

Nigeria: “Ground Zero” for the High Prevalence Neglected Tropical Diseases

Peter J. Hotez^{1,2*}, Oluwatoyin A. Asojo^{2,3}, Adekunle M. Adesina^{2,4}

1 Sabin Vaccine Institute and Texas Children’s Hospital Center for Vaccine Development, Departments of Pediatrics (Section of Pediatric Tropical Medicine) and Molecular Virology & Microbiology, Baylor College of Medicine, Houston, Texas, United States of America, **2** National School of Tropical Medicine, Baylor College of Medicine, Houston, Texas, United States of America, **3** Department of Pathology and Microbiology, University of Nebraska Medical Center, Omaha, Nebraska, United States of America, **4** Department of Pathology & Immunology, National School of Tropical Medicine, Baylor College of Medicine, Houston, Texas, United States of America

Among all of the African nations, Nigeria has the greatest number of people infected with neglected tropical diseases (NTDs). With the right political will, the country has sufficient resources to expand its current investments for the important work of Nigeria’s NTD program.

In a 2009 analysis of the NTDs in sub-Saharan Africa, one of us identified Nigeria as the country with the greatest number of cases of the so-called high prevalence NTDs, such as the intestinal helminth infections, schistosomiasis, and lymphatic filariasis (LF) [1]. Shown in Table 1 is a list of the major NTDs that can be targeted for integrated NTD control and/or elimination, which also includes onchocerciasis. The information confirms that Nigeria has the greatest number of intestinal helminth infections, i.e., ascariasis, hookworm, and trichuriasis, among all African nations, ranking fourth or fifth globally behind only the much higher populated middle-income Asian nations, such as China, India, and Indonesia [1–4]. Nigeria also has the greatest number of cases of schistosomiasis worldwide, with both intestinal schistosomiasis caused by *Schistosoma mansoni* and the urogenital schistosomiasis caused by *Schistosoma haematobium* endemic to that country [1,5]. In terms of the high prevalence vector-borne NTDs, Nigeria has the greatest number of cases of LF and onchocerciasis in Africa, ranking globally third and first, respectively, and accounting for one-fourth or more of the global disease burden from these two NTDs [6–9]. Nigeria also has an estimated 18 million people at risk for trachoma, with nearly 1.3 million people living with trichiasis [10], and the third or fourth largest number of new cases of leprosy in Africa (behind Ethiopia and the Democratic Republic of Congo) [11], in addition to some of the greatest number of cases of the lower prevalence NTDs, including yellow fever, rabies, and Buruli ulcer in Africa [1]. The World Health Organization (WHO) reports that there may be 21 “alleged” or “suspected” remaining cases of dracunculiasis in Nigeria [12], although

it is widely accepted that transmission of guinea worm has been interrupted there.

The high prevalence NTDs are responsible for an enormous disease burden in Africa, equivalent to almost one-half the disease burden from malaria when measured in disability-adjusted life years [1]. There is an equally important adverse economic impact because of the effects of these NTDs on maternal-child health and worker productivity in Africa [1]. However, the seven most common NTDs can often be controlled or in some cases even eliminated through low cost “rapid-impact” packages of drugs, which are either donated by multinational pharmaceutical companies or through the purchase of low-cost generic drugs. At a cost of less than US\$1 per person annually, the prevalence of the intestinal helminth infections and schistosomiasis could be reduced in some areas, while LF, onchocerciasis, and trachoma might even be eliminated over a period of several years. Therefore, based on Nigeria’s current population estimate of approximately 150 million people [13], we estimate that such goals could be achieved in Nigeria for significantly less than US\$100 million annually. Because the seven high prevalence NTDs have been shown to actually cause poverty, the economic rate of return for integrated NTD control and elimination would be substantial.

The enormous disease and economic burden resulting from the seven high prevalence NTDs persist in Nigeria despite the country’s economic capacity to absorb some or all of the costs required for disease control and elimination. Nigeria is the most populated nation in Africa, accounting for approximately 20% of Africa’s population (Figure 1, Table 2) [6,13,14]. It is also the 8th most populated nation worldwide, roughly equivalent to the population of Bangladesh and Brazil [13,14], but with a gross domestic product (GDP) and purchasing power parity that ranks it with several western European countries such as Belgium or Sweden [15]. Indeed, Nigeria has the third largest economy in Africa, behind South Africa and Egypt, ranking 32nd globally with a GDP of over US\$300 billion [15,16]. Additional estimates indicate that Nigeria is ranked among the top 20 countries globally for foreign direct investments [17]. Moreover, Nigeria is currently experiencing enormous economic growth, which exceeded 8% in 2010 [18,19], and was almost 7% in 2011 [19].

