific product or R&D stage. A consistent pattern of heavier investment in basic & early-stage research was evident across all but one of the helminth infections, particularly for strongyloidiasis & other intestinal roundworms (97%), roundworm (92%), whipworm (89%) and schistosomiasis (88%). Only onchocerciasis saw a majority of its funding (74%) go to clinical development. Funding for clinical development & post-registration studies increased by 46% (up $7.8m) in 2018, while funding for basic & early-stage research fell (down $5.7m, -8.7%).

The top 12 funders again accounted for 96% of all reported helminth infection R&D funding in 2018. As in every year since 2013, the top three funders were the US NIH, the Gates Foundation and industry, who collectively provided three-quarters ($67m, 76%) of total funding.

In line with the steady state of overall funding, there was a mixed picture of relatively modest changes among the top funders of helminth R&D in 2018. The largest decreases came from the US NIH (down $3.2m, -8.1%), the EC (down $2.1m, -65%) and Inserm (down $1.5m, -87%). Inserm dropped out of the top 12 as a result, as did the Brazilian FINEP, despite a small increase in its 2018 funding (up $0.2m, 35%). The most notable increases came from the Gates Foundation (up $2.2m, 15%), industry (up $1.9m, 15%) and the German DFG (up $0.8m, 54%), while two French public funders, the ANR and the IRD, entered the top 12 funders in 2018 – the first time that IRD has appeared in the top 12.

In 2018 the public sector funded just under two-thirds of helminth infection R&D ($55m, 62%), 95% of which came from HICs ($52m). The remaining funding was provided by the philanthropic sector ($19m, 22%) and industry ($15m, 17%), with MNCs providing the vast majority ($14m, 92% of industry funding).

Table 16. Top helminth R&D funders 2018

Funder	US$ (millions) 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
US NIH	35	36	29	40	31	31	30	33	39	36	41
Gates Foundation	20	18	23	21	23	25	19	19	14	17	19
Aggregate industry	10	7.2	8.1	4.2	8.8	16	12	8.2	13	15	17
German BMBF	0.2	0.3	0.5	1.2	0.7	0.3	0.3	<0.1	6.2	5.8	6.6
Wellcome Trust	4.6	5.0	7.6	5.8	7.0	4.5	3.7	3.6	3.3	2.6	3.0
German DFG	7.0	0.6	0.7	2.8	3.1	-	2.2	1.5	1.6	2.4	2.7
Indian ICMR	0.5	1.1	1.3	1.5	1.7	1.5	1.4	1.2	2.1	1.4	1.6
UK MRC	1.0	1.0	3.1	2.1	1.9	2.6	1.3	1.1	0.7	1.4	1.5
EC	3.0	8.0	6.8	7.8	7.5	7.2	5.2	3.8	3.2	1.1	1.3
French ANR	-	0.2	-	0.3	-	-	-	-	0.5	1.1	1.2
French IRD								-	0.1	0.9	1.0
Swiss SNSF	0.3	0.1	0.5	0.5	0.3	0.3	0.2	0.8	0.5	0.7	0.8
Subtotal of top 12^	88	82	86	91	90	94	79	74	86	85	96
Disease total	92	85	91	96	93	96	80	76	90	89	100

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.
- No reported funding
▨ Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

Funding from the public sector fell (down $4.2m, -7.1%), driven by decreases from both HICs (down $3.7m, -6.6%) and LMICs (down $0.5m, -18%), although this followed a significant jump in public funding the previous year. Industry investment increased by $1.9m (up 15%), as growing investment from MNCs (up $3.8m, 39%) outweighed a decrease from SMEs (down $1.9m, -61%). The combined impact of the increase in industry investment and the drop in public funding meant that industry provided its highest ever share of investment for helminth R&D. Philanthropic funding also increased modestly (up $1.4m, 8.0%).

Figure 15. Helminth R&D funding by sector 2018

Private (SMEs) 1%
Private (MNCs) 15%
Philanthropic 22%
Public (LMICs) 3%
Public (HICs) 59%
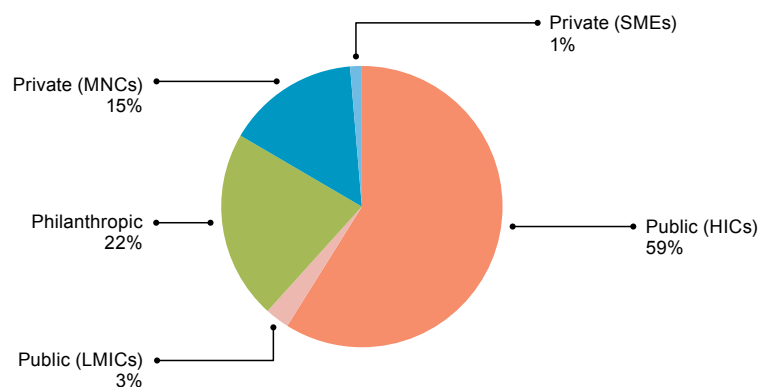
DENGUE

Dengue is a viral infection transmitted to humans by the female *Aedes* mosquito – most often *Aedes aegypti* (common in urban environments) and *Aedes albopictus* (common in rural environments). The dengue virus has four serotypes, each with multiple genotypes. First time infection rarely results in anything more serious than a severe flu-like illness; subsequent infections with a different serotype (or even genotype) can result in severe disease, and are more likely to lead to dengue haemorrhagic fever. For children in affected regions, dengue is a leading cause of serious illness and death. Dengue outbreaks often occur in Asia, Central America and South America; the disease is now present in more than 100 countries, up from only nine in 1970.[129]

Dengue's prevalence in high- and upper-middle-income countries across Asia and Latin America and demand from travellers and the military has created a potential dengue vaccine commercial market large enough to attract industry investment in vaccine R&D. Dengue vaccine R&D investment has thus been excluded from the G-FINDER scope.

No curative treatment is available, so management is focused on supportive therapy and the control of onward transmission. Despite the unmet need, there is little advanced dengue drug research. Drug candidates in clinical development include repurposed drugs, such as celgosivir, while other direct-acting antivirals such as DengueCide and JNJ-1A are in pre-clinical development.[130,131] Biologic R&D – included in the G-FINDER scope for the first time this year – is currently centred on the pre-clinical development of monoclonal antibody (mAb) therapeutic candidates, including DENV mAb and AB513,[132,133] both of which can neutralise all four dengue serotypes.

There is a pressing need for diagnostics that work across the full spectrum of disease, and can distinguish dengue from other causes of fever.[134] The first reverse transcription polymerase chain reaction (RT-PCR) diagnostic test capable of detecting all four serotypes was approved by the US FDA in 2012 (CDC DENV-1-4), but has shown a lower clinical sensitivity in practice.[135] Several advanced tests are being adapted for dengue virus detection, including isothermal molecular technologies such as the DENV RT-LAMP and DENV NASBA assays, both from the US NMRC; US CDC's DENV TMA assay; and DENV RT-RPA from TwistDx.[136–138] Point-of-care serological tests based on antigen or antibody detection (such as the SD Bioline Dengue Duo RDT) are already available. Unfortunately, these tests cannot distinguish between serotypes, and may lack sensitivity and specificity.[137]

Several new vector controls targeting the *Aedes* mosquito are in development, including adulticidal oviposition traps and space spray insecticides. Field experiments for biological control tools are ongoing across Asia and South America for the *Wolbachia* bacteria method, including a large cluster-randomised controlled trial in Indonesia;[139,140] trials in China and Thailand which combine the sterile insect technique with *Wolbachia*-based incompatible insect technique (SIT/IIT);[56,141,142] and a trial in Brazil of the second generation genetically manipulated 'Friendly' *Ae. Aegypti* (OX5034).[143,144]

$79.8 MILLION
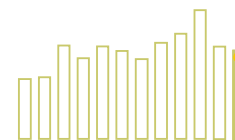
TOTAL SPEND ON DENGUE R&D IN 2018

2%

OF GLOBAL R&D FUNDING

2.9M DALYS
40,407 DEATHS
IN 2017
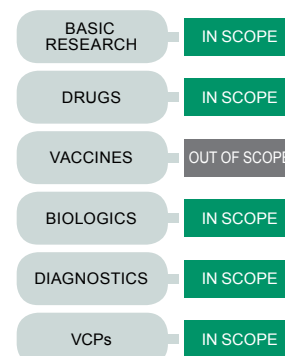
BASIC RESEARCH	IN SCOPE
DRUGS	IN SCOPE
VACCINES	OUT OF SCOPE
BIOLOGICS	IN SCOPE
DIAGNOSTICS	IN SCOPE
VCPs	IN SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Global funding for basic research and product development for dengue in 2018 was $80m, representing a slight drop (down $3.6m, -4.4%) from the previous year. An additional $22m was invested in R&D of multi-disease vector control products targeting *Aedes* mosquitoes – the vector for dengue, as well as Zika and a number of other viral diseases – which was an increase of roughly $9.0m over 2017. Funding for multi-disease vector control products R&D has been included as a standalone category in G-FINDER since 2017; if this funding was allocated equally across individual target pathogens – our approach pre-2017 – in both 2017 and 2018, total dengue funding would have remained essentially unchanged (down $0.4m, -0.5%).

As in previous years, basic research received the largest share of total funding ($38m, 48%), followed by drugs ($23m, 29%), vector control products ($8.3m, 10%) and diagnostics ($6.7m, 8.4%). The biologic product category was introduced in 2018 and received $1.3m (1.6% of global dengue funding). With the exception of new funding for biologics, investment across all product areas decreased or was flat, though in the case of vector control products this reflects the separation of dengue-specific R&D from funding targeting multiple mosquito-borne pathogens, which did increase significantly (see page 91).

The largest decrease was for dengue R&D which was not allocated to a specific product (down $2.9m, -55%) although this was partly artificial, driven by lower reported funding from the Indian ICMR (down $2.2m, -49%) as a result of its ongoing funding being reallocated to basic research thanks to more granular reporting. The next largest decrease was in vector control products (down $1.4m, -14%). Funding for chemical vector control products nearly halved (down $1.3m, -48%) almost entirely due to reduced industry investment (down $1.4m, -50%) while biological vector control product funding remained stable (down $0.1m, -0.9%) following the previous year's decline. Funding for diagnostics fell slightly (down $0.3m, -4.7%) as a result of reduced investment from the US NIH (down $0.5m -15%). Basic research funding remained essentially stable (down $0.2m, -0.4%), though there were opposing changes at the funder level: decreases from traditionally large funders – US NIH (down $2.2m, -7.6%) and the Gates Foundation (down $1.4m, -100%) – were mostly offset by increased efforts from smaller funders, including the Indian ICMR (up $1.6m, 559%), Institut Pasteur (up $0.8m, 103%) and the Brazilian FAPEMIG (up $0.6m, 674%). The net result of these changes would have been a small decline in basic research funding without the artefactual increase from ICMR due to better reporting. Funding for drug development also stayed largely unchanged (down $0.2m, -0.9%), as a substantial reduction from the US NIH (down $4.1m, -35%) was offset by higher industry investment (up $5.0m, 51%) driven by funding for a new Phase I trial. The $1.3m for biologics R&D came exclusively from industry, and all went to basic & early-stage research.

Over two-thirds of all dengue R&D funding in 2018 was for basic & early-stage research ($57m, 71%), with $16m (20%) for clinical & field development. The remaining ($6.7m, 8.4%) was not allocated to a specific product or R&D stage.

Investment in basic & early-stage research declined for the second consecutive year (down $7.1m, -11%), mostly driven by changes in the drug development pipeline. There was sharply lower investment in early-stage drug R&D from both industry (down $4.8m, -50%) and the US NIH (down $2.5m, -25%), although in the case of industry this was a result of drug candidates progressing through the pipeline to clinical development. Funding for clinical & field development increased by half (up $5.5m, 52%) on the back of record-high investment from industry (up $12m, from a low base), most of which was for drug development – including $10m in new funding for a Phase I trial. Biological vector control products saw a big fall in the share of investment directed to field trials, which fell from 62% to 22% as a result of the World Mosquito Program transitioning from dengue-specific research to a multi-disease focus.

Figure 16. Dengue R&D funding by product type 2009-2018
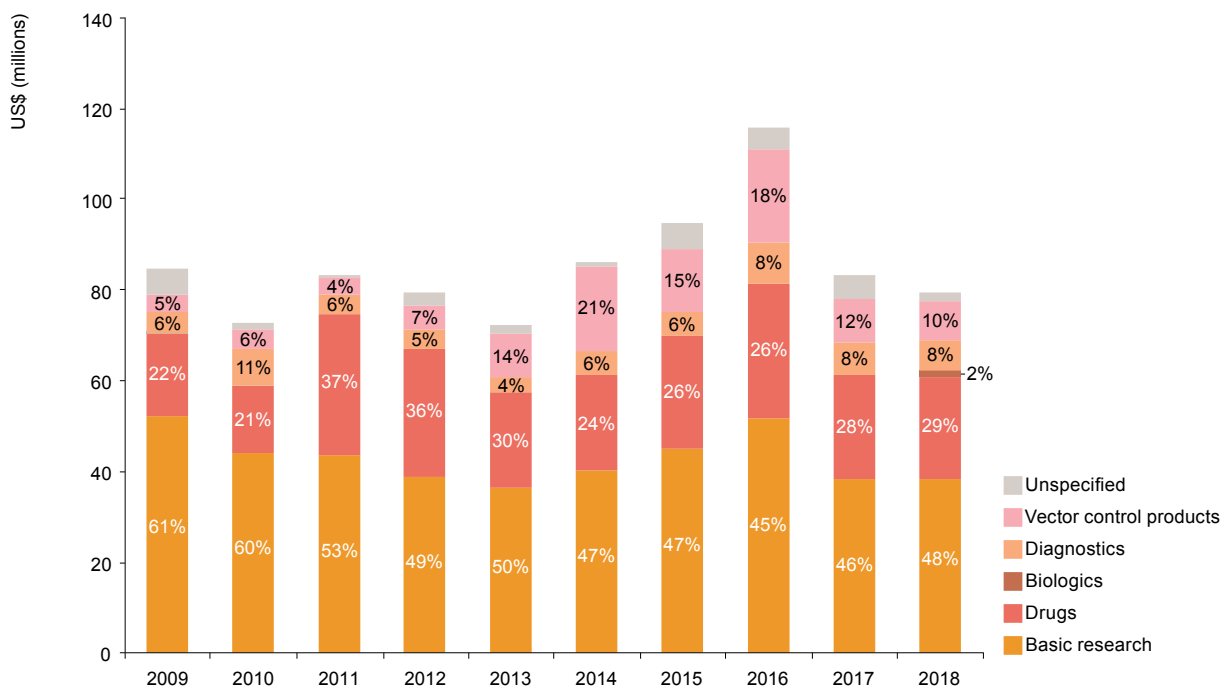
The top 12 funders in 2018 accounted for almost all (97%) of dengue R&D funding globally. As in previous years, the top three funders – the US NIH, industry and the Gates Foundation – collectively provided just over three-quarters of total funding ($60m, 76%).

The most significant changes in annual funding came from the two largest funders of dengue R&D, with the decrease in overall investment largely attributable to a second consecutive year of declining funding from the US NIH (down $7.5m, -17%). This drop in NIH funding affected all product areas, but the largest decrease was for drug R&D (down $4.1m, -35%), entirely as a result of reduced funding to industry (down $4.6m, -67%). The most significant increase – and the primary reason that overall funding for dengue R&D fell only slightly – was from industry (up $5.6m, 44%). This was almost entirely for drug development (up $5.0m, 51%), and resulted in the highest industry investment in dengue R&D ever recorded by the G-FINDER survey.

Changes from all of the other top funders were relatively modest. Although the Wellcome Trust (down $0.7m, -16%) and the Gates Foundation (down $0.4m, -8.2%) both decreased their dengue-specific funding slightly, these figures do not take into account increases in their dengue-related multi-disease vector control product funding to Monash University for the World Mosquito Programme.

Two-thirds of all dengue R&D funding in 2018 came from the public sector ($54m, 67%) down from just under three-quarters in 2017. HICs once again provided the vast majority of public funding ($47m, 87%), with the remainder coming from LMICs ($6.7m, 13%). The private sector accounted for nearly a quarter ($18m, 23%) of all dengue investment, up from just 15% the previous year. The majority of industry funding came from MNCs ($15m, 82%), with the remainder ($3.3m, 18%) coming from SMEs. The philanthropic sector provided 9.9% of all dengue funding ($7.9m).

Table 17. Top dengue R&D funders 2018

Funder	US$ (millions)										2018 % of total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
US NIH	47	44	52	46	37	42	48	60	45	38	47
Aggregate industry	5.5	7.7	12	9.0	7.9	8.1	15	18	13	18	23
Gates Foundation	1.8	<0.1	<0.1	1.0	10	16	7.5	16	4.8	4.4	5.5
Indian ICMR	1.1	1.5	1.5	1.3	1.9	1.8	2.0	3.6	4.8	4.2	5.2
Wellcome Trust	1.5	2.1	6.2	4.9	3.5	6.2	5.8	5.6	4.2	3.5	4.4
US DOD	5.2	0.4	1.1	0.4	0.2	0.2	1.1	1.6	2.7	3.1	3.9
UK MRC	0.2	<0.1	0.7	0.4	0.5	0.8	1.6	1.6	2.0	1.9	2.3
Institut Pasteur	2.2	3.3	2.5	2.0	2.0	2.0	2.1	1.9	0.8	1.6	2.0
Brazilian FAPEMIG	2.7	1.7	<0.1	0.1	<0.1	<0.1	<0.1	0.6	0.1	0.8	1.0
Australian NHMRC	1.2	1.4	2.0	2.9	1.6	3.1	0.6	0.8	0.4	0.6	0.8
German DFG	<0.1	<0.1	<0.1	1.6	0.9	-	0.5	0.7	0.7	0.6	0.7
Colombian Colciencias	0.9	1.0	-	3.2		0.2	0.4	-	-	0.5	0.7
Subtotal of top 12^	77	68	80	76	70	85	91	113	80	77	97
Disease total	85	73	83	79	72	87	95	116	83	80	100

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.
- No reported funding

███████ Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

The drop in public sector funding (down $8.0m, -13%) came largely from HICs (down $7.8m, -14%), although LMIC funding also dropped slightly (down $0.3m, -4.2%). The increase in private sector funding (up $5.6m, 44%) essentially came entirely from MNCs (up $5.5m, 59%), with SME investment unchanged (up <$0.1m, 0.3%). Philanthropic funding decreased (down $1.1m, -13%).

Figure 17. Dengue R&D funding by sector 2018

Private (SMEs) 4%
Private (MNCs) 19%
Philanthropic 10%
Public (LMICs) 8%
Public (HICs) 59%
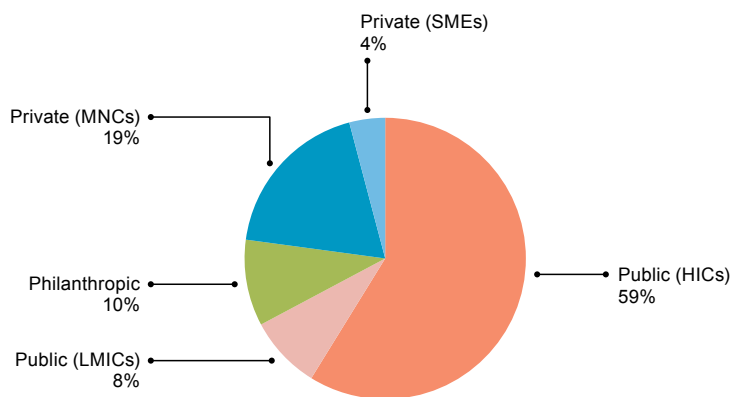
HEPATITIS C

Hepatitis C is a blood-borne infectious disease caused by the hepatitis C virus (HCV), primarily affecting the liver. HCV causes both acute and chronic infection, with symptoms in the acute phase including fever, fatigue and jaundice. However, up to 80% of acute cases are asymptomatic, meaning that many HCV infections will go undetected until chronic disease develops, sometimes decades later. Although 20-40% of acute infections resolve spontaneously without treatment, the remaining 60-80% of cases will progress to chronic infection.[145] Without treatment, chronic hepatitis C is a lifelong disease which can lead to life threating liver damage (cirrhosis and fibrosis) and hepatocellular carcinoma (liver cancer).

There are six main genotypes of HCV, with genotypes 4, 5 and 6 disproportionately affect developing countries, while having a low prevalence in high-income countries.[146] Since R&D efforts have moved from genotypic-specific to pan-genetypic products, we have replaced the genotype restriction for inclusion in G-FINDER with more detailed restrictions on LMIC applicability and use.

There are 15 direct-acting antiviral (DAA) drugs available on the market, including four pan-genotype combinations. DAA-based regimens are more effective, require a shorter duration of treatment, are appropriate for most patients and have fewer side effects than previous interferon- and ribavirin-based treatments. Due to these advancements, in 2018 the WHO recommended that persons over the age of 12 years should be treated with DAAs.[147] However, DAA-based regimens are expensive, and access remains limited in LMICs.[148] The Medicines Patent Pool licenced a pan-genotype, fixed-dose combination DAA (glecaprevir/pibrentasvir) in 96 LMICs, but has not reached agreements for its generic production.[149] More research is also needed to assess DAA-based regimens in developing country populations, adolescents, children under 12, and pregnant women. Several other multi- or pan-genotypic DAA-based regimens are undergoing trials, including ravidasvir/sofosbuvir – the only pan-gentoypic regimen in late-stage development – and two paediatric regimens, sofosbuvir/velpatasvir in Phase II trials and glecaprevir/pibrentasvir in expanded access Phase III trials.[147,150,151]

There is also a need for HCV diagnostic tests that are affordable and simple to use in developing country contexts,[147] especially tests usable for treatment monitoring, screening and tests of cure. The WHO has prequalified nine HCV diagnostic tests, including three RDTs and one viral load test.[152] Future diagnostic R&D needs to validate the use of dried blood spots for serological and molecular assays, validate core antigen-based assays as the gold standard for confirmatory tests and test of cure, and develop a true point-of-care nucleic acid test. Two diagnostics are in late stages of development: the Genedrive HCV ID Kit for confirmatory diagnosis/treatment monitoring and test of cure,[153] and the STANDARD Q HCV Ab test as a point-of-care antibody assay.[154]

There is no vaccine against HCV, although there are some pan-genotypic candidates in early-stage development, such as the Burnet Institute's HepSeeVaxDelta3 candidate.[155] Only two candidates have reached clinical development and both have been unsuccessful: GSK's GSK3378455A and NIAID's AdCh3NSmut1/MVA-NSmut.[156,157]

$45.6 MILLION
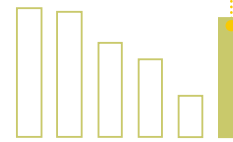
TOTAL SPEND ON HEPATITIS C R&D IN 2018

1%
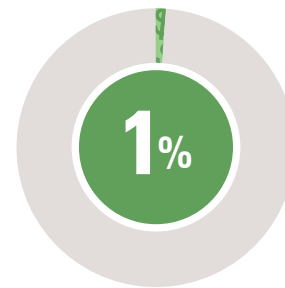
OF GLOBAL R&D FUNDING

13M DALYS
449,333 DEATHS
IN 2017
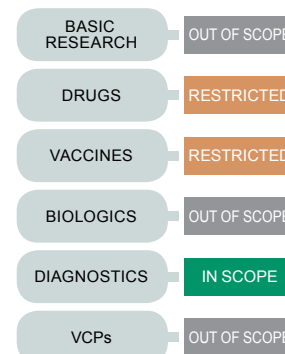
BASIC RESEARCH	OUT OF SCOPE
DRUGS	RESTRICTED
VACCINES	RESTRICTED
BIOLOGICS	OUT OF SCOPE
DIAGNOSTICS	IN SCOPE
VCPs	OUT OF SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Figure 18. Hepatitis C R&D funding by product type 2013-2018
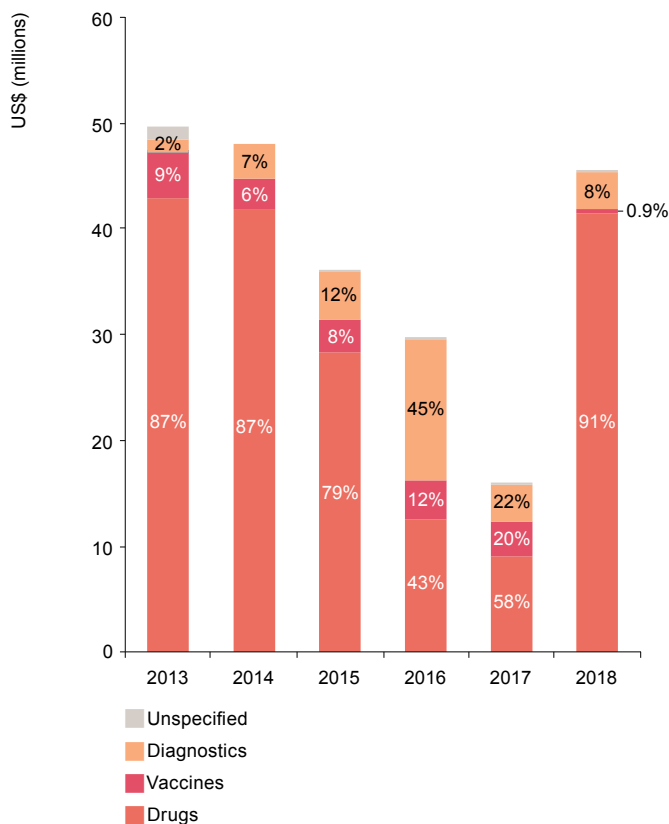
Global funding for LMIC-focused hepatitis C R&D in 2018 was $46m, a nearly three-fold increase from 2017 (up $30m, 188%).* Not only was this the first increase in annual funding since the 2013 inclusion of hepatitis C in the G-FINDER survey, it also largely reversed the effect of four consecutive years of declining funding, and returned investment to levels around those last seen in 2014.

