



Federal Ministry  
of Education  
and Research

# Global health in the focus of research

**Funding concept: Neglected and poverty-related diseases**





# Contents

Foreword	2
<hr/>	
Introduction	3
<hr/>	
Overview – Neglected and poverty-related diseases	7
<hr/>	
The ‘big three’ – malaria, HIV/Aids and tuberculosis .....	7
Neglected tropical diseases (NTDs) in the narrower sense .....	8
Infectious diseases with a high infant mortality rate .....	8
New and emerging infectious diseases .....	8
The global burden of diseases .....	8
Need for further research .....	11
Research funding .....	13
Non-BMBF research funding in Germany .....	13
The role of charities .....	14
Research funding by the European Commission .....	15
New financing models – innovative research funding methods	16
<hr/>	
Research for global health – the BMBF’s strategy for the years 2015–2020	18
<hr/>	
The four cornerstones of research funding .....	18
Coordinating global research efforts .....	22
Outlook	23
<hr/>	
List of Abbreviations	24
<hr/>	
Imprint	25
<hr/>	



## Foreword

Billions of people in the poorest regions of the world suffer from infectious diseases, including numerous children. In order to improve the health of these populations, we have to sustainably combat infectious diseases on a global scale. Particular attention must be paid to tropical diseases like river blindness, sleeping sickness and leishmaniasis, which are regarded as poverty-related infectious diseases, along with HIV/Aids, tuberculosis and malaria. In this country, some diseases can be cured – or at least treated – with modern drugs. However, in the poverty-stricken regions of the world, these diseases represent an enormous problem. Effective treatments are often not available or not appropriate for use on the ground, especially in poorer countries. The situation is aggravated by the fact that, to date, there simply are no effective drugs or vaccines to combat certain diseases.

There is thus an urgent need to develop new drugs, vaccines and diagnostics that are both effective and affordable in developing countries. The international community and the industrial nations in particular bear a great responsibility in this respect. With this in mind, under the German presidency, the G7 leaders and science ministers have agreed to implement extensive measures in the fight against neglected and poverty-related diseases. In addition to the global health and development policies, research on these diseases is the main focus of these measures.

The Federal Ministry of Education and Research is embracing this responsibility. Initially launched in 2011, we have now further developed our strategic funding concept on „Neglected and poverty-related diseases“, which boosts German research efforts and bundles our efforts in the field of global health policy: we are placing the development of urgently needed therapies, vaccines and diagnostics at the very heart of our funding activities.

It must be our common goal to reduce the burden and alleviate the suffering of the afflicted, and to break through the vicious circle of poverty and disease. Research and development can make a key contribution to the global fight against neglected and poverty-related diseases.

A handwritten signature in black ink that reads "Johanna Wanka". The signature is fluid and cursive.

Prof. Dr. Johanna Wanka  
Federal Minister of Education and Research



## Introduction

Core elements of social development and the fight against poverty include access to adequate health services and protection against the risk of disease. Many people in developing and newly industrialised countries do not have adequate access to vital healthcare services. Vaccines, drugs and other medical interventions are often not obtainable locally or are beyond the financial means of those in need. Yet, for a number of diseases affecting people almost exclusively in low- and middle-income countries, neither effective drugs nor vaccines are available – inter alia, on account of the limited market incentives for the research-based pharmaceutical industry. The industrial nations bear a special responsibility in this respect: increased research and development in cooperation with local partners in the affected countries may play a crucial role in improving the healthcare situation of the people in developing and newly industrialised countries. At the same time, in order to reach vulnerable populations, the underdeveloped health systems must be strengthened.

In 2000, the United Nations (UN) established eight Millennium Development Goals (MDGs) in order to significantly reduce extreme poverty around the world by the target date of 2015. One of the cornerstones of these goals is achieving good health for all. In September 2015, the UN passed an agenda entitled “Transforming our world” setting a total of 17 new Sustainable Development Goals<sup>1</sup> that seek to build on the MDGs by 2030. Among other things, Goal 3, “Ensure healthy lives and promote well-being for all at all ages” stipulates the following:

- End the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases
- Reduce the global maternal mortality ratio to less than 70 per 100,000 live births and
- End preventable deaths of newborns and children under 5 years of age.

In June 2015, the G7 leaders agreed to step up their joint activities to contain neglected tropical diseases, placing a particular emphasis on further research.<sup>2</sup> The G7 science ministers addressed this topic at their meeting in October 2015, during which specific measures were agreed. Moreover, in May 2015, the World Health Assembly, the central decision-making body of the World Health Organization (WHO), endorsed an action plan to tackle the health issues of populations in poor regions and passed landmark resolutions on malaria control and the global immunisation programme.

1 Further information is available at <https://sustainabledevelopment.un.org> under the section headed “Sustainable Development Goals”.

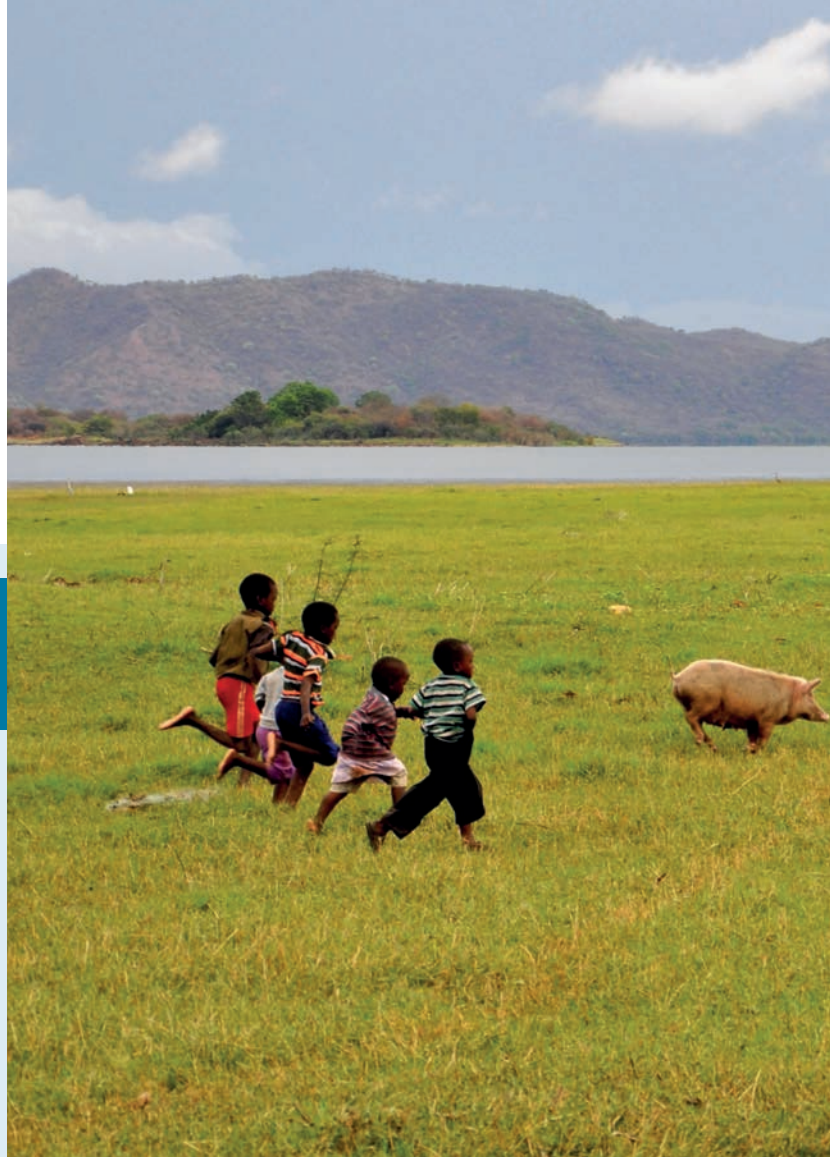
2 Further information on the G7 summit is available on the homepage <http://www.bundesregierung.de> under the heading “Topics” and the tab marked “G7/G8/G20”.

