

FEBRUARY 2010

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ENDING THE NEGLECT OF NEGLECTED TROPICAL DISEASES

NTDs are diseases of poverty, affecting nearly everyone in the “bottom billion” of the world’s poorest people.

41 MILLION

The number of people infected with trachoma in 2008; down from 149 million in 1997.

It is essential to scale-up quickly the rapid-impact package to address the seven most common NTDs.

More than 1 billion people, about one-sixth of the world’s population, are infected with one or more of 13 “neglected tropical diseases” (NTDs).¹ These diseases are the most common afflictions of the world’s poorest people (see table).

NTDs have a terrible impact on health, impede child growth and development, harm pregnant women, and often cause long-term debilitating illnesses. They cause an extraordinary amount of ill health, disability and disfigurement, and are often deadly. As a result, those who suffer from NTDs are frequently shunned by their families and their communities. In addition, people with these diseases are often unable to work productively, leading to enormous economic losses for them, their families, and for the nations in which they live.

Despite their significance, relatively little financial support has been provided to address NTDs, compared to the burden of ill health that they cause. This is especially regrettable, since significant progress has been made to control or eliminate some of the NTDs, including Chagas disease, lymphatic filariasis, onchocerciasis, and leprosy. It is also lamentable because, a “rapid-impact package” of four drugs is available that can simultaneously treat the seven most common NTDs for between 40 cents and 80 cents per person per year.² Given the exceptional amount of good health that can be gained in the fight against NTDs for such a small amount of money, an important global challenge is to spread the rapid-impact package as fast as possible to all places where it can be of benefit.

The Magnitude of NTDs

The NTDs shown in the table are 13 parasitic and bacterial infections that affect approximately 1.4 billion people worldwide who live on less than US\$1.25 a day. Seven of these diseases are especially important given the large number of people affected by them. A number of infections related to intestinal worms, which are called soil-transmitted helminths, affect an extraordinary number of people. Roundworm (ascariasis) affects 807 million

people worldwide; whipworm (trichuriasis) affects 604 million; and hookworm affects 576 million. The four other most common NTDs include: schistosomiasis (snail fever), affecting about 200 million people; lymphatic filariasis (elephantiasis), which affects 120 million people; blinding trachoma, affecting more than 80 million people; and onchocerciasis (river blindness), which affects almost 40 million people.

The impact of NTDs on health globally can best be understood by measuring the years of healthy life lost from NTDs due to illness, disability, and premature death. A commonly used measure of these healthy life years lost is the DALY, which stands for Disability Adjusted Life Year. A number of diseases kill more people than NTDs do.

The Major Neglected Tropical Diseases, Ranked by Prevalence

DISEASE	GLOBAL PREVALENCE (MILLIONS)
Ascariasis (roundworm)	807
Trichuriasis	604
Hookworm infection	576
Schistosomiasis	207
Lymphatic filariasis (elephantiasis)	120
Trachoma	41
Onchocerciasis (river blindness)	37
Leishmaniasis	12
Chagas disease	8-9
Leprosy	0.4
Human African trypanosomiasis	0.02
Dracunculiasis	0.01
Buruli ulcer	Not determined

Sources: Based on Peter J. Hotez et al., “Current Concepts: Control of Neglected Tropical Diseases,” *New England Journal of Medicine* 357, no. 10 (2007): 1019; “What Is Trachoma,” accessed at www.trachoma.org, on Jan. 29, 2010; and “Human African Trypanosomiasis,” accessed at www.who.int/trypanosomiasis_african/disease/en/index.html, on Jan. 29, 2010.

However, some estimates suggest that NTDs result in as many DALYs lost annually as would be lost by malaria, largely because of the extent to which the NTDs make people sick for long periods of time and the manner in which they cause long-lasting disabilities.³

Who Is Most Affected?

Seven of the most common NTDs can be found in a number of countries, primarily in Africa, but also Brazil and Cambodia. Six of the common NTDs are found in many countries in sub-Saharan Africa and five NTDs can be found in many of the other low- and middle-income countries of Africa, Asia, and Latin America.