In 2018, the vast majority of hepatitis C R&D funding was concentrated in drug development ($42m, 91%). This was the highest proportion of investment in hepatitis C drug R&D since its inclusion in the G-FINDER survey. The remaining funding was for diagnostics ($3.5m, 7.7%), vaccines ($0.4m, 0.9%) and R&D not allocated to a specific product ($0.1m, 0.3%).

The overall increase in funding for hepatitis C was entirely due to a $32m (355%) increase in drug development funding, driven by increases from both industry (up $28m, 542%) and MSF (up $3.9m, 859%), both for clinical trials in LMICs. Funding for vaccine R&D fell to a record low (down $2.8m, -88%), primarily due to a drop in funding from the main funder in this area, the US NIH (down $1.9m, -91%). Reported funding for diagnostic R&D remained stable (up <$0.1m, 1.3%), although this might have increased – on the back of a $2.8m disbursement from Unitaid to FIND for hepatitis C diagnostic development (after reporting no funding in 2017) – if not for non-participation by a key industry diagnostic developer, which contributed to a $2.0m (-83%) drop in industry investment in diagnostic R&D.

The vast majority of hepatitis C R&D funding in 2018 was for clinical development & post-registration studies ($41m, 89%), with only $3.5m (7.7%) reported for early-stage research; remaining funding was not allocated to a specific product or R&D stage ($1.4m, 3.1%). This was the highest proportion of investment in clinical development & post-registration studies for hepatitis C since its inclusion in the G-FINDER survey, and the highest proportion for any G-FINDER neglected disease in 2018. It was also a significant increase from the previous year, when clinical development & post-registration studies accounted for only 24% of all funding for hepatitis C R&D, driven by a jump in investment from industry for drug clinical trials (up $33m, from a low base). Accordingly, funding for drug R&D was overwhelmingly focused on clinical development & post-registration studies ($41m, 98% of total drug funding), 80% of which was industry investment. In contrast early-stage research represented the majority of funding for diagnostic R&D ($3.1m, 89%), and all of the $0.4m in hepatitis C vaccine R&D funding, reflecting the current state of the vaccine pipeline.

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* The genotype-specific scope restrictions on hepatitis C were lifted in 2018 and more detailed restrictions on LMIC applicability added in their place. These changes may have contributed to the inclusion of a broader range of funding than in previous years.

Table 18. Top hepatitis C R&D funders 2018

| Funder | US$ (millions) | | | | | | 2018 % of total |
	2013	2014	2015	2016	2017	2018	
Aggregate industry	29	27	22	11	7.5	34	74
MSF	-	-	-	-	0.5	4.4	9.6
Unitaid	-	-	-	6.0	-	2.8	6.1
French ANRS	2.0	9.5	4.5	5.0	2.4	1.5	3.3
US NIH	11	6.9	4.9	4.4	3.5	1.1	2.3
Wellcome Trust	<0.1	<0.1	<0.1	<0.1	-	0.7	1.6
Thai GPO	<0.1	<0.1	0.3	0.1	0.3	0.5	1.0
UK MRC	0.4	0.4	0.4	0.4	0.3	0.4	0.9
Brazilian FINEP		-	0.2	0.2	-	0.2	0.3
Burnet Institute	<0.1	<0.1		0.2	0.1	0.1	0.3
Indian DBT	1.2	<0.1	0.4	0.1	0.1	0.1	0.2
Canadian CIHR	-	-	-	-	0.6	<0.1	0.2
Subtotal of top 12^	49	48	36	30	16	46	100
Disease total	50	48	36	30	16	46	100

^ Subtotals for 2013-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.

- No reported funding

▨ Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

In 2018, the top 12 funders for hepatitis C R&D provided almost all of the reported investment ($46m, 99.8%). As in every previous year, industry remained the top funder, providing 74% of all reported LMIC-specific hepatitis C funding, up from 48% in 2017. This marks the largest amount and proportion of industry funding for hepatitis C R&D since its inclusion in the survey, and the highest proportion for any G-FINDER neglected disease in 2018. Collectively, industry and the next two largest funders – MSF and Unitaid – accounted for 90% ($41m) of all hepatitis C R&D funding in 2018.

The largest increase – and the main reason for the overall increase in hepatitis C funding – came from industry (up $26m, 346%), with almost all its funding directed to drug development. The next largest increase came from MSF (up $3.9m, 859%) for its collaboration with DND*i* on the STORM-C project, which includes a Phase III trial on a ravidasvir and sofosbuvir combination treatment. Unitaid (up $2.8m after no reported funding in 2017) re-entered the top 12 after dropping out in 2017 due to funding a new grant to FIND for diagnostic development. The most significant decrease came from the US NIH (down $2.4m, -69% overall), whose funding fell to a record low, primarily due to sharp reduction in funding for vaccine R&D.

Just under three-quarters of all developing country-specific hepatitis C R&D funding came from industry (74%, $34m), followed by the public sector ($6.8m, 15%) and the philanthropic sector ($5.1m, 11%). Investment provided by the private sector increased more than four-fold (up $26m, 346%), with MNCs driving the increase (up $28m, 542%), making it the highest ever investment from the private sector for hepatitis C R&D. The public sector reported an overall drop in funding from 2017 (down $1.1m, -13%), a new low point for its investment in hepatitis C. This was largely due to a decrease from HICs (down $4.0m, -55%), which hid smaller increases by LMICs (up $0.2m, 27%) and multilaterals (up $2.8m, following no investment in 2017). The philanthropic sector reported increased investment in 2018 (up $4.7m from a low base in 2017), driven by MSF and Wellcome Trust investments in drug trials, bringing philanthropic sector funding levels to a new high.

Figure 19. **Hepatitis C R&D funding by sector 2018**
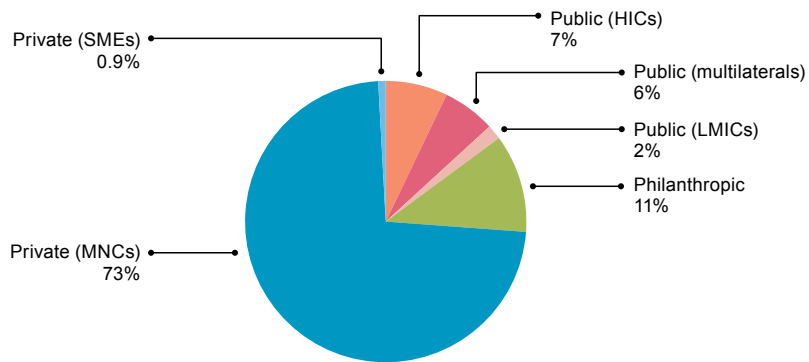
LEPROSY

Leprosy, also known as Hansen's disease, is caused by *Mycobacterium leprae* and is transmitted via air droplets from the nose or mouth of infected people. Leprosy mainly affects the skin and nerves and has an incubation period that can be as long as 20 years. The disease is curable with multidrug therapy using a combination of rifampicin, clofazimine and dapsone (for multibacillary leprosy), or rifampicin and dapsone (for paucibacillary leprosy). However, if left untreated, leprosy can cause nerve damage, muscle weakness and permanent impairments.

The current drug regimen for leprosy has been standard treatment for 30 years and, although highly effective, it requires between six and 24 months of treatment.[158] Further research is needed to improve and simplify drug regimens, and to provide products for nerve function management.[158,159] Bedaquiline, an antibiotic approved for the treatment of MDR-TB and found to be effective in the treatment of leprosy in animal models,[160] is currently undergoing Phase II clinical trials.[161]

Leprosy vaccine and biologic R&D was included in the G-FINDER scope for the first time this year given the absence of effective preventive or therapeutic vaccines. Immunisation with BCG has only a modest ability to prevent leprosy (26% in observational studies, 41% in experimental studies) and post-exposure BCG immunisation may cause paucibacillary disease in some individuals.[162] Preventive and therapeutic vaccine R&D for leprosy is currently underway to identify antigens that can offer post-exposure immunoprophylaxis or confer protection without exacerbating nerve damage, most notably LEP-F1/GLA-SE (LepVax), which is currently in Phase Ib/IIa clinical trials.[163]

Diagnosis of leprosy is primarily based on identifying key clinical features of infection, meaning that asymptomatic early-stage cases are often missed or diagnosed late, leading to continued disease transmission. Elimination of leprosy will likely require new and improved diagnostics capable of identifying asymptomatic cases, as well as all symptomatic forms (paucibacillary, borderline tuberculoid, borderline, borderline lepromatous or multibacillary) of the disease.[164] The Infectious Disease Research Institute (IDRI) is one organisation currently developing rapid diagnostic tests for leprosy,[165,166] including co-development of NDO-LID, which to date has been limited by very low capacity to detect true positives in both paucibacillary (14.9%) and multibacillary (47.9%) Brazilian patients.[167] Additional immuno-diagnostic tests include Leiden University's Field-friendly lateral flow assays (LFAs), currently in late-stage development.[168]

$10.2 MILLION

TOTAL SPEND ON LEPROSY R&D IN 2018

<0.1M DALYS 0 DEATHS
IN 2017
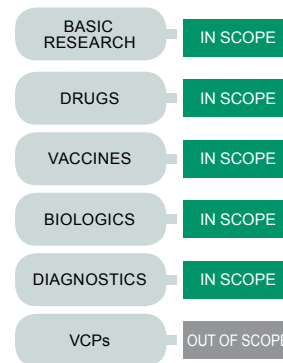
BASIC RESEARCH	IN SCOPE
DRUGS	IN SCOPE
VACCINES	IN SCOPE
BIOLOGICS	IN SCOPE
DIAGNOSTICS	IN SCOPE
VCPs	OUT OF SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Global investment in leprosy basic research and product development was $10m in 2018. Despite the inclusion of leprosy vaccine and biologics R&D in the G-FINDER scope for the first time this year, total investment in leprosy R&D fell by $2.3m (-19%) compared to the previous year, undoing the effects of three years of marginal growth, and taking funding to its lowest level since its all-time low in 2011.

Over two-thirds of all funding for leprosy R&D in 2018 was for basic research ($7.1m, 69%), with less than a third allocated to product development ($3.1m, 30%). Diagnostics ($1.5m, 15%) again received slightly more funding than drugs ($1.1m, 11%), with the remainder going to vaccines ($0.5m, 4.7%), reflecting ongoing investment – captured for the first time in the expanded G-FINDER scope – for clinical development of the leprosy vaccine candidate LepVax (LEP-F1 + GLA-SE). This research is being undertaken by the Infectious Disease Research Institute (IDRI) and is funded by ALM, and entered Phase I clinical trials in late 2017. There was no reported investment in the newly-included biologics category.

The increases in funding for diagnostic and drug R&D were real, and were driven by increased investment in these areas by the US NIH and industry, respectively. However, the increase in funding for basic research was primarily the result of more detailed reporting from the Indian ICMR, whose funding for its leprosy-specific intramural institute had previously been classified as unspecified. As a result, funding to unspecified R&D fell dramatically (down $6.2m, -98%) compared with the previous year, due in large part to this more granular reporting, and in part to a genuine reduction in overall funding from the ICMR.

The majority of all investment in leprosy R&D in 2018 was for basic & early-stage research ($8.0m, 78%), with less than a fifth reported for clinical development & post-registration studies ($1.8m, 18%). The remaining $0.4m (4.1%) of leprosy R&D funding was not allocated to a specific product or R&D stage.

Table 19. **Leprosy R&D funding by product type 2009-2018**

Product / US$ (millions)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
Basic research	7.3	5.2	7.7	11	12	7.3	5.8	6.9	5.7	7.1	69
Diagnostics	1.6	1.5	1.3	1.5	0.8	0.2	0.8	0.4	0.3	1.5	15
Drugs	0.9	1.2	0.3	0.6	0.2	<0.1	0.3	0.2	0.4	1.1	11
Vaccines										0.5	4.7
Biologics										-	-
Unspecified	2.7	3.0	-	3.0	<0.1	3.7	4.7	4.2	6.3	<0.1	0.9
Total	12	11	9.4	16	14	11	12	12	13	10	100

- No reported funding
▭ Category not included in G-FINDER

Table 20. **Top leprosy R&D funders 2018**

Funder	US$ (millions) 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
US NIH	6.2	4.0	4.7	11	6.3	5.9	4.5	5.1	2.4	3.2	31
Indian ICMR	2.1	3.2	2.5	0.8	3.7	3.7	4.9	4.1	6.0	2.1	20
Aggregate industry	-	<0.1	0.1	-	<0.1	<0.1	0.7	0.4	0.4	1.2	12
UK MRC	-	-	-	-	-	<0.1	<0.1	0.2	0.7	0.8	7.8
effect:hope								0.1	0.6	0.6	5.8
ALM	0.6	0.5	0.6	0.4	0.2	<0.1	-	-	<0.1	0.6	5.6
Canadian CIHR	0.2	-	-	-	-	-	-	-	0.3	0.4	4.0
TLMI		0.3	0.4	0.4	0.7	0.7	0.6	0.5	0.8	0.4	3.7
LRI[A]							0.6	0.6	0.5	0.3	2.9
R2STOP										0.3	2.5
CLTRF	-		-	-		-	-	0.1	0.1	<0.1	1.0
Swiss SNSF		-	-	-	-	-	-	<0.1	<0.1	<0.1	0.8
Subtotal of top 12^	12	11	9.4	15	13	11	12	12	12	10	97
Disease total	12	11	9.4	16	14	11	12	12	13	10	100

[A] The Leprosy Research Initiative (LRI) was established in 2013 and receives funding from: the Netherlands Leprosy Relief (NLR), American Leprosy Missions (ALM), the German Leprosy and Tuberculosis Relief Association (DAHW), effect:hope, the Leprosy Mission International (TLMI), the Mission to End Leprosy, Plan:G and the Turing Foundation. To avoid double counting, this table captures spending by the LRI, and not the grants made to the LRI by its partner organisations ($0.4m in 2018). Listed totals and rankings may therefore understate the total financial commitment of LRI partners to leprosy R&D.

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.

- No reported funding

Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

In 2018, 23 organisations provided funding for leprosy R&D, reflecting a diverse funder base compared to most other diseases with similarly low levels of funding. As with previous years, the top two funders of leprosy R&D were the US NIH and the Indian ICMR. While these two organisations still collectively provided more than half ($5.3m, 51%) of all funding for leprosy R&D in 2018, this was the lowest share since 2007, down from a peak of 86% just four years ago in 2014. The ongoing decline in funding concentration at the top came despite an increase in US NIH funding, and was primarily due to the sizeable overall decrease in funding from Indian ICMR (down $3.9m, -65%) discussed above. Together, these changes also helped restore the US NIH to its historical place as the largest funder of leprosy R&D.

At the same time, industry investment reported for leprosy R&D tripled in 2018 (up $0.8m, 199%), pushing it to its highest level ever reported. This helped reduce reliance on the historical top two funders and placed industry among the top three funders of leprosy R&D for the first time since 2015.

Two-thirds of all leprosy R&D funding in 2018 came from the public sector ($6.8m, 67%). This was followed by contributions from the philanthropic sector ($2.2m, 22%) and from industry ($1.2m, 12%), the latter exclusively from multinational pharmaceutical companies, and representing the largest ever share from the private sector. Public funding came mostly from HICs ($4.6m, 67% of public funding); this was a change from 2017, when LMICs provided almost two-thirds of the public total.

CRYPTOCOCCAL MENINGITIS

Cryptococcal meningitis is an opportunistic infection that causes inflammation of the tissue covering the brain and spinal cord. It is caused primarily by *Cryptococcus neoformans*, a microscopic and easily inhaled fungus found throughout the world. In healthy individuals, inhalation of the fungal spores rarely leads to serious illness; but for immunocompromised individuals, such as those with HIV/AIDS, cryptococcal infection (cryptococcosis) can be serious and even deadly. Cryptococcosis can affect multiple organs, but the primary site of infection is usually the lungs. Cryptococcal meningitis occurs when the infection spreads to the brain and central nervous system, with symptoms including headaches, fever, neck pain, light sensitivity and altered mental state (ranging from confusion to coma). Mortality rates for cryptococcal meningitis can be as high as 70%.[169]

Cryptococcal meningitis can be effectively treated with medicines such as amphotericin B and flucytosine, but these are poorly suited to developing country use. Amphotericin B is expensive and requires administration at a hospital, and flucytosine requires careful blood monitoring. As a result, cryptococcal meningitis in developing countries is usually treated with fluconazole, which is only partially effective.[170] There is a need for affordable, efficacious drugs that are adapted for resource poor settings. New antifungal agents, repurposed drugs and immunotherapies are all being investigated.[171] Several new antifungal agents targeting various biochemical processes are in the early stages of development and show promising activity against cryptococcal meningitis. One such candidate is the new long-acting azole-like compound VT-1129 – currently in pre-clinical development – which received Fast Track designation from the US FDA in 2016.[172] Clinical trials are also being conducted on new oral formulations of amphotericin B (MAT2203).[173] A number of repurposed drugs are under investigation for their efficacy against cryptococcal species alone or in conjunction with the current amphotericin B and fluconazole therapies, including the anti-cancer drug tamoxifen, which is in Phase II trials for a short-course combination therapy with amphotericin B and fluconazole.[174] Monoclonal antibodies and immunomodulators alone or in combination with antifungal agents have demonstrated success in treating cryptococcal meningitis and cryptococcosis more generally. There are currently no late-stage candidates in the drug or biologic pipeline.

Accurate rapid diagnostic tests for cryptococcal infection are available and appropriate for use in developing country settings, meaning that diagnostics are excluded from the G-FINDER scope.

$7.7 MILLION

TOTAL SPEND ON CRYPTOCOCCAL MENINGITIS R&D IN 2018

181,100 DEATHS
IN 2014
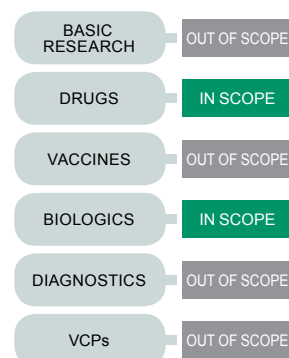
BASIC RESEARCH	OUT OF SCOPE
DRUGS	IN SCOPE
VACCINES	OUT OF SCOPE
BIOLOGICS	IN SCOPE
DIAGNOSTICS	OUT OF SCOPE
VCPs	OUT OF SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Global investment for cryptococcal meningitis product development in 2018 was $7.7m. While this was a sizeable decrease (down $3.4m, -31%) from the previous year's peak of $11m, total investment in 2018 remains larger than in the years prior to 2017.

In 2018, biologics R&D was added to the G-FINDER scope for cryptococcal meningitis. Despite this expansion in scope all investment continued to go exclusively towards drug R&D.

Over half of all funding for cryptococcal meningitis R&D in 2018 was for early-stage research ($4.6m, 59%), with nearly all the remaining funding allocated to clinical development & post-registration studies ($2.9m, 37%); the rest of the funding was not allocated to a specific R&D stage. As in previous years, US NIH was by far the largest funder of early-stage research ($4.3m, 94% of early-stage research funding). For the second year in a row, funding to EDCTP through the UK Joint Global Health Trials scheme – a partnership between the UK DHSC, MRC, DFID and the Wellcome Trust – represented the most significant investment in clinical development funding ($2.4m, 85% of clinical development funding).

Table 21. Cryptococcal meningitis R&D funding by product type 2013-2018

Product	US$ (millions)						2018 % of total
	2013	2014	2015	2016	2017	2018	
Drugs	3.2	5.9	5.4	5.9	11	7.7	100
Biologics						-	-
Unspecified						-	-
Total	3.2	5.9	5.4	5.9	11	7.7	100

\- No reported funding
▓ Category not included in G-FINDER

Seven organisations reported investment in cryptococcal meningitis R&D in 2018, compared to the peak of eight funders in 2017. The US NIH continued to provide the largest share ($4.6m, 61% of total funding), as has been the case every year since it was added to the G-FINDER survey in 2013. Funders from the UK contributed almost all remaining funding ($2.9m, 38%), which consisted of funding from UK DHSC ($1.1m, 14%), UK DFID ($0.8m, 9.9%), and UK MRC ($0.6m, 7.4%), as well as the Wellcome Trust ($0.4m, 5.8%). As in 2017, the majority of UK funding ($2.4m, 85%) went to EDCTP. The only other funding was provided by the Swiss SNSF ($0.1m, 1.5%) and the Brazilian FAPESP (<$0.1m, 0.4%), the latter reporting funding for cryptococcal meningitis R&D for the first time.

The most significant contributor to the overall decrease in cryptococcal meningitis R&D funding in 2018 was a drop in US NIH funding (down $2.1m, -31%), although they remained the top funder of cryptococcal meningitis R&D. The remainder was due to smaller decreases in funding from UK DHSC (down $0.6m, -36%) and UK MRC (down $0.5m, -47%).

As in previous years, nearly all cryptococcal meningitis R&D in 2018 was provided by the public sector in HICs ($7.2m, 94%), accompanied by a small contribution from the philanthropic sector ($0.4m, 5.8%). For the first time, a small proportion of funding was provided by the public sector in LMICs, via the contribution from the Brazilian FAPESP (<$0.1m, 0.4%).

Table 22. Cryptococcal meningitis R&D funders 2018

Funder	US$ (millions)						2018 % of total
	2013	2014	2015	2016	2017	2018	
US NIH	1.5	4.4	3.2	4.5	6.7	4.6	61
UK DHSC					1.7	1.1	14
UK DFID	-	-	-	-	0.9	0.8	9.9
UK MRC	1.4	1.3	2.1	1.1	1.1	0.6	7.4
Wellcome Trust	0.3	<0.1	<0.1	<0.1	0.4	0.4	5.8
Swiss SNSF	-	-	-	-	0.1	0.1	1.5
Brazilian FAPESP				-	-	<0.1	0.4
French ANRS	-	-	-	0.2	0.2	-	-
Fondation Mérieux	<0.1	<0.1	<0.1	<0.1	<0.1	-	-
Australian NHMRC	<0.1	0.1	-	-	-	-	-
Disease total	3.2	5.9	5.4	5.9	11	7.7	100

\- No reported funding
▓ Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

SNAKEBITE ENVENOMING

Snakebite envenoming results from the bite of a venomous snake, and if not treated quickly and effectively can result in life-long disability, or lead to amputation or death. Snakebite envenoming is prevalent in tropical and sub-tropical regions in Africa, Asia, Oceania and Latin America. This is the first year that snakebite envenoming has been included in the G-FINDER report.

Antivenoms – biological immunotherapeutics – have been used to treat snakebite envenomation for more than a century, and can be highly effective if given at the right time, at the right dose, and for the right snake. However there is a critical lack of high-quality, safe and effective region-specific antivenoms appropriate for use in LMICs, particularly in sub-Saharan Africa and Asia. Even the best currently-available antivenoms – all of which are based on animal-derived antibodies – are expensive to manufacture, can be complex to administer and store; carry the risk of adverse reactions including anaphylaxis and serum sickness; and are unable to neutralise all of the toxic effects of envenomation.[175] There is a need for R&D to support the approval and introduction of safe, effective, high-quality antivenoms that are appropriate for the regions in which they are used, as well as to deliver next generation antivenoms that are more effective, more affordable, safer and heat-stable.[176] Next generation antivenoms in preclinical development include single domain antibodies such as camelid-derived V_HH[177] and human scFv,[178] as well as several types of non-antibody-based molecules, such as nanoparticles, peptides and oligonucleotide aptamers.[179,180]

In low-resource settings where immediate treatment may be impossible, heat-stable venom-agnostic oral drugs are also needed as a first-line therapeutic to slow down neurotoxicity and prolong the window for victims to receive antivenom.[181] The development of broad-spectrum small molecule inhibitors could help bridge this gap; the repurposed phospholipase A2 inhibitor varespladib is currently in pre-clinical trials and shows promise as a first line and combination therapy against venom-induced myonecrosis and haemorrhagic toxicity.[182,183]

There is also a need for affordable, rapid, point-of-care diagnostics capable of identifying the common species in high-burden areas, with low to no cross reactivity between venoms. The only existing point-of-care diagnostic is only available in Australia and is specific to Australian snake species.[184] Two lateral flow assays for Taiwanese[185] and Indian[186] snakes are currently in clinical development.

More basic research is needed to accurately estimate the burden of snakebite envenoming, and to understand the natural history and pathogenesis of disease, and the structure and properties of toxins and their variability between regions and species.

$6.6 MILLION

TOTAL SPEND ON SNAKEBITE ENVENOMING R&D IN 2018
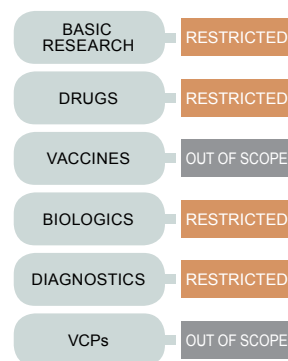
BASIC RESEARCH	RESTRICTED
DRUGS	RESTRICTED
VACCINES	OUT OF SCOPE
BIOLOGICS	RESTRICTED
DIAGNOSTICS	RESTRICTED
VCPs	OUT OF SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Table 23. Snakebite envenoming
R&D funding by product type 2018

Product	US$ (millions) 2018	2018 % of total
Basic research	3.4	52
Biologics	1.4	21
Drugs	1.4	20
Diagnostics	0.4	6.4
Unspecified	<0.1	0.3
Total	6.6	100

Table 24. Top snakebite envenoming
R&D funders 2018

Funder	US$ (millions) 2018	2018 % of total
US DOD	1.1	16
UK DFID	0.8	11
Aggregate industry	0.7	10
French ANR	0.6	9.6
US National Science Foundation	0.5	7.2
Australian NHMRC	0.4	5.7
UK NIHR	0.3	5.2
Wellcome Trust	0.3	4.9
Spanish CSIC	0.3	4.7
UK MRC	0.3	4.5
Brazilian FAPESP	0.3	4.2
Swiss SNSF	0.3	4.0
Subtotal of top 12	5.8	88
Disease total	6.6	100

Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

Global funding for basic research and product development for snakebite envenoming (SBE) was $6.6m in 2018. This is the first time that SBE has been included in the G-FINDER scope.

