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Theme:

**The Control and Elimination of Preventive
Chemotherapy Neglected Tropical Diseases
(PC/NTDs) in Nigeria: Strategy for meeting the
WHO 2030 Elimination goals**

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The Nigeria Case Study in NTD Control Efforts

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Abstract

Neglected Tropical Diseases (NTDs) are a category of 20 diseases mostly found in the tropics. These diseases are termed neglected because they, unfortunately, receive relatively little attention from national governments and are of low priority for international public health issues. NTDs are endemic in 149 out of 193 countries worldwide, representing 77.2% of the global distribution. More than a billion people, including more than 500 million children, are afflicted by at least one NTD, and 500,000 people die each year because of infections. The global burden of NTDs has brought them to the limelight and consequently resulted in efforts towards controlling and eliminating them, culminating in the WHO 2021 to 2030 road map that targets NTDs for elimination by 2030. The Federal Ministry of Health of Nigeria initiated a program for national NTD control and elimination in 2009. This program focuses on integrated and cost-effective approaches to control and/or eliminate NTDs. As a follow-up to the 2009 national NTD program, Nigeria keyed into the first road map that aimed at the eradication or prevention of transmission by the year 2020 and the second road map which aims to eliminate them by 2030. These have resulted in some modest successes, particularly in the eradication of guinea worm, mapping of onchocerciasis and Lymphatic filariasis as well as mass distribution of drugs. There are several challenges faced in the NTDs control and elimination efforts as identified in this paper and solutions proffered. NTDs in Nigeria still constitute major public health problems and obstacles to socioeconomic development. It is expected that greater action/commitment will be taken in the new 2021-2030 road map tagged to achieve the set targets for the elimination of NTDs by the end of 2030.

Keywords: Neglected Tropical Diseases, Control, Elimination, Nigeria

Introduction

Millions of people living in the world, particularly in the tropics, are affected by a heavy burden of communicable and non-communicable diseases. Due to the devastating nature of communicable

diseases, much attention has been paid by the global community over the decades especially, the “big three” namely HIV/AIDS, tuberculosis, and malaria. Accordingly, large-scale financial support through strong initiatives sponsored by the Group of Eight (G8) governments has been invested in the fight

against these diseases. Interestingly, these control efforts have yielded impressive results.

However, several other diseases abound in the tropics and continue to thrive owing to a combination of harsh economic conditions, poverty, poor housing, inadequate environmental sanitation, limited health facilities, climate change, and a host of other factors. Accordingly, these were forgotten diseases and most endemic to the tropics [1]. Unfortunately, these neglected or forgotten diseases have received relatively little attention from national governments and are of low priority for international public health issues. Since this group of neglected diseases is mostly prevalent in the tropics and sub-tropical countries, they were tagged Neglected Tropical Diseases (NTDs) during stakeholder meetings held in 2003 and 2005 in Berlin, Germany, to set the pace for global NTD initiatives [2].

According to the World Health Organization, Neglected Tropical Diseases (NTDs) are a category of 20 diseases mostly found in the tropics. These conditions include Chagas disease, leishmaniasis, leprosy, rabies, Buruli ulcer, dengue fever, lymphatic filariasis (elephantiasis), human African trypanosomiasis (HAT) (sleeping sickness), dracunculiasis (guinea worm disease), onchocerciasis (river blindness), schistosomiasis, soil-transmitted helminthiasis (ascariasis, hookworm, trichuriasis), echinococcosis, food-borne trematodiasis, cysticercosis/taeniasis, trachoma, and yaws. They have devastating health, social, and economic consequences for more than one billion people [2].

The symptoms of NTDs differ significantly from one disease to another. Some are acute, while others, such as sleeping sickness, leprosy, and guinea-worm disease, are chronic [3]. NTDs rarely cause death but can cause significant disability that persists for a lifetime. Unlike some common infectious diseases, most NTDs do not spread widely; they pose little risk to people in high-income countries. Instead, climate and its effects on the distribution of vectors and reservoir hosts, in addition to poor socioeconomic conditions, limit their distribution largely to the tropics.

Among the 20 NTDs recognized by the WHO, Nigeria is endemic and currently controls or eliminates 12 of them. These include guinea worm disease, onchocerciasis, lymphatic filariasis,

schistosomiasis/soil-transmitted helminths, human African trypanosomiasis, trachoma, leprosy, Buruli ulcer, rabies, yaws, leishmaniasis, and snake bites. One of the many factors that have allowed these infectious diseases to thrive, especially in rural populations, is ignorance and lack of knowledge about how to recognize and treat NTDs [4].

Why Control or Eliminate Neglected Tropical Diseases

The Burden of NTDs

The burden of NTDs is high. NTDs are endemic in 149 out of 193 countries worldwide, representing 77.2% of the global distribution. More than a billion people, including more than 500 million children, are afflicted by at least one NTD, and 500,000 people die each year because of infections. It is noted that NTDs rank among the top 10 global causes of early deaths and years of healthy life lost to long-term impairment [5], while it has been reported that the majority of NTDs are severely debilitating, accounting for almost 57 million disability-adjusted life years (DALYs) [1,6]. Accordingly, DALYs are extensively employed to evaluate the long-term burden of NTDs; however, they do not account for the full political and social consequences of diseases that often maim rather than kill [7].

Sub-Saharan Africa (SSA) accounts for 90% of the NTD disease burden owing to widespread poverty and the distinct characteristics of some NTDs to thrive in specific climates [8]. For instance, soil-transmitted helminths, schistosomiasis, lymphatic filariasis, trachoma, and onchocerciasis affect more than 500 million people in sub-Saharan Africa, resulting in various disabilities [9]. Furthermore, seven million pregnant women and 40–50 million schoolchildren are affected by hookworm infections with disabling complications [10].

NTDs have a negative influence on the general health and life expectancy of disadvantaged communities as well as an economic impact on their ability to work [11]. The economic impact of NTDs is determined by the type and intensity of infection. Due to severe disability, people with NTDs are unable to work and produce income at a local level, which has an impact on the national economy. In general, NTDs cost billions of dollars in lost revenue each year by interfering with agricultural and industrial labour productivity, as well as the wage-earning capacity of people who are already impoverished and living on less than \$2 per day [12].

Socioeconomic Impact of NTDs.