## Leaders' Declaration of the G7 Summit on Health Issues (June 2015)

The G7 closing statement emphasised the fundamental right of every human being to enjoy the highest attainable standard of health and the importance of strengthening health systems in the long term.

In addition to antimicrobial resistances and Ebola/health security, the fight against neglected tropical diseases was a key priority. At the summit in June 2015, the G7 leaders agreed on the following measures to combat NTDs:

- Emphasise the vital role of research in the development and implementation of new means of combating these diseases.
- Work collaboratively with all important partners, including the WHO Global Observatory on Health, particularly with regard to improving the coordination of worldwide research and development efforts.
- Commit to supporting NTD-related research activities with a focus on areas of most urgent need. Acknowledge the role of the G7 Science Academies in identifying these areas.
- Stimulate both basic research on prevention, control and treatment on the one hand and research focusing on the faster and targeted development of easily usable and affordable drugs, vaccines and point-of-care technologies on the other.
- Support community-based response mechanisms as part of measures to strengthen health systems and make suitable therapies and drugs available in order to achieve the goal of eliminating NTDs by 2020.
- Combat infant mortality and improve maternal health.



## Resolutions of the G7 science ministers (October 2015)

The G7 science ministers resolved to:

- Extend their research to include the entire spectrum of neglected and poverty-related infectious diseases.
- Step up all measures that are currently being implemented on poverty-related infectious diseases and coordinate their research funding.
- Enhance the mapping and coordination of publicly funded research activities on neglected and poverty-related infectious diseases. On this basis, a joint research initiative will be the focus of discussion at a conference in 2016.
- Further encourage research endeavours on neglected and poverty-related infectious diseases and to continue to provide financial support to innovative research instruments, like product development partnerships.



By adopting the UN resolution and the final communiqués issued by the G7 leaders and the G7 science ministers, the Federal Government has pledged its commitment to achieving these ambitious goals.

The Federal Government's "Research Agreement on diseases that can be transmitted from animals to humans (zoonoses)" makes a national contribution to the implementation of the G7 Summit Agreement and the communiqué of the G7 science ministers. Numerous infectious diseases, including the majority of the neglected tropical diseases (NTDs), are zoonoses. Therefore, the research programme of zoonotic infectious diseases must treat the health of humans and animals as a single entity. This "One Health" approach is the guiding principle of the research agreement, which was renewed in 2015 by the Federal Ministry of Education and Research (BMBF), the Federal Ministry of Health (BMG), the Federal Ministry of Food and Agriculture (BMEL) and the Federal Ministry of Defence (BMVg).

In the summer of 2013, the Federal Government published its strategy paper on "Shaping Global Health – Taking Joint Action – Embracing Responsibility". Research for global health is one of five focal topics

outlined in the concept (see box).<sup>3</sup> Funding research and development on neglected and poverty-related diseases is also a priority focus area of the Federal Government's 2010 Health Research Framework Programme (see box).<sup>4</sup> Furthermore, within the framework of its Africa Strategy (2014), the BMBF pledged to increase its international commitment in the field of global health research – with a particular regional focus on Africa (see box).<sup>5</sup> The above mentioned concepts are the political foundation for the BMBF's funding strategy, which was published in 2011 for the first time in the "Neglected tropical and poverty-related diseases" funding concept. The concept aims to intensify research activities for the benefit of the health and well-being of people in poorer countries and to coordinate German efforts in this field.<sup>6</sup>

3 The Federal Government's strategy paper on "Shaping Global Health – Taking Joint Action – Embracing Responsibility" (2013); BMG

4 The Federal Government's Health Research Framework Programme (2010); BMBF

5 The Africa Strategy 2014–2018 "Africa as a Partner in Education and Research"; BMBF

6 "Neglected and poverty-related diseases" funding concept (2011); BMBF

## The political framework for research on neglected and poverty-related diseases.

### The Federal Government's Health Research Framework Programme

The programme defines the strategic orientation of the biomedical research landscape in Germany and serves as a basis for government-funded health research projects in institutions of higher education, university hospitals, nonuniversity research institutes and in industry. The programme focuses on six fields of action.

- Pooled research on common diseases
- Individualised medicine
- Prevention and nutrition research
- Health care research
- Health industry
- Global cooperation in health research

### The BMBF's Africa Strategy

The BMBF launched its Africa Strategy as the basis for the systematic expansion and strengthening of cooperation with African countries in the fields of education and research. Particular emphasis is being placed here on higher education, professional training and advanced vocational training. The BMBF's Africa Strategy lists 30 measures that are to be implemented in the coming years, including activities addressing global health issues.

The purpose of this document is to present the BMBF's plans to upgrade the funding concept and bring its initiatives in line with the new requirements and international agreements. These changes took both the closing statements of the 2015 G7 summit and the G7 science ministers' meeting into account, as well as WHO's most recent recommendations and the UN's new Sustainable Development Goals. The funding concept was developed by building on the elements of the concept that was launched in 2011 (national funding, European cooperation, product development and partnership with Africa) and incorporating additional aspects (pandemic control measures and non-communicable diseases) in order to give due consideration to the new and growing requirements of the global health policy.

### The Federal Government's strategy paper on „Shaping Global Health – Taking Joint Action – Embracing Responsibility“

As the Federal Government's response to the new challenges of a global health policy, the concept represents Germany's role in resolving global issues. It concentrates on five focal areas in which Germany can make a sustainable contribution to the improvement of global health:

- Providing effective protection against cross-border threats to health
- Strengthening and facilitating the development of health systems throughout the world
- Increasing intersectoral cooperation – interaction with other policy areas
- Promoting health research and the health care industry – providing important impulses for global health
- Strengthening the global health architecture





## Overview – Neglected and poverty-related diseases

The term “neglected and poverty-related diseases” is not clearly defined. In general, the term refers to infectious diseases that occur primarily in low- and middle-income countries or which constitute a particularly high disease burden in these regions. These diseases can have a considerable impact on patients’ quality of life, severely limiting their social and economic participation, and may even prove fatal.

The terms “neglected diseases” and “neglected tropical diseases (NTDs)” refer to infectious diseases that are endemic in tropical developing countries. Effective drugs or vaccines are seldomly available. The term “poverty-related diseases” has a broader meaning, including both NTDs and infectious diseases that also occur in developed countries. Whilst they can usually be cured or controlled in industrialised nations, diseases like HIV or tuberculosis claim millions of lives among the poorest populations.

In the BMBF’s current funding concept, the term “neglected and poverty-related diseases” includes diseases from the following groups:

- The ‘big three’ – malaria, HIV/Aids and tuberculosis
- NTDs, focusing on the 17 diseases prioritised by WHO
- Diseases to which children in developing countries are particularly susceptible, like diarrhoea, pneumonia or meningitis
- Emerging infectious diseases of specific relevance for developing countries.

### The ‘big three’ – malaria, HIV/Aids and tuberculosis

In terms of mortality and disease burden, malaria, HIV/AIDS and tuberculosis are by far the most important poverty-related diseases. Worldwide, more than three million people die of these three diseases every year, the vast majority live in developing countries.