A little over half of all SBE R&D funding in 2018 was for basic research ($3.4m, 52%). Biologics received the next largest share ($1.4m, 21%), closely followed by drugs ($1.4m, 20%). The small amount of remaining funding ($0.4m, 6.4%) went to diagnostics.

Funding for basic research was provided almost entirely by the public sector (97%), with a third coming from UK public funders ($1.1m, 33%) including DFID, MRC and NIHR. In contrast, nearly half of all investment in biologic R&D was provided by industry ($0.7m, 49%). Most of the investment in drug development for SBE came via US DOD grants to US-based SMEs focusing on broad-spectrum therapeutics ($1.1m, 80% of the total). Over half of all diagnostic R&D funding came from the UK NIHR as part of its support for the African Snakebite Research Group ($0.2m, 54%), and just over a quarter from the Indian BIRAC ($0.1m, 28%) for the development of a regionally-specific rapid diagnostic test kit.

The vast majority of all funding for SBE R&D in 2018 went to basic & early-stage research ($5.9m, 89%), with only 10% ($0.7m) invested in clinical development & post-registration studies. The remaining 1.2% (<$0.1m) was not allocated to a specific product or R&D stage.

This focus on basic & early-stage research was common to both drug and diagnostic funding, neither of which had any clinical development funding. Investment in biologics development was more balanced, with 49% of funding going to clinical development & post-registration studies, including post-registration studies in Senegal and Cameroon.

A total of 29 organisations provided funding for SBE R&D in 2018; this is an unusually large number in comparison to other neglected diseases with similarly low levels of funding – approached only by leprosy – although this may reflect targeted outreach to specialist SBE funders as part of this year's G-FINDER survey.

The top 12 funders of SBE R&D accounted for 88% ($5.8m) of global funding in 2018, but only a little over a third ($2.5m, 38%) came from the top three funders – the US DOD, the UK DFID and industry – which was the lowest concentration from the top three funders of any neglected disease in 2018.

The US DOD was the largest funder of SBE R&D in 2018, investing exclusively in drug development. UK DFID was the next largest funder, following a new $0.8m grant to IAVI, while three other UK-based organisations also featured in the top 12. While the Brazilian FAPESP was the only LMIC funder in the top 12, funding was also reported from other LMICs, including India, Benin, Senegal and Mexico.

The public sector provided the vast majority ($5.5m, 83%) of all global funding for SBE R&D in 2018, with much smaller contributions from industry ($0.7m, 10%) and the philanthropic sector ($0.4m, 6.4%). Public sector funding came primarily from HICs ($4.7m, 85% of all public funding), with the remainder ($0.8m, 15%) coming from LMICs, while industry investment came exclusively from SMEs.

G-FINDER began tracking global investment in snakebite envenoming basic research and product development in 2019. Also in 2019, Policy Cures Research was also commissioned by the Wellcome Trust to conduct a landscape analysis of global funding for SBE research, including biomedical R&D as well as implementation, operational and health systems and policy research, from 2007 to 2018. The resulting report, "Global funding for snakebite envenoming research 2007-2018" can be found at **https://www.policycuresresearch.org/analysis** or via **https://go.aws/2Rhaehj**

HEPATITIS B

Hepatitis B is a disease of the liver caused by infection with the hepatitis B virus (HBV), and can be either acute or chronic. Acute infection is more common and more severe in adults and adolescents, but the likelihood of developing chronic disease is dramatically higher in infants and children under five. As many as 80-90% of children infected during the first year of life will progress to chronic disease, but this falls to less than 5% for otherwise healthy adults.[187] Almost all of the burden of HBV-related disease is due to chronic hepatitis B – largely due to cirrhosis or liver cancer – following infection transmitted from mother to child at birth or acquired in early infancy. Although HBV is prevalent worldwide, the burden of hepatitis B is disproportionately high in low- and middle-income countries, and co-infection with HIV is not uncommon.[188] Hepatitis B was added to the G-FINDER scope in 2018, restricted to LMIC use and applicability.

An effective vaccine against HBV exists, with the current HBV preventive vaccine series (a dose at birth followed by two subsequent booster doses) providing protection in more than 95% of vaccinated infants. Vaccination against HBV remains the main strategy for the control and elimination of hepatitis B, and has been included in the national infant immunisation schedule of 185 countries.[188] However, tools to diagnose and treat HBV are sub-optimal.

Serological assays detecting HBV surface antigen (HBsAg) have been the mainstay of HBV screening and diagnosis; rapid diagnostic tests (RDTs) are available as cheap and generally accurate alternatives to laboratory-based immunoassays, although both may fail to identify low HBsAg concentrations,[189] for example in HIV co-infection. However, for confirmation of diagnosis, treatment monitoring and detection of drug resistance, there is a need for robust, low-cost, point-of-care molecular diagnostics that can quantify HBV viral load.[190,191] Two assays have recently been developed for POC molecular platforms – Cepheid's Xpert HBV VL[192] and Molbio Diagnostics' Truenat HBV VL[193] – but neither is currently WHO-prequalified and cost may remain a barrier to access. Another molecular test designed explicitly for low-resource settings, DRW's SAMBA POC platform, has HBV qualitative and semi-quantitative assays in early-stage development.[194]

Oral therapy with recommended first-line HBV treatments such as entecavir or tenofovir alafenamide is generally safe and well tolerated, and can result in virological suppression in more than 95% of patients. Long-term treatment and viral suppression is associated with regression of cirrhosis and reduced incidence of hepatocellular carcinoma, but seroclearance is uncommon and lifelong drug treatment is required for most patients.[195] At least two candidates are in clinical development for functional cure of hepatitis B – defined by sustained undetectable surface antigen levels, regardless of seroconversion – including inarigivir in Phase II, and HS-10234 in Phase III.[196,197] Novel therapies aimed at achieving HBV seroclearance are also in development, including immune stimulators, and other host-targeting bio-therapeutics.[198,199]

There is also a lack of data that could be used to inform population approaches to HBV screening, monitoring and treatment in LMICs,[200] such as studies on the epidemiology of HBV drug and vaccine escape mutations in LMICs,[201] suggesting a need for additional basic research.

$5.7 MILLION

TOTAL SPEND ON HEPATITIS B R&D IN 2018

24M DALYS
741,267 DEATHS
IN 2017
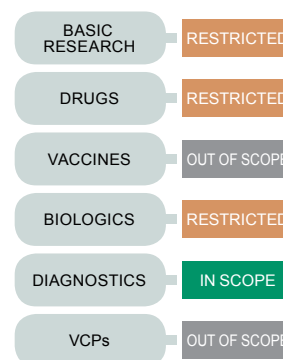
BASIC RESEARCH	RESTRICTED
DRUGS	RESTRICTED
VACCINES	OUT OF SCOPE
BIOLOGICS	RESTRICTED
DIAGNOSTICS	IN SCOPE
VCPs	OUT OF SCOPE

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Table 25. Hepatitis B R&D funding by product type 2018

Product	US$ (millions) 2018	2018 % of total
Basic research	1.9	33
Diagnostics	0.8	13
Drugs	0.6	9.9
Biologics	-	-
Unspecified	2.5	43
Total	5.7	100

- No reported funding

Table 26. Hepatitis B R&D funders 2018

Funder	US$ (millions) 2018	2018 % of total
Inserm	1.8	31
US NIH	1.3	22
UK MRC	0.7	12
Indian ICMR	0.7	12
Colombian Colciencias	0.5	9.5
Swiss SNSF	0.4	7.5
French ANRS	0.1	2.5
Indian DBT	0.1	2.1
Thai GPO	<0.1	1.1
Brazilian FAPERO	<0.1	0.4
Aggregate industry	<0.1	0.3
Argentinian MINCYT	<0.1	0.2
Disease total	5.7	100

Global funding for LMIC-focused basic research and product development for hepatitis B in 2018 was $5.7m. This is the first time that hepatitis B has been included in the G-FINDER report.

A little under half ($2.5m, 43%) of all hepatitis B R&D funding in 2018 was not allocated to a specific product. The funding that was went mostly to basic research ($1.9m, 33% of total funding), followed by R&D for diagnostics ($0.8m, 13%) and drugs ($0.6m, 9.9%). No funding was reported for hepatitis B biologic R&D. Just over half of all basic research funding was provided by organisations based in LMICs ($1.1m, 57%), while the US NIH provided the vast majority of funding for diagnostic ($0.6m, 78%) and drug ($0.5m, 89%) R&D.

A little over twice as much was invested in basic & early-stage research ($2.2m, 39% of total funding), as in clinical development & post-registration studies ($1.0m, 17%), with remaining funding not allocated to a specific product or R&D stage. However, funding for clinical development & post-registration studies represented 80% ($0.5m) of all funding for hepatitis B drug R&D – primarily related to a US NIH-funded Phase III trial conducted in Thailand and Laos by the French IRD – and a little under two-thirds ($0.5m, 59%) of all funding for hepatitis B diagnostic R&D.

Twelve organisations provided funding for hepatitis B R&D in 2018. The two largest funders were Inserm and the US NIH, who collectively provided more than half ($3.0m, 53%) of all hepatitis B R&D funding in 2018.

Essentially all reported investment in LMIC-focused hepatitis B R&D in 2018 came from the public sector ($5.7m, 99.7%), three-quarters ($4.3m, 75%) of which came from HICs, and a quarter ($1.4m, 25%) from LMICs. All reported industry investment came from SMEs (<$0.1m, 0.3% of total funding).

BURULI ULCER

Buruli ulcer, also known as Bairnsdale ulcer, is a chronic disease caused by *Mycobacterium ulcerans*. In developing countries, children under the age of 15 are at greatest risk. While the exact transmission mode is unknown, living around marshy areas with stagnant or slow-moving water can be a risk factor in endemic regions. Buruli ulcer usually appears as a painless lump or nodule that can later develop into an ulcer, usually on the arms or legs. *M. ulcerans* produces a toxin known as mycolactone, which causes tissue damage and can depress the immune response. As a result, coinfection with HIV can make Buruli ulcer more complex to address. If left undiagnosed or untreated, infection with *M. ulcerans* can lead to skin, tissue or bone damage, with surgery or amputation sometimes required.

Treatment options, including antibiotics and surgery, are effective if the disease is diagnosed early, however current diagnostics are both costly and complex.[202] FIND is developing several Buruli ulcer diagnostics in collaboration with the WHO and other partners. These include an instrument-free point-of-care test as well as tools that can be used at peripheral health centres.[84] Aptagen is also in the early stages of developing a point-of-care diagnostic based on RNA aptamers.[84,203]

Drug treatment is with a combination of two antibiotics given daily (or twice-daily) for eight weeks. The most commonly used regimen in sub-Saharan Africa combines one oral and one injectable antibiotic, but recent evidence suggests that all-oral regimens may be equally effective.[204] Recent research calls for ongoing monitoring to detect any emerging drug-resistant strains,[205] highlighting the need for new drugs that are less complicated to administer or can be given for a shorter period. Although there are few new drug candidates currently in development specifically for Buruli ulcer, two investigational tuberculosis drugs – telacebec (Q203) and TB47 – have demonstrated efficacy against Buruli ulcer in pre-clinical studies.[206,207]

The BCG vaccine (designed for TB) provides short-term protection, but is not an adequate substitute for a specifically targeted vaccine. Buruli ulcer vaccine development is in the very early stages of research.[208] A recombinant *Mycobacterium marinum* strain expressing MU-Ag85A – the only candidate in the pre-clinical pipeline – has demonstrated superior immunogenicity and protection over the BCG vaccine.[209]

$3.3 MILLION

TOTAL SPEND ON BURULI ULCER R&D IN 2018
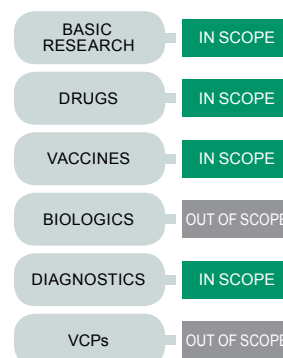
BASIC RESEARCH	IN SCOPE
DRUGS	IN SCOPE
VACCINES	IN SCOPE
BIOLOGICS	OUT OF SCOPE
DIAGNOSTICS	IN SCOPE
VCPs	OUT OF SCOPE

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Table 27. Buruli ulcer R&D funding by product type 2009-2018

Product US$ (millions)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
Basic research	1.0	1.4	0.9	1.8	3.7	1.6	1.0	1.1	2.8	2.3	70
Drugs	0.3	0.8	0.7	0.7	0.8	0.2	0.2	1.2	1.3	0.9	27
Diagnostics	0.3	0.8	0.3	1.1	0.8	1.3	0.5	0.5	0.3	0.1	3.5
Vaccines	0.2	2.2	2.1	2.0	0.9	-	-	-	-	-	-
Unspecified	0.1	0.7	2.2	0.9	0.8	0.8	0.4	<0.1	<0.1	-	-
Total	2.0	5.9	6.2	6.5	6.9	4.0	2.0	3.0	4.4	3.3	100

- No reported funding

Global funding for basic research and product development for Buruli ulcer in 2018 was $3.3m. This represented a decrease of $1.1m (down 25%) compared to 2017.

Retrospective data corrections from the Australian NHMRC raised our estimate of funding for 2017 from $2.9m to $4.4m – meaning that in 2017, funding for Buruli ulcer R&D actually increased by $1.4m, rather than remaining static as originally stated in last year's G-FINDER report. The drop in 2018 funding therefore represents the first fall after two years of significant growth, returning funding to roughly 2016 levels.

Most investment in Buruli ulcer R&D in 2018 was in basic research ($2.3m, 70% of total funding), followed by drug development ($0.9m, 27%), with the small amount of remaining funding going to diagnostic R&D ($0.1m, 3.5%). As in each of the previous four years, there continued to be no reported funding for vaccine development, following the conclusion of the EC-funded BuruliVac project. While the distribution of funding was similar to the previous year, there was a reduction in investment across all product areas, reflecting the drop in overall funding.

Essentially all investment in Buruli ulcer R&D in 2018 was for basic & early-stage research ($3.3m, 99%), with the remaining funding (<$0.1m, 1.0%) not allocated to a specific R&D stage. There was no reported funding for clinical development, due entirely to a drop in funding for diagnostic clinical development in 2018.

A total of nine organisations provided funding for Buruli ulcer R&D in 2018, down from a peak of 14 organisations in 2017.

Together, the Australian NHMRC and US NIH accounted for the majority of Buruli ulcer funding in 2018 ($2.2m, 67%). Following the retrospective inclusion of 2017 funding from the Australian NHMRC, this was the second year in a row that it and the US NIH have featured as the top two funders of Buruli ulcer R&D, with the Australian NHMRC clearly the largest global funder of Buruli ulcer R&D in both years. This likely reflects increased interest in Buruli ulcer among Australian researchers following a recent spike in domestic incidence of the disease.

The overall drop in funding for Buruli ulcer R&D was due to the absence of any reported funding from the French ANR (the third-largest funder of Buruli ulcer R&D in 2017, with $0.4m), and numerous small reductions from other funders. The only material increase in funding was from Inserm (up $0.2m, 376%) for basic research.

The bulk of investment in Buruli ulcer R&D in 2018 came from the public sector ($2.9m, 89%), all of which was provided by HICs. Remaining funding was provided by the philanthropic sector ($0.4m, 11%), the majority of which came from the Wellcome Trust.

Table 28. Buruli ulcer R&D funders 2018

Funder	US$ (millions) 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
Australian NHMRC	0.1	0.1	<0.1	<0.1	-	0.1	<0.1	<0.1	1.3	1.3	40
US NIH	0.9	1.3	1.4	1.1	1.0	-	-	1.1	1.0	0.9	27
Wellcome Trust	<0.1	<0.1	0.3	0.3	0.3	0.2	<0.1	<0.1	0.3	0.3	8.3
Inserm	-	-	-	-	-	-	-	<0.1	<0.1	0.2	6.8
Flemish EWI								0.3	0.2	0.2	6.4
UK MRC	-	-	-	-	0.2	0.2	0.1	0.1	0.2	0.1	4.6
Institut Pasteur	0.4	0.5	0.2	0.4	0.4	0.4	0.5	0.5	0.3	0.1	3.9
Medicor Foundation		0.4	0.1	0.2	0.2	0.2	0.4	0.1	0.2	<0.1	2.5
German BMBF	-	-	-	-	-	-	-	-	<0.1	<0.1	1.0
French ANR	-	-	-	0.2	-	-	0.3	0.3	0.4	-	-
Anesvad Foundation									0.2		
Gates Ventures									<0.1		
Disease total	2.0	5.9	6.2	6.5	6.9	4.0	2.0	3.0	4.4	3.3	100

- No reported funding

Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

TRACHOMA

Trachoma is an infectious eye disease caused by the bacterium *Chlamydia trachomatis*. The infection can be spread by contact with infected eyes or nasal discharge, including via contact from flies and shared use of clothing and towels. Trachoma is common among children and in areas where there is unclean water and poor sanitation. After repeat infection and without medical treatment, the eyelid can turn inwards, causing the eyelashes to rub against the eyeball, resulting in scarring, visual impairment or irreversible blindness.

WHO recommends a combination of interventions known as the SAFE strategy for the elimination of trachoma,[210] which is an acronym for *surgery* (which has low acceptance and high recurrence rates); *antibiotics* (including treatment with azithromycin, though over-reliance on a single drug therapy can increase the risk of drug resistance); *facial cleanliness*; and *environmental improvement* to reduce transmission.

Because of the challenges associated with successful implementation (and sustainability) of the SAFE strategy, a vaccine is needed. The most advanced trachoma vaccine candidate is NIAID's live-attenuated (plasmid-deficient) trachoma vaccine, which is currently in pre-clinical development.[211]

Clinical diagnosis of trachoma is not always reliable, and current diagnostic tests are expensive and complex.[212] Studies have shown that an antibody-based multiplex assay could be used to diagnose trachoma in low-prevalence settings.[213] One candidate, the Pgp3 LFA-cassette, has been evaluated in field studies in Nepal, showing high specificity (99%) but low sensitivity (40%).[214]

$2.1 MILLION

TOTAL SPEND ON TRACHOMA R&D IN 2018

0.3M DALYS 0 DEATHS
IN 2017
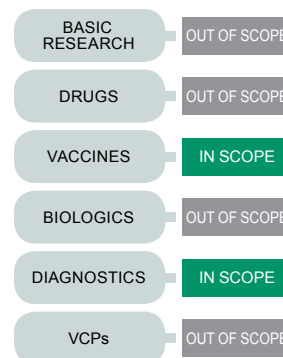
BASIC RESEARCH	OUT OF SCOPE
DRUGS	OUT OF SCOPE
VACCINES	IN SCOPE
BIOLOGICS	OUT OF SCOPE
DIAGNOSTICS	IN SCOPE
VCPs	OUT OF SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Global funding for trachoma product development was $2.1m in 2018. This was a drop of $0.8m (-27%), reversing the previous year's funding increase.

The decline was driven by the cessation of funding from the German DFG and Institut Pasteur (jointly down $1.2m, -100%), both of which had reported non-product-specific funding in the past. As a result, almost all R&D funding in 2018 was for vaccine development ($2.0m, 95%), all of which came from the EC through the TracVac Consortium. This marks the highest level of funding for trachoma vaccines on record. The minimal remaining funding was for diagnostics ($0.1m, 5.5%), which had received no funding in 2017. It came exclusively from the German BMBF, which became a first time funder of trachoma R&D in 2018.

All reported funding for trachoma vaccines and diagnostics in 2018 was for discovery and pre-clinical research.

Table 29. Trachoma R&D funding by product type 2009-2018

Product / US$ (millions)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
Vaccines	0.8	0.8	0.8	1.1	1.2	1.0	1.2	1.2	1.7	2.0	95
Diagnostics	0.5	2.8	5.4	0.6	0.7	0.2	-	0.2	-	0.1	5.5
Unspecified	0.1	-	-	0.4	0.5	0.1	-	0.8	1.2	-	-
Total	**1.4**	**3.6**	**6.1**	**2.2**	**2.3**	**1.4**	**1.2**	**2.3**	**2.8**	**2.1**	**100**

- No reported funding

Only two organisations reported funding for trachoma product development in 2018. Almost all of this funding came from the EC ($2.0m, 95%), which first provided trachoma funding in 2017, with the remainder provided by the German BMBF ($0.1m, 5.5%). The overall drop in trachoma R&D funding was due to the absence of funding from the German DFG in 2018, following a $1.0m contribution (37% of total funding) in 2017. The US NIH did not provide any funding for trachoma R&D for a second consecutive year, after consistently funding between 2008 and 2016, at an average of $1.2m a year.

For the second year running, trachoma R&D was funded exclusively by the high income country public sector, with philanthropic sector funding – from the Wellcome Trust – last reported in 2016.

Table 30. Trachoma R&D funders 2018

Funder / US$ (millions)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
EC	-	-	-	-	-	-	-	-	1.7	2.0	95
German BMBF	-	-	-	-	-	-	-	-	-	0.1	5.5
German DFG	-	-	-	-	0.2	-	-	0.7	1.0	-	-
Institut Pasteur	-	<0.1	<0.1	-	0.1	0.1	-	0.1	0.1	-	-
US NIH	1.3	1.3	1.2	1.6	1.6	0.9	1.0	1.4	-	-	-
Wellcome Trust	-	-	-	0.6	0.4	0.3	0.2	<0.1	-	-	-
US CDC	-	-	-	-	-	0.1	-	-	-	-	-
Aggregate industry	-	2.3	4.8	-	-	-	-	-	-	-	-
Lygature			0.1								
Swedish Research Council	0.1	-	-	-	-	-	-	-			
Disease total	**1.4**	**3.6**	**6.1**	**2.2**	**2.3**	**1.4**	**1.2**	**2.3**	**2.8**	**2.1**	**100**

- No reported funding

Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

LEPTOSPIROSIS

Leptospirosis is an infection caused by bacteria of the genus *Leptospira*, which affects both humans and animals. The infection is transmitted to humans through contact with the urine or blood of infected animals, either directly or via contaminated water, food or soil. People who live in tropical climates, who work in flooded areas such as rice paddies and sugar cane plantations, or who work with animals are most at risk. The bacteria can survive for several weeks in water or soil, and outbreaks often occur after flooding.

Diagnosing leptospirosis can be challenging due to the non-specific symptoms of early infection, which are shared with a number of other diseases, such as dengue and malaria, as well as the fact that some infected individuals may remain asymptomatic. Without treatment, the infection can progress to a more severe second phase, causing meningitis, kidney and liver failure, respiratory distress, and sometimes death.

Effective, appropriate drugs exist for leptospirosis, meaning that infection can be successfully treated if it is diagnosed. However, accurate diagnosis of leptospirosis during the acute phase of the disease is currently only possible with sophisticated laboratory tests, which are unsuitable for remote settings. There is a real need for new, easy-to-use tests that can quickly and accurately diagnose acute infection in the field. Several rapid point-of-care tests are available on the market, but none of these are widely approved due to their lack of specificity and sensitivity.[215] The promising diagnostic LEPkit assay has demonstrated higher sensitivity and specificity than existing rapid diagnostic tests, but its development status has not been updated since 2017.[216]

$1.7 MILLION

TOTAL SPEND ON LEPTOSPIROSIS R&D IN 2018

2.9M DALYS 58,900 DEATHS IN 2015

BASIC RESEARCH	OUT OF SCOPE
DRUGS	OUT OF SCOPE
VACCINES	OUT OF SCOPE
BIOLOGICS	OUT OF SCOPE
DIAGNOSTICS	RESTRICTED
VCPs	OUT OF SCOPE

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Table 31. Leptospirosis R&D funders 2018

| Funder | US$ (millions) | | | | | | 2018 % of total |
	2013	2014	2015	2016	2017	2018	
Indian ICMR	-	-	-	1.2	1.4	0.9	54
Institut Pasteur	0.4	0.9	1.0	1.2	1.9	0.4	26
US NIH	-	0.3	0.3	-	-	0.3	18
Aggregate industry	-	-	-	-	<0.1	<0.1	2.4
Inserm	-	-	-	0.2	-	-	-
Colombian Colciencias		<0.1	-	-	-	-	-
plan:g	<0.1	-	-	-	-	-	-
Disease total	0.4	1.4	1.4	2.5	3.3	1.7	100

- No reported funding

Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

Funding for leptospirosis diagnostic R&D – the only product area included in the G-FINDER scope – totalled $1.7m in 2018, dropping by half (down $1.6m, -49%) from its record high in 2017. Leptospirosis R&D funding had previously been trending upwards ever since its inclusion in G-FINDER in 2013, with the 2018 fall wiping out the most of the growth in funding since 2014.

As in 2017, the vast majority of funding for leptospirosis diagnostics in 2018 was not allocated to a specific R&D stage ($1.4m, 82%), while the remainder was allocated to discovery and pre-clinical research ($0.3m, 18%).