Increasingly, much of Nigeria’s economic growth depends on oil and other fossil fuels. Today, Nigeria ranks 15th globally in world oil production and 5th in oil exports, in addition to 11th in natural gas exports [20]. The excessive dependence on fossil fuels has created a

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* E-mail: hotez@bcm.edu

Peter Hotez, MD, PhD, FASTMH, FAAP, is Dean of the National School of Tropical Medicine, Baylor College of Medicine, Head of the Section of Pediatric Tropical Medicine and Texas Children’s Hospital Endowed Chair of Tropical Pediatrics, Texas Children’s Hospital. He is also President of the Sabin Vaccine Institute. Oluwatoyin Asojo, PhD, is an Assistant Professor in the Department of Pathology and Microbiology, University of Nebraska Medical Center. Adekunle Adesina, MD, PhD, FCAP, FMCPATH, is Professor of Pathology and Immunology and Medical Director, Section of Neuropathology, Baylor College of Medicine, and Director of the Molecular Neuropathology Laboratory at Texas Children’s Hospital.

Table 1. Ranking of Nigeria by neglected tropical diseases cases and prevalence.

Disease	Estimated Number of cases in Nigeria	Ranking in Africa	Percentage of Global Disease Burden	Ranking Globally	Reference
Ascariasis	55 million	1	7%	5th behind India, Indonesia, China, and Bangladesh	[1–4]
Hookworm	38 million	1	7%	Tied for 4th with China behind India, Indonesia, and Bangladesh	[1–4]
Trichuriasis	34 million	1	6%	4th behind India, Indonesia, and Bangladesh	[1–4]
Schistosomiasis	29 million	1	14%	1	[2,5]
Lymphatic filariasis	• 25 million • 80–121 million estimated at risk, requiring mass drug administration	1	21%	3rd	[6–8,27]
Onchocerciasis	30 million at risk, requiring mass drug administration	1	36%	1	[6,9]
Trachoma	18 million at risk	Not determined	Not determined	Not determined	[10]
Leprosy	4,531 registered prevalence	4	2%	7th	[11]

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structural imbalance and lack of diversification leading to high youth unemployment and widespread insecurity [18]. The term “resource curse” has been applied to countries such as Nigeria that have enormous natural resources but underperform with respect to their human development index (HDI) and other metrics linked to a robust economy [21]. Indeed, despite its wealth, Nigeria ranks only 158th in terms of its HDI [22], and so far the country has been unable to meet its Millennium Development Goals (MDGs), including MDG 6 for combating HIV/AIDS, malaria, and other diseases [13]. Additionally, between the years 1990 and 2006, Nigeria regressed in several developmental indices, notably the percentage of its population that had access to safe water coverage and basic sanitation. As of 2006, a majority of Nigerians lack access to safe water coverage (53%) and sanitation (70%) [23]. This situation is not unique to Nigeria, but unfortunately is common among many African nations.

The good news is that Nigeria has made some important strides in NTD control and elimination [6,24]. Some of these successes were accomplished in collaboration with the WHO, UNICEF-Nigeria, and the Atlanta-based Carter Center and its Nigerian offices in Jos, as well as other non-governmental developmental organizations (NGDOs) [6,8,24,25,26]. The clearest public health victory has been with respect to guinea worm (dracunculiasis) eradication. In 1986, Nigeria accounted for approximately 75% of the world’s 3.3 million cases of dracunculiasis. Through investments by the Nigerian government that exceeded US\$2 million,

in addition to other public and private support, transmission of guinea worm has been halted since 2009 [6]. In addition, with support from the International Trachoma Initiative (ITI), the Nigeria national program has received more than 4.7 million Zithromax treatments since 2010 [10]. In 2011, Nigeria was scheduled to treat 3.1 million people [10], or possibly as many as 5 million [27]. Moreover, in collaboration with the African Programme for Onchocerciasis Control (APOC), the Nigerian Federal Ministry of Health has ensured that more than 96% of 35,000 Nigerian communities at risk for river blindness have received or still receive annual community-directed treatments with ivermectin (CDTI) [24] (Figure 2). These activities have occurred through support of the APOC Trust Fund, NGDOs, and the Nigerian government [24]. Outcomes of recent epidemiological assessments conducted with support from APOC indicate that onchocerciasis transmission has been halted in foci in Ebonyi, Kaduna, and Zamfara states [27]. For onchocerciasis and the other high prevalence NTDs, including LF, schistosomiasis, and trachoma, some of the most notable gains have occurred in the states of Plateau and Nasarawa, where the Carter Center maintains active programs of mass drug administration [6,25,26]. As a result, there has been a 95% reduction in onchocercal nodules in these two states, and an 83% reduction in the prevalence of LF [6,25,26]. Moreover, praziquantel mass drug administration for schistosomiasis is being integrated with LF and onchocerciasis control and elimination efforts, with targeted praziquantel treat-

ment for schistosomiasis now ongoing in six states [6,8,27] (Supporting Document S1).

Despite these victories and accomplishments, much of the Nigerian population still lacks access to essential medicines for the high prevalence NTDs. Beginning in 2009, a national program for NTD control and elimination was initiated to promote integrated control nationally. The NTD program of the Nigerian Federal Ministry of Health currently addresses the following diseases: LF, onchocerciasis, schistosomiasis, soil-transmitted helminth infections, trachoma, leprosy, Buruli ulcer, human African trypanosomiasis, and guinea worm disease. The strategy of the NTD program is to progressively reduce morbidity, disability, and mortality due to NTDs using integrated and cost-effective approaches with the goal to eliminate NTDs in Nigeria by the year 2020 [27].