Although effective drugs against **malaria**, which is caused by a parasite, are currently available, resistance continues to grow steadily. Therefore, new medicines are urgently needed. Efforts to develop a vaccine have met with initial success: nevertheless, although it is possible to achieve a limited immunisation, there is no guarantee for reliable individual protection. Like other diseases that can be transmitted to humans by animals (zoonoses), limiting or eradicating the intermediate animal hosts (vector control) is imperative to prevent malaria. Since mosquitoes spread the disease, the global malaria epidemic cannot be halted without long-term, environment-friendly mosquito control operations.

There is still no cure for infections of the **human immunodeficiency virus** (HIV); despite numerous research projects, an effective vaccine is not yet available. However, a variety of reliable medications have now been developed to prevent the outbreak of **AIDS** (Acquired Immune Deficiency Syndrome). Nevertheless, many people, particularly those in Sub-Saharan Africa, do not have access to these drug therapies. Prevention options are urgently needed, first and foremost for women, for whom the risk of infection is generally



higher than for men. To enable these women to take control and protect themselves more reliably, intensive efforts have been made for some years now to develop methods of preventing infection that are for external use.

The treatment of **tuberculosis** continues to be a major global concern. Especially under rural conditions, making an accurate diagnosis can be very difficult the corresponding drug therapy is long-lasting and has numerous side effects. The inadequate supply of effective medicines leads to low cure rates, which were 86% worldwide in 2013.<sup>7</sup> Moreover, multi-resistant pathogens continue to be on the rise, increasing the costs of treatment, at the same time prolonging therapy or even rendering it impossible in some cases. Particularly worrying are the co-infections with tuberculosis and HIV: HIV carriers are much more likely to develop severe forms of tuberculosis. In some cases, there may even be problematic interactions between the different medications.

### Neglected tropical diseases (NTDs) in the narrower sense

NTDs are a group of tropical diseases that are caused by bacteria, viruses, protozoa or helminths. The majority of these diseases are zoonoses. WHO has compiled a list of 17 endemic and debilitating diseases (see box) and has set itself the goal of overcoming their global impact as a priority. Nevertheless, WHO stresses that there are other neglected tropical diseases in addition to the 17 it has prioritised. Moreover, the Ebola crisis of 2014/15 made it brutally clear that diseases that are not on the WHO list may also meet the criteria of the prioritised NTDs. The first ten of the diseases listed below are the subject of the London Declaration on Neglected Tropical Diseases, which was endorsed by pharmaceutical companies and product development partnerships in collaboration with WHO, several governments and the Bill & Melinda Gates Foundation.<sup>8</sup> The signatories have committed themselves to help eradicate, or at least control, these ten diseases by 2020.

According to WHO, NTDs are endemic in 149 countries and regions, while two or more of these diseases may be encountered in at least 100 countries. According to WHO, these 17 diseases affect more than one billion people.

### Infectious diseases with a high infant mortality rate

Diseases that are responsible for a high infant mortality rate in low- and middle-income countries include bacterial pneumonia and meningitis, diarrhoea and rheumatic fever. Children suffering from malnutrition are particularly vulnerable. As a result of underdeveloped healthcare systems, these diseases are often not diagnosed and treated in time. Available vaccines are frequently not distributed.

### New and emerging infectious diseases

In 2014/2015, the Ebola epidemic exposed the risk potential of emerging pathogens with dramatic consequences. In our highly mobile world, pathogens are able to travel great distances rapidly, posing a regional or even global threat in the blink of an eye. One reason could be hitherto unknown pathogens like the MERS (Middle East respiratory syndrome) coronavirus or re-emerging infections like whooping cough (pertussis) or Rift Valley fever.

### The global burden of diseases

The suffering caused by poverty-related diseases is immense. Viewed in isolation, the mortality rate is not an accurate reflection of the true situation. Nevertheless, according to WHO statistics, neglected and poverty-related diseases claimed the lives of more than three million people around the world in 2012. More than 90% died as a result of the 'big three' (malaria, HIV/AIDS and tuberculosis). Although, at approximately 5%, the group of 17 NTDs had a considerably lower death toll, they continue to be an urgent global health problem when taking additional factors (e.g. disability) into consideration.

The description of the debilitating burden caused by a disease provides a more realistic picture than the corresponding mortality statistics. Besides the mortality rate, it also includes reduced life expectancies and the deterioration in quality of life arising from the afflic-

7 WHO: Global Tuberculosis Report 2014

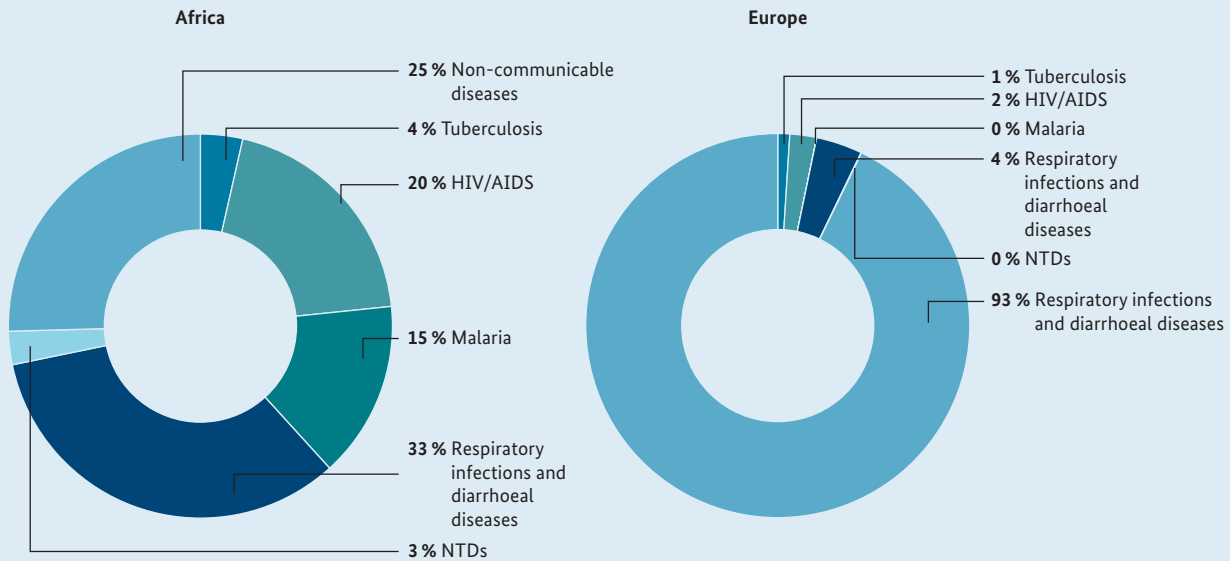
8 London Declaration on Neglected Tropical Diseases, 2012