- (i) *High mortality:* In addition to debilitating illness, severe disfigurement, and disability, NTD infections result in death and reduced life expectancy. An estimated 832,900 infected people die annually [13]. Studies have shown that severely affected members of a community die much earlier than those who are uninfected. In onchocerciasis, for instance, blind people on average die earlier than their peers with normal sight [14].
- (ii) *Social life:* Some NTDs affect the social lives of infected people in endemic communities, resulting in various forms of stigmatization, discrimination, and marginalization. Physical impairments, such as scarring and deformity, may result in low self-esteem, marital conflicts, spousal abandonment, divorce, and the breakdown of family structure [15].
- (iii) *Labour and productivity:* Many NTDs affect the labour and productivity of afflicted individuals in endemic communities. For instance, those who are blind to onchocerciasis or trachoma or afflicted with gross lymphedema and elephantiasis of the limbs and hydrocoele are unable to take up and effectively perform useful economic activities. They often abandon their productive jobs and switch to less remunerative jobs to enable them to cope with their incapacitation [16]. Furthermore, many incapacitated farmers are forced to abandon their distant fertile farmlands for less fertile ones around their homes to enable them to cope [17]. This results in low productivity in poor endemic communities, which increases the degree of poverty.
- (iv) *Effect on population:* NTDs have been reported to cause population maladjustments in hyperendemic communities. For example, the low population densities and desertifications of many fertile river valleys in the Savannah zone of West Africa are due to onchocerciasis [18]. Blindness and impaired vision resulted in the emigration of people, especially young ones, from remote endemic areas to other places in search of better opportunities and to beg for alms. The consequence is leaving only the elderly and very young people (who are non-productive) in such communities, exacerbating the degree of poverty in such affected communities.
- (v) *Effect on education:* NTDs, such as schistosomiasis and soil-transmitted helminthiasis, directly affect the education of infected school-aged children by interfering with their growth rate and cognitive development. Bouts of sickness/illness affect school attendance and overall performance on examinations and, by implication, affect their future development [19]. In addition, the incapacitation of parents or guardians indirectly affects their education, as they may be expected to fill the gaps created for economic activities. Sometimes, children may be forced to withdraw from school and be introduced to wage-earning activities (i.e., child labour) at young ages. They may be required to lead a blind parent to seek economic survival through alms begging [20].
- (vi) *Cost of treatment and lack of access to healthcare:* In addition to other impacts, the cost of treatment of NTDs by persons and families imposes a tremendous socioeconomic burden. Due to the level of poverty in endemic areas, the cost of treatment and care may be greater than the income of people. For instance, in Ghana, it costs men with hydrocoele about USD 30 for hydrocoele repairs, which represents over a month's income for the average Ghanaian [21]. It was also reported that an individual with severe onchocercal skin disease (OSD) spends an additional USD 20 per annum on health-related expenditures compared to an uninfected person [22]. Furthermore, the long-term nature of NTD infections in many communities is compounded by a lack of access to quality healthcare [23].

Although these diseases afflict the world's vulnerable and disadvantaged people, driving them further into poverty, global and national responses to NTDs have been inadequate. Therefore, instead of being ignored, these deadly diseases should be a priority for endemic countries [24].

3.0 History of Neglected Tropical Diseases Control Efforts

The control of neglected tropical diseases dates to ancient times when they were recognized because of their distinct signs and symptoms, especially associated disfigurements. Consequently, there have been attempts to treat or control these illnesses for thousands of years. For example, ancients devised methods for slowly removing guinea worms from the subcutaneous tissues of the lower extremities, as well as a method for immunizing people against leishmaniasis by inoculating children on the extremities or buttocks with live *Leishmania* parasites to prevent disfiguring ulcers on the face caused by sandfly bites [25]. "Leishmanization" in the Middle East and Central Asia undoubtedly preceded the first Jennerian immunization attempts in the late 1700s by centuries.

Unprecedented attempts to control NTDs were made in the 20th century, many of which were successful. In the early 1900s, the London and Liverpool Schools of Tropical Medicine invented methods for treating and preventing illnesses. The contributions of many scientists such as the French Physician and Scientist Eugene Jamot in the identification and treatment of human African trypanosomiasis in Cameroon and other parts of West Africa; (the development of a network of research institutes for parasitic diseases by Kenneth S. Warren, Head of Health at the Rockefeller Foundation in the late 1970s who created the term "great neglected diseases (GND) of mankind" contributed significantly to the efforts to control NTDs [25, 26, 27].

For instance, Warren cited studies showing that schistosomiasis caused liver illness in 100 million people but received only about \$5 million in total research funding globally. Through Warren's GND Network, many scientists started fundamental research and observed the advantages of collaboration [7, 27], which has helped in the control/elimination of NTDs. Although research facilities in Africa's endemic regions were sponsored by the British government and European Schools of Tropical Medicine, there was an urgent need to prioritize affordable treatments in addition to proven or effective treatments.

Due to poor funding resulting from the lack of political will by governments, it became necessary to identify both effective and cost-effective techniques for solving the problems associated with tropical

diseases. Early attempts to promote mass therapy and worm control with anthelmintic medication laid the foundation for later developments in mass treatment of endemic communities. For example, Frank Hawking used diethylcarbamazine citrate (DEC) for lymphatic filariasis (LF) in the 1950s and the 1960s [28, 29], and the Chinese used DEC-fortified salt for filariasis management in a population of 350 million people [28, 29, 30]. More than 50 years were required to accept and implement mass treatment.

3.1 Preventive Anthelmintic Chemotherapy: Mass Treatment without Individual Diagnosis

Despite modest efforts and achievements aimed at the control of NTDs, there was little funding available by the 1990s for the study and treatment of NTDs. This has also affected the number of scientists capable of tackling the menace of NTDs. By the turn of the millennium, the study of infectious tropical pathogens had fallen behind other branches of biomedical sciences. In addition to rapidly advancing techniques in transmission dynamics and mathematical modelling, modern molecular and immunological methods have not been readily applied to parasites [15, 31, 32].

Then, two crucial events occurred in the control of NTDs:

1. The first significant development in the control of diseases in the poor occurred with the emergence of multinational pharmaceutical businesses, which started concentrating on the treatment of tropical infections around the world. Multidrug therapy (MDT; rifampicin, clofazimine, and dapsone), which was provided by Novartis (formerly Ciba-Geigy) in 2000 after the WHO-authorized MDT in 1984, was developed because of early findings from TDR-sponsored leprosy research. It has become increasingly clear that multinational pharmaceutical companies could contribute significantly to global humanitarian efforts to cure human parasitic diseases on a large scale.

Following the discovery and isolation of the ivermectin class of anthelmintic drugs by Satoshi Omura and colleagues in Japan from *Streptomyces* bacterium, Nobel Prize winner William Campbell led efforts at Merck Sharp and Dome (MSD) to develop and test them [5]. The initial study focused on veterinary applications to treat intestinal helminths and ectoparasite infections in animals. Clinical trials quickly validated ivermectin's therapeutic benefit in

the treatment of human onchocerciasis (river blindness), prompting MSD Chief Executive Officer Roy Vagelos to announce the donation of Mectizan (ivermectin) through the Mectizan Donation Program 'for as long as needed' [33].