NTDs are diseases of poverty, affecting nearly everyone in the “bottom billion” of the world’s poorest people. NTDs are especially prevalent in subtropical and tropical climates. Women and children who live in unhygienic environments with limited access to clean water and sanitary methods of waste disposal face the biggest threat of NTDs. Pregnant women also face special risks from some NTDs, as discussed below. People engaged in farming are particularly susceptible to NTDs because of their close contact with soil, which can harbor many of the parasites and worms that cause NTDs. People who live in Africa and rely on rivers for drinking and bathing are also more likely to be affected by certain NTDs, such as onchocerciasis. Individuals whose labor or domestic chores are centered on freshwater sources are also more likely to contract NTDs.⁴

In addition, the burden of the “worm” diseases has to do not only with being infected but also with the number of worms in the body. Children of preschool age have the greatest number of worms. In addition, the prevalence of intestinal worms in many children of school age in the highest burden countries is exceptionally high. It is estimated, for example, that over 75 percent of the school-age children in Rwanda are infected with soil-transmitted helminths.⁵

How Are NTDs Transmitted?

The soil-transmitted helminths have very similar life cycles. Humans ingest the eggs of the worms. The eggs hatch into larvae, which travel to different parts of the body depending on the type of worm. The worms might feed on food from the human host or attach themselves to the intestinal lining and live off the blood of the host. Eggs pass from the human host in feces and can then be picked up by others who will get infected.

Schistosomiasis is caused by a liver fluke. People with schistosomiasis release fluke eggs in their urine or feces. The flukes infect freshwater snails. When humans swim, bathe, or work in water with infected snails, the fluke can penetrate their skin. One form of fluke manifests itself in the intestinal

tract and liver and another in the urinary tract, in all of which they can cause severe disease.

The cycle of transmission for lymphatic filariasis is very different from that for the helminthic infections. In this case, mosquitoes bite infected humans and pick up the larvae, which develop inside the mosquito and migrate to the insect’s mouth. When this mosquito bites a human, it transmits the hatched larvae into the skin. Larvae can survive in the lymphatic system for up to six years and when they die, they cause the severe disfigurement associated with lymphatic filariasis.

The black fly that causes onchocerciasis goes through a similar process. Infected flies carry the larvae from person to person through bites in the skin. These become adult worms and the females release millions of small larvae into the body.

Trachoma is caused by bacteria that lead to a discharge in the eye. It is transmitted when someone comes in contact with the discharge, usually by touch. However, flies can also spread the disease from person to person.⁶

The Consequences of NTDs

NTDs can have terrible social and economic consequences, as well as a major impact on the health and well-being of those infected. On the clinical side, trachoma, for example, can lead to redness and swelling of the eye, sensitivity to light, corneal scarring, and eventually permanent blindness. Schistosomiasis is associated with painful and/or bloody urination, bloody diarrhea, enlargement of the liver and/or spleen, and liver cancer; it is also the most deadly of the NTDs. Lymphatic filariasis is well known for the horrible swelling it can cause of the extremities. Onchocerciasis leads to skin problems and can also lead to blindness.

The helminthic infections are generally associated with abdominal pain, loss of appetite, malnutrition, diarrhea, and anemia. In addition, chronic helminthic infection in children can limit the physical and mental development of the child. Pregnant women with hookworm are at high risk of giving birth to low birth-weight babies, of poor milk production, and of birthing babies who fail to thrive. In addition, pregnant women with anemia, commonly caused in low-income countries by hookworm, are three and a half times more likely to die during childbirth than women who are not anemic. This risk is especially significant for pregnant women in sub-Saharan Africa—a quarter to a third of them are infected with hookworm.⁷ Whipworm can also lead to severe growth retardation in children.