## The 17 NTDs prioritised by WHO

1. **Dracunculiasis (guinea-worm disease):** A nematode infection transmitted exclusively by drinking-water contaminated with parasite-infected water fleas.
2. **Lymphatic filariasis:** Infection transmitted by mosquitoes causing abnormal enlargement of limbs and genitals (elephantiasis) from adult worms inhabiting and reproducing in the lymphatic system.
3. **Leprosy:** A complex disease caused by a bacterial infection mainly of the skin, peripheral nerves, mucosa of the upper respiratory tract and eyes.
4. **Human African trypanosomiasis (sleeping sickness):** A parasitic infection spread by the bites of tsetse flies that is almost 100% fatal without prompt diagnosis and treatment to prevent the parasites invading the central nervous system.
5. **Trachoma:** A chlamydial infection transmitted through direct contact with infectious eye or nasal discharge, or through indirect contact with unsafe living conditions and hygiene practices, which left untreated causes irreversible corneal opacities and blindness.
6. **Schistosomiasis:** Trematode infections transmitted when larval forms released by freshwater snails penetrate human skin during contact with infested water. Symptoms due to infected organs (pain, diarrhoea, urinary tract infections or even cancer of the bladder).
7. **Soil-transmitted helminthiasis:** Nematode infections transmitted through soil contaminated by human faeces causing anaemia, vitamin A deficiency, stunted growth, malnutrition, intestinal obstruction and impaired development.
8. **Chagas disease:** A life-threatening illness mainly transmitted to humans through contact with vector insects (triatomine bugs).
9. **Leishmaniases:** Disease transmitted through the bites of infected female sandflies that in its most severe (visceral) form attacks the internal organs and in its most prevalent (cutaneous) form causes face ulcers, disfiguring scars and disability.
10. **Onchocerciasis (river blindness):** Infection transmitted by the bite of infected blackflies causing severe itching and eye lesions as the adult worm produces larvae and leading to visual impairment and permanent blindness.
11. **Dengue:** A mosquito-borne infection causing flu-like illness that may develop into severe dengue and cause lethal complications.
12. **Rabies:** A preventable viral disease transmitted to humans through the bites of infected dogs that is invariably fatal once symptoms develop.
13. **Buruli ulcer:** A debilitating mycobacterial skin infection causing severe destruction of the skin, bone and soft tissue.
14. **Yaws:** A chronic bacterial infection affecting mainly the skin and bone.
15. **Taeniasis and neurocysticercosis:** An infection caused by adult tapeworms in human intestines; cysticercosis results when humans ingest tapeworm eggs that develop as larvae in tissues, affecting the brain. Most common cause of epilepsy in developing countries.
16. **Echinococcosis:** Infection caused by the larval stages of tapeworms forming pathogenic cysts in humans and transmitted when ingesting eggs most commonly shed in faeces of dogs and wild animals.
17. **Foodborne trematodiasis:** Infection acquired by consuming fish, vegetables and crustaceans contaminated with larval parasites; causes acute and chronic liver damage.



**Burden of disease for neglected and poverty-related diseases as well as non-communicable diseases in Africa and Europe (2012)**



The WHO uses “Disability-Adjusted Life Years” (DALYs) as a measurable parameter for the reduction of the quality of life mediated by a disease. DALYs encompass both the sum of the “Years of Life Lost” (YLL) due to premature mortality and the “Years Lost due to Disability” (YLD), i.e. years spent with decreased quality of life, in the population. In 2012 people living in Africa lost approx. 315.000 DALYs, people living in Europe approx. 167.000 DALYs due to the represented diseases.

NTDs: neglected tropical diseases

Non-communicable diseases: cancer, neurological and psychiatric diseases, diabetes, cardiovascular diseases

Source: WHO: health statistics and information systems

tion (e.g. due to a disability, chronic disease progression or the inability to work). One way of measuring the burden of diseases are the so-called DALYs<sup>9</sup> (Disability Adjusted Life Years lost).

Worldwide, malaria and HIV/AIDS claim more than 80 million healthy life years. It is estimated that neglected diseases are responsible for 26 million healthy life years lost. Tuberculosis is the cause of almost 50 million DALYs<sup>10</sup>.

Children under the age of five and pregnant women are particularly at risk of contracting poverty-related diseases. Although the situation has improved in the years since 2000, the Millennium Development Goals of reducing infant mortality by two-thirds and maternal mortality by three-quarters have not been met. Between 1990 and 2013, infant mortality among children under five was only reduced by 50% – from 12.7 million to 6.3 million. Half of these deaths were caused by infections that are largely preventable. The

main causes of death are diarrhoea and pneumonia as children’s immune systems are not fully developed. This is further aggravated by their immediate living conditions in respect of drinking water, inadequate sanitation, hygiene and diet.

However, even non-fatal infections like parasitic diseases can lead to severe disorders like growth disturbance and developmental delays, which may also affect children’s school success. Viral inflammations of the liver, particularly hepatitis B and C, may have equally serious consequences in the poorest nations.

Moreover, pregnant women are particularly at risk: it is estimated that 800 women die from complications of pregnancy and childbirth every day. For example, malaria is much more severe in women who are pregnant, whilst treatment is only possible to a limited extent, owing to side effects for the unborn child. Therefore, there is an urgent need for new, safe drugs that considerably improve the prognosis for both mother and child.

9 Sum of the life years impaired due to ill-health and disability and lost due to premature death in a population group.

10 Hotez et al., PLOS Neglected Tropical Diseases (2014)

### Need for further research

Thus, as shown above, the need for further research follows on directly from the inadequate therapies, prevention options and diagnostics. The situation is aggravated by the lack of research capacities in the countries most affected and the fact that the available epidemiological data are incomplete. A number of unresolved questions regarding the optimisation of healthcare and supply systems also need to be addressed to ensure that those suffering from infectious diseases receive adequate treatment. Since there are gaps in almost every research field, from basic medical research to the discovery of new substances and clinical development, right through to research on improved applications, efforts must be stepped up accordingly. The national science academies of the G7 countries have developed a series of necessary strategies to face the challenges posed by NTDs. The recommendations, which may also be applied to the wider spectrum of poverty-related diseases for the most part, will serve as a basis in identifying the following key requirements for future research efforts.<sup>11</sup>



#### Low mortality rate - high disease burden An example

Lymphatic filariasis is a neglected disease that affects more than 120 million people around the world. In approximately 40 million cases, victims develop the most severe form of the disease, elephantiasis, when blockages in the lymphatic system cause extreme swelling of the legs or external genitalia. Although the infection is very rarely fatal, the swellings and the resulting incapacity lead to a significant deterioration in quality of life. Patients are restricted in their ability to participate in society and/or professional life.



#### 1. Extending research capacities in the affected countries

The responsibility for sustainable research on poverty-related diseases must be increasingly transferred to the countries concerned, based on their needs and in accordance with their own research and healthcare programmes. By facilitating technology transfer and establishing research cooperations, developed countries can help to extend the necessary local capacities and bring them into line with international standards.

#### 2. Stepping up research efforts

Basic research efforts must be stepped up, focusing specifically on the biology of the pathogens, host responses and the interactions between various diseases. Further priorities include intensifying research on vectors and intermediate hosts and developing new methods of control. Particular emphasis should be placed on testing livestock and wildlife as sources of existing and potential new pathogens.

At the same time, it is crucial that the entire applied research process into the relevant diseases is advanced, investigating potential applications of new techniques and therapies more quickly and systematically to ensure they are used efficiently without delay. Furthermore, careful consideration of the economic, regulatory and social framework conditions is required in order to implement measures effectively. Finally, developing an internationally coordinated methodology is a prerequisite for a comparative assessment of the success of the measures.

11 Please see the homepage for further information: [http://who.int/en/under-the-section „Health Topics“ and the tab marked „Filariasis“](http://who.int/en/under-the-section-„Health-Topics“-and-the-tab-marked-„Filariasis“).