Both Mectizan and MDT have contributed to the establishment of a new paradigm in which a drug created or developed by a large pharmaceutical company can be repurposed to treat human ailments in global mass drug distribution schemes. Mectizan became critical in the later stages of the World Bank's Onchocerciasis Management Program (OCP) in West Africa when it was used to supplement vector control to reduce the burden of microfilariasis [34]. The Mectizan Donation Program played a significant role in enabling the expansion of onchocerciasis programs based on the idea of community-directed treatment with ivermectin (CDTI), an approach developed by WHO/TDR, OCP, and APOC-sponsored research in Africa's remaining onchocerciasis-endemic countries, when the World Bank established the African Program for Onchocerciasis Control (APOC) in 1995 [35]. The main objective of the APOC was to create long-term Mectizan delivery systems employing CDTi within five years (CDI Study Group, 2010). Additionally, several non-governmental development organizations (NGDOs) were strongly committed to APOC's multi-donor funding and helped implement country programs while also contributing 25% of the funds [36].

2. The theoretical framework of human helminth infection population and transmission dynamics models created in 1982 and 1985 respectively, along with proof that such constructs could be successfully used to deworm children with intestinal helminths, was a second accelerant. Johnson & Johnson donated mebendazole in response to these efforts, while GlaxoSmithKline later provided albendazole [37]. The schistosomiasis control initiative, which was initially seed-funded by the Bill & Melinda Gates Foundation (BMGF), was able to scale up the use of praziquantel, ultimately leading to the donation of the medication by Merck KGa, as it has been demonstrated to have a potential impact on human schistosomiasis [38]. Merck KGaA obtained a donation agreement for praziquantel for schistosomiasis treatment in school-age children in 2007 thanks to the efforts of the WHO and the Financial Times. Initially, 20 million tablets were distributed each year; however, by 2017, the total

number of donated tablets had increased to 250 million.

Meanwhile, in 1993, Bailey et al. spearheaded efforts to investigate the mass treatment of trachoma with azithromycin, which resulted in the donation of Pfizer through Joseph Cook's International Trachoma Initiative (ITI). Following the World Assembly Resolution in 1997, which called for the elimination of lymphatic filariasis as a public health problem, the Global Program to Eliminate Lymphatic Filariasis (GPELF) was established in 2000. GPELF, based on studies funded by the TDR, started using combinations of albendazole and diethylcarbamazine (in Asia) or albendazole and ivermectin (in Africa in onchocerciasis-endemic countries) to treat millions of people annually to protect them from LF [39].

3.2 The Journey so far in the Control of NTDs

Since the London Declaration in 2012 and the unveiling of the WHO 2020 Road Map, in which institutions, governmental bodies, research centres, and pharmaceutical corporations vowed to cooperate to control and eradicate at least ten NTDs, significant progress has been made. To highlight a few: more than 1 billion people have received treatment for at least one NTD, 42 countries have eradicated at least one NTD, and there are approximately 500 million fewer individuals who are at risk of NTDs. Furthermore, silos are dissolving as cross-sector initiatives, particularly across NTDs, WASH (Water, Sanitation and Hygiene), and education, are put into place. However, persistent difficulties have made the catastrophic effects of health inequality more apparent than ever before. A new strategy is required to ensure that nobody is left behind.

WHO's open consultative process highlighted the need for fundamental strategy shifts, and a new road map was built on these three key changes:

- Increased accountability, programmatic decisions based on solid evidence, and data-driven responses by accelerating programmatic action and switching from the monitoring process to measuring impact.
- Strengthen cross-cutting approaches; switch from vertical, top-down programs to horizontal, cross-cutting programming by combining efforts and enlisting partners from various sectors and disciplines to create integrated, holistic approaches. It is also important to keep patients at the centre of

these interventions.

- Changing from partner-led to country-driven and owned programming means that interventions will reflect local needs and be in line with the global health agenda, thus facilitating national ownership.

The WHO NTD Road map 2021-2030 has set the following overarching targets:

- a. reduce by 90% the number of people requiring treatment for NTDs.
- b. at least 100 countries to have eliminated at least one NTD.
- c. eradicate two diseases (dracunculiasis and yaws)
- d. reduced the disability-adjusted life years (DALYs) related to NTD by 75 %.

4.0 Available Tools for the Control and Elimination of NTDs

It is clear from the burden and socioeconomic aspects of NTDs that this group of diseases constitutes major public health problems and obstacles to socio-economic development; as a result, they can no longer be taken for granted. As a result, the WHO (2005) developed an innovative strategy to combat NTDs based on a combination of five (5) public health interventions: large-scale preventive treatment, intensified disease management, integrated vector management, access to safe water, sanitation, hygiene, and veterinary public health.

4.1 Interventions that can be used to Combat NTDs:

- Large-scale Preventive treatment
 - Intensified disease management
 - Integrated Vector Management
 - Safe water, sanitation, and hygiene
 - Veterinary public health
- (a) *Large-scale Preventive treatment:* This intervention aims to make preventive drugs more widely available. Since the late 1980s, efforts by biomedical scientists to develop newer drugs to control or eradicate NTDs have yielded results. Some of the drugs developed by pharmaceutical companies are now effective in controlling morbidity and reducing the transmission of many of these neglected diseases (Table 1).
 - (b) *Intensified Disease Management (IDM):* Intensified disease management of NTDs involves caring for infected individuals and

those at risk for infection. The key strategies are:

- (i) making an early diagnosis,
- (ii) providing treatment to reduce infection and morbidity, and
- (iii) managing complications.

The World Health Organization (WHO) advocates this strategy for controlling and preventing NTDs, such as Buruli ulcer, Chagas disease, human African trypanosomiasis, leishmaniasis, leprosy, and yaws. The aim is for intensified disease management to allow these diseases to be easily managed within the primary healthcare system.

