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# Sub-Saharan Africa's "Other Diseases": A Comparison of the Global Response to Neglected Tropical Diseases and HIV/AIDS in Ghana

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Abbreviations:

UN- United Nations

MDG- Millennium Development Goals

SDG- Sustainable Development Goals

NTD- Neglected Tropical Disease

TB- Tuberculosis

SSA- Sub-Saharan Africa

GoG- Government of Ghana

GBD- Global Burden of Disease

DALYs- Disability Adjusted Life Years

YLL- Years of Life Lost

YLD- Years Lost due to Disability

GHS- Ghana Health Service

PPP- Public-Private Partnership

STH- Soil Transmitted Helminths

LF- Lymphatic Filariasis

WHO- World Health Organization

SAC- School age children

HAT- Human African Trypanosomiasis

MDA- Mass drug administration

ART- Antiretrovirals

GAC- Ghana AIDS Commission

**Introduction:**

The Millennium Development Goals (MDGs) were established by the United Nations in September 2000 as targets for international progress. These eight goals, which include eradicating extreme poverty, achieving universal education, and promoting gender equality, were unanimously supported by the UN's member states. Though progress varied based on countries and targets, since the MDGs' inception the number of people living in extreme poverty has more than halved and international support from developed nations to less developed countries has

increased 66% (“The Millennium Development Goals Report 2015”). The United Nations Development Programme claims that these achievements, as well as others, distinguish the MDGs as producing “the most successful anti-poverty movement in history”. The Millennium Development Goals were superseded by seventeen Sustainable Development Goals (SDGs), proposed in September 2015.

Despite the goal of addressing multiple indicators of poverty, the MDGs overlooked a crucial aspect of the relationship between healthcare and poverty. Though three of the eight goals are devoted to healthcare development, Goal Six, to “Combat HIV/AIDS, malaria, and other diseases” disregards the latter in terms of over a dozen chronic diseases that disproportionately affect the poor. These “other diseases” likely include what are known as the neglected tropical diseases, and, according to the World Health Organization, affect more than 1.4 billion people worldwide (“Neglected Tropical Diseases”). Many of these diseases have disabling and disfiguring effects that impact communities and keep those inflicted from escaping poverty. Even in the SDGs, Goal 3, to “Ensure healthy lives and promote well-being for all at all ages”, references NTDs just once when noting that the UN hopes to eliminate HIV/AIDS, tuberculosis, malaria, and NTDs by 2030.

The United Nations is not the only entity that prioritizes HIV/AIDS and malaria, as well as tuberculosis (collectively nicknamed “The Big Three”), over NTDs; after all, the diseases are called “neglected” for a reason. Living in the shadow of HIV/AIDS and the rest of The Big Three has kept global awareness of NTDs low and thus NTD programs worldwide receive considerably less funding from non-governmental organizations, charities, and other initiatives. This is especially detrimental for two reasons: Firstly, the cost of treating and preventing the most prevalent NTDs costs less than a dollar per person per year (which is extremely low

especially when compared to the high cost of antiretroviral treatment for HIV patients). Secondly, because of the morbidity of certain diseases, NTDs cause arguably greater harm to the well-being of low to middle-income nations than HIV/AIDS. Thus, if a country dedicates more national and international resources to the prevention and treatment of neglected tropical diseases, that nation will see an increase in social and economic development. Using Ghana as an example, this research will examine the nation's funding and support for NTDs compared to that for HIV/AIDS and the effects on development that would occur if the former cause received the same global support as the latter. This paper will first review literature regarding NTDs and development, followed by the current situation in Ghana and what is being done to address endemic diseases. Additionally, the relationship between HIV/AIDS and development will be assessed, first through an examination of the literature and then through Ghana's approach to HIV/AIDS. This paper will conclude with an analysis of the disparities between support for NTDs and HIV/AIDS and opportunities for further research.

### **Literature Review- Neglected Tropical Diseases:**

The term 'neglected tropical diseases' first appeared in 2005 and refers to "group of chronic, disabling, and disfiguring conditions that occur most commonly in the setting of extreme poverty, especially among the rural poor and some disadvantaged urban populations" (Hotez and Kamath). Most of these seventeen diseases, which include Chagas disease, schistosomiasis, and hookworm, occur in low resource settings in sub-Saharan Africa. Populations in Latin America and Southeast Asia are also affected to a lesser degree. While neglected tropical diseases can be found throughout these regions, they are most common in areas of abject poverty due to poor sanitation and little public health infrastructure. Research shows that 100% of low income countries are affected by at least five NTDs (Manderson et. al).

The neglected tropical diseases' relationship with poverty is a vicious cycle; NTDs often occur in marginalized areas and their disabling effects perpetuate poverty.

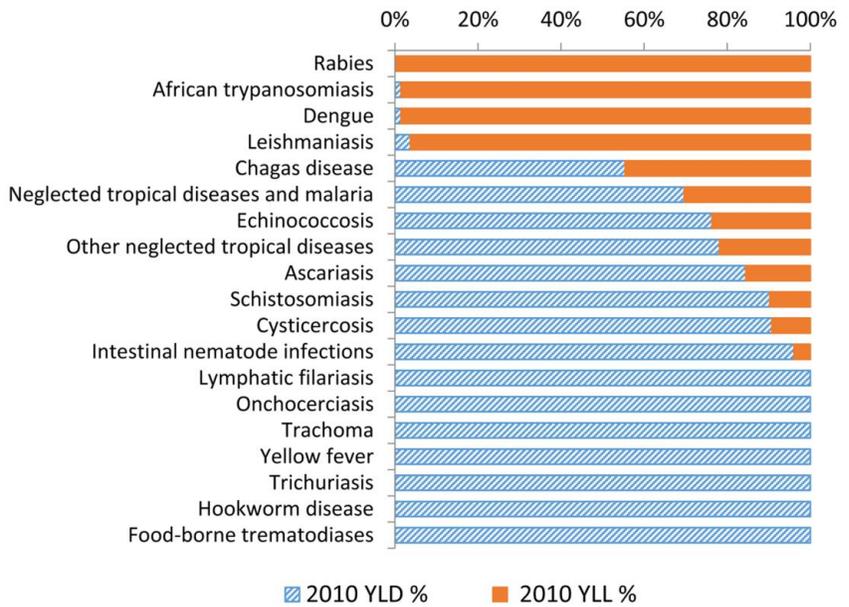
NTDs generally have low mortality rates, but varying rates of morbidity; symptoms and physical deformities caused by NTDs often leave those affected unable to work or participate in day-to-day activities. This loss of 'healthy' life is also known as the burden of disease. The World Health Organization (WHO) measures the global burden of diseases (GBD) in Disability-Adjusted Life Years (DALYs), which are "calculated as the sum of the Years of Life Lost (YLL) due to premature mortality in the population and the Years Lost due to Disability (YLD) for people living with the health condition or its consequences" ("Metrics: Disability-Adjusted Life Years"). This measurement was created in the 1990's to better document the lasting effects that chronic diseases with low mortality rates have. Ideally, the DALY unit can help policy makers prioritize which diseases to focus on in terms of economic and community impact, rather than focusing solely on mortality. Dr. Peter J. Hotez, US Science Envoy and Dean of the Baylor College of Medicine National School of Tropical Medicine, states that when looked in terms of DALYs, NTDs "...rank closely with diarrheal diseases, ischemic heart disease, cerebrovascular diseases, malaria, and tuberculosis as being among the most important health problems in the developing world" (Hotez et. al). When looking only at mortality rates and YLL, NTDs do not offer the same striking effects.