12 G7 Academies' Statement 2015: Neglected Tropical Diseases, Leopoldina



### 3. Developing and providing affordable, suitable therapies while assuring quality control

In order to develop affordable drugs and vaccines that comply with international pharmaceutical quality requirements, it will be necessary to decouple the prices of these medications from the substantial costs incurred by research and development. This means creating new and stronger incentives for industry and science and involving competent regulatory authorities or international initiatives, like WHO, at an early stage. Product development partnerships must be consolidated in order to develop point-of-care technologies that are simple to use in cooperation with endemic countries. Moreover, it is important to establish, coordinate and reinforce the competence of local supervisory authorities with regard to evaluating pharmaceutical quality, effectiveness and safety.

#### Research funding

The research agendas of the industrial nations focus primarily on their own needs. Therefore, to date, research on neglected and poverty-related diseases has been somewhat overlooked. On the strength of commercial considerations, the pharmaceutical industry only conducts relevant research on poverty-related

#### Research needs - three examples

**Tuberculosis:** Drugs are urgently required which significantly reduce treatment time, cause fewer side effects and increase the sufferer's chances of recovery. Patients with resistant tuberculosis need individualised therapies and aftercare. There is still a demand for quicker, more reliable diagnostic equipment that can be easily set up on site. Also high on the agenda is the development of new vaccines, both for therapeutic and preventative purposes.

**Buruli ulcer:** The disease is caused by a bacterium from the same family as the tuberculosis pathogen. As with a number of other diseases, there are no suitable methods of making a reliable, on-site diagnosis at an early stage. Once the disease has progressed, it is extremely difficult to treat. Affected people, up to 70% of whom are children, develop debilitating disfigurements. A further issue is that the exact mode of transmission is still unknown.

**Pneumonia and diarrhoea:** Severe respiratory tract infections and gastrointestinal diseases are the main causes of the high infant mortality rate in developing countries. Although reliable vaccines, diagnostic tests and therapies are available, the specific conditions in the poorest regions hinder their effective use. Careful scrutiny of the day-to-day provision of medical care is imperative in developing strategies that are appropriate for the local conditions. Thus, the results of such systematic health care research can be used as a basis for health policy decision-making.



### The alarming rule of thumb – the 90/10 gap

A mere 10% of the research funds worldwide are invested in developing drugs to treat the diseases that afflict 90% of the world's population. In other words, a total of 1,556 new active agents came onto the market between 1974 and 2004, of which only 21 are effective against poverty-related diseases.<sup>13</sup> This quota has not improved significantly, even over the last ten years. During the period 2000 to 2011, a total of 850 new therapeutic products were registered, a mere four percent of which were developed to combat poverty-related diseases. The same disparity is found in the number of clinical studies conducted: during the period observed, almost 150,000 clinical studies were registered worldwide, of which only 2,016 studies (1.5%) applied to poverty-related diseases.<sup>14</sup>

diseases on a limited scale. In the past, public funding has not been able to fully balance out the resulting shortfall, leading to the so-called 90/10 gap (see box). However, it is a fact that the research and development (R&D) required for these products is primarily financed by public sector subsidies or is sponsored by private non-profit organisations.

The international and national funding landscape in this field is diverse and heterogeneous. Most industrialised countries have set up special funding programmes for R&D in the field of neglected and poverty-related diseases within the remit of the ministries of health, science or development. In addition, there are various publicly subsidised funding institutions, like the German Research Foundation (DFG) in Germany or the National Science Foundation (NSF) in the US. Moreover, certain philanthropic foundations (see below) are influential on the international stage, in particular the Bill & Melinda Gates Foundation (US) and the Wellcome Trust (UK).

### Non-BMBF research funding in Germany

Besides the BMBF and its activities within the framework of this funding concept, mention should be made of the other national research funders, in particular the Federal Ministry for Economic Cooperation and Development (BMZ), the Federal Ministry of Health (BMG) and the German Research Foundation (DFG). The German *Länder* also play a major role by virtue of the universities and via their contribution to the relevant non-university research institutions that they administer jointly with the Federal Government (Helmholtz Association, Max Planck Society, Leibniz Association, Fraunhofer-Gesellschaft).

#### BMZ

As part of its long-standing sponsorship of the WHO's Special Programme for the Research and Training in Tropical Diseases (TDR), the BMZ supports the development of research capacities in the affected countries. In addition to funding research and innovations, a comprehensive and interdisciplinary approach to strengthening health systems is a prerequisite for lasting success in combating poverty-related diseases. Implementing measures that only target individual diseases will not suffice in the long term. Therefore, depending on the local conditions, it is advisable to pool the various activities aimed at controlling poverty-related diseases. For example, improving the medical services goes hand in hand with improving the infrastructure, education and the economic situation. To this end, BMZ focuses on global health issues, strengthening local health structures, utilising synergies with the private sector and developing approaches that encourage health promotion and disease prevention. The BMZ is committed to increasing the effectiveness of development measures in the health sector and works with the partner countries within the framework of the International Health Partnership (IHP+) to shape a joint agenda.

For example, through its special "Health in Africa" programme, the BMZ is helping African partner countries to improve their response strategies in crisis situations and strengthen their health systems on a long-term basis.

13 T. Chirac, Global Framework on Essential Health R&D

14 Pedrique et al., Lancet (2013)



## BMG

The BMG focuses its activities primarily on HIV/AIDS, tuberculosis, hepatitis and tropical diseases. For the most part, research is conducted in the BMG's internal research institutes, like the Robert Koch Institute (RKI) in Berlin, the Paul-Ehrlich-Institut (PEI) in Langen or the Federal Institute for Drugs and Medical Devices (BfArM) in Bonn. Moreover, the BMG funds applicable research projects at the Leibniz Institutes, which are financed jointly with the *Länder*, like the Bernhard Nocht Institute for Tropical Medicine (tropical diseases), the Research Center Borstel (tuberculosis) and the Heinrich Pette Institute (basic research on humanpathogenic viruses). Furthermore, the BMG represents the Federal Government at WHO and coordinates national activities resulting from resolutions passed by WHO (e.g. in the event of epidemic outbreaks).

## DFG

In addition to the extensive, excellence-based funding opportunities offered by the normal procedure, regardless of the subject, the DFG places particular emphasis on research on poverty-related diseases. For example, as part of its "Africa Initiative", the DFG has funded German-African cooperation projects for research on

infectious diseases in humans and animals since 2009. Furthermore, research on poverty-related diseases is conducted in a number of collaborative research centres and research groups.

### The role of charities

Apart from public research funding, private or charitable foundations and individuals are the mainstays of the research landscape, having stepped up their involvement considerably in recent years.

Among the numerous national and international foundations, the Bill & Melinda Gates Foundation stands out in particular. Endowed with a capital of over \$36 billion, it is by far the world's largest private foundation<sup>15</sup>. Also worthy of note is the British Wellcome Trust, the foundation with the highest endowment after the Bill & Melinda Gates Foundation, which funds medical research. A significant proportion of the Wellcome Trust's research funding is invested in health-related research projects outside the UK.<sup>16</sup>

15 Please see the homepage for further information: <http://www.gatesfoundation.org/de>.

16 Please see the homepage for further information: <http://www.wellcome.ac.uk/>.





Among those German foundations that fund research projects, the Volkswagen Foundation in particular offers a special research programme on neglected diseases (see box).