- (c) *Integrated Vector management:* Vector-borne diseases account for approximately 17% of the estimated global burden of communicable diseases [40]. This intervention aims to reduce or eliminate arthropod vectors and snail intermediate hosts that allow NTDs to be transmitted mechanically and/or biologically. The promotion of integrated vector management is a component of the global plan to combat neglected tropical diseases from 2008 to 2015 [41]. Pesticides can be used to control vector-borne diseases and their application is safe and feasible.
- (d) *Safe water, sanitation, and hygiene:* Statistics by the United Nations reveal that 900 million people lack access to safe drinking water and 250 million lack access to adequate sanitation (Centers for Disease Control and Prevention). Clean water and good hygiene are important for the prevention, care, and management of neglected tropical diseases. Until clean water, sanitation, and hygiene improve in endemic areas, many NTDs and other communicable diseases will not be eliminated and certainly not eradicated. As a result, the WHO has called for increased collaboration between the NTD and the Water, Sanitation, and Hygiene (WASH) sectors.
- (e) *Veterinary Public Health:* Some of the morbidity and mortality resulting from NTDs have a major zoonotic component. Zoonotic diseases (zoonoses) are human diseases arising from infections transmitted

Table 1: Currently used drugs against NTDs

INFECTION	DISEASE	CURRENTLY USED DRUGS
Protozoan infection	Chagas diseases	Nifurtimox, Benznidazole
	Human African trypanosomiasis (Sleeping sickness)	Early stage: Pentamidine, Suramin Late stage: Eflornithine, Melarsoprol, Combination Nifurtimox-eflornithine
	Leishmaniasis	Visceral L.: Ambisome, Paromomycin, Miltefosine Cutaneous L.: Glucantime, SSG
Helminth infections	Cysticercosis, zoonotic helminthiasis	Praziquantel, Triclabendazole
	Guinea-worm disease	-
	Lymphatic filariasis	Albendazole, Ivermectin, DEC
	Onchocerciasis (River blindness)	Ivermectin
	Schistosomiasis	Praziquantel
	Soil-transmitted helminth infections (ascariasis, trichuriasis, hookworm)	Albendazole/Mebendazole, Pyrantel, Levamisole
Bacterial infections	Buruli ulcer	Rifampicin, Streptomycin, Clarithromycin, Moxifloxacin
	Leprosy	MDT (Rifampicin, clofazimine, dapsone)
	Trachoma	Tetracycline eye ointment, Azithromycin
	Yaws	Benzathine penicillin
Viral infection	Dengue, Dengue haemorrhagic fever	Need for antiviral drugs

between domesticated vertebrates (livestock or companions) and wild animals. Some examples include brucellosis, cysticercosis, echinococcosis, foodborne trematodiasis, human African trypanosomiasis, leishmaniasis, and rabies. These neglected zoonotic diseases are associated with people living close to animals. The intervention was to break the zoonotic transmission chain.

NOTE: The control/elimination of NTDs depends on the application or combination of these five (5)

strategies. For example, intervention for the morbidity caused by lymphatic filariasis involves a combination of preventive chemotherapy, case management for individuals with hydrocoele, and the control of mosquito vectors.

4.2 Summary of the Road Map for the Elimination of Neglected Tropical Diseases, 2021-2030

It is important to note that elimination or interruption of transmission of NTD is the reduction of the incidence of infection to zero caused by a specific NTD in a defined geographical area, with minimal

risk of re-introduction because of deliberate efforts. In addition, continued action to prevent the re-establishment of transmission may be required. On the other hand, the elimination of a disease as a public health problem is defined by the achievement of measurable targets set by WHO in relation to that specific NTD. When elimination as a public health problem is reached, continued action is required to maintain the targets and/or advance the interruption of transmission. The documentation of the elimination or interruption of transmission as a public health problem is called validation.

The first roadmap for the prevention and control of NTDs was published in 2012. From then up to 2020, substantial progress has been made in NTD control and prevention. For example, 600 million fewer people required interventions against several NTDs than in 2010, and 42 countries, territories, and areas have eliminated at least one disease [42]. Dracunculiasis is on the verge of eradication; lymphatic filariasis and trachoma have been eliminated as public health problems in 17 and 10 countries, respectively; onchocerciasis has been eliminated in four countries in the Americas, and the annual number of cases of human African trypanosomiasis has fallen from more than 7000 in 2012 to less than 1000 in 2019 [40]. Progress against NTDs has alleviated the human and economic burden that they impose on the world's most disadvantaged communities.

Despite substantial progress made since 2010, many of the targets set for 2020 in the first road map were not met. The new road map 2020-2030 identifies critical gaps and actions required to reach the targets set for 2030. Ambitious impact-oriented targets are required to achieve Sustainable Development Goals (SDGs) and accelerate the control and elimination of NTDs [40]. The 2021-2030 road map tagged, ***“Ending the neglect to attain the Sustainable Development Goals”*** was endorsed by the 73rd World Health Assembly pursuant to decision EB146(9) of the 146th session of the Executive Board in 2020.

In summary, the Road Map for Neglected Tropical Diseases 2021-2030 was built on three foundational pillars that will support global efforts to control, eliminate, and eradicate neglected tropical diseases[42].

Pillar 1: This pillar refers to Accelerating

programmatic actions required to reduce the incidence, prevalence, morbidity, disability, and death caused by neglected tropical diseases. The actions required for each disease and disease group can be assessed in the following three areas:

- Technical requirements.
- Strategy and service delivery; and
- Enablers

(a) *Technical requirements:* This involves the following.

- Scientific understanding of the disease epidemiology and pathology,
- Diagnostics: Availability of effective, standardized, and affordable diagnostics for timely detection, assessment of endpoints, surveillance, and
- Effective intervention: Effective, affordable interventions for prevention, treatment, case management, rehabilitation, and care, as well as continued innovation and adaptation of interventions.

(b) *Strategy and Service Delivery:* This involves the following.

- Operational and normative guidance to develop a clear definition of endpoints and operational approach to achieve and sustain them, availability of technical guidelines, for example, for validation or verification and equitable access to interventions (e.g., disadvantaged, vulnerable, and inaccessible populations)
- Planning, governance, and programme implementation such as appropriate country governance and commitment for program management and effective delivery, clear stakeholder responsibilities, and effective, coordinated working processes to implement relevant interventions.
- Monitoring and evaluation including NTD monitoring and evaluation framework and mechanisms to monitor and report progress towards stated goals, as well as strengthened and institutionalized surveillance for the disease, including post-validation and elimination surveillance.
- Access and logistics: This involves an adequate supply of affordable, quality-assured medicines, diagnostics, and other medical products at all levels and an efficient supply chain for the effective allocation and distribution of medicines, diagnostics, and

other medical products.

- Health care infrastructure and workforce: This includes robust health systems and primary health care infrastructure and laboratory capacity and network to support NTD programs as well as skilled healthcare workers, including community volunteers and community healers, to meet clinical, entomological, and community needs.

(c) *Enablers*: Enablers involve the following:

- Advocacy and funding include clear identification of funding gaps, resource mobilization plans to address them, and adequate international and domestic funding to ensure the sustainability of programmes deployed with adequate lead time and consistency.
- Collaboration and multi-sectoral action that involves collaboration among stakeholders across levels and sectors with clear accountability to ensure an effective and synergetic approach to delivering interventions as well as the involvement of communities at risk and affected communities, for example, in programme design.
- Capacity and awareness building, which involves capacity-building to ensure high-performing programmes, for example, pre-deployment and in-service training, transfer of skills from vertical NTD programmes to primary health systems, as well as educating and informing endemic communities, such as behavioural changes, MDA scheduling, treatment, and care options.