NTDs by themselves not only have enormous effects on individuals but also worsen the effects of other major infectious diseases or make individuals more susceptible to them. Recent studies have shown that many people have one or more NTDs at the same time as they have HIV or malaria, which worsens the intensity of those diseases. In addition, helminthic infections may serve as important factors in the transmission of HIV/AIDS.⁸

Genital schistosomiasis in females may develop into lesions that increase susceptibility to becoming infected with HIV.⁹ Neglected tropical diseases are also associated with the onset of some chronic noncommunicable diseases, such as the bladder cancer associated with urinary schistosomiasis.¹⁰

Social stigma is a major consequence of the NTDs. Many of the NTDs cause disability and disfigurement, resulting in individuals being shunned by their families and their communities. When not treated, for example, leprosy can cause terrible skin lesions that have been stigmatized since biblical times. Few health conditions are as stigmatizing as the swelling of limbs and genitalia that can result from lymphatic filariasis. Individuals who are stigmatized are less likely to leave their homes to seek diagnosis and treatment. Social stigma is particularly demoralizing for young women because they are often left unmarried and unable to work, in settings where the social “value” of a woman has much to do with her marital status.

NTDs also have a major impact on the productivity of individuals and the economic prospects of communities and nations. Children are disproportionately affected by NTDs and often suffer long-term consequences from them. Hookworm infection in school-age children contributes in some areas to drops in school attendance by greater than 20 percent and poor school attendance and poor school performance reduce future earnings. In fact, hookworm has been shown to reduce future wage earning capacity in some affected areas by up to 43 percent.¹¹

NTDs adversely affect economic productivity at the individual, family, community, and national levels. NTDs lead to important losses in income that cause some families to sell assets to try to stay financially solvent. In addition, regions severely affected by onchocerciasis often cannot be used effectively for economic activities such as farming, since families that try to live in these areas are at risk of being blinded by the disease. Trachoma alone has been shown to contribute annually to an estimated \$2.9 billion loss in productivity worldwide.¹²

In short, the NTDs are diseases of the poor that help to keep them poor. They also negatively affect the economic development prospects of the countries in which these people live.

Progress in the Fight Against NTDs

Despite the many people still affected by NTDs, considerable progress has been made in the fight against a number of them. Onchocerciasis has been eliminated as a public health problem in 10 countries in West Africa. Guinea worm is nearing eradication as a result of a global effort that focused on health education and teaching people to filter their water through finely woven cloth. In fact, the number of Guinea worm cases has fallen from more than 3.5 million in 1986 in 20 countries to fewer than 5,000 cases in six countries in 2007.¹³

In 1997, the World Health Organization developed a strategy known as SAFE (surgery, antibiotics, face washing, environmental change) to combat trachoma worldwide. As a result of the pro-

gram, trachoma prevalence has been reduced globally from 149 million cases in 1997 to 41 million cases in 2008. The program was particularly effective in Morocco, where the SAFE strategy was the first to be tested at the national level. Through the donation of over \$72 million worth of drugs by Pfizer to treat trachoma, as well as interventions to improve environmental hygiene, Morocco has eliminated trachoma as a public health problem.¹⁴

Lymphatic filariasis has been controlled in China, Thailand, Sri Lanka, Suriname, and the Solomon Islands. This was accomplished by annual administration of appropriate drugs to all of the people of an affected area, usually by working closely with communities. Two pharmaceutical companies, Merck and Pfizer, have donated drugs for the program against lymphatic filariasis. In its first eight years alone, the Global Program to Eliminate Lymphatic Filariasis has made significant progress in preventing lymphatic filariasis. An estimated 6.6 million newborns were saved during this period from acquiring lymphatic filariasis and 9.5 million people previously infected with overt manifestations of the disease were protected from developing severe disease.¹⁵

In addition, a better foundation has been set globally, as well as within some countries, for dealing more effectively and on a broader scale with NTDs. This builds on work done by a variety of partnerships, including the Global Alliance to Eliminate Lymphatic Filariasis, the African Programme for Onchocerciasis Control, and the Partnership for Parasite Control. The Global Network for Neglected Tropical Diseases, for example, has been established at the Sabin Vaccine Institute to help develop more coherent, effective, and efficient approaches to NTD control. The Global Network is comprised of a number of member organizations who deliver treatments on the ground, including the Earth Institute at Columbia University, Helen Keller International, the Global Alliance to Eliminate Lymphatic Filariasis, the International Trachoma Initiative, the Schistosomiasis Control Initiative at Imperial College, and the Task Force for Global Health. The Global Network works to build advocacy, policy, and resource mobilization efforts to support members and local governments in implementing NTD control programs.