Though the GBD DALY measurement offers a better understanding of the effects of NTDs, many scholars believe the measurement is flawed and that GBD calculations severely underestimate the burden that NTDs diseases cause. Drs. Charles H. King and Anne-Marie Bertino argue that the YLD is not accurate, as there is no typical or average disability of a disease as well as additional inhibiting factors such as poverty and access to healthcare (King

and Bertino). Additionally, because NTDs affect mainly the poor living in rural areas, accurate epidemiological data is difficult to procure. They also argue that DALYs heavily stress YLL, which continues to emphasize communicable and lethal diseases that are more common in wealthier

countries. This puts NTDs at a disadvantage, as the number of deaths due to those diseases is estimated to be below half a million (Hotez), a fraction of the number of deaths caused by The Big Three. However, even when looked at in the current DALY measurement, research from the WHO shows that NTDs cause 56.6 million disability-adjusted life years lost, compared to 46.5 million DALYs due to malaria and 34.7 million DALYs lost due to TB (Utzinger et. al). Those with NTDs often suffer from more than one infliction, which can cause additional impairment and that co-morbidity is not calculated into the DALY.

Figure 1 shows the disparities between YLL and YLD for each of the NTDs. For most of the diseases, YLD accounts for most, if not all, of the DALY calculation (Hotez, Alvarado, et. al). Hotez, as well as others, argue that DALY measurements do not take into effect that some noncommunicable diseases, such as cancer, cardiovascular disease and liver disease, may result



*Fig. 1- Fractions of YLD and YLL (as components of DALYs) for each of the NTDs (Hotez, Alvarado, et al).*

from untreated NTDs. If GBD estimates included the link between NTDs and chronic conditions, there would likely be a rise in both years of life lost and years lost to disability due to NTDs.

The damaging effects that NTDs cause vary by disease and level of morbidity. Some NTDs may lead to anemia and malnourishment, while others can lead to blindness or the disfigurement of limbs. Symptoms may be acute and last for a few days at a time or leave the inflicted person permanently disabled. Studies have shown that infections are associated with “decreased physical function, decreased productivity, and decreased wage-earning capacity in later adulthood”, which King and Bertino list as a main reason why neglecting to control NTDs is perpetuating poverty. They also stress the lasting effects of the NTDs; most are chronic conditions and complications from infections often persist for half the individual’s life, even decades after treatment. Since those living in poverty often spend a majority of their life working, the physical and financial tolls NTDs take can begin early and can last a lifetime. The authors argue that without a better approach to NTDs, achieving the MDGs will be impossible.

Jeremiah Norris, Carol Adelman, Yulya Spantchak, and Kacie Marano, researchers at the Hudson Institute, note that the results of NTDs influence not only MDG six, but two (access to education), three (gender equality), four (improving child health), and five (improving maternal health). Many of the neglected tropical diseases disproportionately affect women and children, and may keep the latter from attending school on a regular basis. By controlling NTDs, multiple factors of poverty are addressed, and a foundation can be laid for alleviating the strain of poor health in impoverished areas. The authors cite the World Bank’s praise of the WHO’s Onchocerciasis Control Program, who called it one of “the most successful and cost-effective public health efforts ever launched” (6).

The researchers at the Hudson Institute attribute the Onchocerciasis Control Program's success partially to its use of public-private partnerships (PPPs). When national governments cooperating with pharmaceutical companies, international agencies (such as the World Bank and WHO), and non-governmental organizations, NTD interventions are more likely to succeed. PPPs dedicated to NTDs in Africa often cooperate with each other as well as governments and NGOs. Hotez, along with Drs. David H. Molyneux and Alan Fenwick write that some of the best approaches have been through PPPs and community-directed treatment initiatives. By coordinating efforts with governments and community health providers, PPPs are better able to distribute medications and control the transmission of NTDs. Scholars Bush and Hopkins also discuss the benefits of PPPs, highlighting that NGOs are more likely to succeed in increasing prevention and control when both international and local partnerships are created.