Pillar 2: This pillar refers to intensifying cross-cutting approaches, which can be achieved as follows:

- (a) Integrated approaches across NTDs: Integration of interventions for several NTDs and their mainstreaming into national health systems. An integrated approach will bring the programs for NTDs that are endemic in a country into a single NTD platform, which will allow links among programs, when practical. Integration can occur within different areas, such as social mobilization, drug distribution, active case-finding, point-of-care diagnosis, self-care, and vector control.

- (b) Mainstream delivery platforms within national health systems: Mainstreaming NTD activities into the health system and building the capacity to deliver interventions through its infrastructure will contribute to sustainable and efficient NTD prevention and control, enabling NTD patients to access all aspects of treatment, care, and support. Examples of mainstream collaboration with other health programs include mental health, disability and inclusion, women's and child health, eye health, nutrition, immunization, tuberculosis, malaria, and HIV/AIDS programs.

- (c) Coordinate efforts across sectors: coordination among adjacent sectors in the broader NTD network. The health ministry needs to coordinate with other ministries and authorities. Examples of inter-sectoral collaboration include water, sanitation, and hygiene (WASH), agriculture, the environment, livestock, wildlife (One Health Approach), education, justice and social welfare, infrastructure and the built environment, and food safety.

Pillar 3: Changing operating models and cultures to facilitate country ownership.

- (a) Meeting the targets set on the road map will require shifts in organizational structures, ways of working, and thinking. The roles and responsibilities must be clear at each level and sector of the global NTD community to define the appropriate operating model.
- (b) Countries are both drivers and beneficiaries of progress towards the road map targets for 2030, and country ownership is essential for meeting the 2030 NTD targets with the support of regional and global stakeholders. Local governments (at the municipality and district levels) are also essential for the successful implementation of interventions and the coordination of multisectoral actions.
- (c) NGDO partners play a pivotal role at all levels, particularly in certain countries. A clear delineation of responsibilities among partners will ensure geographical coverage,

avoid duplication, and ensure that no community is overlooked. The coordination of this extensive and diverse network will be supported by the WHO, which will work with all stakeholder groups.

Targets: Three types of targets were set by the road map: overarching, cross-cutting, and disease-specific.

(a) *Overarching global targets for 2030:* The overarching global targets for 2030 are in line with the Sustainable Development Goals and the WHO's 13th General Programme of Work:

- Reduce by 90% the number of people requiring treatment against NTDs
- Reduce by 75% NTD-related DALYs
- 100 countries achieving elimination of at least 1 NTD
- Eradication of 2 NTDs (dracunculiasis and yaws)

(b) *Cross-cutting Targets for 2030:* A set of cross-cutting targets has been devised to measure progress in four areas:

(i) *Integrated Approaches*

- Reduce deaths from vector-borne diseases by 75%
- Achieve 75% integrated treatment coverage index for preventive chemotherapy
- 40 countries adopting skin NTD strategies

(ii) *Multisectoral Coordination*

- Ensure 100% access to basic water supply, sanitation, and hygiene in NTD-endemic areas.
- Get 90% of countries integrating NTDs in national strategic plans
- Protect at least 90% of the population from catastrophic out-of-pocket health expenditures due to NTDs

(iii) *Universal Health Coverage*

- Obtain 90% of countries including NTD interventions in their package of essential health services and budgeting for them.
- Ensure that 90% of countries have guidelines for the management of NTD-related disabilities within their national health systems.

(iv) *Country Ownership*

- Ensure that 90% of countries report on all

relevant NTDs

- Ensure that 90% of countries collect and report NTD data disaggregated by gender.

(c) *Disease-specific Targets*

- The road map includes one main target and one or two additional sub-targets for 2030 for each disease or disease group.
- Each target has milestones for 2023 and 2025 in addition to the 2020 baselines. This framework will enable the tracking of progress towards the goals set for eradication, elimination as a public health problem, and control.

5.0 Appraisal of NTDs Control/Elimination Efforts in Nigeria

Globally, sub-Saharan Africa accounts for 90% of the NTD disease burden, and Nigeria has the highest prevalence in the continent [8]. Nigeria has the highest prevalence of onchocerciasis and schistosomiasis worldwide. These endemic NTDs place an enormous burden on Nigeria, constituting public health problems and negatively impacting the socioeconomic development of the affected individuals, communities, and the nation.

Consequently, the Federal Ministry of Health initiated a program for national NTD control and elimination in 2009. This program focused on integrated and cost-effective approaches to control and/or eliminate NTDs. As a follow-up to the 2009 national NTD program, Nigeria keyed into the first road map for the prevention and control of NTDs driven by the London Declaration on NTDs launched on the 30th of January 2012 aimed at the eradication or prevention of transmission by the year 2020. An appraisal of the NTD control/elimination efforts in Nigeria up to 2020 is presented below.

5.1 The Present Status of NTD Control And Elimination in Nigeria

(a) *Guinea Worm Disease:*

The eradication of guinea worm disease, also called dracunculiasis or dracontiasis, was initiated and given impetus by the resolutions adopted in April 1981 by the Steering Committee of the International Drinking Water Supply for the elimination of guinea worms in each endemic country. The Nigerian Guinea Worm Eradication Programme (NIGEP) was established in 1988, with confirmation of the endemic status of guinea worm disease in Nigeria. NIGEP, with the support of United Nations (UN)

agencies (WHO, UNICEF, UNDP, and partners (Bank of Credit and Commerce International (BCCI), JICA, Global 2000, Yakubu Gowon Centre, etc.), conducted its first nationwide village-by-village search for cases of dracunculiasis between August 1988 and February 1989. This survey showed that there were 653,495 cases distributed across 6000 villages in 20 States and the Federal Capital Territory. As a result of an integrated control strategy involving surveillance, case containment, provision and use of portable water, treatment of water sources with biodegradable insecticides, mobilization, and health education, the number of guinea worms was reduced from identified 653,495 cases in 1988 to zero in 2008. This coordinated effort by NIGEP and other collaborators yielded a dramatic and measurable impact, as the last case of guinea worm disease in Nigeria (a 58-year-old migrant farmer from Ezza Nkwubor in Ebonyi State) was reported in 2008. After five years of case search, the country was declared guinea worm-free by the WHO in December 2013.

(b) *Onchocerciasis*

Nigeria is the most endemic country in the world, accounting for approximately 40% of the global prevalence [43]. Because of the socioeconomic impact of onchocerciasis on infected individuals in endemic communities, treatment with ivermectin to control onchocerciasis as a public health problem started in 1991. Epidemiological evidence shows that large-scale treatment with ivermectin stopped/interrupted onchocerciasis disease transmission, especially in areas with a high percentage of treatment and population coverage, the global community, including Nigeria, moved from the control to the elimination program. Elimination of onchocerciasis requires sustained annual treatment coverage rates of $\geq 80\%$ at the community level for 15–20 years [44].