The number of funders for leptospirosis diagnostic R&D rose to four in 2018, with the US NIH providing funding (of $0.3m) for the first time since 2015. The Indian ICMR was the largest funder ($0.9m, 54% of total leptospirosis R&D funding), followed by the Institut Pasteur ($0.4m, 26%), with remaining funding coming from SMEs (<$0.1m, 2.4%). Funding from both ICMR and Institut Pasteur was lower in 2018, causing the drop in overall funding for leptospirosis R&D.

Almost all reported funding was provided by the public sector ($1.6m, 98%), just over half of which came from LMICs ($0.9m, 55% of all public funding, entirely from India), and the remainder from HICs ($0.7m, 45%). The private sector again made a small contribution (<$0.1m, 2.4% of the total), following its first ever investment in 2017.

RHEUMATIC FEVER

Rheumatic fever is a bacterial infection caused by *Streptococcus pyogenes* (also known as Group A streptococcus, GAS) that most commonly affects children aged 5-14 years. It usually follows untreated bacterial throat infections, and without treatment can lead to complications such as rheumatic heart disease, in which the heart valves are permanently damaged. It may also progress to heart failure and stroke.

Acute rheumatic fever can be treated using currently available drugs (although post-infection prophylaxis requires multiple doses of antibiotics); however, treatment of rheumatic heart disease often requires surgery. The main R&D required is therefore the development of a vaccine. Several GAS vaccines are in development, with only two candidates in clinical trials: StreptAnova, which completed a Phase I trial in December 2017, and MJ8VAX, whose Phase I clinical trial indicated the need for additional investigations to optimise its immunogenicity and improve dosing.[217,218] Phase I/IIa trials are planned for StreptInCor, the most advanced pre-clinical candidate.[218]

$1.7 MILLION

TOTAL SPEND ON RHEUMATIC FEVER R&D IN 2018

8.8M DALYS
245,372 DEATHS
IN 2017
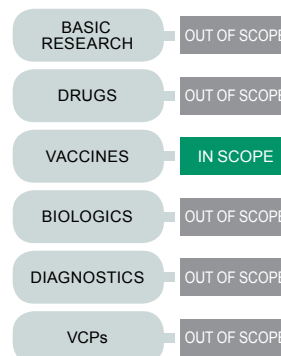
BASIC RESEARCH	OUT OF SCOPE
DRUGS	OUT OF SCOPE
VACCINES	IN SCOPE
BIOLOGICS	OUT OF SCOPE
DIAGNOSTICS	OUT OF SCOPE
VCPs	OUT OF SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Table 32. Rheumatic fever R&D funding by product type 2009-2018

Product	US$ (millions) 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
Vaccines	3.4	2.1	0.8	0.9	0.9	1.3	2.3	1.2	1.4	1.7	100
Unspecified	0.2	-	0.1	0.1	-	<0.1	<0.1	0.1	0.3	-	-
Total	3.6	2.1	0.9	1.0	0.9	1.4	2.3	1.3	1.7	1.7	100

- No reported funding

Global funding for rheumatic fever R&D was $1.7m in 2018, which was essentially unchanged from the previous year, and less than half of its 2009 peak.

Vaccines are the only product area for rheumatic fever included within the scope of G-FINDER. The bulk of this funding was for discovery & pre-clinical research ($1.2m, 74%), with the remainder going to clinical development ($0.4m, 26%).

There were three funders of rheumatic fever vaccine R&D in 2018. The US NIH contributed two-thirds of the total ($1.1m, 67%), and the remaining funding was provided by the Australian NHMRC ($0.4m, 26%) and the New Zealand HRC ($0.1m, 6.7%), which last reported funding in 2016. Neither Australia's Austrade, nor the Indian CSIR, who between them provided funding worth $0.4m in 2017, reported any funding for rheumatic fever in 2018.

For the fourth consecutive year, rheumatic fever R&D in 2018 was exclusively funded by the public sector; with the absence of funding from the Indian CSIR, all of this funding came from HICs.

Table 33. Rheumatic fever R&D funders 2018

Funder	US$ (millions) 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
US NIH	0.9	1.0	0.5	0.5	0.6	0.6	1.1	1.0	0.8	1.1	67
Australian NHMRC	0.7	0.8	0.3	0.3	0.3	0.7	-	-	0.4	0.4	26
New Zealand HRC	-	-	-	-	-	-	0.6	0.4	-	0.1	6.7
Indian CSIR	-	-	-	-	-	-	-	0.2	-	-	-
Austrade								-	0.2	-	-
Brazilian BNDES						-	0.6	-	-	-	-
Aggregate industry	1.8	-	-	-	-	0.2	-	-	-	-	-
Swedish Research Council	<0.1	-	0.1	0.1	-	-	-	-			
Australian NHF	<0.1	0.2						-			
Australia - India SRF		0.1									
Fondazione Cariplo	0.1	-									
Disease total	3.6	2.1	0.9	1.0	0.9	1.4	2.3	1.3	1.7	1.7	100

- No reported funding

█████ Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

MYCETOMA

Mycetoma is a chronic infection of the skin and soft tissue caused by either flesh-eating fungi (eumycetoma) or bacteria (actinomycetoma). When left untreated, it can affect deeper tissues and lead to amputation. Although the true global incidence and prevalence of mycetoma is still not fully known,[219] it most often occurs across the so-called mycetoma belt, which includes Sudan, Chad, Ethiopia, Senegal, Somalia, Yemen, Mauritania, Venezuela, Mexico and India. Mycetoma has been included in the G-FINDER scope for the first time this year.

There is a need for new tools to address the ongoing challenge of mycetoma in endemic countries, including new drugs and diagnostics, as well as basic research to fill critical information gaps.

Despite the availability of several drugs for the treatment of mycetoma, including the antifungals ketoconazole and itraconazole, and the antibiotics amikacin and co-trimoxazole,[220] significant R&D gaps still exist. Antifungals targeting eumycetoma are only 25-35% effective, are costly, require extended treatment and can cause serious side effects.[221] DND*i* is currently supporting a Phase II trial of fosravuconazole in Sudan to assess whether it is superior to these existing antifungals.[222] While antibiotics used for the treatment of actinomycetoma have a cure rate of 90%, the global rise of antimicrobial resistance threatens their long term effectiveness.

Existing tools for diagnosing mycetoma are often inappropriate for use in LMICs, as they are invasive, time-consuming and require a well-equipped laboratory.[223] There is a need for cheap, rapid and accurate point-of-care diagnostics for patients with early lesions.[223]

More basic research is needed in order to accurately estimate the burden of mycetoma, to understand its epidemiology and mode of transmission, and to facilitate the development and use of new drugs and diagnostics.[219,221]

$0.9 MILLION

TOTAL SPEND ON MYCETOMA R&D IN 2018
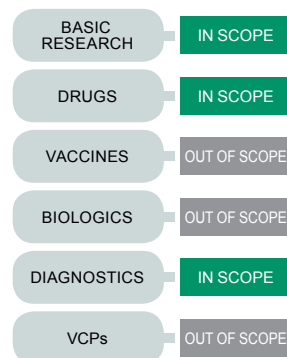
BASIC RESEARCH	IN SCOPE
DRUGS	IN SCOPE
VACCINES	OUT OF SCOPE
BIOLOGICS	OUT OF SCOPE
DIAGNOSTICS	IN SCOPE
VCPs	OUT OF SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Table 34. Mycetoma R&D funding by product type 2018

Product	US$ (millions) 2018	2018 % of total
Basic research	0.2	19
Drugs	<0.1	<0.1
Diagnostics	-	-
Unspecified	0.7	81
Total	0.9	100

- No reported funding

Table 35. Mycetoma R&D funders 2018

Funder	US$ (millions) 2018	2018 % of total
UK DHSC	0.7	81
US NIH	0.2	19
Aggregate industry	<0.1	<0.1
Disease total	0.9	100

Direct global funding for basic research and product development for mycetoma in 2018 was $0.9m. An additional $0.7m in mycetoma-specific R&D funding was provided as onward funding from Global Health Innovation Technology Fund (GHIT Fund) to DND*i*, but this funding has already been captured in the G-FINDER totals as part of the non-disease-specific core funding going to the GHIT Fund, and is not included here in order to prevent counting the same funding twice.

The majority of all direct funding for mycetoma R&D in 2018 was a single grant from the UK DHSC ($0.7m, 81% of total funding), not allocated to a specific product or R&D stage, for a UK and low- and middle-income country partnership aimed at improving diagnosis, prevention, response and treatment. Remaining funding was allocated to basic research ($0.2m, 19%), and drugs (<$0.1m, 0.1%). While there was no funding reported specifically for diagnostics, the UK DHSC grant targets diagnosis alongside prevention and treatment. The additional $0.7m in already-counted onward funding from the GHIT Fund went to the Phase II clinical development of mycetoma drugs.

Aside from the GHIT Fund's excluded onward funding, only three organisations provided funding for mycetoma R&D in 2018. The largest funder was the UK DHSC ($0.7m, 81%), followed by the US NIH ($0.2m, 19%) – meaning that 99.9% of all funding came from the public sector in HICs – while there was also a small (<$0.1m, 0.1%) contribution from industry.

NON-DISEASE-SPECIFIC FUNDING

G-FINDER includes four categories of funding that cannot be allocated to a specific neglected disease: core funding of a multi-disease organisation; platform technologies; multi-disease vector control products; and other R&D.

Core funding refers to non-earmarked funding given to organisations that work in multiple disease areas, where the expenditure per disease is not determined by the funder. This is often the case for funding given to intermediary organisations that have a broad disease scope, such as the GHIT Fund and the EDCTP.

Platform technologies are tools that can be applied to a range of areas, but which are not yet focused on a particular disease or product. Private sector investment in R&D for platform technologies is excluded to ensure that only developing country-relevant R&D is captured. The platform technology category includes adjuvants and immunomodulators, delivery technologies and devices, and general diagnostic platforms.
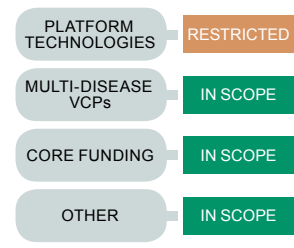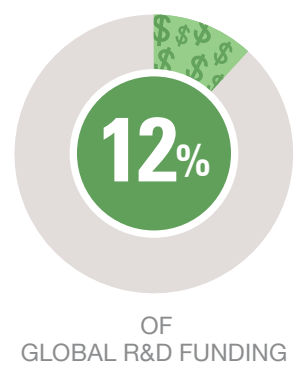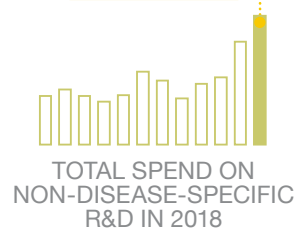
Adjuvants and immunomodulators are compounds or structures that improve the efficacy of vaccines by boosting the human immune response. Aluminium-based adjuvants have long been used, but new, more potent adjuvants are needed.[224] Several early-stage initiatives are underway, including the EC-funded MucoVac and TRANSVAC2, and the Global Health Vaccine Accelerator Platform programme, funded by the Bill & Melinda Gates Foundation.[225]

Delivery technologies and devices are needed to simplify the administration of vaccines and drugs, including nasal or patch-based delivery systems and low-cost formulations for the extended release of therapeutics. Examples include Monash University's MicroCube platform,[226] and MIT's drug capsule for sustained release of malaria and HIV drugs.[227]

General diagnostic platforms include technologies allowing simultaneous detection of multiple disease-causing agents, and non-invasive technologies that simplify disease diagnosis. A number of diagnostic platforms are in early-stage development , including Global Good's rapid culture assay for detecting TB and sepsis,[228] a lensless microscope from Caltech,[229] and a multiplex fever diagnostic test from FIND and MSF.[230]

The '**multi-disease vector control product**' category captures R&D funding for products that target vectors capable of transmitting several different diseases, including biological and chemical VCPs as well as reservoir-targeted vaccines. Examples of projects in this category include the early-stage development of gene drive systems that alter mosquito populations,[231] and chemical and genetic screens to identify new molecules targeting *Aedes* mosquitoes.[232,233]

The '**other R&D**' category captures any grants that cannot be otherwise allocated, such as research into the interaction between HIV and TB.

$500 MILLION

TOTAL SPEND ON NON-DISEASE-SPECIFIC R&D IN 2018

12%

OF GLOBAL R&D FUNDING

PLATFORM TECHNOLOGIES	RESTRICTED
MULTI-DISEASE VCPs	IN SCOPE
CORE FUNDING	IN SCOPE
OTHER	IN SCOPE

G-FINDER exclusively covers research aimed at developing new health technologies – see the Introduction for details

Table 36. Top core funders 2018

Funder	US$ (millions) 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
EC	20	2.2	26	26	27	24	44	9.1	61	83	23
Wellcome Trust	-	-	-	28	28	19	10	40	52	60	16
Gates Foundation	6.7	1.5	-	5.9	11	7.3	32	28	65	58	16
UK DHSC									24	51	14
Japanese MHLW*										22	6.1
Aggregate industry	-	-	-	-	6.1	17	14	20	25	17	4.6
UK DFID	12	13	10	3.0	5.7	2.9	6.3	11	15	13	3.7
German BMBF	-	-	<0.1	<0.1	<0.1	0.1	<0.1	4.8	3.9	8.5	2.4
Japanese MOFA*										8.3	2.3
MSF		4.8	5.1	5.9	5.6	4.9	4.9	4.9	5.3	7.0	1.9
Spanish MAEUEC	-	3.3	3.2	0.3	-	2.5	2.1	0.3	-	5.3	1.5
Catalan DOH	0.9	1.7	1.9	1.1	0.8			3.5	1.9	3.6	1.0
Subtotal of top 12^	68	64	82	108	114	108	141	152	280	335	92
Total core funding	76	78	94	112	122	112	149	168	297	363	100

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.
* The Japanese Ministry of Health, Labour and Welfare (MHLW) and the Japanese Ministry of Foreign Affairs (MOFA) participated in the survey for the first time this year. Recipient-reported funding from these agencies was previously aggregated as funding from the Japanese Government.
- No reported funding
Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

Funding for neglected disease basic research and product development that was not targeted at a specific disease increased by $100m (up 25%) to a new record high of $500m in 2018, accounting for 12% of all neglected disease R&D funding.

Most non-disease-specific funding was for projects only relevant to neglected diseases ($426m, 85%); the remainder ($74m, 15%) was for R&D relevant to both neglected disease *and* emerging infectious diseases (EID), a little under half of which was for multi-disease vector control products.

CORE FUNDING OF MULTI-DISEASE ORGANISATIONS

Core funding of organisations conducting R&D in multiple diseases accounted for almost three-quarters of non-disease-specific funding ($363m, 73%) in 2018, representing 8.9% of total global funding for neglected disease R&D. For the fourth year in a row, core funding reached a record high, although the 2018 increase (up $66m, 22%) was smaller than the previous year's record growth.

The record-high level of core funding seen in 2018 was a reflection of record funding for both the European and Developing Countries Clinical Trials Partnership (EDCTP) and the Global Health Innovative Technology Fund (GHIT Fund). Well over a third (38%) of all core funding in 2018 went to EDCTP, with significant increases in funding to EDCTP from the UK DHSC (up $26m, 115%) and the EC (up $21m, 35%). Along with sizeable increases in funding to the GHIT Fund from the Japanese Ministry of Health, Labour and Welfare (MHLW) and the Japanese Ministry of Foreign Affairs (MOFA, collectively up $14m, 84%), these increases were the major driver of the overall growth in core funding.

Further increases came from the Wellcome Trust (up $7.4m, 14%), which was also partly due to an increase in funding to the GHIT Fund, the Spanish MAEUEC ($5.3m, after no funding in 2017) and the German BMBF (up $4.6m, 118%). These increases were partially offset by reductions in core funding from industry (down $8.7m, -34%) and the Gates Foundation (down $7.0m, -11%), after record highs the previous year. Two organisations, Swiss SDC and Swedish SIDA, dropped out of the top 12 funders, replaced by two Spanish public organisations: the MAEUEC and the Catalan DOH.

Table 37. Top funders of platform technologies 2018

Funder	US$ (millions) 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
Gates Foundation	17	15	7.0	19	16	11	19	33	15	18	43
US NIH	7.0	6.4	3.6	21	23	5.4	4.5	13	10	13	30
Gates Ventures									2.8	2.8	6.4
Aggregate industry	<0.1	1.5	-	0.2	<0.1	<0.1	0.3	<0.1	-	1.4	3.3
EC	0.6	2.1	1.4	1.2	2.8	3.4	6.8	1.9	3.6	1.3	3.1
US DOD	-	1.3	1.6	2.7	3.7	2.6	1.2	0.4	-	1.2	2.8
UK DFID	-	-	-	-	-	-	-	-	-	0.8	1.9
Innovate UK									<0.1	0.8	1.9
Fondation Mérieux		-	-	-	-	-	-	-	0.3	0.6	1.5
French ANR	-	0.3	-	-	-	-	-	-	-	0.3	0.7
Indian DBT	-	3.4	0.3	4.4	0.5	<0.1	1.3	2.3	0.3	0.3	0.7
South African DST	-	-	-	-	-	-	-	-	0.2	0.3	0.6
Subtotal of top 12^	26	32	19	52	47	24	38	54	34	41	96
Total funding for platform technologies	26	32	19	53	47	24	38	54	35	43	100

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.
- No reported funding
▢ Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.

PLATFORM TECHNOLOGIES

A total of $43m was invested in R&D for platform technologies in 2018, accounting for 1.1% of total global funding of neglected diseases. This was an increase of $9.5m (up 29%), driven by a spike in funding for platform technologies relevant to both neglected and emerging infectious diseases, but follows a significant drop in funding the previous year.

The majority of funding for platform technologies went to general diagnostic platforms ($17m, 38%) and adjuvants and immunomodulators ($16m, 37%); the remainder went to delivery technologies and devices ($11m, 24%), with most of this for technologies targeted for vaccines ($8.4m, 80% of delivery technologies funding) rather than drugs ($2.1m, 20%).

With the exception of drug delivery technology and devices, which fell by $4.5m (-68%) to a five year low (albeit after a record-high in 2017), all platform technology categories received more funding in 2018. The largest increase was for vaccine delivery technologies, which almost quadrupled in funding (up $6.2m, 277%), as a result of increased investment from the Gates Foundation, due in part to cyclical funding to UCL for developing platforms for ultra-low-cost vaccines. Funding for general diagnostic platforms also rose (up $5.4m, 29%) due to increases from the Gates Foundation (up $4.0m, 200%) and a new $1.4m investment from an SME – reflecting their joint funding of a diagnostic platform focused on LMIC-needs. Funding for adjuvants and immunomodulators increased (up $2.4m, 18%; reversing the drop seen in 2017); this was driven entirely by increased investment from the US NIH (up $4.3m, 65%), offset by the Gates Foundation (down $2.2m, -37%), the other major contributor, which reduced its funding for the third year in a row.

As in all previous years, funding for platform technologies was highly concentrated, with the top two funders – the US NIH and Gates Foundation – providing just under three-quarters of all funding ($31m, 73%). All other top funders collectively invested less than $10m in platform technology R&D, although, other than the EC (which was down $2.3m, -63%), all increased their spending.

MULTI-DISEASE VECTOR CONTROL PRODUCTS

In 2018, a total of $31m was invested in R&D for multi-disease vector control products, accounting for 0.8% of global neglected disease R&D funding. This was an increase of $6.4m (up 26%) from the previous year, when this category was first included in G-FINDER, although its share of global funding remained essentially unchanged. All funding for multi-disease vector control product R&D was applicable to both neglected diseases and EIDs. Nearly three-quarters ($22m, 72%; up from 55% in 2017) of this funding was for vector control products specifically targeting *Aedes* mosquitoes – which transmits dengue, Zika and chikungunya – while the remainder ($8.9m, 28%) went towards R&D for unspecified or multiple vectors

Multi-disease vector control product funding was fairly evenly split between chemical ($16m, 52%) and biological vector control products ($15m, 48%). An increase in funding for biological vector control product R&D (up $5.0m, 51%) was the major driver of the increase in overall multi-disease vector control product R&D funding in 2018, driven by $4.1m in new project funding from the Wellcome Trust to the World Mosquito Programme, and new funding from the US CDC. Funding for chemical vector control product R&D was mostly unchanged (up $0.6m, 4.0%).

Global funding for multi-disease vector control product R&D in 2018 was relatively evenly balanced between field development & post-registration studies ($11m, 34%) and early-stage research ($9.9m, 32%), with the remainder ($11m, 35%) not allocated to a specific R&D stage. Funding for all R&D areas increased, headlined by growth in funding for early-stage research (up $2.0m, 25%), which included $2.4m in new project funding from US NIH to Princeton University for developing new chemical-based mosquito traps and repellents.

Four funders provided the bulk of all funding for multi-disease vector control product R&D ($26m, 84%): the US NIH with $8.1m (26% of total vector control product funding), mainly for biological control products; the US DOD with $7.6m (24%), exclusively for chemical vector control products; the Wellcome Trust with $5.9m (19%) exclusively for biological vector control products, and the US CDC with $4.8m (15%), split almost evenly between chemical and biological vector control products. Aside from decreases by the Brazilian DECIT (down $1.3m, -73%) and the US DOD (down $0.7m, -8.5%), every top funder increased their investment in 2018, notably: the Wellcome Trust, which more than doubled its funding (up $3.7m, 163%), the US CDC (up $2.2m, 85%), and the US NIH (up $2.0m, 33%).

OTHER R&D

A total of $63m was reported as Other R&D (1.5% of total global funding). More than half of this funding was for projects relevant solely to neglected diseases ($37m, 59%); the remaining 41% ($26m) was for projects relevant to both neglected diseases and EIDs, up from 31% in 2017.

Funding for other R&D increased significantly (up $19m, 45%), largely driven by increased funding for fundamental research relevant to both neglected diseases and EIDs, particularly research to understand the biology of flaviviruses and the *Aedes* mosquito, as well as increased investment in drug discovery programs for neglected diseases.
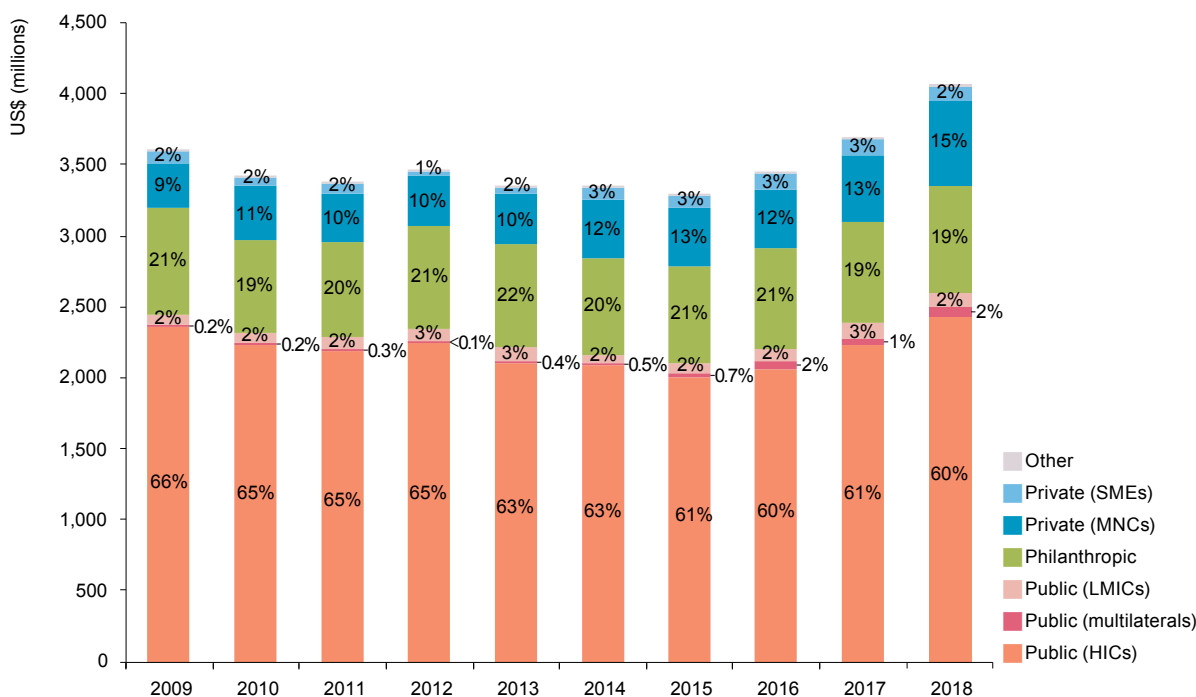
FUNDERS

FUNDER OVERVIEW

Global funding for neglected disease basic research and product development totalled $4,055m in 2018, easily eclipsing 2017's record high.

Despite its record-high level of investment ($2,599m), the public sector's share of total funding actually fell marginally, equalling its lowest ever level (64% of total funding) because of strong growth from the private sector. HIC governments once again provided the vast majority of public funding ($2,429m, 93%), with the remainder divided between multilateral organisations ($75m, 2.9%) and LMIC governments ($95m, 3.7%). The philanthropic sector provided almost a fifth of total funding ($760m, 19%), its largest contribution since 2008. Industry funding reached a record high of $694m (17% of total funding) of which multinational pharmaceutical companies (MNCs) provided the vast majority ($598m, 86%), with the remaining 14% ($96m) coming from small pharmaceutical and biotechnology firms (SMEs).

The headline increases in both global funding (up $374m, 10%) and public sector funding (up $214m, 9.0%) were partly due to improved reporting by the US NIH. Once this and other survey effects are accounted for, the real increase in global funding was $290m (up 7.9%) – still the largest real increase ever seen in the history of the G-FINDER survey – and the true public sector increase was $121m (up 5.1%). This was matched by the increase from the private sector, which invested $118m more than in 2017 (up 20%), its sixth straight year of growth and largest annual increase in ten years. Funding from the philanthropic sector also increased, by $43m (6.0%).