### Research funding by the European Commission

The European Research Framework Programmes are one of the most important sources of funding for researchers in Germany. In its research framework programmes, the European Commission has made funding research on poverty-related diseases a thematic priority, especially since the Sixth Framework Programme (2002–2006). Horizon 2020 – the European Union’s research framework programme that was implemented in 2014 – offers a variety of funding options with a particular focus on product development. Horizon 2020 also made specific provision for allocating significantly higher subsidies to the European-African funding initiative EDCTP (European and Developing Countries Clinical Trials Partnership) (see below).<sup>17</sup>

<sup>17</sup> Horizon 2020 – The EU Framework Programme for Research and Innovation; European Commission



### Volkswagen Foundation: promotion – of young researchers

The Volkswagen Foundation’s funding initiative “Knowledge for Tomorrow – Cooperative Research Projects in Sub-Saharan Africa” aims to offer young African scientists attractive perspectives in their home countries. Therefore, working together with other European foundations, the Volkswagen Foundation finances research projects that are developed and implemented by African scientists in cooperation with German partners. This offers young researchers in Africa the opportunity to obtain higher qualifications at their home institutions. To this end, the Foundation is pursuing a long-term, sustainable objective via a three-stage career model that enables young scholars in the region to engage in longer-term research at African institutions after their doctorate. The funding programme gave rise to the African Network for Neglected Tropical Diseases (ARNDT).<sup>18</sup>



<sup>18</sup> Volkswagen Foundation



## New financing models – innovative research funding methods

Research and development for new drugs, vaccines and diagnostic methods is time-consuming and risky, necessitating substantial investments (sums of up to hundreds of millions are commonplace). From a market-based point of view, such investments are only worthwhile if the high costs of development can be offset or even exceeded by subsequent returns. In the case of poverty-related diseases, these investments do not pay off and therefore efforts must be made to dissociate the development costs more effectively from the product price.

As in every product development, the research and development for poverty-related diseases can be boosted by two different strategies: either by financing individual or multiple steps of the product development process or by creating market incentives that spontaneously stimulate the development of the product.

The BMBF and most other public funders directly finance individual or multiple steps of the product development process, usually via project funding; this support leads to a cost reduction for the developer. Financing the development of a drug calls for a concerted approach on the part of several stakeholders, owing to the high costs involved. A successful model in this respect are product development partnerships (see box).

One example of a market incentive that stimulates R&D is the so-called advance market commitment (AMC), in other words, a binding purchase contract. This guarantees revenue for the research company once the product is on the market, thereby reducing the development risk. The first AMC was launched in 2007 for a pneumococcal vaccine with a volume of 1.5 billion euros; the partners were the Bill & Melinda Gates Foundation and Canada, Italy, Russia, the United Kingdom and Norway.



### PDPs – a success story

The abbreviation PDP stands for product development partnerships, international non-profit organisations that develop vaccines, drugs and diagnostics for neglected diseases and make them available at affordable costs. They coordinate the collaboration between partners from academic institutes, public research facilities, non-governmental organisations and research-based pharmaceutical companies. Since this modus operandi distributes the costs and risks among numerous stakeholders, the new drugs can be sold at prices that even poorer countries can afford. PDPs work in the same way as large industrial enterprises using so-called portfolio management. Several projects are initiated at the same time; on the basis of regular evaluations, the funds that have been provided by the various sponsors are reallocated as appropriate. This ensures continued funding for promising projects, while less successful projects can be stopped.

Likewise, incentives are created by coming to an agreement with the regulatory authorities with regard to accelerated test processes for drugs and vaccines. This extends the patent protection periods and thus leads to longer guaranteed returns.

The Global Health Investment Fund (GHIF) is a new financing tool<sup>19</sup>. Designed by the Bill & Melinda Gates Foundation, the fund was established in late 2013 with a fund volume of \$108.36 million. The Fund is currently being supported by the BMZ on behalf of the German government. It finances the development and market launch of new drugs, vaccines and diagnostic instruments and of family planning products in developing countries. By dint of a complex investment strategy, the profit-oriented fund aims to finance affordable solutions for developing countries with other sources of revenue, for example by profiting from concomitant higher prices in developed markets. Any profits the Fund makes are not distributed but reinvested. Investments to date have resulted in the development of a tuberculosis test, an oral cholera vaccine and a new drug to treat river blindness, illustrating the enormous potential of this pilot *social impact investment fund* in the health sector.

<sup>19</sup> <http://www.ghif.com/>

## Research for global health – the BMBF’s strategy for the years 2015–2020

The BMBF’s research funding for research on neglected and poverty-related diseases was first bundled strategically in a funding concept in 2011. Since then, the BMBF has assumed greater responsibility for global health research on both the national and the international stage. The 2015–2020 strategy includes research funding activities in the form of both new and established instruments. Moreover, the BMBF is committed to improving the coordination of international research projects in the future.

### The four cornerstones of research funding

The enhanced funding concept builds on the four cornerstones of BMBF funding. New important perspectives in light of recent developments have been incorporated in the new funding concept or merged

with existing aspects. The aim and priority of the funding concept continues to bundle BMBF activities, ensure their compatibility with relevant national and international initiatives and to consolidate the German research landscape in the field of neglected and poverty-related diseases in the long term.

### 1st cornerstone: national research landscape

Germany looks back on a long tradition in the field of infection research and boasts internationally renowned institutes for tropical medicine. Nonetheless, in the past, neglected diseases and, to a certain extent, poverty-related diseases were not regarded as a central research focus in Germany. Therefore, strengthening the national research landscape and improving the networking of the stakeholders is a key objective of the funding concept.





### German Center for Infection Research (DZIF)

The DZIF groups its research activities into nine Thematic Translational Units, which each address high-priority research issues concerning infectious diseases. In the field of neglected and poverty-related diseases, these include malaria, HIV/AIDS and tuberculosis, as well emerging and recurrent infections (e.g. Ebola, MERS). Furthermore, the four partner institutions in Africa (Ghana, Burkina Faso, Gabon and Tanzania) bear testimony to the particular importance the DZIF attaches to global health. In close collaboration with the African partners, the goal is to establish research capacities that meet international standards: a vital element in the fight against malaria, HIV/AIDS, tuberculosis and, as in the case of Ebola, outbreaks of emerging infections.

To this end, the BMBF focuses on two different instruments – project funding and institutional funding. The BMBF uses project funding to systematically initiate new funding measures in fields with a huge demand for further research. This also includes the promotion of young researchers in order to safeguard the expansion of the national research landscape in the long term. As early as 2010, new junior research groups were established to work with partners in the most severely affected countries. The BMBF will continue to place particular emphasis on promoting young researchers and attracting talented scientists.

Under the “Research Agreement on Zoonoses”, which was renewed in 2015 by the BMBF, the BMG, the BMEL and the BMVg, the BMBF intends to fund a “National Research Platform for Zoonoses” from 2016 onwards. The network will enable research consortia, junior research groups and individual projects to work together on current challenges (rapid response).

Founded by the BMBF in 2011, the German Center for Infection Research (DZIF, see box) pools the activities of research-oriented universities, government research establishments and non-university research institutes to create an umbrella organisation with an integrative approach. This facilitates collaboration on major pro-

jects in the field of infection research, also with regard to poverty-related diseases. From now on, the DZIF will continue to play a key role in German research on these diseases. Together with the *Länder*, the BMBF invests approximately €38 million in its endeavours each year.

### 2nd cornerstone: promotion of product development partnerships (PDPs)

The second cornerstone of the funding concept is the continuous support of PDPs. Since 2011, the BMBF has funded four PDPs with a total funding volume of some €26.4 million. In light of global challenges, these funds were deployed in a targeted manner, notably to advance the development of products for the prevention, diagnosis or treatment of two groups of diseases: neglected tropical diseases and diseases that primarily affect children in the poorest regions.