Moreover, the Global Network for Neglected Tropical Diseases, with funding from the Bill & Melinda Gates Foundation, has recently developed a regional approach to NTDs that focuses on Africa, Asia, and Latin America. The Global Network will create hubs in each of these regions to coordinate NTD efforts, raise funds for addressing NTDs, and provide technical support to NTD activities. In addition, the Global Network is working with the Inter-American Development Bank and the Pan American Health Organization to create a trust fund for combating NTDs in Latin America and the Caribbean. This will support the delivery of about 200 million treatments against NTDs.

Funding for NTD control has increased from both the philanthropic sector and bilateral development agencies such as the United States Agency for International Development (USAID). USAID has committed \$30 million to date for an integrated NTD control program, and will scale up to \$50 million in fiscal year 2009. In addi-

tion, President Obama recently announced a six-year global health initiative, which includes NTDs in a longer-term plan for U.S. government spending.

Thanks to advocacy efforts such as those being carried out by the Brazilian national soccer team, the actress Alyssa Milano, and former United States Health and Human Services Secretary Tommy Thompson, an increasing number of people worldwide are beginning to appreciate the human and economic toll of NTDs. They are also beginning to understand how NTDs can often be addressed quickly in low-cost and highly efficient ways.

Addressing the Unfinished Agenda for NTD Control

The successes against NTDs so far suggest that considerable additional progress can be made, at relatively low cost and rapidly, to combat the exceptional number of cases of NTDs that remain worldwide. However, further progress is likely to require concerted action in a number of areas, including: scaling up the rapid-impact package; focusing on deworming; integrating NTD control with other programs; developing new technologies to address NTD control; and moving forward with political will.

IMPLEMENTING THE RAPID-IMPACT PACKAGE

It is essential to scale-up quickly the rapid-impact package referred to earlier, to address the seven most common NTDs. The package includes a combination of four of six drugs: albendazole or mebendazole, praziquantel, ivermectin or diethylcarbamazine, and azithromycin.

Four of the six drugs that are used against the seven most common NTDs are donated by pharmaceutical companies, including Glaxo Smith Kline, Johnson and Johnson, Merck, and Pfizer. In sub-Saharan Africa, the projected overall cost of the program is about 40 cents to 80 cents per person per year, which would be a “best buy” in global health, given its low cost and large impact on public health.

Following the lessons of the onchocerciasis program and others, the rapid-impact package can be put in place quickly with the help of distributors of medicine who are chosen from among members of the affected communities. They would be brought into the program through social mobilization activities. These efforts would bring together key actors from the public and private sectors in a partnership and would seek to involve affected communities in program design, implementation, and monitoring. This type of community-directed treatment for onchocerciasis with ivermectin has proven particularly successful in rural Africa where treatment has been extended to nearly 60 million people. In fact, a recent study showed that community-directed interventions are much more effec-

tive than conventional delivery approaches, which have less community participation, in combating most communicable diseases in sub-Saharan Africa.¹⁶

FOCUSING ON DEWORMING

Periodic deworming of young children is also a “best buy” in global health and should be a major focus of attention.¹⁷ In 2001, in fact, WHO adopted a resolution to “deworm” 75 percent of all at-risk school-age children by 2010. Deworming is the single most cost-effective means to improve school attendance. There is also historical evidence that deworming improves children’s cognitive skills and their potential to learn and leads to greater literacy and higher productivity among adults.¹⁸ In addition, recent studies have shown that deworming children may significantly reduce the burden of malaria, since children infected with ascariasis are twice as likely to get severe malaria as children not infected.¹⁹