All of the increase in public sector funding came from HIC governments and multilaterals (up $222m, 9.7% overall, for a real increase of $128m, 5.6%), and all of the increase in industry investment came from MNCs (up $132m, 28%, a record increase). Funding was lower from both LMIC governments (down $7.9m, -7.6%) and SMEs (down $14m, -12%), however in the case of SMEs this was partly a reflection of changes in survey participation, and in both cases follows an extended period of funding growth.

Figure 20. Total R&D funding by sector 2009-2018

PUBLIC FUNDERS

Globally, the public sector invested $2,599m in neglected disease basic research and product development in 2018. This was once again significantly higher than the previous year (up $214m, 9.0%), representing a record high. A little under half of this increase was due to more granular reporting of HIV investments from the US NIH, but, even if this effect is excluded, public funding still increased substantially (up $121m, 5.1%) and to record-high levels.

The US government was once again the largest public funder, providing nearly three-quarters ($1,779m, 71%) of all public funding for neglected disease R&D in 2018. This was the largest contribution from the US government since 2009, building on two consecutive years of growth. The UK government provided $230m (9.2% of all public funding) – also its largest ever contribution – followed by the EC with $134m (5.4%).

For the second year running, each of the US, UK and EC increased their investment in neglected disease R&D. The largest increase, by any measure, came from the US, with a headline increase of $148m (up 9.1%), or $54m (up 3.3%) once the effect of better NIH reporting is accounted for. UK government funding increased by $32m (up 16%), driven by record-high funding from the UK DHSC and UK DFID. A smaller increase from the EC (up $8.9m, 7.1%) coincided with its largest ever disbursement to the EDCTP. Other notable increases came from the governments of Japan (up $15m, 82%), which has increased its funding for four years running, and Australia (up $11m, 44%). The largest decrease came from France (down $5.4m, -11%) – whose funding declined for the fifth consecutive year – followed by the Netherlands (down $4.7m, -19%). Multilateral funding – almost entirely from Unitaid – increased by $22m (up 41%) to a record high of $75m.

Public funding from LMICs fell by $7.9m (-7.6%), driven by lower funding from India (down $9.4m, -12%, after a record high in 2017) and South Africa (down $1.9m, -13%), and offset slightly by a rebound in funding from Brazil (up $3.6m, 45%). Despite this overall decrease, both LMIC public funding overall and Indian government funding remain well above their pre-2017 levels.

Table 38. **Top public R&D funders 2018**

Country US$ (millions)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
United States of America	1,798	1,706	1,672	1,769	1,574	1,583	1,516	1,615	1,631	1,779	68
United Kingdom	131	144	116	81	111	116	95	105	197	230	8.8
EC	123	96	115	99	118	116	141	85	125	134	5.2
Germany	35	38	33	56	46	50	56	50	70	73	2.8
India	28	43	48	48	56	43	48	55	76	66	2.6
France	49	41	62	55	81	66	66	52	50	44	1.7
Australia	26	29	36	46	24	36	21	23	25	36	1.4
Japan	6.2	9.4	3.5	2.6	11	11	14	17	18	33	1.3
Netherlands	28	19	25	16	24	19	5.4	25	25	21	0.8
Switzerland	8.7	15	15	17	17	19	21	19	18	17	0.7
Canada	18	9.5	9.6	18	20	13	10	7.1	13	15	0.6
South Africa	7.3	7.8	7.1	5.7	13	4.4	6.9	12	15	13	0.5
Subtotal of top 12^	2,319	2,176	2,163	2,242	2,100	2,082	2,007	2,075	2,264	2,462	95
Total public funding	2,444	2,320	2,289	2,348	2,219	2,166	2,102	2,200	2,385	2,599	100

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.

PUBLIC FUNDING BY GDP

Absolute funding can be a misleading measure of public investment in neglected disease basic research and product development, as it can understate the relative contributions of smaller countries and LMICs. For this reason, we also analyse countries' investments in relation to their gross domestic product (GDP).

When analysing by proportion of GDP rather than absolute funding, a slightly different picture of public funding emerges – one which gives greater recognition to the contributions of nations with smaller populations or lower income per head.

The US and the UK remain the top two funders of neglected disease R&D, but a record high level of investment relative to GDP from the UK leaves the gap between it and the US smaller than it has ever been. South Africa becomes the third-largest funder when analysed by proportion of GDP, up from twelfth place measured by absolute funding. Similarly, Australia and Switzerland's rankings improve when analysed by percentage of GDP, while France, Germany and Japan's fall. The rankings of the US, UK, India, Netherlands and Canada are similar using either metric.

Two countries not ranked among the top 12 funders by absolute funding are included when instead ranked by contribution relative to GDP: Spain and Norway. Japan, however, drops out of the list when GDP is factored in, while the EC is unlisted because it cannot be easily included in this analysis.

Figure 21. Public R&D funding by GDP 2018^*
(A value of 10 is equivalent to an investment of 0.01% of GDP)
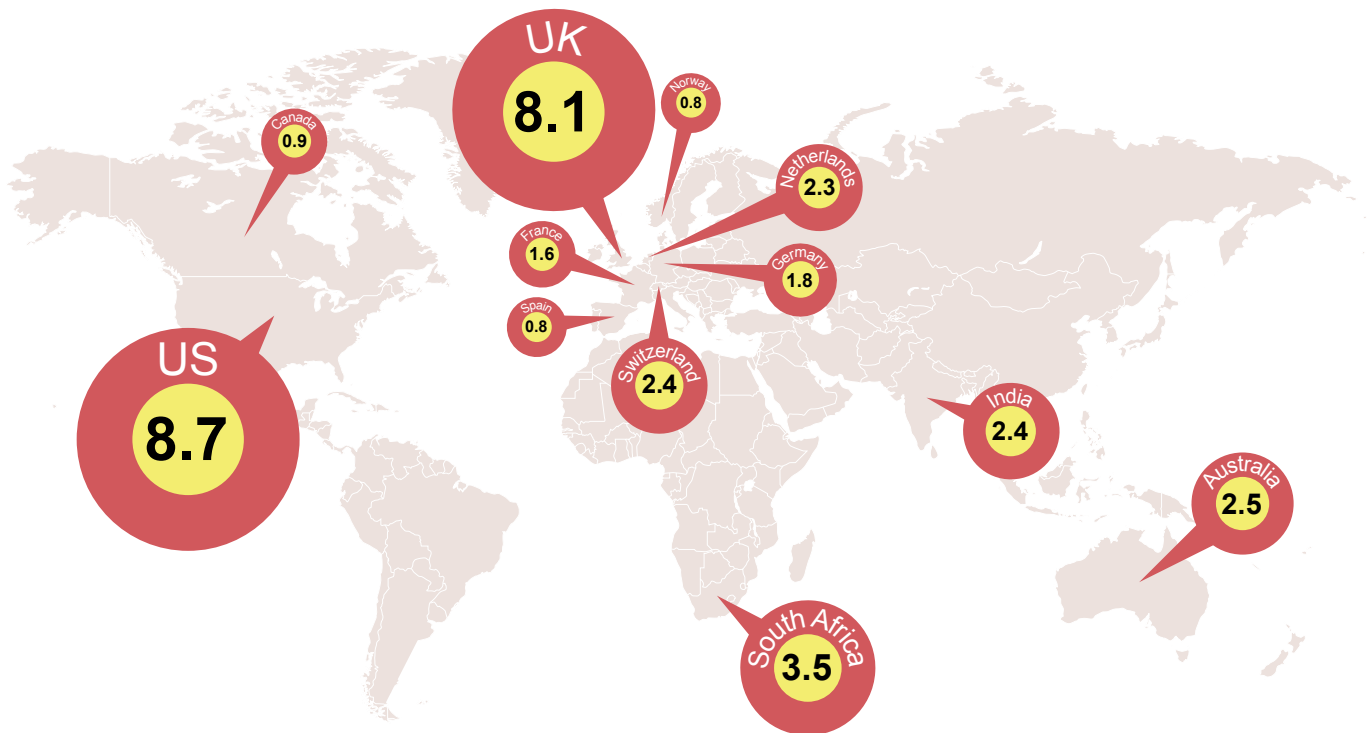
^ GDP figures taken from International Monetary Fund (IMF) World Economic Outlook database
* Figure provides value of (US$ funding / GDP) * 100,000

MEASURING FUNDING BASED ON PURCHASING POWER PARITY

The G-FINDER survey uses market exchange rates to convert grants made in currencies other than US dollars (US$). These rates are the best available measure of how many US$ could have been purchased with the units of currency provided by the grant.

Some experts argue that it is more accurate to measure the impact of R&D funding using purchasing power parity (PPP) exchange rates rather than market exchange rates.[234, 235] PPP exchange rates are market rates adjusted to reflect differences in the purchasing power of different currencies, so that they capture, for example, not just how many rupees a dollar can buy, but also how India's different price level influences the final amount of goods and services that can be purchased using rupees in India rather than dollars in the US. Since there are persistent differences in US$-denominated price levels between HICs and LMICs, PPP exchange rates treat local currency funds spent in LMICs as relatively more valuable than the number of US$ they could be exchanged for on international currency markets. This provides a measure of funding impact – of how many dollars' worth of R&D a given grant will be able to purchase.

It is not possible to perfectly apply a PPP exchange rate approach to the G-FINDER data, as G-FINDER tracks funding flows by organisation, not the location where funds are ultimately spent. However the following figures are an illustration of what the G-FINDER funding totals would look like if we tried to adjust them for recipients' price level using PPP rates. These figures exclude all funding without a listed recipient nation, or for which the World Bank provides no PPP exchange rate. This excludes grants worth $153m in 2018, of which $120m (78%) is US NIH grants for HIV to 'multiple product developers'.

A switch to PPP measurement substantially increases the total value of 2018 neglected diseases R&D investment for which there is a valid recipient nation, by $549m (14%), because – on average – funds are spent in nations with a lower price level than that of the US, so US$ measures understate their impact.

The effect of converting grants using PPP exchange rates is particularly strong for diseases with large proportions of LMIC-directed funding: the value of funding for bacterial pneumonia & meningitis more than doubles when measured on a PPP basis (up $101m, 109%), as does funding for leptospirosis (up $2.2m, 135%). *Salmonella* infection R&D also rises significantly (up $65m, 73%).

In line with the overall increase in measured funding, most diseases see increased funding under PPP exchange rates. Only Buruli ulcer (down <$0.1m, -0.6%) and rheumatic fever (down <$0.1m, -2.4%) report actual decreases when taking into account recipient nation price level, though HIV/AIDS (up 2.6%) and hepatitis C (up 2.2%) both report only slight relative increases, suggesting that their investment is directed mostly to HIC recipient nations where price levels are higher.

Using PPP exchange rates in place of market exchange rates also substantially increases measured funding from LMIC governments, due to their high share of domestic funding and generally lower price levels.

The biggest beneficiary of this effect is the Indian government, which sees the impact of its investments more than triple (up 233%) when measured using PPP exchange rates. Taking price level into account, India is the world's third-largest funder relative to GDP, only marginally behind the US and the UK. Other LMICs experience similar, though smaller, increases in their measured funding: South Africa's public funding nearly doubles when measured using PPP rates (up 98%) – making it the fourth-largest funder relative to GDP – while Chile and Brazil are each credited with 67% more funding based on their domestic price levels.

Using PPP exchange rates also changes how measured funding is allocated across R&D stages. Because clinical development & post-registration studies funding tends to be directed to nations with a lower price level than basic & early-stage research funding, PPP accounting suggests that clinical development & post-registration studies funding sees more of a boost to its purchasing power. Clinical development & post-registration studies funding is increased by 19% using PPP rates, while basic & early-stage research rises by only 11%. This adjustment pushes the measured share of clinical development & post-registration studies funding to 36% of global funding (up 1.4%) and reduces the share for basic & early-stage research to 42% (down 1.0%). The effect of PPP measurement is particularly strong for core funding for multi-disease R&D organisations, which see a 21% increase in their measured funding on the basis of significant flows of Wellcome Trust funding to India, Thailand and Malawi. This likely understates the impact of core funding measured at PPP, since it accounts for funding to the EDCTP at the price level of the Netherlands, rather than that of the ultimate recipients of its onward funding.

HIGH-INCOME COUNTRIES AND MULTILATERALS

Collectively, HIC governments and multilaterals once again provided almost all ($2,504m, 96%) public funding for neglected disease basic research and product development in 2018. A third consecutive year of increased funding (up $222m, 9.7%) lifted investment to its highest ever level, although a little under half of this increase was due to clearer reporting of HIV investments from the US NIH. If this effect is excluded, funding still increased markedly (up $128m, 4.7%) and to a record high.

The headline increases in funding from both HIC governments overall (up $200m, 9.0%) and the US government in particular (up $148m, 9.1%) were both inflated by the improvement in US NIH reporting. Adjusting for this change, the true increase in HIC government funding was $107m (up 4.8%). The US remains the major driver of the adjusted increase (up $54m, 3.3%), with the genuine increase in US NIH spending hiding a sharp drop in funding from the US DOD (down $19m, -20%). The next largest increase came from the UK (up $32m, 16%), which reached its highest ever level due to another year of record-high investment from the UK DHSC (up $21m, 50%) and DFID (up $14m, 13%). Sizeable increases from Japan (up $15m, 82%), Australia (up $11m, 44%) and the EC (up $8.9m, 7.1%) also contributed to the overall funding growth. Decreases that did occur were modest in comparison, with the largest coming from France (down $5.4m, -11%) and the Netherlands (down $4.7m, -19%, due to a cyclical drop in funding to IPM).

Multilaterals invested a total of $75m in neglected disease R&D in 2018, representing 2.9% of all public funding and 1.9% of global funding – this was the highest share ever recorded in both instances. Funding from multilaterals increased for the sixth consecutive year (up $22m, 41%), once again setting the record for the largest contribution from this sector. Yet again, Unitaid was also the largest multilateral funder ($73m, 97%) and accounted for the entirety of the increase (up $22m, 44%).

As in previous years, funding from HIC governments and multilaterals was concentrated on HIV/AIDS, TB and malaria, which collectively accounted for three-quarters ($1,851m, 74%) of 2018 funding. The large increase in HIV/AIDS R&D funding (up $119m, 12%) was driven by the US NIH (up $135m, 18%) – partly as a result of improved reporting – and a significant increase in funding from Unitaid (up $18m, 51%). These were offset by decreases from a number of other funders, notably US DOD (down $14m, -40%) and USAID (down $11m, -17%), along with a number of European public funders. Investment in TB R&D from HICs and multilaterals also increased (up $30m, 7.9%), again led by the US NIH (up $31m, 13%) – which made its largest ever investment in TB – alongside the UK DFID (up $9.5m, 67%) and USAID (up $4.1m, 34%), outweighing smaller decreases from several European public funders. After a major increase the previous year, funding for malaria fell (down $13m, -3.8%), due to cuts by DFID (down $5.3m, -14%), the NIH (down $5.3m, -3.0%) and other European funders.

Investment in non-disease-specific research increased by $91m (up 45%) to a record high of $293m. The increase was driven by a doubling of UK DHSC investment (up $27m, 109%), along with a sizeable increase from the EC (up $20m, 30%) – both of which were essentially all for EDCTP – along with a $22m disbursement from the Japanese Ministry of Health, Labour and Welfare to the GHIT Fund and a smaller increase from the US NIH (up $12m, 40%). Overall, just under half ($40m, 43%) of the total increase in non-disease-specific research funding went to EDCTP.

Funding for bacterial pneumonia & meningitis increased (up $6.6m, 71%) for the first time – after four years of declining funding – as a result of UK investment from DFID (up $5.3m, 598%) and new funding from the NHS ($1.9m). Apart from malaria, the only other disease to see a notable fall in funding from HICs and multilaterals was dengue (down $7.8m, -14%), almost entirely due to reduced investment from the NIH (down $7.5m, -17%) whose funding fell for a second consecutive year.

As in previous years, more than half ($1,298m, 52%) of all HIC government and multilateral funding for neglected disease R&D in 2018 was for basic & early-stage research. Just over a quarter ($685m, 27%) was explicitly directed to clinical development & post-registration studies, although of the remaining $521m (21% of total funding) which was not allocated to a specific R&D stage, just over a quarter ($137m, 26%) went to the EDTCP, which is focused on clinical development. Funding from HIC governments and multilaterals increased for both basic & early-stage research (up $99m, 8.2%) and clinical development & post-registration studies (up $31m, 4.8%) in 2018.

Table 39. Public (HIC and multilaterals) R&D funding by disease 2009-2018

Disease or R&D area	US$ (millions)										2018 % of total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
HIV/AIDS	1,169	1,087	1,056	1,078	982	990	925	958	981	1,100	44
Tuberculosis	348	324	296	288	293	324	334	371	387	418	17
Malaria	300	323	300	301	300	297	287	305	346	333	13
Kinetoplastid diseases	108	109	100	96	88	97	87	96	105	98	3.9
Diarrhoeal diseases	109	89	98	91	92	89	77	59	68	68	2.7
Helminth infections (worms & flukes)	55	53	50	61	52	47	43	44	56	52	2.1
Dengue	61	54	60	57	47	52	62	71	55	47	1.9
Salmonella infections	38	40	35	43	42	41	40	54	42	44	1.8
Bacterial pneumonia & meningitis	13	19	29	17	28	20	18	12	9.2	16	0.6
Cryptococcal meningitis					2.9	5.8	5.3	5.8	11	7.2	0.3
Hepatitis C					15	20	13	19	7.2	6.0	0.2
Snakebite envenoming										4.7	0.2
Leprosy	7.4	4.2	4.8	11	6.4	6.1	4.7	5.7	3.6	4.6	0.2
Hepatitis B										4.3	0.2
Buruli ulcer	1.7	4.0	3.7	3.7	4.3	0.7	1.0	2.4	3.6	2.9	0.1
Trachoma	1.4	1.3	1.2	1.6	1.9	1.1	1.0	2.3	2.8	2.1	<0.1
Rheumatic fever	1.6	1.9	0.9	1.0	0.9	1.2	1.7	1.3	1.5	1.7	<0.1
Mycetoma										0.9	<0.1
Leptospirosis					0.4	1.3	1.4	1.3	1.9	0.7	<0.1
Platform technologies	8.1	12	12	28	31	12	17	18	13	18	0.7
Adjuvants and immunomodulators	3.2	4.3	2.0	20	17	3.5	3.4	11	7.5	12	0.5
General diagnostic platforms	2.2	6.0	9.1	7.8	9.0	6.3	12	5.9	4.3	4.9	0.2
Vaccine delivery technologies and devices	2.6	0.8	0.4	0.3	4.3	1.6	0.6	0.2	0.6	0.9	<0.1
Drug delivery technologies and devices	<0.1	0.5	-	0.1	-	0.6	0.6	0.7	0.7	0.6	<0.1
Multi-disease vector control products									20	24	0.9
Core funding of a multi-disease R&D organisation	67	71	88	70	70	64	82	66	142	214	8.6
Unspecified disease	79	50	72	109	62	35	33	22	26	37	1.5
Total public funding (HICs/multilaterals)	**2,368**	**2,241**	**2,208**	**2,256**	**2,117**	**2,105**	**2,033**	**2,114**	**2,282**	**2,504**	**100**

Hepatitis C, cryptococcal meningitis and leptospirosis were added to G-FINDER in 2013. Multi-disease vector control products were added in 2017. Hepatitis B, mycetoma and snakebite envenoming were added in 2018.
- No reported funding

LOW- AND MIDDLE-INCOME COUNTRIES

Public funders from LMICs invested a total of $95m in neglected disease product development and basic research in 2018, representing 3.7% of global public funding. This was a slight reduction from the previous year (down $7.9m, -7.6%), marking the first drop in annual funding from this sector since 2014. However this followed a significant increase (to a record high) in 2017, and LMIC public sector funding remained well above its 2016 level despite the drop.

Once again, almost all ($91m, 96%) reported LMIC public funding for neglected disease R&D in 2018 came from just three countries: India ($66m, 70%), South Africa ($13m, 14%) and Brazil ($12m, 12%).

After three years of growth and a record high in 2017, India, the largest LMIC funder, decreased its public funding in 2018 (down $9.3m, -12%). This was principally due to a drop in ICMR funding (down $12m, -18%), offset by smaller increases from DBT (up $1.9m, 34%) and BIRAC (up $1.8m, 114%, to the highest level ever recorded). While Indian public funding declined, the decrease was less than half of the size of the preceding year's increase, implying that the long term trend is still one of sustained growth. Similarly, the slight decline in South African public funding (down $1.9m, -13%) followed three years of growth and still leaves funding slightly above its 2016 level. The 2018 decline in South African public funding was almost entirely due to reduced investment from the South African MRC (down $1.7m, -26%), while funding from South African DST remained stable (down $0.3m, -3.1%). Public funding from Brazil rebounded (up $3.6m, 45%) after a significant drop the previous year, lifted by increases from FINEP (up $2.1m, 319% to the highest level ever recorded) and FAPEMIG (up $1.8m, 216%). Despite increased funding from the Brazilian government and a decline in funding from South Africa, South Africa remained the second-largest LMIC funder for the second year in a row. The only other LMIC governments to report more than $1.0m in funding in 2018 were Columbia and Thailand.

Compared to HIC governments, funding from LMIC governments is much less concentrated on HIV/AIDS, TB and malaria. However in 2018 these three diseases still accounted for nearly two-thirds ($58m, 60%) of total LMIC public funding for neglected disease R&D, up from a record low of just 50% in 2016. The largest decreases in LMIC public funding in 2018 were in leprosy (down $3.9m, -63%) and kinetoplastid R&D (down $2.7m, -30%), both driven by lower intramural funding from the ICMR. Investment in HIV/AIDS R&D also decreased (down $2.6m, -26%) following reductions from the two largest LMIC public funders: the South African MRC (down $1.9m, -51%) and the Indian ICMR (down $1.4m, -81%). The largest increases in LMIC public funding were for *Salmonella* infections (up $1.6m, from a low base), following increases from the Indian ICMR (up $1.4m, from a low base) and DBT (up $0.2m, 319%); and bacterial pneumonia & meningitis (up $1.6m, from a low base), as a result of first-time investment from the Indian BIRAC ($1.2m) and South African MRC investment ($0.3m). Funding for TB increased only slightly (up $0.8m, 2.8%) but this, together with the three preceding years of growth, once again took it to the highest level ever recorded by the G-FINDER survey.

In contrast to previous surveys, reporting was sufficiently granular this year to allow meaningful analysis of LMIC public funding by R&D stage, due to more detailed reporting from the Indian ICMR. Just under two-thirds ($60m, 63%) of all LMIC public funding was invested into basic & early-stage research, with a little over a fifth ($20m, 21%) dedicated to clinical development & post-registration studies. Relatively little went to core funding of multi-disease research organisations ($4.0m, 4.1%) or platform technologies ($1.2m, 1.2%), while remaining funding ($10m, 11%) was not allocated to a specific product or R&D stage.

Table 40. Public (LMIC) R&D funding by disease 2009-2018

Disease or R&D area	US$ (millions)										2018 % of total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
Tuberculosis	10	12	18	18	27	14	17	24	29	30	32
Malaria	20	11	14	22	21	9.9	14	15	21	20	21
HIV/AIDS	11	19	19	14	20	6.3	6.4	4.7	9.8	7.2	7.6
Dengue	15	7.7	4.4	7.0	3.6	3.5	4.2	5.5	7.0	6.7	7.0
Diarrhoeal diseases	4.8	7.6	9.8	5.0	5.7	5.9	5.9	8.3	7.3	6.7	7.0
Kinetoplastid diseases	9.0	12	8.3	12	8.2	8.6	8.6	11	9.1	6.4	6.7
Helminth infections (worms & flukes)	1.4	1.3	2.0	3.0	1.9	2.7	2.0	1.7	3.0	2.5	2.6
Leprosy	4.0	3.8	2.7	2.2	4.9	3.8	5.0	4.2	6.2	2.3	2.4
Salmonella infections	<0.1	0.6	0.5	0.3	0.6	0.6	0.2	0.6	0.1	1.8	1.8
Bacterial pneumonia & meningitis	0.4	0.4	0.1	0.3	<0.1	0.3	<0.1	0.6	<0.1	1.6	1.7
Hepatitis B										1.4	1.5
Leptospirosis					-	<0.1	-	1.2	1.4	0.9	0.9
Snakebite envenoming										0.8	0.8
Hepatitis C					5.7	0.2	0.8	0.5	0.6	0.8	0.8
Cryptococcal meningitis					-	-	-	-	-	<0.1	<0.1
Rheumatic fever	-	-	-	-	-	-	0.6	-	0.2	-	-
Platform technologies	-	3.6	0.5	4.7	0.5	0.4	1.4	3.2	1.4	1.2	1.2
General diagnostic platforms	-	1.0	0.4	0.6	<0.1	<0.1	<0.1	0.9	0.9	0.8	0.9
Drug delivery technologies and devices	-	1.7	-	4.2	<0.1	0.3	<0.1	<0.1	0.2	0.3	0.3
Adjuvants and immunomodulators	-	0.6	-	-	-	-	-	<0.1	<0.1	<0.1	<0.1
Vaccine delivery technologies and devices	-	0.3	<0.1	-	0.4	-	1.2	2.3	0.2	-	-
Multi-disease vector control products									2.8	0.8	0.8
Core funding of a multi-disease R&D organisation	0.8	0.5	0.4	-	0.5	0.3	2.8	3.8	2.1	2.1	2.2
Unspecified disease	0.1	-	0.4	4.0	2.4	3.9	0.2	2.3	1.6	1.8	1.9
Total public funding (LMICs)	76	79	81	92	102	61	69	86	103	95	100

▮▮▮ Hepatitis C, cryptococcal meningitis and leptospirosis were added to G-FINDER in 2013. Multi-disease vector control products were added in 2017. Hepatitis B and snakebite envenoming were added in 2018.