Nigeria commenced the onchocerciasis elimination program in 2013. To provide impetus to the elimination strategy, the National Onchocerciasis Elimination Committee (NOEC) was inaugurated in 2015. Amongst other terms of reference, NOEC was charged with the responsibility to determine where and when transmission has been interrupted, where the disease elimination has been achieved, and where mass ivermectin distribution can be safely stopped. After seven (7) years (May 2015–May 2022) of the onchocerciasis elimination program in Nigeria, the NOEC can re-classify the transmission zones based

on emerging epidemiological and entomological results.

1. Transmission has been eliminated in 12 LGAs of Plateau and Nasarawa States since 2017, and approximately 2 million people in these states are no longer in need of MDA. The NOEC is currently working on post-elimination surveillance.
2. Transmission has been interrupted in four (4) States: Kaduna, Zamfara, Kebbi, and Delta. About 8.2 million persons in these four states are no longer in need of MDA for onchocerciasis.
3. Transmission is suspected to be interrupted after DBS OV 16 in children <10 years of age. NOEC collects blackflies for PCR analysis in 13 states namely, Bauchi, Yobe, Oyo, Ekiti, Enugu, Ebonyi, Anambra, Imo, Abia, Cross River, Benue, Jigawa, and FCT.
4. Interruption of transmission of onchocerciasis is on track in nine (9) States namely, Adamawa, Taraba, Kano, Niger, Kwara, Kogi, Edo, Ondo, and Osun. The results of the DBS OV16 analysis are awaited.
5. Transmission is suspected to be ongoing in Ogun States, and DBS samples for OV 16 are being collected to enable reclassification.
6. There is limited epidemiological information in eight (8) States namely Lagos, Bayelsa, Rivers, Akwa Ibom, Borno, Gombe, Katsina, and Sokoto States, and DBS samples for OV 16 analysis were collected for further analysis.

(c) *Lymphatic filariasis*

Nigeria has the third greatest LF disease burden, with an estimated 120 million people infected in 73 counties in the world. The disease threatens over 114 million Nigerians [45].

The Global Program to Eliminate Lymphatic Filariasis (GPELF) was launched by the WHO Health Organization in 2000. The elimination strategy has two components: (i) stopping the spread of infection (interrupting transmission) and (ii) alleviating the suffering of affected populations (controlling morbidity). This was in response to the call of the World Health Assembly (WHA) to member states to initiate steps to eliminate lymphatic filariasis as a public health problem. Interrupting the transmission of LF means providing access to mass

drug administration (MDA) for every eligible person in endemic areas where mapping results indicate an infection of greater than or equal to 1%, covering an entire at-risk population [46].

In Nigeria, the key strategies are mass administration of a combination of ivermectin (150–200 mcg/kg) and albendazole (400 mg) administered together annually, and Morbidity Management and Disability Prevention (MMDP). MDA aims to reduce microfilaremia in the blood of infected persons to levels that can no longer sustain transmission of LF by mosquito vectors to new hosts. Community-wide mass drug administration was preceded by mapping to identify endemic areas for intervention.

Notably, these drugs had limited effects on adult worms. Therefore, for effective interruption of transmission, the drugs are administered annually for at least five years, which is considered to be the reproductive lifespan of adult filarial worms in humans [47, 48]. Vector control is supplemental to the core strategy of MDA and can enhance elimination efforts by reducing mosquito density and preventing human-mosquito contact. Malaria control interventions such as residual spraying and sleeping under long-lasting insecticidal nets (LLIN) have collateral benefits in reducing LF transmission.

The Nigerian Lymphatic Filariasis Elimination Programme (NLFEP) began LF mapping in the country in 2003, and 35 states and the Federal Capital Territory (FCT) completed mapping in all their local government areas (574 endemic and 187 non-endemic LGAs).

According to NLFEP, the status of LF elimination in Nigeria is shown below:

1. There are no LF mapping gaps in the country as all 774 LGAs have been mapped.
2. Developed National LF assessment guidelines.
3. Developed draft National LF Morbidity Management and Disability Prevention (MMDP) guidelines.
4. 95 LGAs in 16 states (Anambra, Cross River, Ebonyi, Imo, Jigawa, Kaduna, Kano, Kebbi, Kogi, Keara, Niger, Nasarawa, Plateau, Sokoto, Taraba and Yobe) and the FCT (>20.8 million people) have stopped LF treatment.
5. 583 endemic LGAs (100%) have received at least one round of LF treatment.

6. 74% of 3,433 lymphoedema cases and 64.1% of 7,681 hydrocele cases have been managed in 17 States and 20 States, respectively.

d. *Schistosomiasis*

Schistosomiasis affecting approximately 258 million people worldwide is the deadliest NTD, with an estimated annual death rate of 200,000, and another 20 million have severe consequences from the disease [49]. Sub-Saharan African countries, with approximately 90% of the world's total cases, are the most affected regions, 6,363 out of 9,684 (65.7%) wards in Nigeria are endemic for schistosomiasis, with Nigeria accounting for a considerable large proportion of the endemicity [49].

The school-based Deworming Program with Praziquantel (PZQ) is the major intervention for the control of schistosomiasis in Nigeria. *School-based deworming is a low-cost program that uses existing school infrastructure to train teachers to administer deworming treatment (safe tablets) to all primary school students on designated "deworming days" once a year. Owing to its efficacy against all schistosome species, PZQ has become the drug of choice for mass drug administration (MDA). It is inexpensive, widely available, safe, and requires minimal training of non-medical personnel [50].*

The key achievements in the control/elimination of schistosomiasis in Nigeria are:

- Completed epidemiological mapping (99.9%) of SCHISTO.
- The transition from paper-based to electronic data collection and real-time transmission of data
- MDA has been achieved in many LGAs; however, an impact assessment has not yet been conducted.
- A significant impact has been recorded in a few states where impact assessments have been conducted. For example, in the Plateau, Nasarawa, and Ondo States, disease prevalence has been reduced significantly in many LGAs.
- Establishment of Coordinating mechanisms such as NTDSC, WASH WG and National De-worming exercises
- Disaggregation of schistosomiasis mapping data by ward and migration from LGA to ward-level implementation in states have been concluded.

e. *Soil-Transmitted Helminthiasis*

In 2001, the World Health Assembly unanimously endorsed a resolution (WHA54.19) urging soil-transmitted helminth (STH) endemic countries to implement strategies to control or eliminate soil-transmitted helminths. Elimination as a public health problem is defined as a <2% proportion of soil-transmitted helminth infections of moderate and heavy intensities [40].