INTEGRATING NTD CONTROL WITH OTHER PROGRAMS

In addition, there are considerable opportunities, in regions of high prevalence of malaria and HIV, for effectively integrating NTD treatment programs with existing AIDS and malaria control programs. This integration could help such programs to reduce the burden of NTDs and the burden of HIV and malaria, while contributing to improving the cost-effectiveness of all of the programs. This is especially important since hookworm and schistosomiasis often worsen the effects of malaria.²⁰ The distribution of bed nets and treatment for NTDs such as onchocerciasis and lymphatic filariasis could also help to control malaria. Such a program led to a substantial improvement in the use of bed nets in central Nigeria, where insecticide-treated bed net distribution was combined with mass drug administration for treatment of lymphatic filariasis and onchocerciasis.²¹

DEVELOPING NEW TECHNOLOGIES

As we look to the longer run, it is also important to invest in the search for new technologies that could help to address NTDs in more effective and efficient ways. With the assistance of the Bill & Melinda Gates Foundation and private donors, work is underway by the Vaccine Development Program at the Sabin Vaccine Institute to develop a hookworm and a schistosomiasis vaccine. A safe and effective hookworm vaccine, particularly if it would confer lifelong immunity, would eliminate the need to provide medicine for deworming twice a year to all children living in affected areas, which is a substantial undertaking. The development of a vaccine for schistosomiasis is also being carried out by the Institut Pasteur.

It is also critical to develop new drugs to combat the NTDs. The world is now dependent on only four drugs to address

the seven most common NTDs. There is resistance to some of the drugs and more extensive use of them could lead to additional resistance. Developing drugs that can combat the NTDs more effectively than the present drugs continues to be a goal of considerable importance.²²

ADDRESSING THE UNDERLYING RISKS

At the same time as countries seek to prevent and treat NTDs through programs of mass drug administration or treatment of specific diseases, they need to work with communities to address the underlying risks for NTDs. For the seven most common NTDs, these risks overwhelmingly relate to the unsanitary living conditions of the poor. It will remain important for people to better understand the importance of good hygiene, to have better access to safe water and sanitary disposal of human waste, and to eliminate worm and parasite breeding sites. In the long run, progress in all these directions will help to reduce the burden of NTDs and sustain reductions. Unfortunately, however, these developments are not likely to take place quickly and the fastest and most cost-effective route to reducing the burden of NTDs will be to implement as fast as possible the rapid-impact package.

MOVING FORWARD WITH POLITICAL WILL

There needs to be political will both globally and within affected countries to scale up the fight against NTDs. Policymakers and key stakeholders need to understand the exceptional burden of NTDs, their terrible effect on the poor, and the extent to which they help trap the poor in poverty. The world has committed to achieving a set of Millennium Development Goals by 2015, one of which is to cut in half the burden of diseases like the NTDs. This will require greater attention to them, as well as greater funding for countries to engage in efforts to address them.²³

Controlling NTDs can have a profound impact on the poorest and most vulnerable people. It can help to free them from a terrible burden of illness and disability and premature death. It can also enable them to develop properly as children and become productive adults. There are low cost, highly effective ways of preventing and treating NTDs that need to be scaled up. There are few better investments in development and in improving the lives of the poor worldwide than an investment in the fight against the NTDs.

Acknowledgments

Richard Skolnik is a lecturer in global health at The George Washington University and the author of *Essentials of Global Health*. Ambareen Ahmed is a senior undergraduate at The George Washington University. Erin Hohlfelder and Karen Palacio of the Sabin Vaccine Institute, and Dr. Peter Hotez of the Sabin Vaccine Institute and The George Washington University, provided considerable assistance in the preparation of this brief. Dr. Anthony Measham also provided valuable comments

on the draft. This brief has been produced with the assistance of a grant from the Novartis Foundation, which is actively involved in helping to address neglected tropical diseases, including through the donation of drugs to fight against leprosy.

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