- No reported funding

Argentina:

- In 2018, the World Bank categorised Argentina as a high income country (rather than an upper-middle income country). This reclassification has been retrospectively applied to historical G-FINDER data, so these LMIC public funding figures do not match previous G-FINDER reports.

- Argentinian funding for neglected disease basic research and product development totalled $0.8m in 2018, and remained essentially stable compared to the previous year (down <$0.1m, -4.4%)

- As in previous years, over half ($0.4m, 56%) of all Argentinian government funding went to kinetoplastid disease R&D and nearly all (88%) was invested in basic & early-stage research.

CHINESE R&D FUNDING PROVIDED BY THE NATIONAL NATURAL SCIENCE FOUNDATION OF CHINA

This year's G-FINDER report includes, for the first time, data on neglected disease R&D funding from the National Natural Science Foundation of China (NSFC) that falls within the G-FINDER scope.

We emphasise that these figures do not represent a complete estimate of China's public funding for neglected disease R&D, since they do not account for any funding provided by Chinese central government agencies other than the NSFC, or funding from lower levels of government. Because of these limitations, the listed figures for NSFC funding should not be compared to those for national governments, and no NFSC funding is included in any of the G-FINDER totals elsewhere in this report.

The $11m in neglected disease funding for basic research and product development provided by the NSFC in 2018 focused on TB, which received $4.4m, or 42% of its overall funding. Most of the remainder went to malaria ($1.5m, 14%), helminth infections ($1.3m, 12%), *Salmonella* infections ($1.1m, 11%) and diarrhoeal diseases ($0.8m, 7.9%).

Helminth funding was mostly for schistosomiasis ($1.1m, 86%), with small amounts of remaining funding split across multiple helminth infections, tapeworm, hookworm, strongyloidiasis and roundworm (all <$0.1m). *Salmonella* funding was mostly split between multiple *Salmonella* infections ($0.7m, 59%) and non-typhoidal *S. enterica* ($0.4m, 37%), with <$0.1m for typhoid and paratyphoid fever. Diarrhoeal disease funding went to cryptosporidiosis ($0.3m, 39%), cholera ($0.3m, 32%) and *Shigella* ($0.2m, 28%).

All NSFC funding in 2018 went to China-based academic and research institutions, with the vast majority going to basic research ($8.5m, 80%) – in line with the NSFC's role as a science and technology agency – and drug R&D ($1.1m, 11%). There was relatively little funding for vaccines ($0.4m, 3.4%) and diagnostics ($0.2m, 2.2%), and almost none reported for biologics, vector control products or microbicides (all <$0.1m).

Of the $2.1m not allocated to basic research (20% of total funding), the vast majority ($1.7m, 83%) went to discovery and pre-clinical R&D. Essentially all funding not earmarked for either basic research or pre-clinical R&D did not specify an R&D stage ($0.3m, 16% of non-basic research spending).

The distribution of basic research funding broadly mirrored that of overall funding, with 46% going to TB and smaller shares for helminths (13% of basic research funding), *Salmonella* (11%), malaria (11%) and diarrhoeal diseases (9.5%). The largest share of drug funding went to malaria, which received $0.5m (43% of drug funding), with most of the remainder going to TB ($0.4m, 35%).

PHILANTHROPIC FUNDERS

The philanthropic sector provided a total of $760m in funding for basic research and product development for neglected diseases in 2018, an increase of $43m (up 6.0%). While smaller than the funding increases from the public sector and industry, this took philanthropic funding to its highest level in a decade. The sector's share of total funding remained essentially unchanged at 19%.

As in previous years, the Gates Foundation and the Wellcome Trust collectively provided the vast majority of philanthropic funding, jointly accounting for 93% of the total. Both organisations further increased their funding in 2018: the Gates Foundation (up $36m, 6.5%) to its highest level since 2009, and the Wellcome Trust (up $11m, 10%) to its highest level since 2012. Among smaller donors, an increase from MSF (up $6.9m, 56%) was offset by decreases from Gavi (down $4.1m, -55%) and the Against Malaria Foundation (down $2.3m, -88%).

Table 41. **Top philanthropic R&D funders 2018**

Funder	US$ (millions)										2018 % of total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
Gates Foundation	670	552	549	544	563	556	565	578	550	585	76
Wellcome Trust	60	70	83	129	119	111	87	105	108	120	16
Gates Ventures									20	20	2.6
MSF	4.7	4.8	5.3	5.9	6.1	4.9	6.4	11	12	19	2.5
Gavi		2.6		10	20		11	6.1	7.5	3.4	0.4
Fundació La Caixa		0.3	3.5	2.9	3.2		3.8	3.7	5.3	3.3	0.4
Funds raised from the general public	0.5	0.4	0.6	0.4	0.7	1.0	1.3	1.2	1.6	2.3	0.3
Fondation Mérieux	<0.1	1.9	1.3	0.6	0.4	0.4	0.4	0.3	0.6	0.8	0.1
amfAR	0.3	0.3	0.2	2.3	2.0		0.2	0.4	-	0.7	<0.1
effect:hope								0.1	0.6	0.6	<0.1
ALM	0.6	0.5	0.6	0.4	0.4	0.2	-	-	<0.1	0.6	<0.1
All other philanthropic organisations	21	25	20	21	10	10	7.5	5.6	11	4.6	0.6
Total philanthropic funding	757	658	663	717	724	684	682	712	717	760	100

Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients and so may be incomplete.
- No reported funding

Philanthropic organisations have placed an increasing emphasis on non-disease-specific funding over the course of the last decade, with almost a quarter of all philanthropic funding in 2018 ($178m, 23%) not allocated to a specific disease – up from just 5.2% in 2008, and double the 2018 proportion of non-disease-specific funding from the public sector. Almost three-quarters ($130m, 73%) of philanthropic non-disease-specific funding was provided as core funding to multi-disease organisations, with most of the remainder split between platform technologies ($22m, 12%) and unspecified R&D ($19m, 11%). Just over two-thirds (68%) of philanthropic funders' core funding once again went to researchers and developers, with the top three such recipients remaining unchanged from 2017: the University of Oxford ($20m, 22% of the total – exclusively from the Wellcome Trust); and the California Institute for Biomedical Research ($14m, 16%) and the recently-established Bill & Melinda Gates Medical Research Institute ($14m, 15%) – both exclusively from the Gates Foundation. A smaller proportion of philanthropic core funding went to PDPs (18% of the total) and other intermediaries (14%). Non-disease-specific philanthropic funding increased by $16m (up 9.6%) in 2018, driven by increased funding from the Wellcome Trust (up $11m, 21%) to several multi-disease organisations, including the GHIT Fund and Hilleman Laboratories.

As has been the case in every year of the G-FINDER survey, malaria, TB and HIV/AIDS again collectively received the majority ($428m, 56%) of all philanthropic funding for neglected disease R&D in 2018 (although this share has been declining over the last decade – while non-disease -specific investment has grown – and remains at a near-record low). Funding for TB (up $25m, 22%) and malaria (up $17m, 12%) rose after decreases in 2017, while funding for HIV/AIDS (down $11m, -7.3%) fell to its lowest recorded share of philanthropic funding, and funding for diarrhoeal diseases (down $9.8m, -17%) also fell; all of these changes were driven by changes in funding from the Gates Foundation. The only notable change in disease-specific funding not linked to the Gates Foundation was for hepatitis C (up $4.7m, 1022%), reflecting MSF's funding for the Storm-C trial.

More than a third of all philanthropic funding was directed to basic & early-stage research ($278m, 37%) followed by a quarter of funding going to clinical development & post-registration studies ($193m, 25%). Core funding for multi-disease organisations accounted for a fifth of funding ($149m, 20%) with 2.9% ($22m) going to platform technologies. Remaining funding ($118m, 16%) was not allocated to a specific product or R&D stage.

Table 42. Philanthropic R&D funding by disease 2009-2018

Disease or R&D area	US$ (millions)										2018 % of total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
Malaria	253	143	209	179	167	181	146	147	135	152	20
Tuberculosis	130	142	122	127	152	157	150	116	113	138	18
HIV/AIDS	160	161	159	168	156	142	136	151	148	137	18
Diarrhoeal diseases	58	56	39	51	66	49	52	59	58	48	6.3
Bacterial pneumonia & meningitis	28	54	42	55	29	7.7	43	27	31	34	4.4
Helminth infections (worms & flukes)	26	23	31	27	31	31	23	22	18	19	2.5
Kinetoplastid diseases	61	34	24	22	21	34	16	27	20	19	2.5
Salmonella infections	3.8	7.5	9.8	13	15	11	17	16	18	18	2.4
Dengue	3.3	3.4	6.5	6.2	14	23	13	22	9.1	7.9	1.0
Hepatitis C					0.1	0.1	<0.1	<0.1	0.5	5.1	0.7
Leprosy	1.1	2.8	1.8	2.1	2.1	1.3	1.2	1.4	2.4	2.2	0.3
Cryptococcal meningitis					0.3	<0.1	<0.1	<0.1	0.4	0.4	<0.1
Snakebite envenoming										0.4	<0.1
Buruli ulcer	0.3	1.9	2.5	2.9	2.6	3.2	1.0	0.6	0.8	0.4	<0.1
Trachoma	-	-	0.1	0.6	0.4	0.3	0.2	<0.1	-	-	-
Leptospirosis					<0.1	-	-	-	-	-	-
Rheumatic fever	0.2	0.2	-	-	-	-	-	-	-	-	-
Platform technologies	18	16	7.3	20	16	12	19	33	19	22	2.9
Adjuvants and immunomodulators	2.7	6.0	4.1	9.9	5.2	5.4	9.1	7.2	6.0	3.8	0.5
General diagnostic platforms	8.2	4.2	1.7	9.7	8.7	4.0	4.3	11	5.8	9.4	1.2
Drug delivery technologies and devices	0.1	-	-	0.2	1.7	1.7	3.1	2.6	5.6	1.2	0.2
Vaccine delivery technologies and devices	6.6	5.4	1.5	0.6	-	0.9	3.0	12	1.4	7.6	1.0
Multi-disease vector control products									2.2	6.9	0.9
Core funding of a multi-disease R&D organisation	6.7	6.4	5.3	41	45	32	50	78	127	130	17
Unspecified disease	9.1	7.9	3.4	2.5	8.1	1.4	13	13	14	19	2.5
Total philanthropic funding	757	658	663	717	724	684	682	712	717	760	100

Hepatitis C, cryptococcal meningitis and leptospirosis were added to G-FINDER in 2013. Multi-disease vector control products were added in 2017. Snakebite envenoming was added in 2018

\- No reported funding

PRIVATE SECTOR FUNDERS

The private sector invested a total of $694m in neglected disease basic research and product development in 2018*, accounting for 17% of total global funding. This was significantly higher than the previous year (up $118m, 20%), and represents the highest ever level of private sector investment in neglected disease R&D. Once again, the vast majority of this funding ($598m, 86%) came from multinational pharmaceutical companies (MNCs), with small pharmaceutical and biotechnology firms (SMEs) contributing the remainder ($96m, 14%).

The strong growth from industry was exclusively driven by MNCs, whose investments increased by $132m (up 28%). SME investment fell for the first time in six years. Much of the apparent $14m (-12%) drop in SME investment was due to survey non-participation, while the genuine decrease from regular SME survey participants was more modest (down $4.7m, -4.9%).

MULTINATIONAL PHARMACEUTICAL COMPANIES

Just under three-quarters ($442m, 74%) of all MNC investment in neglected disease R&D in 2018 went to HIV/AIDS, malaria and TB, down from 79% in 2017. Of the remaining disease groups, only diarrhoeal diseases ($40m, 6.8%) and hepatitis C ($33m, 5.6%) received more than 5% of MNC funding.

MNCs increased their investment in nearly every disease in which they are active. The largest increase by far was for HIV/AIDS, where investment reached $199m (up $58m, 41%). This is the largest amount MNCs have ever invested in HIV/AIDS, driven in large part by increased investment in vaccine development (up $42m, 70%). MNC investment in hepatitis C R&D rose more than six-fold (up $28m, 542%), also to a record high, driven by investment in fixed-dose drug combination clinical trials in LMICs. Funding for malaria increased by $16m (up 11%), with a considerable increase in funding for drug development (up $36m, 47%) – mainly for Phase II single-exposure radical cure trials – offsetting a decline in funding for vaccine development (down $21m, -34%). MNC funding for diarrhoeal diseases increased by $13m (up 48%), as investment in rotavirus vaccine development more than doubled (up $13m, 147%) on the back of an LMIC-specific vaccine trial for registration purposes. An increase in MNC investment in kinetoplastid R&D (up $8.7m, 51%) was driven by record-high funding for sleeping sickness ($12m in 2018, an increase of $8.8m compared with 2017).

Virtually all MNC investment in neglected disease R&D was for drug and vaccine R&D. Most investment was for clinical development & post-registration studies ($422m, 71%), with just 20% ($118m) for early-stage research. Remaining MNC investment ($59m, 9.8%) was not allocated to a specific product or R&D stage, including, for example, core funding provided to the GHIT Fund. MNC investment in clinical development & post-registration studies increased considerably (up $140m, 50%) as products progressed through the pipeline, while investment in early-stage research fell (down $15m, -12%).

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* This figure slightly understates overall private sector funding, as one company was unable to provide data in time to be included in the G-FINDER analysis. The organisation, an MNC, invested $3.8m in R&D for malaria which is not included in any of the totals.

Table 43. MNC R&D funding by disease 2009-2018

Disease or R&D area	US$ (millions)										2018 % of total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
HIV/AIDS	20	19	16	16	10	43	50	82	140	199	33
Malaria	82	111	91	106	75	119	144	141	137	153	26
Tuberculosis	122	157	153	136	114	102	99	90	90	91	15
Diarrhoeal diseases	38	35	24	29	41	33	22	15	27	40	6.8
Hepatitis C					29	27	22	7.0	5.2	33	5.6
Kinetoplastid diseases	3.7	9.8	10	18	17	12	16	13	17	26	4.3
Dengue	4.5	7.2	11	8.5	7.5	7.6	14	15	9.4	15	2.5
Helminth infections (worms & flukes)	10	3.9	2.7	3.6	8.8	7.1	11	8.2	9.7	14	2.3
Bacterial pneumonia & meningitis	28	27	35	38	33	34	13	22	2.0	3.9	0.7
Salmonella infections	2.1	3.3	5.2	4.3	4.3	4.0	3.7	4.2	2.1	1.5	0.3
Leprosy	-	-	-	-	<0.1	<0.1	0.7	0.4	0.4	1.2	0.2
Mycetoma										<0.1	<0.1
Rheumatic fever	1.8	-	-	-	-	0.2	-	-	-	-	-
Core funding of a multi-disease R&D organisation	-	-	-	-	4.2	11	14	20	25	17	2.8
Unspecified disease	-	-	3.2	1.5	6.0	1.4	0.7	0.7	0.6	4.5	0.7
Total MNC funding	313	372	351	361	350	401	410	418	466	598	100

◼️ Hepatitis C was added to G-FINDER in 2013. Mycetoma was added in 2018.

- No reported funding

SMEs invested a total of $96m in neglected disease R&D in 2018, accounting for 14% of total industry funding. This was down from 19% in 2017, reflecting both the major increase in MNC investment and a drop in reported investment by SMEs (down $14m, -12%). As noted earlier, this drop was partly due to survey participation, and the genuine decrease was only $4.7m (-4.9%). However even this figure hides a more complex story, as the drop in overall SME investment came entirely from HIC-based firms; investment from regular survey participants in HICs fell by $9.6m in 2018 (down 34%), while investment from LMIC-based SMEs actually increased (up $4.1m, 6.1%), This further extended the long-term trend which has seen LMIC-based firms come to dominate global SME investment in neglected disease R&D: three-quarters ($72m, 75%) of all SME investment in 2018 came from LMIC-based firms, primarily from India.

Table 44. **SME R&D funding by disease 2009-2018**

Disease or R&D area	US$ (millions)										2018 % of total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
Bacterial pneumonia & meningitis	9.7	8.2	6.4	5.9	19	19	26	37	35	38	39
Salmonella infections	2.0	0.2	<0.1	0.3	6.4	13	12	22	22	24	25
Diarrhoeal diseases	5.6	0.7	5.4	2.8	6.8	9.5	15	17	9.3	7.9	8.2
HIV/AIDS	21	15	10	8.0	6.7	6.7	8.9	7.0	14	7.8	8.1
Tuberculosis	19	19	16	9.7	5.4	8.6	11	9.6	15	6.5	6.8
Malaria	21	12	7.8	7.7	6.4	6.9	7.2	5.5	5.3	5.2	5.4
Dengue	1.0	0.6	0.6	0.5	0.4	0.5	1.1	2.5	3.3	3.3	3.4
Helminth infections (worms & flukes)	0.4	3.3	5.5	0.6	<0.1	8.7	0.9	<0.1	3.1	1.2	1.2
Snakebite envenoming										0.7	0.7
Hepatitis C					-	-	-	3.7	2.4	0.4	0.4
Kinetoplastid diseases	1.1	1.1	4.0	0.8	0.7	7.1	4.7	1.6	0.1	<0.1	<0.1
Leptospirosis					-	-	-	-	<0.1	<0.1	<0.1
Hepatitis B										<0.1	<0.1
Trachoma	-	2.3	4.8	-	-	-	-	-	-	-	-
Leprosy	-	<0.1	0.1	-	-	-	-	-	-	-	-
Multi-disease vector control products									0.7	-	-
Core funding of a multi-disease R&D organisation	-	-	-	-	1.9	5.7	-	-	-	-	-
Unspecified disease	-	-	-	<0.1	-	-	-	-	-	-	-
Total SME funding	80	65	61	37	54	85	86	106	110	96	100

Hepatitis C and leptospirosis were added to G-FINDER in 2013. Multi-disease vector control products were added in 2017. Snakebite envenoming and hepatitis B were added in 2018.
- No reported funding

As with MNCs and the public sector, around three-quarters of all SME investment went to just three diseases; unlike the other sectors, these diseases were bacterial pneumonia & meningitis, *Salmonella* infections and diarrhoeal diseases, which collectively accounted for 72% ($70m) of all SME investment in 2018. Irregular survey participation among SMEs makes analysis of funding trends difficult, though the broad picture is one of slight reductions in investment from regular survey participants across several diseases, following a period of rapid and sustained growth. The largest such drop was for HIV/AIDs (down $3.1m, -31%) mostly caused by reduced investment in vaccine development. Funding for TB also decreased (down $2.6m, -31%), as did helminth infections (down $1.9m, -61%) and diarrhoeal diseases (down $1.5m, -16%). The only meaningful increases in SME funding were for bacterial pneumonia & meningitis (up $2.6m, 7.5%) and *Salmonella* infections (up $2.3m, 10%). SMEs were the only private funders to invest in any of the new diseases or products included in this report, providing $0.7m for snakebite envenoming R&D, and less than $0.1m for hepatitis B.

The overwhelming majority of SME funding was for clinical development & post-registration studies ($85m, 88%), just under two-thirds of which was for Phase II vaccine trials. A further $8.2m (8.5%) was for early-stage research, while the remainder ($3.3m, 3.4%) was not allocated to a specific product or R&D stage.

IN-KIND CONTRIBUTIONS

In addition to their direct R&D spend, companies conducting neglected disease R&D incur a range of other costs, such as infrastructure costs and costs of capital. These costs are not included in G-FINDER, due to the difficulty of accurately quantifying or allocating them to neglected disease programmes. G-FINDER also does not include the cost of companies' non-R&D contributions to combating neglected diseases, such as drug donations for mass drug administration programmes.

Companies also provide in-kind contributions that are specifically targeted to neglected disease R&D, but cannot easily be captured in monetary terms. Although difficult to quantify, these inputs are of substantial value to their recipients, and may represent a significant cost to companies.

While some companies have nominated areas where they provide such contributions, others wished to remain anonymous.

Table 45. Typical industry in-kind contributions 2018

In-kind contribution	Examples	Some company donors^
Transfer of technology and technical expertise to develop, manufacture, register and distribute neglected disease products	• Identifying scientific obstacles • Sharing best practices and developing systems for clinical, technical and regulatory support • Developing capacity for pharmacovigilance • Donating equipment	Eisai GSK Johnson and Johnson MSD Novartis Otsuka Sanofi ViiV Healthcare
Provision of expertise	• Supporting clinical trials • Collaboration of scientists, sharing trial results and facilitating parallel, concurrent testing • Participation on scientific advisory or management boards of external organisations conducting neglected disease R&D • Providing expertise in toxicology/ADME and medicinal chemistry • Evaluating new compounds proposed by external partners • Allowing senior staff to take sabbaticals to work with neglected disease groups	Abbvie Daiichi Sankyo Eisai GSK Johnson and Johnson MSD Novartis Otsuka Sanofi ViiV Healthcare
Teaching and training	• In-house attachments offered to LMIC trainees in medicinal chemistry, clinical trial training etc • Providing training courses for LMIC researchers at academic institutions globally • Organising health care provider training in LMICs for pharmacovigilance of new treatments • Organising conferences and symposia on neglected disease-specific topics	Abbvie GSK Johnson and Johnson MSD Novartis Otsuka Sanofi ViiV Healthcare
Intellectual property	• Access to proprietary research tools and databases • Sharing compound libraries with WHO or with researchers who can test and screen them for possible treatments • Providing public and non-for-profit groups with information on proprietary compounds they are seeking to develop for a neglected disease indication • Forgoing license or providing royalty-free license on co-developed products	Abbvie Eisai GSK Johnson and Johnson Novartis Sanofi ViiV Healthcare
Regulatory assistance	• Allowing right of reference to confidential dossiers and product registration files to facilitate approval of generic combination products • Covering the cost of regulatory filings • Providing regulatory expertise to explore optimal registration options for compounds in development	Eisai GSK Johnson and Johnson MSD Novartis Sanofi ViiV Healthcare

^ Company donors listed do not necessarily engage in all activities listed as examples of in-kind contributions.

FUNDING BY ORGANISATION

The top 12 funders (including aggregated industry funding) accounted for 90% of all global funding for basic research and product development in 2018, up marginally from 89% in 2017. The US NIH, aggregate industry and the Gates Foundation remained the top three funders of neglected disease R&D, and together provided 71% of total funding. This represents a slight increase from 69% in 2017, but is still below their peak of nearly three-quarters (74%) of total funding in 2016.

For the third consecutive year, almost all of the top funders increased their funding. This included the US NIH and Gates Foundation, who had been the only top funders to reduce their investment in 2017. The largest increase in funding came from the US NIH (up $165m, 12%), although just over half (57%) of this was due to improved reporting of HIV/AIDS projects. As a result, the largest real increase in 2018 funding came from industry (up $118m, 20%), whose collective investment exceeded that of the Gates Foundation – traditionally the second-largest global funder of neglected disease R&D behind only the US NIH – by more than $100m. This was despite an increase in funding from the Gates Foundation (up $36m, 6.5%), which took the Foundation's investment to its highest level in nearly a decade.

Other significant increases came from Unitaid (up $22m, 44%), thanks to its increased investment in HIV R&D, and three UK funders: the DHSC (up $21m, 50%) – joining the top 12 funders for the first time in just its second year as a funder of neglected disease R&D – and DFID (up $14m, 13%), who increased its funding for the second year running, and the Wellcome Trust (up $11m, 10%) whose funding grew for the third consecutive year.

There were only two notable decreases in funding from organisations in the top 12 funders in 2018. Funding from the US DOD fell by $19m (-20%), largely driven by a $14m (-40%) drop in funding for HIV/AIDS R&D due to the conclusion of a Congressional Special Interest project. The other decrease came from the Indian ICMR (down $12m, -18%); while this left ICMR's funding substantially below the previous year's peak, 2018 still represents its second highest reported funding and follows three consecutive years of prior funding growth. A drop in funding from the UK MRC (down $5.7m, -13%) caused it to fall out of the top 12 funders for the first time since the beginning of the G-FINDER survey.

Table 46. Top neglected disease R&D funders 2018

Funder	US$ (millions)										2018 % of total
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	
US NIH	1,556	1,498	1,466	1,571	1,372	1,369	1,346	1,438	1,424	1,589	39
Aggregate industry	393	437	412	397	404	486	496	524	576	694	17
Gates Foundation	670	552	549	544	563	556	565	578	550	585	14
EC	123	96	115	99	118	116	141	85	125	134	3.3
UK DFID	78	85	66	40	64	69	55	58	107	121	2.9
Wellcome Trust	60	70	83	129	119	111	87	105	108	120	3.0
USAID	104	105	100	101	87	82	78	81	88	86	2.1
US DOD	113	79	89	87	102	102	77	83	95	77	1.9
Unitaid	-	-	-	0.4	9.0	17	20	49	51	73	1.8
UK DHSC	0.6	0.3							42	64	1.6
Indian ICMR	20	24	24	25	38	35	36	43	66	54	1.3
German BMBF	7.1	9.8	9.0	17	16	18	26	33	46	50	1.2
Subtotal of top 12^	3,226	3,069	3,027	3,109	2,990	3,043	2,995	3,120	3,280	3,647	90
Total R&D funding	3,595	3,416	3,364	3,469	3,348	3,337	3,282	3,437	3,681	4,055	100

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.

⬜ Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients so may be incomplete.