Awareness of the NTDs and their effects on impoverished populations has grown in past years, but remains overshadowed by the publicity on The Big Three. Critics of the institutional neglect regarding NTD policies and support cite the rhetoric surrounding NTDs (such as how they are classified as "other diseases" in the MDGs) as a vital disadvantage to the cause. By categorizing NTDs as "other diseases", not only is the opportunity for name recognition lost, but their importance undermined. Even in MDG 6's targets, only The Big Three are mentioned by name ("The Millennium Development Goals Report 2015"). Again, acknowledgment is simply implied in Target 8, which aims to "have halted by 2015 and begun to reverse the incidence of malaria and other diseases". The Target Indicators, which are set in place to help measure MDG progress, list only malaria and TB in their descriptions. Hotez, Molyneux, and Fenwick state that the lack of awareness affects donors and policy makers' actions; donors are hesitant to support causes they know little about and policy makers place a heavier focus on programs dedicated to

The Big Three. King and Bertino argue that the flaws of the DALY measurement also dissuade politicians from taking a firmer stance on NTDs. HIV/AIDS amounts to greater DALYs lost than NTDs, and when looked at only in terms of YLL, HIV/AIDS's greater mortality rate offers greater shock value. Since developing countries often lack adequate healthcare resources, delegating limited funds is a challenge. To better understand the impact that NTDs have on their constituents, national and international policy makers must understand the effects morbidity diseases have on a population, in addition to mortality rates. Global awareness of NTDs is not yet widespread, but is gaining traction; in 2010, the UN General Assembly recognized combating NTDs as an imperative step in reaching the MDGs (Norris et. al). Multiple governments (including high-income countries such as the United States) have expressed support for the prevention and control of NTDs, though they remain overshadowed by The Big Three.

When compared to The Big Three, there is a paucity of international health organizations and partnerships dedicated to the control of NTDs. However, various non-governmental and governmental organizations have developed with the goal of eradicating NTDs or eliminating them as a public health problem. The WHO released a report in 2012 detailing the impact of the neglected tropical diseases as well as listing how NTD interventions could "contribute directly to the attainment of several Millennium Development Goals" ("NTD RoadMap 2012" 1). The WHO set goals to eradicate certain diseases in certain countries by 2020, including blinding from trachoma by 2010. The report admits that the frailty of health systems in low and low-middle income countries may sway donors from giving aid over long periods of time. The Uniting to Combat Neglected Tropical Diseases coalition, supported by USAID the Bill & Melinda Gates foundation among many others, was founded to support the WHO in its mission of preventing and controlling NTDs. The coalition published the London Declaration, a commitment by the

coalition's partners to mitigate the effects of NTDs by 2020, in 2012. Through donations from pharmaceutical companies, 3.5 billion treatments have been given to endemic countries since the declaration's inception ("The Third Report: Country Leadership and Collaboration on NTDs").

### **Neglected Tropical Diseases in Ghana:**

Ghana is endemic with twelve diseases with a high number of DALYs lost, a prohibitive factor in the country's development. A study published by the Institute for Health Metrics and Evaluation at the University of Washington notes that life expectancy at birth for Ghanaians is 64.9 years, but when adjusted for health and disabilities, the figure drops to 55.3 years ("GBD Profile: Ghana"). The Government of Ghana (GoG) began its NTD Programme in 2006, with a focus on the distribution of medications known as "preventative chemotherapy" (the use of a combination of drugs for prevention purposes). The program, whose goal is to "prevent, control, eliminate or eradicate the Neglected Tropical Diseases from Ghana by the year 2020" ("Ghana Neglected Tropical Disease Master Plan 2013-2017"), with support from the GoG, Ghana Health Service, and WHO, published the Ghana Neglected Tropical Disease Master Plan in 2014. This five-year plan lists information about the twelve NTDs endemic in Ghana, as well as updated strategies on how to achieve the Programme's goal by 2020. Many of these goals are concurrent with or more aggressive than global goals recommended by the WHO. The master plan lists yearly milestones throughout the five-year period, such reductions in prevalence or increases in surveillance. Operational costs were estimated at \$12,676,761 USD per year for the first three years, with the majority of funds going to monitoring and evaluation/research and interventions for preventative chemotherapy diseases. In addition to funding, the GoG will distribute millions of donated ivermectin, praziquantel, and albendazole tablets per year.

Neglected Tropical Disease	Estimated Population Infected in SSA	Estimated Population Infected in Ghana	Ghana Prevalence Ranking
STH infections	29%	.2-.3%	-
Schistosomiasis	25%	58%	3
Lymphatic Filariasis	6-9%	~4%	-
Onchocerciasis	5%	~5%	7
Trachoma	3%	<.01%	-
Guinea Worm	<.01%	<.01%	2
Buruli Ulcer	<.01%	<.01%	2
Yaws	<.01%	0.70%	1
Rabies	<.01%	n/a*	-
Leprosy	<.01%	<.01%	-
Leishmaniasis	<.01%	<.01%	-
Human African Trypanosomiasis	<.01%	n/a*	-

*Fig. 2- Neglected Tropical Diseases and their prevalence in SSA and Ghana. \*These diseases are lethal and those infected typically die within a year of their diagnosis.*

The Ghana Health Service (GHS), part of the GoG's Ministry of Health, describes NTD prevention and control as a medium priority in terms of needed policies and additional resources. Despite extra funding as a result of the Master Plan, the priority ranking and lack of political focus on NTDs makes the goal of elimination and eradication difficult. Figure 2 lists the diseases currently found in Ghana, the worldwide prevalence, and the national prevalence. Ghana's NTD Programme focuses mainly on treatment, however, sustainable policy efforts are needed to help prevent the impoverished conditions that allow these diseases to occur. Many of the NTDs are transmitted through contaminated drinking water or vectors such as mosquitoes or black flies. National policies including vector control, increased support for sanitation in poor areas, and better access to health care could help reduce the prevalence of most NTDs. Currently the GoG has no policies or framework for NTD control ("Ghana Neglected Tropical Disease Master Plan 2013-2017" 13). Prior to the Master Plan, annual budget plans regarding NTDs were not consistently funded. This is partially due to financing for the health sector, as the GoG allocates

around only 13% of their budget for healthcare (12). This number falls short of the Abuja Declaration's recommendation that all African Union countries dedicate 15% to their annual budget to health. As a result of limited funding, poor sanitation, and inadequate access to treatment, NTDs continue to be endemic in Ghana.