Nigeria has sufficient wealth and resources in order to build on its past successes and embark on an expanded and aggressive program of national disease control and elimination for its highest prevalence NTDs. Costing less than 0.1% of its GDP annually, the program would be comprised of integrated mass drug administration efforts to target the intestinal helminth infections, schistosomiasis, LF, and onchocerciasis, possibly together with administration of long-lasting insecticide-treated nets to also target malaria and LF, as well as the SAFE (surgery, azithromycin antibiotics, facial cleanliness, and environmental control) strategy for trachoma elimination. Through its long-standing collaborations with international agencies such as APOC, WHO, and UNICEF, as



Figure 1. Location of Nigeria. From CIA – The World Factbook (<https://www.cia.gov/library/publications/the-world-factbook/geos/ni.html>), accessed 1 February, 2012.
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well as CBM, ITI, the Carter Center, Helen Keller International, Sightsavers International, Mission to Save the Helpless (MITOSATH), and other NGOs, the Nigerian Federal Ministry of Health has acquired deep and lasting technical expertise in order to ensure such expanded activities are conducted at maximal efficiencies, minimal costs, and with adequate monitoring and evaluation. A key component would include accelerated mapping

of NTDs in Nigeria [28], including an ongoing partnership with the Swiss Tropical and Public Health Institute [29]. A national program of NTD control and elimination, coupled with increased access to clean water and sanitation, would simultaneously serve to strengthen health systems in many of the more fragile Nigerian states, and would represent a highly effective pro-poor strategy for Nigerian President Goodluck Jonathan in

his first elected term. Doing so would be an appropriate activity for a nation currently undergoing its longest period of civilian rule since independence and one recently awarded a seat on the United Nations Security Council [30].

There is also an urgent need for new and improved control tools for Nigeria's NTDs, including the development of a new macrofilaricide for onchocerciasis and other medicines, simpler and less expen-

Table 2. Facts and figures about Nigeria.

Category	Number	Ranking	Countries with Comparable Ranking	Reference
Population	<ul style="list-style-type: none"> • 152 million (2010) • 165 million (projected in 2015) 	8	Bangladesh And Brazil	[13,14]
GDP (purchasing power parity)	\$378 billion (2010)	32	Belgium and Sweden	[15]
Ranking of economy in Africa		3	Behind South Africa and Egypt	[15,16]
HDI (Human Development Index)	0.470 (2005)	158	Eritrea and Tanzania	[22]

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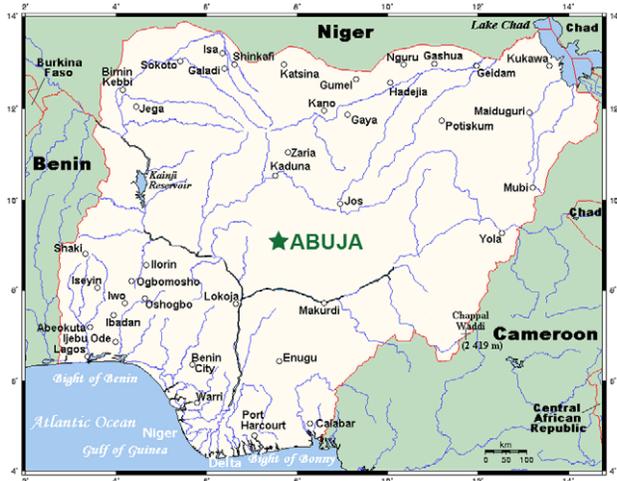


Figure 2. Map of Nigeria. From CIA – The World Factbook (<https://www.cia.gov/library/publications/the-world-factbook/geos/ni.html>), accessed 1 February, 2012. doi:10.1371/journal.pntd.0001600.g002

sive diagnostic reagents, and NTD vaccines [6]. In parallel with expanded disease control and elimination efforts, Nigeria's best universities and research institutes must expand their research and training capacity for NTDs. Several Nigerian capacity-building and partnering

programs with institutions in the United States and United Kingdom are already in place, including one between the Nigeria's National Academy of Science together with the US National Academies through the African Science Academy Development Initiative (ASADI) [31], and between

the University of Ibadan (in partnership with several other Nigerian universities) and two US universities (Northwestern University and Harvard School of Public Health) through the Medical Education Partnership Initiative in Nigeria (MEPIN) supported by the US National Institutes of Health [32], but these too could be expanded.

A Nigeria free from its high prevalence NTDs can be expected to accelerate that nation's economic development through improvements in child growth, intellect and cognition, pregnancy outcome, and worker productivity. Through expansions in integrated NTD control and disease elimination, Nigeria would become an important role model for all of Africa.

Supporting Information

Supporting Document S1 "Brief on NTD," unpublished document by Nigerian Ministry of Health, received January 24, 2012. (DOC)

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