- No reported funding

FUNDING FLOWS

Organisations can invest in neglected disease basic research and product development in two main ways: by funding their own in-house research (internal investment, also referred to as intramural or self-funding); or by giving grants to others (external investment). This external investment can either be given directly to researchers and developers, or it can be provided via PDPs and other intermediaries. Some organisations invest only internally (most pharmaceutical companies, for example); others, such as the Wellcome Trust, only invest externally (i.e. they do not conduct R&D themselves). Other organisations, such as the US NIH and the Indian ICMR, use a mixed model, providing external grants to others as well as funding their own research programmes.

Figure 22. R&D funding flows 2018
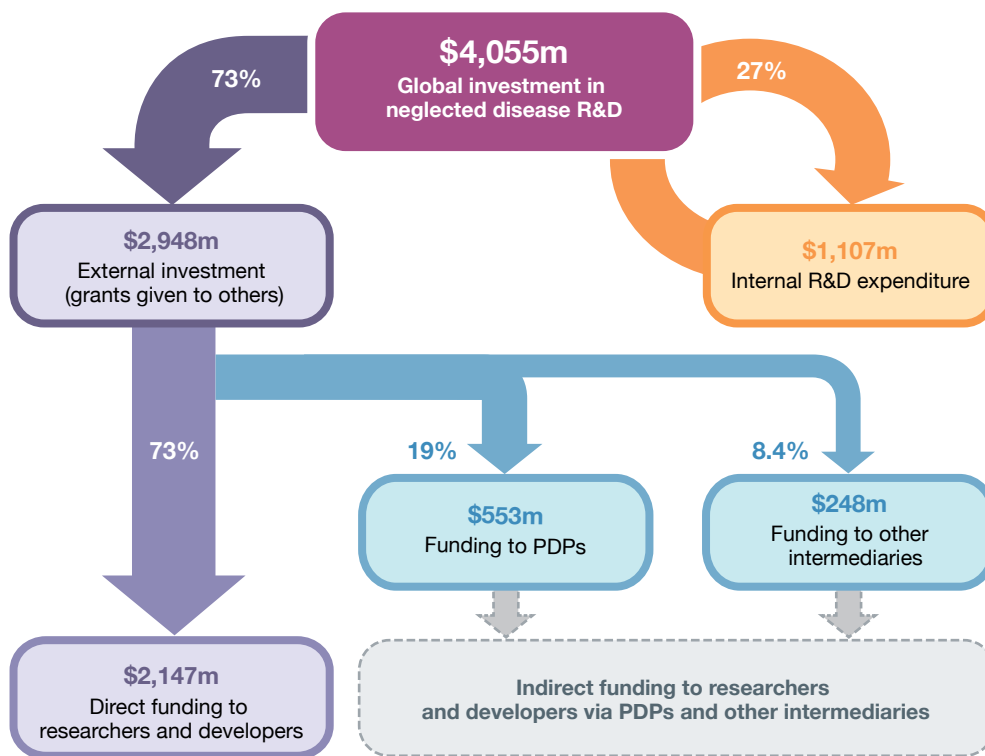
A key point to note when analysing external investment flows is that different types of funders generally invest in different types of recipients. Science and technology (S&T) agencies, for example, mainly provide funding directly to researchers and developers (usually accounting for around three-quarters of their funding). Philanthropic foundations and aid agencies are the source of the vast majority of PDP funding (typically 80-90%). In contrast, non-PDP intermediary organisations generally have a broad funding base, supported by both S&T and aid agencies as well as philanthropic foundations.

As a result, changes in S&T agency funding are more likely to affect researchers and developers; changes in philanthropic or aid agency funding are more likely to affect PDPs; and non-PDP intermediary organisations are the least vulnerable to changes from one donor funding stream.

FUNDING FLOW TRENDS

Almost three-quarters ($2,948m, 73%) of all funding for neglected disease basic research and product development in 2018 was given externally in the form of grants or contracts, with internal investments ($1,107m, 27%) making up the remainder. External funding increased by $260m (up 9.7%) to a record high, largely driven by an increase in public sector funding. Self-funding increased by $115m (up 12%), its largest increase since 2008, entirely due to increased investment by industry.

Just under three-quarters ($2,147m, 73%) of all external funding disbursed in 2018 was given directly to researchers and developers. This was the highest ever level of funding to researchers and developers (up $178m, 9.1%), however their share of total funding was unchanged from 2017. A notable development was the increase in funding directly to researchers and developers (rather than via fund managers) from both philanthropic funders (up $19m, 4.1%) and public multilaterals (up $19m, 57%), both reaching record highs.

More than a quarter ($801m, 27%) of all 2018 external funding was given to fund managers, which either pass funding on to researchers and developers, or invest it in their own internal R&D activities. This share was also unchanged from 2017, but represented an $82m increase in disbursements to fund managers in 2018 (up 11%) to their highest ever level of funding, eclipsing the previous peak in 2008. For the second year in a row, the major driver was increased funding to intermediaries (up $55m, 28%), with notable increases in funding to EDCTP and the GHIT Fund; although funding to PDPs also increased slightly (up $27m, 5.1%). Historically, funding to intermediaries has been significantly lower than funding to PDPs, but this gap has been narrowing since 2008 and became smaller than ever in 2018.

A total of $553m (19% of all external investment) was channelled through PDPs in 2018. PDP funding increased for the second consecutive year (up $27m, 5.1%) after an historic low in 2016. Funding to PDPs from S&T agencies increased significantly (up $22m, 34%), driven by an increase in funding to PDPs from the US NIH (up $18m, 43%, essentially all to FHI 360) – a record disbursement which took NIH PDP funding to nearly triple its 2016 level – and the German BMBF (up $6.0m, 42%, also to a record high). PDP funding from aid agencies fell slightly (down $4.8m, -2.2%) as a result of decreases from USAID (down $11m, -17%), the Dutch DGIS (down $4.7m, -19%) and Irish Aid (down $4.0m, -63%); this was despite a $20m (20%) increase from UK DFID, which took its PDP investment to its highest level ever recorded. The remainder of the overall increase in PDP funding came primarily from the philanthropic sector (up $11m, 5.2%), most of which was from the Gates Foundation (up $8.2m, 4.0%).

A total of $248m (8.4% of all external investment) was directed to other (i.e. non-PDP) intermediaries. As in 2017, funding in 2018 again reached unprecedented levels, increasing by over a quarter (up $55m, 28%), after having doubled the previous year. This increase in funding for other intermediaries was largely driven by public funders in HICs (up $53m, 36%), and the major beneficiary was the EDCTP (up $38m, 36%), which has driven the increases in intermediary funding in each of the last two years. A $15m (38%) increase in funding for the GHIT Fund contributed the remainder of the growth in funding for other intermediaries in 2018.

Figure 23. R&D funding flow trends 2009-2018
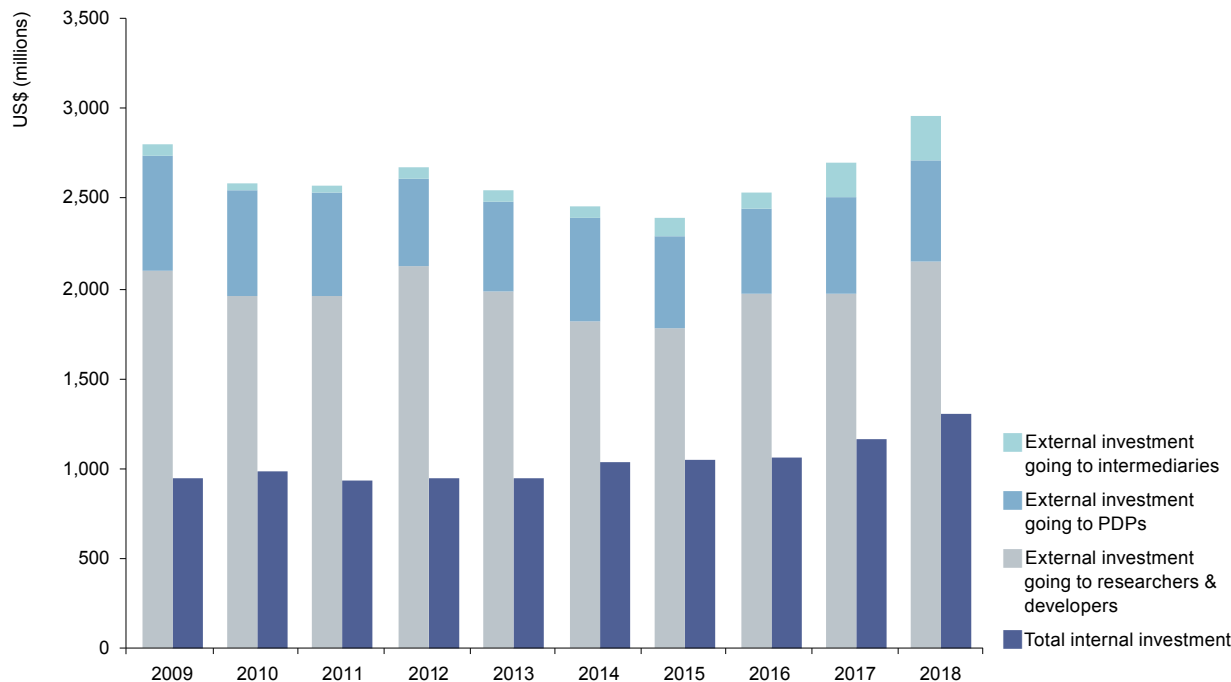
FUNDING FLOWS BY R&D STAGE

Funding for neglected disease R&D in 2018 was once again slightly more focused on basic & early-stage research (43% of overall funding) than on clinical development & post-registration studies (35% of total funding), although the gap between the two continued to narrow, and the share of funding going to basic & early stage research fell to an all-time low. Core funding of multi-disease R&D organisations accounted for a further 10% of total funding and platform technologies 1.1%, while the remaining 10% of global funding was directed to projects which did not specify an R&D stage. While funding increased for all areas in 2018, the increase was heavily focused on clinical development & post-registration studies, which accounted for half (53%) of the total headline increase in annual funding for neglected disease R&D, and nearly two-thirds (64%) of the real funding increase once improved US NIH reporting is accounted for.

In contrast to overall funding, more than half (55%) of all self-funding in 2018 was for clinical development & post-registration studies, with basic & early-stage research only accounting for a little over a third (37%). However, these figures fail to tell the whole story. Internal investment by industry has increasingly focused on clinical development & post-registration studies, which in 2018 accounted for nearly three-quarters (74%) of all internal investment by industry – a record high – with only 18% going to early-stage research. In contrast, public sector self-funding focused heavily on basic & early-stage research (68%), with less than a quarter (23%) going to clinical development & post-registration studies. This reflects the dominant role played by S&T agencies, which provided 76% of total public sector self-funding, with the US NIH alone accounting for more than half (55%).

External funding given directly to researchers and developers looks quite similar to internal investment by the public sector; the majority (59%) of funding in 2018 went to basic & early stage research, compared to just a quarter (26%) for clinical development & post-registration studies. Core funding accounted for a further 6.8% and platform technologies 1.7%, while the remaining 6.6% did not specify an R&D stage.

Just under half (46%) of funding to PDPs was not allocated to a specific R&D stage, mostly representing portfolio-based investment that supports product development from discovery through to post-registration. The next largest share (38%) went to clinical development & post-registration studies – representing a narrow majority (53%) of the PDP funding for which an R&D stage was specified – and 15% went to basic & early-stage research.

The vast majority (83%) of funding to non-PDP intermediaries was given as core funding, and therefore not allocated to a specific R&D stage. However, more than two-thirds (67%) of this core funding to non-PDP intermediaries was funding to the EDCTP, suggesting that a large proportion of non-PDP intermediary funding was ultimately devoted to clinical development.

FUNDING FOR PRODUCT DEVELOPMENT PARTNERSHIPS

PDPs received a total of $553m in funding for neglected disease R&D in 2018. This was the most funding since 2014, although the increase in overall neglected disease R&D funding meant that the share of total funding going to PDPs remained unchanged; they accounted for 14% of all funding for neglected disease basic research and product development, and 19% of external investment. Although annual changes in funding to PDPs should be interpreted with caution given its highly cyclical nature, funding to PDPs has now increased for two straight years after the historic low in 2016. The 2018 increase (up $27m, 5.1%) was driven by a second consecutive year of increased investments from HIC government agencies, as well as a partial reversal of last year's drop in funding to PDPs by the Gates Foundation.

The significance of PDPs tends to be obscured by the dominant role played by the US NIH, which is the largest funder of neglected disease R&D, but which allocates only a small – though increasing – portion of its funding to PDPs. If the US NIH is excluded, the importance of PDPs to other funders' product development becomes clearer, with PDPs collectively managing just under a third (31%) of all non-NIH external grant funding for neglected disease R&D in 2018.

The three highest-funded PDPs in any given year generally receive between 40% and 50% of total PDP funding, though the identity of these top recipients tends to vary from year to year. In 2018, the top three recipients were PATH, IAVI and the TB Alliance, which jointly received just under half ($250m, 45%) of all PDP funding.

The overall increase in funding, and most of the big individual increases, were due to additional funding from the top three 2018 funders: UK DFID, the US NIH and the Gates Foundation. The largest increase in PDP funding was for PATH (up $34m, 52%) – the top funded PDP in eight out of the past ten years – driven mainly by the Gates Foundation and a record-high disbursement from the UK DFID. Funding to FHI360 reached a record high (up $20m, 59%) as a result of increased NIH funding to the HIV Prevention Trials Network, which focused on clinical trials of long-acting injectable PrEP and biologics. TB Alliance, which ranked among the top three PDP recipients for the first time since 2015, likewise received additional funding (up $18m, 37%), driven by big increases from the UK DFID – which nearly doubled its 2017 funding – and the Gates Foundation. Funding to IVCC also increased (up $17m, 148%), again thanks to UK DFID and cyclical funding from the Gates Foundation, which had provided no funding in 2017. The only PDPs which experienced major decreases in funding were MMV (down $22m, -27%) – in alignment with the funding needs of its product development cycle – and Aeras (down $17m, -65%). The drop in funding to MMV was entirely cyclical, while the decline in funding to Aeras reflects its permanent closure and the transfer of its clinical research programmes and assets to IAVI, whose funding also fell slightly in 2018 (down $5.5m, -6.4%).

A little under three-quarters ($394m, 71%) of all funding to PDPs in 2018 was directed to one of three diseases: HIV/AIDS ($176m), malaria ($123m), and tuberculosis ($95m). This share was down from the previous year, as funding for these diseases remained flat (malaria) or fell slightly (HIV/AIDS and tuberculosis), while funding for bacterial pneumonia & meningitis and non-disease-specific funding both increased.

Table 47. Funds received by PDPs 2009-2018

PDPs	US$ (millions) 2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 % of total
PATH	151	81	106	91	88	128	89	50	67	101	18
IAVI	79	73	67	66	64	43	70	93	86	81	15
TB Alliance	40	55	40	48	55	58	74	41	50	68	12
MMV	48	76	80	54	70	77	81	63	79	58	10
DND*i*	34	35	38	32	35	56	33	49	57	57	10
FHI360	32	28	32	13	7.0	26	14	13	35	55	9.9
FIND	17	29	24	24	25	25	17	29	27	34	6.2
IPM	36	33	15	24	31	28	27	21	40	31	5.6
IVCC	16	18	3.1	14	26	13	33	34	11	28	5.0
Aeras	62	45	47	42	43	58	34	32	26	9.3	1.7
IDRI	20	14	25	12	6.3	15	6.6	8.6	9.0	8.5	1.5
IVI	14	10	5.9	8.8	10	6.8	7.4	6.8	13	8.0	1.4
TBVI	<0.1	4.2	3.9	5.3	5.8	4.4	9.0	8.7	8.5	5.8	1.1
CONRAD	25	20	27	34	28	19	4.1	9.6	14	3.4	0.6
Sabin Vaccine Institute	2.3	-	0.1	-	-	0.7	-	2.0	1.3	2.8	0.5
EVI	3.9	5.3	7.8	2.2	6.6	3.1	3.8	2.0	2.3	2.5	0.5
TCH-CVD	8.5	4.5	9.1	5.4	2.0	3.3	1.1	0.2	0.3	-	-
WHO/TDR[A]	36	30	32	-	-	2.2	4.5	4.8	0.2	-	-
OWH[B]	18	24	12	7.6	-	-	-	-	-	-	-
Total funding to PDPs	**644**	**585**	**573**	**483**	**502**	**567**	**508**	**467**	**526**	**553**	**100**

[A] TDR's mission extends beyond product development, but it operated as a de facto PDP from the 1970s until 2012, when it decided to focus on implementation research and research capacity strengthening. Funds received in 2014-2018 are related to the CEWG pooled fund demonstration projects only.
[B] As of 2013, OWH funding is included under PATH.
- No reported funding

FUNDERS OF PDPS

Historically, philanthropic organisations have always provided the majority of funding to PDPs. This changed in 2017, which marked the first time ever that PDPs received more funding from governments than they did from philanthropic organisations. This was true once again in 2018; the majority of funding for PDPs came from HIC government agencies ($318m, 57%), with most of the remainder from philanthropic organisations ($221m, 40%), primarily the Gates Foundation. And while the majority ($217m, 68%) of all HIC government funding to PDPs came via aid agencies rather than science and technology agencies – which contributed 28% ($88m) – this gap narrowed in 2018, leaving aid agencies and science and technology agencies with respectively their lowest and highest recorded shares.

Table 48. Top funders of PDPs 2018

Funder	US$ (millions)										2018 % of org's funds given to PDPs	2018 % of total PDP funding
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018		
Gates Foundation	349	311	278	264	256	315	281	241	202	210	36	38
UK DFID	71	85	66	40	64	69	52	53	100	119	99	22
US NIH	21	11	41	16	14	36	19	21	42	60	3.8	11
USAID	84	84	81	80	67	61	62	49	67	55	64	10
Dutch DGIS	20	17	21	13	23	19	4.5	25	25	20	100	3.7
German BMBF	-	-	1.3	6.3	5.3	7.3	9.0	11	14	20	41	3.6
Australian DFAT				8.4	-	8.0	7.9	7.8	11	11	100	2.0
UK DHSC									15	10	16	1.9
Unitaid	-	-	-	0.4	9.0	10	17	18	5.8	9.2	13	1.7
EC	1.7	8.0	10	8.0	8.8	6.8	13	8.8	9.7	8.1	6.0	1.5
MSF	4.7	4.8	5.1	5.9	6.1	4.9	4.9	4.9	5.3	7.0	36	1.3
Swiss SDC	2.5	4.7	3.7	3.4	4.5	6.9	8.0	6.0	6.7	5.8	100	1.0
Subtotal of top 12 funders of PDPs^	598	550	532	454	473	548	484	449	504	537		
Top 12 % of total PDP funding^	93	94	93	94	94	97	95	96	96	97		
Total funding to PDPs	644	585	573	483	502	567	508	467	526	553		

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.

- No reported funding

▨ Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients so may be incomplete.

Two HIC government funders – one an aid agency and the other an S&T agency – drove the overall increase in PDP funding in 2018, with funding from both hitting record highs for the second year in a row. The largest increase came from the UK DFID (up $20m, 20%), driven by increased funding to TB Alliance for tuberculosis drug development and to PATH for meningococcal vaccine R&D. This was nearly matched by the increase from the US NIH (up $18m, 43%), which primarily went to FHI360. This increase took the proportion of US NIH funding allocated to PDPs in 2018 to 3.8% of its total investment, breaking last year's record for the highest ever share. It also meant that NIH overtook USAID as the largest US government funder of PDPs, as USAID funding to PDPs fell by $11m (-17%) following a big drop in its funding to CONRAD for microbicide development. There were smaller decreases from other government agencies, including the Dutch DGIS (down $4.7m, -19%) and UK DHSC (down $4.3m, -29%), while funding from the Gates Foundation increased slightly (up $8.2m, 4.0%), after reaching an all-time low in 2017.

Public sector multilateral organisations provided $11m to PDPs in 2018 (2.0% of all PDP funding), the bulk of which was from Unitaid ($9.2m, 82% of multilateral PDP funding). Unitaid also accounted for the entirety of the $3.1m overall increase in multilateral PDP funding, with its $3.5m increase (up 60%) offsetting a slight decrease from the World Bank.

FUNDING FOR OTHER INTERMEDIARIES

'Other' intermediary organisations (i.e. those that are not PDPs) also aim to accelerate neglected disease basic research and product development, but do so without managing a product portfolio of their own. Instead, they generally act as coordinating agencies, receiving funding from multiple sources and passing this on to researchers and developers (either directly or via PDPs).

Non-PDP intermediaries collectively received $248m in 2018, representing 6.1% of all neglected disease R&D funding and 8.4% of all external funding. This was the largest amount and largest share ever received by this sector, surpassing the previous record high set in 2017. The EDCTP once again received more than half of this investment ($142m, 57%), followed by the GHIT Fund ($53m, 21%), the Barcelona Institute for Global Health (ISGlobal, $14m, 5.7%) and the Clinton Health Access Initiative ($12m, 4.9%).

Funding to other intermediaries increased by just over a quarter (up $55m, 28%) in 2018, after doubling the previous year, and has now increased in seven out of the last eight years. The 2018 increase was primarily due to increased investment in the EDCTP and the GHIT Fund. The $38m (36%) increase in funding to the EDCTP came from the UK DHSC (up $25m, 95%) and the EC (up $21m, 35%). Disbursements to the GHIT Fund increased by over a third (up $15m, 38%) thanks to a near doubling of investments from Japanese government funders (up $14m, 84%), coinciding with the start of the FY2018-FY2022 strategic plan for GHIT 2.0. Funding to ISGlobal increased by $5.4m (62%), driven by the contributions from the Spanish MAEUEC ($4.0m, after reporting no funding in 2017).

In 2018, 83% of all funding for other intermediaries ($206m) was not earmarked by the funder for a specific disease, up from 75% the previous year, with the majority ($137m, 67%) of this non-disease-specific investment going to the EDCTP. Of the $42m (17%) in funding for other intermediaries that was disease-specific, the vast majority (93%) was invested in the three diseases that receive the majority of all global funding: $21m for HIV/AIDS, $12m for TB and $5.8m for malaria.

FUNDERS OF OTHER INTERMEDIARIES

The majority of funding for other intermediaries typically comes from public funders, with S&T agencies historically providing approximately half of all funding, and aid agencies around one fifth. In 2018 the public sector overall provided 87% of all funding to non-PDP intermediaries, its highest share since 2012.

The increase in funding to other intermediaries in 2018 was largely driven by increased investments from the top three 2017 funders: the EC, the UK DHSC and the Japanese government. The EC provided just under a third ($81m, 32%) of all funding to non-PDP intermediaries, almost exclusively to the EDCTP, surpassing 2017's historic high. The UK DHSC's share of other intermediary funding rose to 21%, after almost doubling their funding to the EDCTP in 2018 (up $25m, 95%). The third largest funder of other intermediaries, the Japanese Ministry of Health, Labour and Welfare, invested $22m, exclusively in the GHIT Fund.

Public funders of other intermediaries tend to focus on recipients in their region; essentially all funding from the EC, the UK DHSC, the UK MRC, the UK DFID, Inserm and the French ANRS went to the EDCTP; all Japanese government investment went exclusively to the GHIT Fund; and Spanish public sector organisations only funded ISGlobal.

Table 49. Top funders of intermediaries 2018

Funder	US$ (millions)										2018 % of org's funds given to intermediaries	2018 % of total intermediaries funding
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018		
EC	20	2.2	26	26	27	24	45	9.5	60	81	60	32
UK DHSC									27	52	81	21
Japanese MHLW										22	100	8.9
Gates Foundation	14	6.3	5.6	4.4	7.3	7.9	7.9	7.8	13	15	2.6	6.1
German BMBF	-	1.2	0.7	1.9	3.3	6.3	9.7	16	14	12	25	5.0
Unitaid	-	-	-	-	-	-	-	-	12	12	17	4.9
USAID	5.6	6.2	6.1	5.9	5.3	9.8	9.1	12	8.9	8.5	9.9	3.4
Japanese MOFA										8.3	100	3.3
Aggregate industry	3.4	-	-	-	3.8	8.3	5.5	7.7	13	7.6	1.1	3.1
Wellcome Trust	0.2	0.2	-	-	-	-	0.6	1.2	1.5	6.6	5.5	2.7
Spanish MAEUEC	-	-	-	0.3	-	3.0	2.4	0.3	-	4.0	75	1.6
UK MRC	-	4.9	-	<0.1	-	-	2.9	2.8	4.5	3.8	10	1.5
Subtotal of top 12 funders of intermediaries^	58	33	45	59	63	74	106	93	184	233		
Top 12 % of total intermediary funding^	99	97	100	98	98	100	98	96	95	94		
Total funding to intermediaries	59	34	45	61	64	74	107	96	193	248		

^ Subtotals for 2009-2017 top 12 reflect the top funders for those respective years, not the top 12 for 2018.

- No reported funding

▨ Funding organisation did not participate in the survey for this year. Any contributions listed are based on data reported by funding recipients so may be incomplete.

* The Japanese Ministry of Health, Labour and Welfare (MHLW) and the Japanese Ministry of Foreign Affairs (MOFA) participated in the survey for the first time this year. Recipient-reported funding from these agencies was previously aggregated as funding from the Japanese Government.

DISCUSSION

Global funding for neglected disease R&D reached a new record high in 2018, on the back of three consecutive years of growth

Global funding for basic research and product development for neglected diseases in 2018 topped the $4 billion mark for the first time, totalling $4,055m. This was a new record high, beating the previous record – set just the year before – by a considerable margin: even after adjusting for all changes in survey scope, participation and reporting, global funding for neglected disease R&D increased by $290m in 2018 (up 7.9%). This is the largest real increase in annual funding for neglected disease R&D ever seen in the 12 year history of the G-FINDER survey, and the first time that funding has increased in three consecutive years.