Soil transmitted helminth (STH) infections such as hookworm, ascariasis, and trichuriasis, are the most common NTDs in sub-Saharan Africa and account for over 30 million DALYs lost. These conditions account for 80% of the disease burden of the top NTDs (Norris et al). It is estimated that between one-quarter and one-third of people living in SSA, as well as one-half of school age children (SAC), have at least one STH infection (Hotez and Kamath). The infections most commonly affect SAC and can cause malnutrition, stunted growth, and cognitive impairment. Ghana is considered endemic with a prevalence of about .2 to .3% of the population affected in certain districts ("Ghana Neglected Tropical Disease Master Plan 2013-2017" 16). STH infections are often recurring, and endemic communities may see increases in school absences and poor academic performance (Hotez and Kamath). The bodily effects and lost education due to soil-transmitted helminthiasis can impact adulthood as well and reduce the victim's earning potential later in life. Studies report that successful deworming campaigns lead to great economic growth in marginalized areas, and that for every \$1 spent on helminth treatment, a community will gain more than \$30 (Norris et al). The NTD Programme notes in its Master Plan that they hope to treat 80% of SAC for STH and reduce morbidity levels by 2020 through MDA in schools and improved water sanitation ("Ghana Neglected Tropical Disease Master Plan 2013-2017" 27).

Schistosomiasis, also known as bilharzia or snail fever, is the second most prevalent NTD after hookworm, with about 192 million cases in sub-Saharan Africa (Hotez and Kamath). Ghana

accounts for 7.8% of these cases, tied with the Democratic Republic of the Congo as the country with the third highest prevalence of the disease, at an estimated 15 million citizens as of 2009. SAC account for the majority of cases, followed by adolescents and young adults. Most infections occur in those who live near irrigation schemes or large dam reservoirs (Steinmann, et al). Communities living near Ghana's Lake Volta have a prevalence of schistosomiasis as high as 80-90% ("Ghana Neglected Tropical Disease Master Plan 2013-2017" 15). Infection occurs through contact with freshwater that has been contaminated with snails that carry the *schistosoma* parasite, which penetrates the skin and spreads through the blood to the bladder or intestine. Chronic schistosomiasis may lead to scarring and inflammation of these organs, as well as liver, spleen, and lung damage. Symptoms of chronic infection include growth stunting, fatigue, diminished physical fitness, and impaired cognitive development, all which may prohibit those affected from working or going to school. Communities with a high prevalence of schistosomiasis are often poor, and the disease perpetuates poverty through missed work and education. Thus, the global disease burden in SSA is estimated at 1.6 to 4.2 million DALYs lost each year, though some research suggests that this figure may be substantially higher (Hotez and Kamath). The NTD Programme has called for the treatment of 80% of SAC and increased education, monitoring, and evaluation to eliminate morbidity as a public health problem (an undefined measurement) ("Ghana Neglected Tropical Disease Master Plan 2013-2017" 27).

Trachoma is a disease caused by *Chlamydia trachomatis*. In Ghana, the disease affects mainly children and older women in the Northern and Upper West regions ("Ghana Neglected Tropical Disease Master Plan 2013-2017" 14). Spread through direct and indirect personal contact as well as *Muscae sorbens* larvae transmitted through flies, repeat infections can cause eyelids to turn inwards (entropion). If left untreated, eyelashes may consistently rub on the

eyeball (trichiasis) and result in irreversible visual impairment due to corneal scarring and opacification. Trachoma is considered to be the leading cause of preventable blindness of infectious origin worldwide (Ekuoba-Gyasi), with over 84 million people affected and 7.6 million in the trichiasis stage (“Ghana Neglected Tropical Disease Master Plan 2013-2017” 14). Trachoma is endemic in 29 of the 170 districts in Ghana, all in less developed northern regions. Since 2010, Ghana reported has reported no new cases reaching the trichiasis and blinding stage, though transmission of the disease has yet to cease (“NTD RoadMap 2012” 23). Despite the GoG’s reported elimination of blinding trachoma, the NTD Master Plan lists that the NTD Programme’s hopes to achieve the goal of elimination by 2020 (“Ghana Neglected Tropical Disease Master Plan 2013-2017” 27). Additionally, the Programme aims to reduce the prevalence of trachoma to <math>\lt; .05\%</math> in children 1-9 years old and .1% in those above age 15.

Lymphatic Filariasis is ranked as the NTD with the third or fourth highest global disease burden, with an estimated 2.0 million DALYs lost each year in sub-Saharan Africa (Hotez and Kamath). The parasitic disease, also known as elephantiasis, is spread by mosquitoes infected with *Wuchereria bancrofti* worms, which travel through the blood stream into the lymph vessels. While most cases are asymptomatic (though the parasite still damages the lymph system), a small percentage of people will develop lymphedema or hydrocele. These conditions typically manifest in fluid collection and swelling of the legs, arms, breasts, and genitalia as well as the hardening and thickening of the skin. Aside from social and psychological stigma as a result of disfigurement, disabilities due to lymphedema or hydrocele can prevent workers from taking part in normal activities, resulting in major economic loss. This is especially detrimental to those living in areas of poverty, such as farmers in Northern Ghana, where episodes of acute adenolymphangitis (painful swelling, fever) last an average of five days (Gyapong et. al). In

India, estimates reported that those inflicted with chronic LF may have lost 11 years of productivity and 15% of their individual income per year (Norris et al). As of 2013, LF was present in 74 out of 170 districts in Ghana, with hydrocele or lymphedema affecting up to 4% of the infected population (“Ghana Neglected Tropical Disease Master Plan 2013-2017” 15). The WHO hopes that by 2020, transmission will have ceded in all countries where LF is endemic (“NTD RoadMap 2012” 26). The NTD Programme as a more ambitious objective of eliminating LF by 2015 and to manage current cases through community based MDA (“Ghana Neglected Tropical Disease Master Plan 2013-2017” 26).

Onchocerciasis, known colloquially as river blindness, is another filarial infection transmitted through black flies. After a human is bitten by a black fly infested with the *Onchocerca volvulus* parasite, worms are released into the body’s subcutaneous tissues (“Onchocerciasis (river blindness) - disease information”). The larval worms spread to the skin and eyes, possibly resulting in severe itching and skin disfigurement, as well as irreversible blindness that leaves the victim disabled. As of 2009, Ghana reported the 7<sup>th</sup> highest amount of cases of river blindness, preceded by six other countries in SSA (“NTD RoadMap 2012” 29). Onchocerciasis is endemic in 40 of Ghana’s districts, with local prevalence as high as 11.1% (“Ghana Neglected Tropical Disease Master Plan 2013-2017” 15). To combat transmission of onchocerciasis, the NTD Programme hopes to increase MDA in hyper-endemic communities and increase vector control through the extermination of black flies.