In order to establish a reliable basis for the extension of the funding measure, in 2015, the BMBF commissioned an external evaluation of the PDPs’ funding activities together with the Department for International Development (DfID) in the UK (see box). Overall, the positive evaluation results of the PDPs that received funding confirmed that PDPs do in fact play a major role in developing new, especially urgent interventions in the fight against poverty-related diseases. Therefore, the BMBF intends to launch a second round of PDP funding, in which PDPs for HIV/AIDS and tuberculosis will also be sponsored. In the process, the financial resources will be significantly increased to up to €50 million. The BMBF will take the results of the external evaluation into account when planning the second round of funding.

## External Evaluation of the PDP Funding Activities<sup>20</sup>

The aim of this report was to evaluate the operations, performance and achievements of the PDPs over the last five years and to appraise the PDPs' interaction with their funders. In addition to detailed recommendations for each of the PDPs, the evaluators made the following overall recommendations:

- 1) Public funders should continue to support PDPs. In particular, the continuous portfolio funding approach stimulates the required product development for neglected and poverty-related diseases.
- 1) All PDPs should seek to diversify their funding base in order to ensure that they have the flexibility to set and follow their own strategy and not be driven by the requirements of one dominant funder.
- 1) Funders should agree amongst themselves on the measures of impact and the various parameters, and give clear guidance to PDPs to ensure comparisons can be made in a consistent manner.

### The PDPs that received funding in the BMBF's first round of funding:

- Drugs for Neglected Diseases initiative (DNDi): developing new therapeutic products to treat sleeping sickness, leishmaniasis, Chagas disease and filarial diseases.
- Foundation for Innovative New Diagnostics (FIND): developing a platform to discover diagnostic solutions for sleeping sickness, Chagas, leishmaniasis, malaria and Ebola.
- European Vaccine Initiative (EVI): developing a malaria vaccine for pregnant women.
- Dengue Vaccine Initiative (DVI): development of a dengue vaccine.

### 3rd cornerstone: African and European researchers pursue common goals in the European & Developing Countries Clinical Trials Partnership (EDCTP)

Founded in 2003 as Europe's specific contribution to the Millennium Development Goals, the EDCTP is a joint funding initiative forged as a partnership between countries in Europe and Sub-Saharan Africa. Its objective is to fund clinical trials on vaccines, drugs and diagnostics that focus exclusively on preventing or treating HIV/AIDS, tuberculosis and malaria. Over the course of the first funding programme (EDCTP1) up to 2013, with a total funding volume of approximately € 400 million, EDCTP emerged as one of the world's foremost funding programmes in its field (see box).<sup>21</sup>

EDCTP2, the second programme – launched in 2014 as part of Horizon 2020, the EU Framework Programme for Research and Innovation, with a funding target of up to € 1.9 billion – aims to finance clinical trials on other poverty-related infectious diseases (NTDs and Ebola). The other focus of the initiative is to improve the conditions for conducting clinical research in Sub-Saharan Africa. Thus, the EDCTP also executes a diverse fellowship programme and other funding options, for example the development of National Ethics Committees in the African partner countries.

Having promoted the foundation of EDCTP, the BMBF earmarked substantial funding (approximately € 10 million) to the first programme, which ended in 2013. As the programme runs until 2020, the EDCTP will continue to be one of the central pillars of the funding concept in the years ahead. The BMBF intends to increase its financial contribution significantly (€ 30 million), thereby establishing further funding opportunities for German researchers in the field of poverty-related diseases.

<sup>20</sup> Evaluation of the Product Development Partnerships (PDP) funding activities, The UK Department for International Development (DFID), BMBF, 2015

<sup>21</sup> Assessment of the performance and impact of the first programme of the European & Developing Countries Clinical Trials Partnership (EDCTP), The Technopolis Group, 2014



#### **4th cornerstone: accelerate capacity building, foster synergies and strengthen national health systems**

*Research networks for innovations in the health systems of Sub-Saharan Africa*

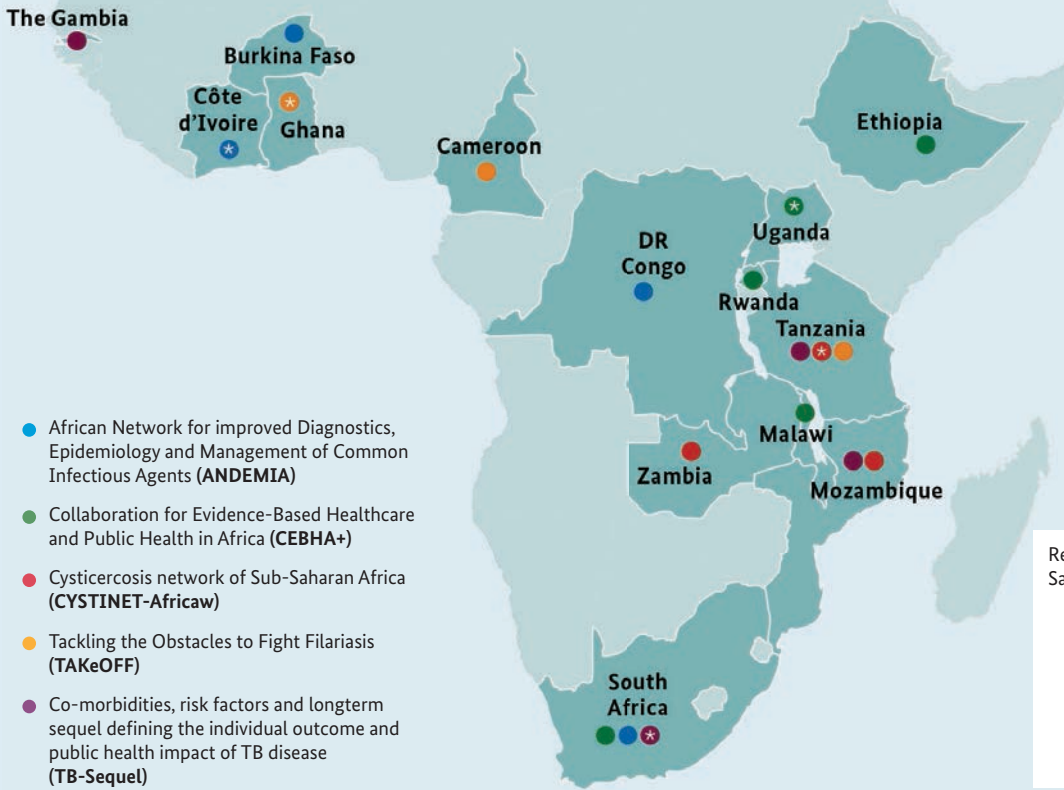
The BMBF's initiative on "Research Networks for Health Innovations in Sub-Saharan Africa" plans to boost sustainable health research cooperation between Germany and the countries of Sub-Saharan Africa. This makes career opportunities available to scientists and doctors in their own countries and helps in strengthening the local health systems.

The five networks approved for funding (see diagram) are being coordinated by African researchers on the ground. The research networks collaborate closely with universities and health care facilities, thereby consolidating both the education and the health systems of the African partner countries over the long term. As a top priority, the networks are engaging in research on the urgent health issues affecting the African partners. Their central task is to fight diseases that pose a particularly high threat to people living in Africa, including tuberculosis and neglected diseases, as well as chronic conditions like diabetes and cardiovascular disease, which have long since ceased to be diseases of affluence. Nowadays, 80% of these non-communicable diseases are also found in low- and middle-income countries where they represent an additional problem for the underdeveloped health systems, aggravating poverty and putting extra pressure on health care.