A modest increase in funding from the philanthropic sector (up $43m, 6.0%) also took its funding to the highest level in a decade, but the real drivers of the funding growth in 2018 were governments and pharmaceutical companies. Public sector funding increased by $121m (up 5.1%) after the effects of better reporting by the US NIH are excluded, which was matched by a $118m increase in industry investment (up 20%). All of the increase in public sector funding came from HIC governments and multilaterals (up $128m, 5.6%, after adjusting for NIH reporting), and all of the increase in industry investment came from MNCs (up $132m, 28%, a record increase).

Investment by multinational pharmaceutical companies reached its highest ever level

The growth in investment by multinational pharmaceutical companies is particularly notable. MNC investment in neglected disease R&D grew by more than a quarter (up $132m, 28%) in 2018, representing the largest real increase in annual industry investment ever recorded. Not only did this take MNC investment in neglected disease R&D to a record high of $598m, it also meant that – for the first time ever – MNCs collectively invested more in neglected disease R&D in 2018 than the Bill & Melinda Gates Foundation, the second-largest individual funder of neglected disease R&D globally. Nor is this impact only due to the aggregation of industry investment: if companies were listed individually instead of in a single anonymous bloc, three of the top 12 funders of neglected disease R&D in 2018 would be MNCs, including the third and fourth largest.

Encouragingly, the increase in MNC investment was almost across the board, with investment increasing in all but one of the diseases in which MNCs are active. Also encouraging is that the 2018 increase was distributed more evenly than in the past; HIV, malaria and TB still accounted for three-quarters (74%) of all MNC investment in neglected disease R&D in 2018, but nearly half (43%) of the growth in MNC investment went to diseases outside of the 'big three'.

The growth in industry investment contributed to a dramatic increase in funding for clinical development & post-registration studies

Funding for basic & early-stage research has historically dominated global funding for neglected disease R&D, and still received the largest share in 2018, accounting for 43% of all global funding. But funding for clinical development & post-registration studies increased by $198m (up 16%) to a record high of $1,405m in 2018. If core funding to EDCTP is counted as well – given that nearly 90% of EDCTP investment goes to clinical trials – the total increase in funding for clinical development & post-registration studies was in fact even higher, totalling $238m. This growth was heavily driven by MNCs, with MNC investment in clinical development & post registration studies increasing by half (up $140m, 50%) to $422m, representing nearly three-quarters (71%) of all MNC investment in neglected disease R&D.

While the scale of the increase in funding for clinical development & post registration studies in 2018 (particularly from MNCs) was unprecedented, it was a continuation of a longstanding trend. The share of total global funding for neglected disease R&D going to clinical development & post registration studies has been trending upwards over the last 12 years, increasing from less than a quarter (22%) in 2007 to more than a third (35%) in 2018.

Figure 24. Share of total funding by R&D stage 2007-2018
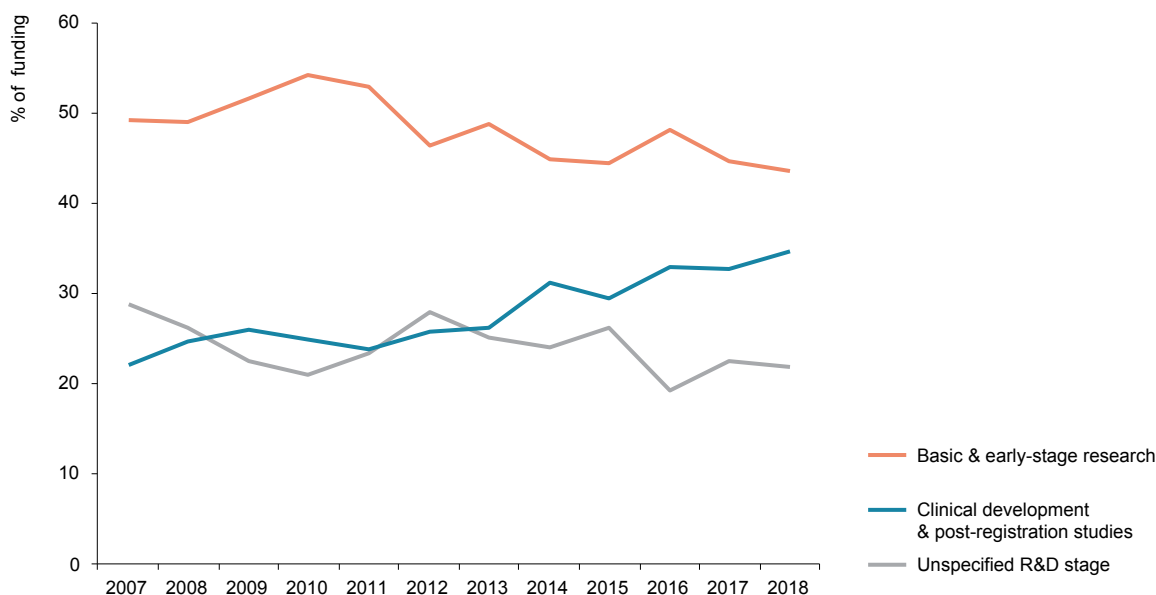
Legend:
- Basic & early-stage research
- Clinical development & post-registration studies
- Unspecified R&D stage

Progress remained encouraging outside of the traditional top funders of neglected disease R&D

Almost all of the biggest funders increased their investments in neglected disease R&D in 2018, with record highs from the US and UK governments, as well as from multinational pharmaceutical companies, an increase from the European Commission to its second highest level ever, and funding from the Bill & Melinda Gates Foundation reaching its highest level in a decade.

But there were also notable increases from funders outside of the top handful of organisations and countries, including many of the emerging funders highlighted in the past two G-FINDER reports: 2018 saw record high levels of funding from the governments of Germany and Japan, as well as from Unitaid and Médecins Sans Frontières. Funding by the Brazilian government rebounded after a record low in 2017, and while funding from both the Indian and South African governments fell, this came after record highs for both countries the previous year.

Funding was lower from both LMIC governments (down $7.9m, -7.6%) and SMEs (down $14m, -12%), however in the case of SMEs this was partly a reflection of changes in survey participation – and in fact hid an increase in investment by Indian SMEs – and in both cases follows an extended period of increasing funding.

Not everything is trending upwards: funding for NTDs has barely shifted over the last decade

Amidst the positive stories of widespread funding increases and record highs, there are still major areas of concern. One of these areas is the level of funding for a critical subset of the neglected diseases covered by G-FINDER: the neglected tropical diseases.

While funding for HIV/AIDS, TB and malaria has taken off in the last three years – along with funding for non-disease-specific R&D – funding for NTDs has been essentially flat for the past decade. In fact, it has gone backwards: funding for NTDs was nearly 10% lower in 2018 than it was 2009, falling by $34m (-9.1%).

Figure 25. Funding by disease category 2007-2018
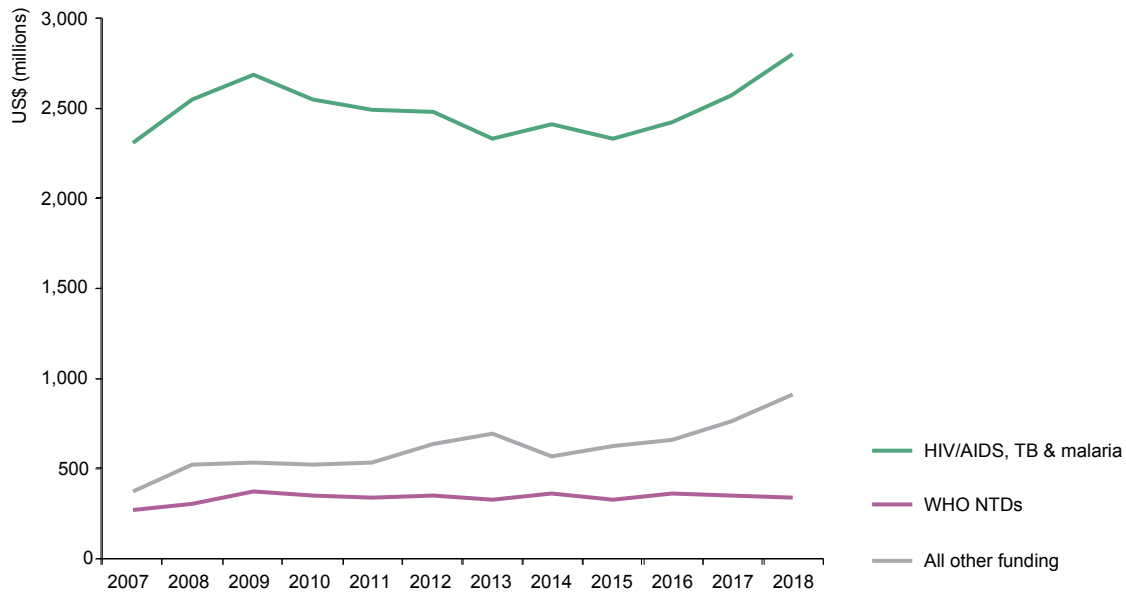
It would be reasonable to assume that funding for NTD R&D has flatlined because NTDs are even less appealing to industry than other neglected diseases, but industry investment in NTDs has actually been one of the few positive stories in this area. Investment in NTDs by MNCs in particular has grown steadily over the course of the last twelve years, increasing five-fold since 2007. This has occurred against the background of an ongoing decline in philanthropic funding for NTDs, which nearly halved over the same period. As a result, MNCs actually invested more in NTD R&D in 2018 than the philanthropic sector did.

However despite their growing investment, MNCs only accounted for 16% of all funding for NTD R&D in 2018 – in line with their contribution to overall neglected disease R&D – meaning that funding for NTDs is heavily reliant on the public sector. This is particularly true for the least-well funded diseases, many of which do not attract industry investment, and which rely on just one or two key funders for the majority of their R&D funding. Of equal concern is the extremely small quantum of funding these diseases receive: there is little chance of meaningful progress in developing missing tools – especially drugs and vaccines – when total global investment in some of these diseases is just $2.0m annually.

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The impact of sustained investment in neglected disease R&D is clear in the growing number of newly-approved products (the last couple of years alone have seen critically important new drugs for sleeping sickness, onchocerciasis, malaria and TB, and LMIC-targeted vaccines for typhoid, rotavirus, and pneumococcal pneumonia) and in a healthy and growing R&D pipeline. This impact has been made possible by – and indeed has required – the many positive trends highlighted in this year's G-FINDER report, including the record-high level of overall funding for neglected disease R&D, increased funding for clinical development & post-registration studies, and increased investment by industry. But the corollary of this success is that more investment will be needed: the R&D pipeline is larger than ever before, with more candidates in late-stage development, and there is still a significant gap between current levels of investment and the level that will be required to translate these candidates into new tools. We also note that progress is not occurring across the board: not all areas are benefitting from increased funding and record highs, with a decade of stagnant funding for NTDs being one key example. And while funding from some countries is laudable, in others it has been going backwards. Addressing this uneven progress is the challenge ahead.

ANNEXE 1

Advisory Committee members & additional experts

ADVISORY COMMITTEE MEMBER	ORGANISATION	TITLE
Dr Ripley Ballou	GlaxoSmithKline Biologicals	Vice President and Head, Global Vaccines US R&D Center
Professor Balram Bhargava	Indian Council of Medical Research	Director General
Dr Graeme Bilbe	Drugs for Neglected Diseases Initiative (DND*i*)	Senior Advisor
Dr François Bompart	Drugs for Neglected Diseases Initiative (DND*i*)	Director of HIV and Hepatitis C Initiative
Dr Wanderley de Souza	Financiadora de Estudio e Projetos (FINEP)	Former President
Dr Emily Erbelding	National Institute of Allergy and Infectious Diseases, National Institutes of Health	Director, Division of Microbiology and Infectious Diseases
Professor Alan Fenwick	Imperial College London	Professor of Tropical Parasitology
Dr Arnuad Fontanet	Institut Pasteur	Head of Emerging Diseases Epidemiology Unit
Dr Sue Kinn	UK Department for International Development (DFID)	Team Leader and Research Manager
Dr Jean Lang	Sanofi Pasteur	Associate Vice President
Dr Carl Mendel	TB Alliance	Senior Vice President, Research & Development
Dr Firdausi Qadri	International Centre for Diarrhoeal Disease and Research (icddr,b)	Senior Scientist and Head of Immunology
Dr John Reeder	World Health Organization; Special Programme for Research and Training in Tropical Disease (WHO/TDR)	Director
Professor Nelson Sewankambo	Makerere University College of Health Sciences	Professor of Internal Medicine
Dr Soumya Swaminathan	World Health Organization	Chief Scientist
Wendy Taylor	The Rockefeller Foundation	Fellow
Dr Tim Wells	Medicines for Malaria Venture (MMV)	Chief Scientific Officer

ADDITIONAL EXPERT	ORGANISATION	TITLE
Jordan Benjamin	Asclepius Snakebite Foundation	Executive Director
Dr Jean-Philippe Chippaux	French Institute of Research for Development	Director of Research
Marie-Paule Kieny	INSERM	Director of Research
Ben Waldmann	Health Action International	Project Manager, Snakebite
Dr David Williams	Global Snakebite Initiative	Chief Executive Officer

ANNEXE 2

Survey respondents

- AbbVie
- Aga Khan University
- Against Malaria Foundation
- Aidsfonds*
- American Leprosy Missions (ALM)
- amfAR, The Foundation for AIDS Research*
- AntivenomSwazi Foundation
- Argentinian Ministry of Science, Technology and Productive Innovation (MINCYT)
- Argentinian National Council for Scientific and Technical Research (CONICET)
- Argentinian National Institute of Biological Production (ANLIS)
- Auritec Pharmaceuticals*
- Austrade
- Australian Commonwealth Scientific and Industrial Research Organisation (CSIRO)
- Australian Department of Foreign Affairs and Trade (DFAT)
- Australian Department of Industry, Innovation and Science (DIIS)
- Australian National Health and Medical Research Council (NHMRC)
- Australian Research Council (ARC)
- Austrian Leprosy Relief Association (ALRA)
- Barcelona Institute for Global Health (ISGlobal) including Clinic Foundation for Biomedical Research (FCRB), Barcelona Centre for International Health Research (CRESIB), and Centre for Research in Environmental Epidemiology (CREAL)
- Baruch S. Blumberg Institute
- BASF
- Bayer CropScience
- Baylor College of Medicine
- Becton, Dickinson and Company (BD)
- Belgian Ministry of Foreign Affairs, Foreign Trade and Development Cooperation (DGDC)
- Belgian National Fund for Scientific Research (FWO)*
- Bill & Melinda Gates Foundation
- BioCryst Pharmaceuticals^
- Biological E
- Biomedical Institute of Valencia (IBV)
- Biotechnology Industry Research Assistance Council (BIRAC)

- Brazilian Araucária Support Foundation for Scientific and Technological Development in the State of Paraná (FAPPR)
- Brazilian Center for Production and Research of Immunobiology (CPPI)
- Brazilian Development Bank (BNDES)
- Brazilian Innovation Agency (FINEP)
- Brazilian Ministry of Health: Department of Science and Technology (DECIT)
- Brazilian Research Support Foundation of the State of Bahia (FAPESB)^
- Brazilian Research Support Foundation of the State of Minas Gerais (FAPEMIG)
- Brazilian Support Foundation for Research in the State of Alagoas (FAPEAL)
- Brazilian Support Foundation for Research in the State of Amapá (FAPEAP)
- Brazilian Support Foundation for Research in the State of Amazonas (FAPEAM)
- Brazilian Support Foundation for Research in the State of Rio Grande do Sul (FAPERGS)
- Brazilian Support Foundation for Research in the State of São Paolo (FAPESP)
- Brazilian Support Foundation for Scientific and Technological Development in the State of Ceará (FUNCAP)
- Brazilian Support Foundation for the Development of Education, Science and Technology in the State of Mato Grosso do Sul (FUNDECT)
- Brazilian Support Foundation for the Development of Scientific and Technological Actions and Research in the State of Rondônia (FAPERO)
- Burnet Institute
- Butantan Institute
- California Institute for Regenerative Medicine (CIRM)*
- Campbell Foundation*
- Canadian Institutes of Health Research (CIHR)#
- Cebu Leprosy and Tuberculosis Research Foundation (CLTRF)
- CEMAG Care^
- Centre Anti Poison et de Pharmacovigilance du Maroc (CAPM)
- Chiang Mai University*
- Children's Investment Fund Foundation (CIFF)*

- Chilean National Commission for Scientific and Technological Research (CONICYT)
- Chilean National Fund for Scientific and Technological Development (FONDECYT)
- Coalition for Epidemic Preparedness Innovations (CEPI)^
- Colombian Department for Science, Technology and Innovation (Colciencias)
- Confluence For Health Action And Transformation Foundation (India Health Fund)
- CONRAD*
- CSL Ltd (including Seqirus)
- Cuban Center for Genetic Engineering and Biotechnology (CIGB)*
- Daiichi-Sankyo
- Damien Foundation (DFB)
- Danish Ministry of Foreign Affairs and the Danish International Development Agency (DANIDA)#
- DesignMedix
- Drugs for Neglected Diseases initiative (DND*i*)
- Dutch Ministry of Foreign Affairs - Directorate General of Development Cooperation (DGIS)
- Dutch Organisation for Scientific Research (NWO)
- effect:hope (The Leprosy Mission Canada)
- Eijkman Institute of Microbiology
- Eisai
- Entasis Therapeutics
- Eppin Pharma^
- European & Developing Countries Clinical Trials Partnership (EDCTP)
- European Commission (Directorate-General for Research and Innovation)#
- European Vaccine Initiative (EVI)
- Evofem^
- Ezequiel Dias Foundation (FUNED)
- FAIRMED
- FHI 360
- Flemish Department of Economics, Science and Innovation (EWI)
- Fontilles
- Foundation for Innovative New Diagnostics (FIND)
- Foundation for Neglected Disease Research (FNDR)
- French Development Agency (AFD)
- French National Agency for Research on AIDS and Viral Hepatitis (ANRS)
- French National Institute of Health and Medical Research (Inserm)
- French National Research Agency (ANR)
- French Research Institute for Development (IRD)
- Gavi, The Vaccine Alliance
- GeneOne Life Science^
- German Federal Ministry for Economic Cooperation and Development (BMZ)
- German Federal Ministry of Education and Research (BMBF)
- German Federal Ministry of Health (BMG)
- German Research Foundation (DFG)
- German University Clinic of Bonn
- Gesea Biosciences^
- GlaxoSmithKline (GSK)
- Global Action Fund for Fungal Infections (GAFFI)
- Global Affairs Canada^
- Global Antibiotic Research and Development Partnership (GARDP)^
- Global Good
- Global Health Innovative Technology Fund (GHIT Fund)
- Grand Challenges Canada (GCC)
- GSK Bio
- Gynuity Health Projects^
- Hamish Ogston Foundation
- Health Action International (HAI)
- Health Research Council of New Zealand (HRC)
- Hepatitis B Foundation
- Hervana Bio^
- Hong Kong Institute of Biotechnology (HKIB)
- Hong Kong Science and Technology Parks Corporation (HKSTP)
- Huesped Foundation*
- Ibero-American Program of Science and Technology for Development (CYTED)
- Indian Council of Medical Research (ICMR)
- Indian Council of Scientific and Industrial Research (CSIR)
- Indian Department of Biotechnology, Ministry of Science and Technology (DBT)
- Indian Department of Health Research, Union Ministry of Health and Family Welfare

* Denotes organisations where funding data was only received via the Resource Tracking for HIV Prevention Research and Development Working Group
^ Denotes organisations that reported EID and/or SRH data only
# Denotes organisations where funding data was taken from publicly available sources

- Indian Department of Science and Technology (DST)
- IndianSnakes.org
- Initiative for MPTs (IMPT) including CAMI Health
- Innovate UK#
- Innovative Medicines Initiative (IMI)#
- Innovative Vector Control Consortium (IVCC)
- INOSAN Biopharma
- Institut Pasteur
- Institut Pasteur de Maroc
- Institut Pasteur de Tunis
- Institute of Clinical Research Benin (IRCB)
- Institute of Tropical Medicine Antwerp (ITM)
- Integral Molecular^
- International AIDS Society
- International AIDS Vaccine Initiative (IAVI)
- International Centre for Genetic Engineering and Biotechnology (ICGEB)
- International Development Research Centre (IDRC)
- International Partnership for Microbicides (IPM)*
- International Union Against Tuberculosis and Lung Disease
- Irish Aid
- Italian Association Amici di Raoul Follerau (AIFO)
- Italian National Institute of Health (ISS)*
- James Cook University including the Australian Institute of Tropical Health and Medicine (AITHM)
- Japanese International Cooperation Agency (JICA)
- Japanese Ministry of Foreign Affairs (MOFA)
- Japanese Ministry of Health, Labour and Welfare (MHLW)
- Jenner Institute^
- Johnson & Johnson
- King Baudouin Foundation
- Kofi Annan Foundation
- Korean Institute of Tuberculosis
- Laboratorios Probiol
- Leadiant Biosciences
- Lepra including Lepra India - Blue Peter Public Health & Research Centre (BPHRC)
- Leprosy Relief Canada (SLC)
- Leprosy Research Initiative (LRI)
- Liverpool School of Tropical Medicine (LSTM)
- Male Contraceptive Initiative (MCI)^
- Mapp Biopharmaceutical^

- Max Planck Institute for Infection Biology (MPIIB)
- Médecins Sans Frontières (MSF)
- Medicines Development
- Medicines for Malaria Venture (MMV)
- Medicines360
- Medicor Foundation
- Melbourne Children's Campus
- Meningitis Research Foundation (MRF)
- Merck for Mothers^
- Mérieux Foundation
- Mexican National Council of Science and Technology (CONACYT)
- Mexican National Institute of Public Health (INSP)
- MicroPharm
- Molbio Diagnostics
- Mologen
- Mologic
- MSD / Merck
- Mundo Sano Foundation
- Mymetics
- National Natural Science Foundation of China (NSFC)#
- Netherlands Leprosy Relief (NLR)
- Nigerian Federal Ministry of Health
- Novartis
- Ophirex
- Otsuka
- Parsemus Foundation^
- PATH including the Malaria Vaccine Initiative (MVI)
- PENTA Foundation
- Pharmaceutical Laboratory of the State of Pernambuco (LAFEPE)
- Philippine Council for Health Research and Development
- Phillip T. and Susan M. Ragon Foundation*
- Population Council
- Preeclampsia Foundation^
- Public Health Agency of Canada (PHAC)*
- Public Health England (PHE)
- Reproductive Health Investors Alliance (RHIA Ventures)^
- Reproductive Health Supplies Coalition (RHSC)
- Research Centre Borstel
- Research Council of Norway

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^ Denotes organisations that reported EID and/or SRH data only
# Denotes organisations where funding data was taken from publicly available sources

- Royal Norwegian Ministry of Foreign Affairs and the Norwegian Agency for Development Cooperation (NORAD)
- Royal Society of New Zealand (RSNZ)
- Sabin Vaccine Institute
- San Raffaele Scientific Institute (IRCCS)*
- Sanofi
- Sasakawa Memorial Health Foundation (SMHF)
- Science Foundation Ireland (SFI)
- Serum Institute of India
- Sidaction*
- Snakebite Healing and Education Society
- South Africa Medical Research Council (MRC)
- South African Department of Science and Technology (DST)
- South African National Health Laboratory Service (NHLS, including South African Vaccine Producers (SAVP))
- Spanish Ministry of Foreign Affairs and Cooperation for Development (MAEC)
- Statens Serum Institute (SSI)
- Sumagen*
- Sumitomo Chemical Company
- Swiss Agency for Development and Cooperation (SDC)
- Swiss National Science Foundation (SNSF)#
- Swiss State Secretariat for Education, Research and Innovation (SERI)
- Swiss Tropical & Public Health Institute (Swiss TPH)
- Synstar Japan
- Tara Health Foundation^
- TB Alliance
- Thai Government Pharmaceutical Organisation (GPO)
- Thai National Science and Technology Development Agency (NSTDA)
- Thai Red Cross AIDS Research Center (TRC-ARC)*
- The Female Health Company*^
- The Leprosy Mission International (TLMI)
- The Wellcome Trust
- The William and Flora Hewlett Foundation^
- TuBerculosis Vaccine Initiative (TBVI)
- Turing Foundation
- UBS Optimus Foundation
- UK Department for International Development (DFID)

- UK Department of Health and Social Care (DHSC)#
- UK Medical Research Council (MRC)
- UK National Health Service (NHS) (including National Institute for Health Research NIHR)
- Unitaid
- University of Arizona
- University of Costa Rica
- University of Dundee
- University of Geneva
- University of Georgia
- University of Melbourne
- University of Nebraska Medical Center
- University of Pittsburgh
- University of Toronto
- University of Tubingen
- US Agency for International Development (USAID)
- US Centers for Disease Control and Prevention (CDC)
- US Department of Defense (DOD) including Defense Advanced Research Projects Agency (DARPA), US Army Medical Research Institute of Infectious Diseases (USAMRIID), the US Naval Medical Research Center (NMRC), Defense Threat Reduction Agency (DTRA) and the Walter Reed Army Institute of Research (WRAIR)#
- US National Institutes of Health (NIH) including the US National Institute of Allergy and Infectious Disease (NIAID)#
- US National Science Foundation (NSF)
- Vaccine Research Insitute (VRI)^
- ViiV Healthcare
- ViroStatics
- Volkswagen Foundation
- Women's Global Health Innovations (WGHI)
- World Health Organization: Special Programme for Research and Training in Tropical Diseases (WHO / TDR)
- Yaso Therapeutics^

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# Denotes organisations where funding data was taken from publicly available sources

ANNEXE 3

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