Yaws, a skin disease that results in bone problems and painful ulcers covering the body, was thought to have been controlled or eradicated in most endemic countries by the 1970’s. However, following the dismantling of most yaws treatment programs, the disease has reemerged in impoverished communities that have little to no access to healthcare (Asiedu).

Ghana is the most endemic country for yaws (Kazadi et. al) with a national prevalence of about 0.7%. Some rural communities (mainly those in the Eastern and Southern region) report prevalence as high as 20% in some schools (“Ghana Neglected Tropical Disease Master Plan 2013-2017” 16). These areas, most located in the humid forest zone, tend to be overcrowded with insufficient clean water, leading to poor hygiene and sanitation. The GoG and the NTD Programme called for the the prevalence of yaws to half by 2013 and to be eliminated by 2015, rather than the WHO’s goal of 2020.

Ghana is also one of the most endemic countries for dracunculiasis, also known as Guinea worm disease. The disease is transmitted through drinking unfiltered water contaminated with copepods and is most commonly reported in SAC. About a year after consuming the water, a long white worm up to 1 meter in length will emerge from a blister on an appendage (most commonly the feet or calves) (Glenshaw et. al). The protrusion of the worm is extremely painful and must be done carefully to avoid breakage of the worm. If an infected person places their appendage in a pond or other water source to seek relief, that water may become contaminated and the disease can spread to others that drink it. In rural communities with inadequate access to healthcare, infection is often recurring. Better sanitation and clean drinking water can help prevent the cycle of the disease. Though Ghana has seen a major reduction in prevalence of Guinea worm since the creation of the Ghana Guinea Worm Eradication Programme in 1989 (and some reports state it has been eradicated since 2011) (“Ghana Neglected Tropical Disease Master Plan 2013-2017” 19), it is highly likely that most cases are not being reported due to a lack of awareness and communication in poorer regions. The GoG offers contradictory reports on whether the disease has been truly eliminated, but has called for its eradication by 2015.

Ghana reports the second highest number of cases of Buruli ulcer after its neighbor, Cote d'Ivoire. Though there are a reported 1,000 cases per year (“NTD RoadMap 2012” 33), the GoG states that official epidemiological data may underestimate the amount of cases due to poor surveillance, misdiagnoses, and a lack of diagnoses in poor communities (“Ghana Neglected Tropical Disease Master Plan 2013-2017” 18). The disease is caused by the *Mycobacterium ulcerans* bacterium, which can lead to chronic infection and disability (“Buruli ulcer”). In their 2012 report, the WHO stated their hopes to treat 70% of cases through antibiotics by 2020 (“NTD RoadMap 2012” 24). Early diagnoses and treatment can prevent permanent deformities, which often carry a stigma that discourages the inflicted from taking an active role in their community.

NTDs in Ghana that affect populations to a lesser extent include rabies, Human African Trypanosomiasis (HAT), leprosy, and leishmaniasis. These diseases, though present in the country, have already achieved WHO elimination targets. Surveillance for these conditions is done less frequently than more endemic diseases, however prior data showed no new cases of HAT since 2000 (“Ghana Neglected Tropical Disease Master Plan 2013-2017” 17). Rabies cases are rarely confirmed by healthcare providers and there is little official data on the topic. The latest data referenced in the Master Plan listed 8980 cases of leishmaniasis in 2004 (8) and 547 new cases of leprosy in 2011 (19).

Most NTDs can be treated or cured through a single dose of certain medications. The use of mass drug administration (MDA) including albendazole, praziquantel, ivermectin or diethylcarbamazine, and azithromycin, has seen positive effects on multiple diseases in the developing world. MDA efforts have led to near eradication of LF in Egypt and Zanzibar and trachoma in Morocco (Hotez et. al). An integrated MDA approach using a combination of the

four medications can prevent or treat the seven most common NTDs for as little as \$0.50 per person per year. This is especially notable when compared to malaria and HIV/AIDS treatment, which cost \$6.64 and \$700 per case annually. Studies have shown an economic return rate of 15% to 30%, with “conservative estimates at \$20 in benefits for every \$1 invested” (Norris et. al) for LF alone. This is because NTD treatment and control prevents physical problems from occurring, thus concurrently preventing the stigma from disabilities and disfigurements that many victims face. When NTDs and their symptoms are treated, citizens are better able to attend school and work regularly, boosting their earning potential and benefitting their nation’s economy.

### **Literature Review- HIV/AIDS:**

Though neglected tropical diseases have plagued humans for centuries, human immunodeficiency virus (commonly abbreviated as HIV) and acquired immunodeficiency syndrome (AIDS) was only discovered in the past century. The condition was first described in the early 1980’s after doctors reported multiple cases of *Pneumocystis carinii* pneumonia in homosexual men (De Cock et. al). Researchers would soon identify the correlation between sexual intercourse and/or intravenous drug use and HIV/AIDS, as well as the virus’s high mortality rate. Though studies began in the U.S., epidemiologists discovered a much larger prevalence in those residing in SSA. Today, the WHO estimates that 36.9 million people are living with HIV/AIDS, with SSA accounting for 25.8 million cases (“HIV/AIDS”).

HIV is transmitted through bodily fluids and those infected may not show symptoms for weeks or months. The virus weakens the immune system and may lead to weight loss, flu-like symptoms, and increased susceptibility to other infections like tuberculosis, meningitis, and some cancers (“HIV/AIDS”). The advanced stage of the virus, which is defined as a T cell count

less than 200 or the development of certain conditions, is known as AIDS and may take 2 to 15 years to develop. Though there is no cure for HIV or AIDS, damage to the immune system can be delayed through the use of antiretroviral drugs (ART). The WHO reports that an estimated 14.9 million people (or 40% of those living with HIV/AIDS) are receiving ART treatments. Similar to NTDs, the highest prevalence of HIV/AIDS exists in SSA. A study published by the Institute of Health Metrics estimates that HIV/AIDS accounts for 3.3% of the global disease burden at 81 million DALYs lost (Ortblad, Lozano, and Murray). Only 5.3% of the DALYs were due to YLDs, with the remaining 94.7% due to YLLs. HIV/AIDS also carries a negative stigma among victims.