#### **Successful projects implemented during EDCTP1**

- 246 projects in over 30 different countries, of which 41 projects with German participation
- Collaborative research executed by 259 participating institutes (seven of which are located in Germany) from 30 Sub-Saharan African countries and 16 European countries
- Supported 100 clinical trials, 23 of which with German participation
- Developed 8 improved medical treatments
- Published over 450 articles
- Trained over 500 African scientists
- Founded, established and extended four African regional networks of excellence
- Developed the Pan African Clinical Trials Registry
- Set up the African Vaccine Regulatory Forum

## Research Networks for Health Innovations in Sub-Saharan Africa



Research Networks for Health Innovations in Sub-Saharan Africa and their German partners:

ANDEMIA/RKI Berlin

CEBHA+/LMU Munich

CYSTINET/TU Munich

TB-Sequel/LMU Munich

TAKeOFF/University of Bonn

Stand: August 2015

### Coordinating global research efforts

The communiqués issued by the G7 leaders and science ministers in 2015 are evidence of their clear commitment to improving the coordination of research endeavours around the world. Identifying research priorities and gaps is a prerequisite to ensure that the limited funds available are assigned both appropriately and efficiently. Equally vital are a thorough understanding and the close coordination of international research funding mechanisms. However, to date, neither an interdisciplinary process nor an appropriate organisation has been established to orchestrate research projects and research funding activities on a broader regional – yet alone a global – scale. Therefore, the BMBF will work closely with the G7 partners, the WHO Global Observatory on Health Research and Development and other relevant stakeholders to coordinate research and development efforts and make the corresponding data available in the public domain. This will enhance the alignment of research and development resources.

Coordinated international endeavours and the harmonised approach of all stakeholders are further prerequisites in effectively strengthening the health systems in poverty-stricken regions. Once again, research can play a major role in improving the situation by analysing deficiencies, optimising processes and mapping and comparing the effectiveness of new health services.

Even under research aspects, fast, coordinated and concerted action is of paramount importance in the event of an outbreak of pathogens with pandemic potential. This is one of the lessons to be learned from the Ebola crisis of 2014/2015. A coordinated response on an international scale is the only way to identify the pathogen, increase our epidemiological understanding and develop therapy options rapidly. Therefore, the BMBF has joined “GloPID-R” (Global Research Collaboration for Infectious Disease Preparedness), an initiative of the European Commission that aims to mobilise prestigious research institutions at short notice in the event of a health crisis to facilitate an immediate reaction as a concerted effort.



## Outlook

This concept provides a framework for the BMBF's research funding for neglected and poverty-related diseases; it provides ample scope for pursuing and developing ongoing activities, ensures that new initiatives are implemented successfully and facilitates intensified international cooperation (see box).

The BMBF pledges to engage in concerted action with all relevant partners. This includes continuing the close collaboration with the appropriate departments of the Federal Government and maintaining regular contact with the main funding organisations, both national and international.

Finally, the BMBF undertakes to cultivate the ongoing dialogue with non-governmental organisations (NGOs). Based on their day-to-day work on the ground, the recommendations of the NGOs are of vital importance for the BMBF and play a key role in the further development of this concept.

The funding concept is reviewed on a regular basis and adjusted in line with the requirements arising from national and international developments. In particular, this refers to the implementation of the obligations resulting from the G7 process and the UN resolution

for sustainable development by 2030. The BMBF will publish biennial progress reports on the implementation of the funding concept.

### The priorities of the funding concept

- A new, five-year round of funding for product development partnerships, scheduled to be launched in 2016, with no restrictions regarding specific poverty-related diseases and a funding volume of up to € 50 million.
- Implement the research networks for health innovations and the interdepartmental Research Agreement on Zoonoses.
- Increase German participation in the EDCTP, both in organisational and financial terms, with the goal of working with the EDCTP partners to ensure the success of an efficient initiative based on partnership.
- Launch the international research coordination on NTDs that has been agreed with the G7 partners by building on existing approaches (e.g. in the context of WHO).
- Continue to develop the national research funding for neglected and poverty-related diseases.



# List of Abbreviations

AMC	Advance Market Commitment
ARNDT	African Network for Neglected Tropical Diseases
BMBF	Federal Ministry of Education and Research
BMG	Federal Ministry of Health
BMZ	Federal Ministry for Economic Cooperation and Development
DALYs	Disability Adjusted Life Years lost
DFG	German Research Foundation
DfID	Department for International Development
DNDi	Drugs for Neglected Diseases initiative
DVI	Dengue Vaccine Initiative
DZIF	German Center for Infection Research
EDCTP	European and Developing Countries Clinical Trials Partnership
EVI	European Vaccine Initiative
R&D	Research and Development
FIND	Foundation for Innovative New Diagnostics
GHIF	Global Health Investment Fund
MDGs	Millennium Development Goals
MERS	Middle East Respiratory Syndrome
NGO	Non-governmental organisation
NSF	National Science Foundation
NTDs	Neglected tropical diseases
PDPs	Product development partnerships
PEI	Paul-Ehrlich-Institut
RKI	Robert Koch Institute
TB	Tuberculosis
TDR	Special Programme for the Research and Training in Tropical Diseases
UN	United Nations
WHO	World Health Organization

**Published by**

Bundesministerium für Bildung und Forschung/  
Federal Ministry of Education and Research (BMBF)  
Division Health Research  
11055 Berlin

**Orders**

In writing to  
Publikationsversand der Bundesregierung  
P.O. Box 48 10 09  
18132 Rostock  
Germany  
E-mail: publikationen@bundesregierung.de  
Internet: <http://www.bmbf.de>  
or by  
Phone: +49 30 18 272 272 1  
Fax: +49 30 18 10 272 272 1

**December 2015**

**Printed by**

BMBF

**Layout**

W. Bertelsmann Verlag, Bielefeld; Christiane Zay

**Photo credits**

Diagram Burden of Disease (p. 10)  
Afrika-Karte (p. 22): DLR PT  
DNDi  
Benoit Marquet: p. 2/3, 11  
Fabio Nascimento: p. 12  
Graham Crouch: Titel, p. 18  
DZIF  
scienceRELATIONS: p. 6/7  
EVI  
Alexandra Longuet: p. 9, 14/15  
FIND  
Xavier Ding: p. 16/17  
Federal Press and Information Office, Steffen Kugler:  
foreword (portrait of Prof. Dr Johanna Wanka): p. 2  
RKI  
Arsène Mossoun: p. 23  
Fabian Leendertz: p. 15  
TU München  
Veronika Schmidt: p. 4/5  
Andrea Winkler: p. 21

**Edited by**

DLR Project Management Agency  
Health Research  
Dr. Isabella Napoli  
Dr. Detlef Böcking  
Heinrich-Konen-Straße 1  
53227 Bonn  
Tel.: 0228 3821-1210  
Fax: 0228 3821-1257  
E-Mail: [isabella.napoli@dlr.de](mailto:isabella.napoli@dlr.de)

This publication is distributed free of charge by the German Federal Ministry of Education and Research as part of its public relations work. It is not intended for commercial sale. It may not be used by political parties, candidates or electoral assistants during an election campaign. This applies to parliamentary, state assembly and local government elections as well as to elections to the European Parliament. In particular the distribution of this publication at election events and at the information stands of political parties, as well as the insertion, printing or affixing of party political information, are regarded as improper use. The distribution of this publication to third parties as a form of campaign publicity is also prohibited. Regardless of how recipients came into possession of this publication and how many copies of it they may have, it may not be used in a manner that may be considered as showing the partisanship of the Federal Government in favour of individual political groups, even if not within the context of an upcoming election.