The strategies for control/elimination of soil-transmitted helminth infections are to control morbidity through periodic mass treatment of at-risk people in endemic areas with albendazole or mebendazole, health education to prevent re-infection, and improved sanitation to reduce soil contamination with infective eggs.

The status of control/elimination of STHs in Nigeria by 2020 is as follows:

- Completion of epidemiological mapping (99.9%) of STHs
- The transition from paper-based to electronic data collection and real-time transmission of data
- MDA against STHs has been achieved in many LGAs; however, an impact assessment has not been conducted.
- A significant impact has been recorded in a few states where impact assessments have been conducted. For example, in the plateau, the prevalence of Nasarawa and Ondo States has been reduced significantly in many LGAs.
- Establishment of the National STH Strategic Plan of Action, Implementation Guidelines, Impact Assessment, Sentinel Site Selection Guidelines

(f) *Human African Trypanosomiasis (HAT)*:

Human African trypanosomiasis

(g) *Trachoma*

Trachomas are the primary cause of infectious blindness worldwide. It is responsible for blindness or visual impairment in approximately 1.9 million people and accounts for approximately 1.4% of all cases of blindness worldwide [43]. The target for the elimination of trachoma as a public health problem is to reduce the prevalence of active trachoma to <5% in children 1-9 years of age and the prevalence of trachomatous trichiasis unknown to the health system to <0.2% in adults aged ≥ 15 years in every

endemic district in the world.

Achievements in trachoma control and eradication by the National Trachoma Task Force include:

1. Mapping was completed in 24 states (and 453 LGAs), with 126 LGAs identified as endemic areas.
2. MDA drug administration, which began in Nigeria in 2010 in 10 LGAs covering five (5) States (Plateau, Nasarawa, Kebbi, Sokoto, and Zamfara), has been successfully scaled up to 122 endemic LGAs by 2020. These efforts have resulted in an 84% reduction, from approximately 30 million people who were at risk of going blind from trachoma to approximately 3.5 million.
3. Improved rating/ranking of Nigeria from the second (2nd) most endemic country in the world in 2016 to the fourth (4th) in 2022 after Ethiopia, the Democratic Republic of Congo (DRC), and Cote d'Ivoire.
4. Training of 175 trachomatous trichiasis (TT) surgeons, 346 surgeon assistants, and 90,000 case finders for additional trachoma impact surveys, case surveillance, and disease management.

h. *Leprosy*

Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*, an acid-fast, rod-shaped bacillus. According to WHO data from 139 countries, there were an estimated 127,558 new cases of leprosy worldwide by 2020. This number includes 8,629 children under 15 years of age. Grade 2 impairments were found in 7,198 of the new cases. Nigeria is among the countries that detect over 1,000 new leprosy cases annually. In 2021, 2,398 new cases of leprosy were reported by the 36 states of the federation, including the FCT. In 2022, 605 new cases were reported in the first quarter.

The elimination of leprosy in Nigeria is hinged on four key goals which are:

- To implement an integrated, country-owned zero Leprosy Road Map
- Scale up leprosy prevention alongside integrated active case detection.
- Manage leprosy and its complications and prevent new disability.
- Combat stigma and ensure human rights are respected.

The major achievements in leprosy control and

elimination in Nigeria are active case detection and management with MTD (Rifampicin, Clofazimine, Dapsone) and the commencement of Single Dose Rifampicin Post Exposure Prophylaxis (SDRPEP), known as Ready4PEP in six (6) states.

i. *Buruli Ulcer*

A Buruli ulcer is a persistent, disabling condition that primarily affects the skin and occasionally the bone. It is caused by the bacterium *Mycobacterium ulcerans*. Buruli ulcers have been reported in 33 African countries, including Nigeria, the Americas, Asia, and the Western Pacific. By 2010, over 5000 suspected Buruli ulcer cases had been reported worldwide. In Nigeria, 223 cases of Buruli ulcers were reported in 2021, and 94 new cases were reported in the first quarter of 2022. New case detection is a key achievement of tuberculosis, Buruli ulcer, and leprosy programs.

h. *Rabies*

Rabies is a highly contagious viral disease that affects all warm-blooded animals and humans (genus *Lyssa* virus). It is spread by the bites of infected animals and humans. Without timely and effective post-exposure prophylaxis, it can kill 100% of the infected victims. Despite the disease's high fatality rate, 100% of vaccines are preventable. The FAO, WHO, and OIE Tripartite created a Stepwise Approach towards Rabies Elimination (SARE). This is aimed at helping countries plan, monitor, and evaluate their progress towards the goal of eliminating dog-mediated human rabies by 2030. This goal necessitates multisectoral and multidisciplinary collaborations, also known as One Health (OH), in the design and implementation of programs, policies, and other initiatives.

Nigeria's One Health (OH) strategic plan was formally unveiled in December 2019, and its implementation is still going with the goal of providing a strategic, dynamic, and functional platform that improves human, animal, and environmental health through interdisciplinary and intersectoral collaboration. The Federal Ministry of Agriculture and Rural Development, Federal Ministry of Health, and Federal Ministry of the Environment, along with their agencies, formed a tripartite for the control and elimination of rabies in Nigeria.

A key achievement for the control and elimination of rabies in Nigeria is the procurement and distribution of the anti-rabies vaccine in 10 states selected based

on the frequency of reported dog bite cases. They are the Adamawa, Benue, Zamfara, FCT, Ebonyi, Abia, Anambra, Bayelsa, Cross River, and Plateau States. Nigeria has a Stepwise Approach towards Rabies Elimination (SARE) score of 1.5/5, which is judged very poor and signifies the need to scale up rabies control and elimination programs.

Nigeria has received support from the Global Alliance for Rabies Control (GARC) through the Federal Ministry of Agriculture and Rural Development to create a collaborative National Rabies Work Plan (NRWP) in 2022, which will be utilized for implementation by 2030.

j. *Yaws*

Yaws are a type of endemic treponematoses and a class of persistent bacterial illnesses. These diseases are caused by the spirochete bacterium *Treponema pallidum* subsp. *pertenue*, which includes endemic syphilis (bejel) and pinta. Yaws are the most common of these three infections. The disease is endemic to 15 countries in Africa, Asia, Latin America, and the Pacific. The Federal Ministry of Health (FMOH) (Yaws Unit of NTDs) estimates that 19 states may be endemic for yaws with three (3) states namely Jigawa, Sokoto, and Bauchi having confirmed cases. The National strategy to eliminate yaws involves the administration of a single round of mass treatment with azithromycin. This is followed by active case detection and targeted treatment of the infected individuals and their contacts. A key achievement in the control/elimination of yaws in Nigeria is active case detection in collaboration with the WHO and the *German Leprosy and Relief Association* (GLRA).

k. *Leishmaniasis*

Leishmaniasis is a vector-borne disease caused by flagellated protozoans belonging to the genus *Leishmania*. The disease is widespread in tropical and subtropical areas and has been identified in 98 countries across Europe, Africa, Asia, and America. It is estimated that between 0.9 and 1.7 million people are estimated to be infected every year, but only a small percentage develop overt disease, with between 20,000 and 30,000 mortalities. The first case of Leishmaniasis in Nigeria was recorded in 1924 in a Plateau State. North Central Nigeria, especially the Plateau State, is the focus area of cutaneous leishmaniasis, although cases have been identified in other parts of the country, such as the Sokoto and Borno States. Cutaneous leishmaniasis is underreported in Brazil.