Due to increased awareness following the 1980s, global support for HIV/AIDS dwarfs that for any other health related cause. This is especially true for donations given to countries in SSA, where most international awareness is focused on. Dr. Peter Amico of Brandeis University and Christian Aran and Carlos Avila of UNAIDS argue that the funding for HIV/AIDS in SSA is disproportionate to the actual disease burden (especially when compared to other regions like Southeastern Asia). The decision on where funding goes does not reflect how many people have the disease or where the disease is most prevalent. Drs. Christopher J.L. Murray and Joseph Dieleman of the Institute for Health Metrics and Evaluation note inequalities in international assistance as well, such as how countries “received less than US\$60 of malaria funding for every year of healthy life lost to malaria, [while] Latin America and the Caribbean received nearly US\$2,000 of malaria funding per year of healthy life lost”. While external global support has increased over time, funding is often distributed based on donor preference rather than recipient need.

Domestic spending on HIV/AIDS surpassed international support in 2011, and was estimated by the Kaiser Family Foundation to have totaled about US\$9.65 billion in 2013 (Kates, Wexler, and Lief). In 2012, two-thirds of low and low-middle income countries (LMICs) increased their funding for HIV/AIDS. However, despite these increases, healthcare in LMICs depend on foreign aid. The United States is the largest provider of governmental assistance toward HIV/AIDS care, with the President's Emergency Plan for AIDS Relief (PEPFAR) accounting for 73% of bilateral aid and 23% of total HIV funding in 2013. Overall, donor governments funded over \$8.46 billion for HIV/AIDS that same year. Multilateral organizations such as The Global Fund to Fight AIDS, Tuberculosis, and Malaria and the World Bank, as well as charities such as the Bill & Melinda Gates Foundation also contribute large sums to HIV/AIDS care.

The Institute for Health Metrics and Evaluation reports that in 2011, \$7.7 billion USD was given in health assistance for HIV/AIDS (Murray and Dieleman). "Other diseases", which likely includes NTDs and encompasses everything but malaria, TB, maternal/child health, noncommunicable diseases, tobacco, and health sector support, accounted for just \$6.5 billion USD. Overall, total spending for The Big Three equaled over \$10.7 billion USD, or one-third of global health spending. In 2012, the U.S. government donated \$7.1 billion USD in health aid, of which only \$89 million USD went to NTDs (Norris et. al 15). In contrast, at least \$4.2 billion USD was allocated for HIV/AIDS and malaria programs.

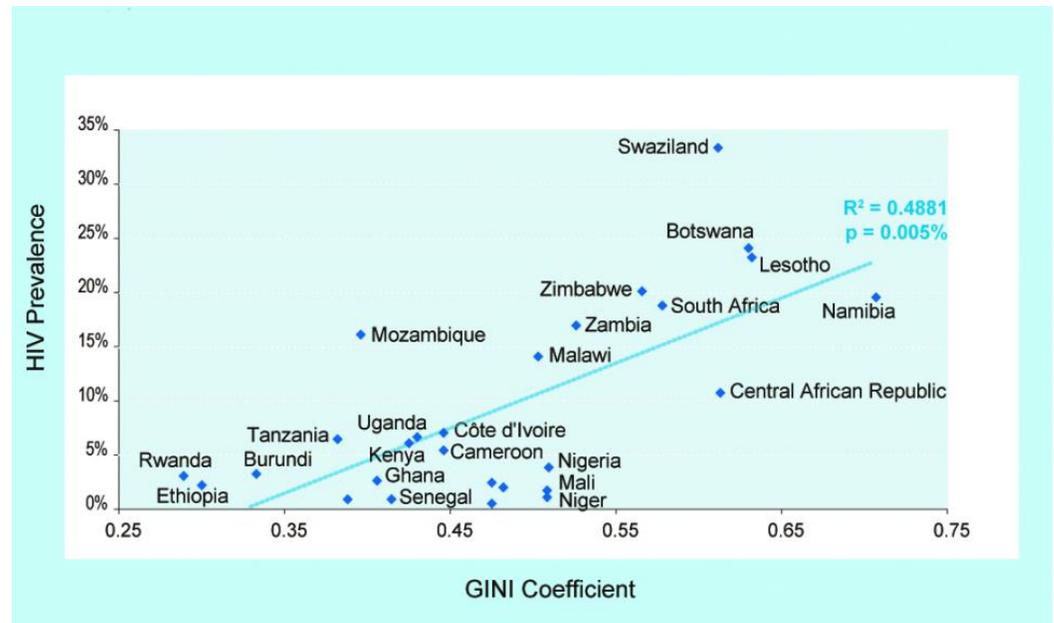
Analysis of HIV/AIDS's impact on poverty varies among scholars and studies. Drs. Peter Piot, Robert Greener, and Sarah Russell counter the misconception that the condition affects

mainly the poor by noting that “the fact that most people living with HIV in the region today are poor simply reflects the fact that the epidemic has now spread throughout

the generalized population in a region that has a high

proportion of poor people”. Being “poor” is a matter of perspective. Countries endemic with HIV/AIDS often see the highest prevalence among their wealthier citizens (though not the wealthiest), especially those living in urban areas. Piot, Greener, and Russell argue that the link between poverty and HIV/AIDS is weaker than that of income, gender equality, and HIV/AIDS.

Fig. 3 shows the correlation between the GINI Coefficient and prevalence of HIV. The authors note that these factors affect social behaviors, including sexual behavior. Greener, along with Stuart Gillespie and Suneetha Kadiyala note that this is likely due to more frequent sexual partner changes among the wealthier and more educated. Because countries report a lower prevalence within poorer communities than wealthier ones, the authors state that “AIDS cannot



*Fig. 3 HIV Prevalence and Income Inequality in Africa. The Gini coefficient has a value between 0 and 1, representing the extremes of income distribution (Piot, Greener, and Russell).*

accurately be termed a ‘disease of poverty’”. Nevertheless, they also write that poorer households suffer more due to the effects of the disease than richer households; in India financial burdens due to HIV/AIDS ranged from costing up to 82% of a family’s income for the poorest quintile and 20% for the richest (Piot, Greener, and Russell).

HIV/AIDS causes financial strain on families regardless of wealth status due to the high cost of treatment. Additionally, loss of work may occur due to infections or symptomatic episodes. However, studies regarding the relationship between HIV/AIDS and economic growth have shown contrasting results. In a Harvard Business School report by Amrita Ahuja, Brian Wendell, and Eric Werker, the association between the virus and economics was found to be “minimal” (38). The authors found that factors such as political stability and institutional development were more likely to aid in expansion. They note that the link between HIV/AIDS and SAC missing school was stronger than that of economic growth, though Jane G. Fortson of the University of Chicago writes that SAC affected by HIV/AIDS (either the child, a family member, or the teacher has the disease) will only lose 0.3 years of schooling compared to those not affected (13). SAC in especially endemic areas (10% prevalence or higher) may lose 0.5 years of schooling. Alywn Young, a professor at the London School of Economics and Political Science argues that the epidemic has had a neutral effect on economic growth. He states that despite the negative association between HIV/AIDS and education, fertility declines due to the disease has mitigated over-population problems and therefore resulted in better, sustainable living conditions (Fortson 1). Reducing fertility rates offsets the negative effects regarding not only education, but adult work performance as well.

## **HIV/AIDS in Ghana**

Ghana is ranked as the nation with the 34<sup>th</sup> highest prevalence of HIV/AIDS, preceded by fellow West African nation Guinea and followed by Mali and Sierra Leone (“Country Comparison: HIV/AIDS - Adult Prevalence Rate”). The disease affects approximately 1.47% of Ghanaians. According to the Ghana AIDS Commission, the GoG’s prevalence is highest in the Eastern, Ashanti, and Greater Accra Regions at 3.7%, 3.2%, and 2.7%, respectively (“Summary of the 2013...”). These regions are all located in the southern half of the country. Comparatively, in the rural north (where poverty rates are higher), regions tend to report a prevalence lower than average. Two of the three northernmost regions, the Northern and Upper West regions, document rates at about 0.8%. The government reports that the majority of new HIV/AIDS cases come from unprotected sexual intercourse between heterosexual couples in urban areas.

The Ghana AIDS Commission (GAC), the GoG’s national HIV/AIDS response, was created in 2002 in order to lessen the effects of the disease throughout the country. Since its implementation, UNAIDS estimates that the rate of HIV/AIDS among Ghanaians dropped from 3.4% in 2002 to its current prevalence of 1.5% (“Country AIDS Response Progress Report – Ghana” 30). GAC’s success is most likely attributed to their education and policy campaigns. Awareness of the dangers of the virus and how to reduce the likelihood of contracting the disease has shown an increase in the use of condoms and increased knowledge of HIV/AIDS status (whether or not one is positive for the virus) (15). An individual knowing that they are positive for the virus results in the individual engaging in less unprotected sexual intercourse, whereas one that was unaware of their status would be less likely to increase their precautions without other cause.

Funding for HIV/AIDS in Ghana comes mainly from international organizations. In 2011, \$60,807,945 USD (or 74.4%) of support for the disease came from foreign funding (99).

Most of the money does not go directly to GAC, but rather NGOs, community-based organizations, or other public health programs (97). The GoG provided \$14,854,634 USD (18.2%) and private sources such as domestic donations comprised the remaining 7.4%. Most international funding is allocated toward prevention or treatment, while the majority of public funding goes toward orphans that have lost their parents to HIV/AIDS or toward administration costs (the latter comprises 30.2% of the GoG's support for HIV/AIDS). PEPFAR alone accounted for \$15,000,000 USD in the same year ("Ghana Planned Funding, FY 2011").

Ghana's overall prevalence of HIV/AIDS, though distant from the high rates in Southern Africa, is similar to that of other West African nations such as Guinea, Mali, and Sierra Leone. These countries are notable as the countries that, along with Liberia, have suffered with an Ebola outbreak since the fall of 2014. Many scholars and scientists agree that the epidemic was widespread in these nations due to high poverty rates, inequality, and institutional strain following civil wars and political unrest. Without a stable healthcare system in place, the hemorrhagic fever was able to affect tens of thousands in West Africa. Though Ghana lacks comprehensive healthcare coverage, its political and economic stability are stronger than its neighbors and most other sub-Saharan African nations. However, despite the efforts of the GoG, GAC, and international organizations, prevalence remains high.

### **Analysis & Discussion- Neglected Tropical Diseases vs. HIV/AIDS in Ghana:**

The discrepancies between funding and disease prevalence are obvious. Though Ghana's national funding for HIV/AIDS and NTDs is similar, global funding for the diseases is extremely disproportionate to the number of people they affect. NTDs affect over 14% of the world's population, yet the largest international donor, the U.S., only dedicated 1.3% of their foreign health aid to the afflictions. HIV/AIDS affects about 1% of all people but receives 25% of all

international assistance for healthcare. Despite Ghana being ranked 34<sup>th</sup> highest for the prevalence of HIV/AIDS, foreign support for the disease in this nation alone accounts for as much funding as two-thirds of the US's entire budget for NTD support. PEPFAR alone donated about \$12,500,000 USD toward HIV/AIDS in 2013; the same amount was spent by the GoG on the NTD Programme the same year.

Allocating healthcare resources in low and low-middle income countries is not an easy task. To choose what conditions receive funding and what amount requires a thorough understanding of how the disease affects the population beyond just symptoms and communicability. Best approaches require knowledge of the social and economic impacts diseases have as well. Unfortunately, policy makers too often look at mortality rates while assessing the impacts of diseases. Even the DALY measurement for HIV/AIDS and NTDs offers a flawed perspective on disease consequence. HIV/AIDS has been responsible for an estimated 81 million DALYs lost, and NTDs at 56.6 million. Though per person, HIV/AIDS appears to cause much more strain than NTDs, the ratio of YLL to YLD makes it difficult to compare the two. The majority of the DALY for HIV/AIDS comes from YLL while NTDs result in higher YLD. The DALY greatly underestimates the impact of YLD; for example, someone with a disability due to NTDs that lives a long life will likely need more care over their lifetime than someone living with HIV/AIDS (as their lifespan is typically shorter). Not only is the person inflicted with an NTD unable to attend school, work, or help with the home, but they will likely require a family member to care for them. This increases the financial strain a household may see due to disability or disfigurement, as the impact of the life of the care taker is not included into the DALY.

Unfortunately it is impossible to fully understand the negative impact that NTDs have regarding economic development, especially in poor communities. Gathering data prevalence and transmission rates in low-resource areas is difficult on its own, and there is a scarcity of data regarding financial losses due to NTDs. However, the studies that have been done consistently report a correlation between control of NTDs and an increase in individual and community earning potential. Investments into prevention and control result in significant economic gains. The Hudson Institute cites studies which estimate that for every dollar that is spent on support for LF, a community will gain anywhere from \$20 to \$60 (Norris et. al 6). Providing surgery to prevent blindness due to trachoma was also cost-effective, yielding \$13 to \$78 per DALY averted (12). NTDs take a toll on communities by disabling their workers; for example, LF can cause the victim to lose up to 11 years of productivity, a number especially worsened by the fact that many of its victims work in the agricultural sector.

The average person may fall victim to the stereotype that HIV/AIDS is a disease of poverty and overestimate its effect on development. This is likely due to the awareness that the cause has received; charities and other organizations have painted a picture of an impoverished African continent ravaged by the condition. The global awareness for HIV/AIDS is widespread, and the cause receives so much in donations due to the work of charities such as (RED) and celebrities including Bono of the band U2. The UN is also responsible for showcasing the disease, as seen in its emphasis in MDG 6 and SDG 3. While any endemic disease with effects as harsh as those of HIV/AIDS will undoubtedly cause some economic loss, it is vital to remember that the virus is most common in the middle class. Though the poor see greater economic strain (due to the high cost of treatment and lack of available adequate care), for most households, an HIV/AIDS diagnosis is not a financial death sentence. On the other hand, the real diseases of

poverty, NTDs, perpetuate poor conditions and keep low-resource areas underdeveloped. Global awareness of the tropical conditions has remained low, despite the fact that the diseases have existed for centuries.

The UN should take a bigger role in highlighting the relationship between NTDs and poverty. The MDGs neglected to even mention NTDs, and the more recent SDGs seemed to mention the term in passing rather than note its importance. When discussing “facts and figures” related to the creation of SDG 3 (Good Health and Well-Being), HIV/AIDS and related terms was referenced over 10 times, while NTDs were again overshadowed as seen in the sub-heading “HIV/AIDS, Malaria, and other diseases” (“Goal 3: Ensure healthy...”). NTDs are mentioned only once during SDG 3’s target indicators, when the UN calls for the eradication of The Big Three, NTDs, hepatitis, water-borne diseases (which can include NTDs), and other communicable diseases. The link between NTDs, SDG 3, and SDGs 1 (No Poverty), 4 (Quality Education), 8 (Decent Work and Economic Growth), and 10 (Reduced Inequalities) is ignored. A larger emphasis on NTDs would add to the success of multiple goals and target some of the true causes of poverty. Meanwhile, HIV/AIDS is often viewed as a disease most commonly affecting the poor and thus receives more attention from the UN and other organizations. However, in many sub-Saharan African nations, this is not the case. While there is a strong correlation between inequality and the prevalence of the virus, it is often those in the middle class that are affected rather than those living in poverty. This is true in Ghana, where areas such as the Greater Accra region, an urban setting where the capital is located, has a prevalence over three times as high as the more rural Upper West region.

Ghana has seen success in combating HIV/AIDS transmission rates by decreasing the prevalence of the disease by more than half in just over a decade. While that is not to say that

current efforts should cease (as they are obviously working), resources could be shifted to NTDs to reach more people and help develop the country's economy, particularly in the northern regions. Ghana is regarded as one of the more developed nations in SSA, yet they rank among the highest for NTDs such as schistosomiasis, yaws, and Guinea worm. By eradicating or eliminating more diseases, the nation could see their poverty rates decrease and increased economic growth.

Misconceptions such as impact on poverty lead to disproportionate support for certain causes. Regarding international donations for healthcare, people are more likely to donate to causes they hear the most about. HIV/AIDS, the largest recipient of international health funding, while a terrible affliction, may not be the epidemic many think it is. For countries like Ghana where the condition is still considered of epidemic proportions (defined by the WHO as 1% or higher), support for HIV/AIDS may not be as beneficial as people think. Yes, funds are necessary to sustain a decline in transmission, but the abundance of funding may be better used in other areas. Given that the cost of treatment is hundreds to thousands of times higher for HIV/AIDS than NTDs, more people could be treated for their disabling conditions with even one million dollars more in support for the latter. A study by the Hudson Institute found that inexpensive MDA programs typically yield an economic return rate of 15% to 30% due to increased abilities to attend school and go to work. Impoverished communities could see rapid development through the use of comprehensive MDA to treat diseases such as schistosomiasis, lymphatic filariasis, and soil-transmitted helminthes. Scholars have debated on the true economic consequences of HIV/AIDS, but study after study has shown the positive effects that eliminating even just one NTD can have on a community.

## **Conclusion:**

Countries and international organizations should allocate more assistance to citizens living in poverty in order to see better economic and social development. In the case of Ghana and NTDs, better healthcare coverage for the tropical conditions would result in more consistent education and higher productivity rates in endemic/impoverished areas, two important aspects of development. Social stigma, in addition to the physical disfigurements that NTDs cause, would diminish, and rural, underserved populations could break their cycle of poverty. Increased support for NTDs results in an increased economic development, especially for the poor. In contrast, increased support for HIV/AIDS, while successful, has shown neutral progress toward a country's growth.

Countries like Ghana that have low rates of HIV/AIDS but a high prevalence of NTDs should also increase awareness of the latter conditions in order to encourage more international funding for the afflictions that are most prohibitive toward their development. Unfortunately support is too often given based on awareness of a cause rather than importance of that cause. International donors may think their funds are going to help the poor in Africa, although in some cases their donations may not reach the people they think they are helping. The UN should also offer better solutions for NTDs, rather than place them in the shadow of The Big Three. Knowledge of diseases beyond DALYs and mortality is necessary to understand which conditions affect which people and how so. For some sub-Saharan African countries, additional funding for the "other diseases" may be a huge component in aiding economic and social stability.

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