In Borno state, 410 cases and 516 new cases were reported in 2019 and 2020, respectively. As of January 2021, 220 affected persons were detected in 26 localities and were receiving treatment from the Borno State Ministry of Health, with assistance from the World Health Organization [51]. To control the outbreak, the WHO worked with the administration of Borno State to raise awareness about the causes of the disease, its preventative measures, and the importance of prompt reporting and treatment in high-risk regions. The WHO team assisted the state health authorities in training 60 community announcers and 40 health professionals in 12 areas to educate residents about infection prevention, support case discovery, and facilitate referrals to teaching hospitals. Additionally, the WHO has established community testing and treatment facilities where sick people are given medical attention. For ongoing monitoring, two sentinel sites were also established: one at the state dermatological health centre and the other at the university teaching hospital [51].

No drugs or vaccines are currently available to prevent infection. The National strategy for control is aimed at protection from bites of sandfly vectors and the use of insect repellents.

1. Snakebite

Snakebites are a neglected public health concern in many tropical and subtropical countries. It is estimated that 5.4 million snake bites are estimated to occur each year, resulting in 1.8 2.7 million cases of envenoming (i.e., poisoning from snake bites). Between 81,410 and 137,880 people die each year, and there are many cases of amputation and other types of lasting disabilities. In Nigeria, snakebites remain a common and serious problem, especially in rural areas where access to prompt and effective treatment is limited. A greater percentage of snakebite victims were not present at the hospital in Nigeria. There appears to be no national strategy to control and eliminate snakebites in Nigeria.

Substantial progress was made by the end of 2020 in the control and elimination of some NTDs in Nigeria. Examples include guinea worm disease (which has been eliminated in Nigeria since 2013), onchocerciasis, lymphatic filariasis, schistosomiasis, and soil-transmitted helminths. A lot more needs to be done for other NTDs like human African trypanosomiasis, trachoma, leprosy, Buruli ulcer, rabies, yaws, leishmaniasis, and snake bites as many of the targets set for them in 2020 were not met. It is expected that greater action/commitment will be

taken in the new 2021-2030 road map tagged ***“Ending the neglect to attain the Sustainable Development Goals”***. to achieve set targets for the remaining NTDs by the end of 2030.

5.2 Integrated Approach to Neglected Tropical Diseases

The Federal Ministry of Health, in partnership with NGDO, initiated the Integrated Approach to Neglected Tropical Diseases (UNITED) program to control seven NTDs: blinding trachoma, bilharziasis, elephantiasis, river blindness, hookworm, whipworm, and roundworm. These targeted NTDs are preventable through proven, cost-effective interventions such as mass drug administration, which entails the distributing of four (4) drugs namely raziquantel (for schistosomiasis), albendazole (for LF, hookworm, whipworm, and roundworm), ivermectin (for onchocerciasis and LF), and azithromycin (for trachoma) to everyone in the community once or twice a year. Because many NTDs are controlled through similar community mechanisms, the program took an integrated implementation approach to administer drugs for multiple diseases simultaneously. The UNITED program reached over 39 million people with annual mass treatment to reduce illness and distributed over 110 million drugs in Kano, Katsina, Zamfara, Kaduna, and Niger States.

The UNITED consortium is led by Sightsavers and includes Helen Keller International, CBM, MITOSATH, the Carter Center, the Liverpool School of Tropical Medicine Centre for Neglected Tropical Diseases, the London Centre for NTD Research, Imperial College's Partnership for Child Development and Schistosomiasis Control Initiative, the London School of Hygiene and Tropical Medicine, the Natural History Museum, Accenture Development Partnerships, and Crown Agents.

Some of the activities of this program include strengthening health system coordination structures, integrating NTDs into the overall health sector agenda, building capacity for coordination, leadership, and management of NTD programs at the national and subnational levels, and supporting policy development for NTD programming. These activities resulted in the establishment of functional NTD technical advisory committees in UNITED-supported states and provided technical leadership to state NTDs teams for improved service delivery; development of NTDs and civil society engagement

framework that provides strategies for collaborating toward budget advocacy for NTDs; facilitated state governments' endorsement of strategic plans to address NTDs from 2015 to 2020; and supported the development of a national NTDs and water, sanitation, and hygiene (WASH) engagement framework for strengthened collaboration and the implementation of a capacity building plan at national and sub-national levels.

6.0 Challenges in the Control/Elimination of NTDs in Nigeria

A few challenges have affected the successful control and elimination of NTDs in Nigeria[52]. These include:

6.1. Poor Geographic and Treatment Coverage:

Maintaining MDA for the entire at-risk population once a year for at least five years with a coverage of at least 65% is necessary for Nigeria to stop LF transmission. For onchocerciasis, we need to sustain annual treatment coverage rates $\geq 80\%$ at the community level for 15–20 years. Unfortunately, in some endemic locations, minimal geographic and treatment coverage has not yet been achieved.

Possible Intervention: To increase compliance with MDA, endemic communities may benefit from extensive health education and incentives. These inducements can be provided in the form of goods (such as bed nets) or human resources (such as hosting free clinics to treat other illnesses if time permits).

6.2. Challenges in Reaching Remote Areas: The MDA campaign has been limited because some endemic villages are difficult to reach owing to their remoteness and difficult terrains.

Possible Intervention: In such cases, sufficient time needs to be set aside to analyze the population and develop efficient health promotion strategies in cooperation with regional health authorities and reputable local leaders. It may be helpful to visit villages at least once for advocacy before the campaign begins, meet local elders, build trust, and then return to announce the campaign date.

6.3. Rural to Urban Migration: Compelling data suggest that the most prevalent type of migration in Africa is rural-rural migration, which includes seasonal mobility among its many components [53]. The implications of the campaign to interrupt

filariasis, whether it is rural-urban or urban-urban migration, are extremely clear. For example, MDA is more successful in rural endemic regions than in urban areas. Infected villagers migrate from villages where an active ivermectin distribution program (IDP) takes place in a city (without IDP) for economic reasons. As a result, infected migrants is infected will not receive treatment. This may create a problem for control/elimination efforts when a critical mass of migrants builds up.

6.4 Migration of Nomadic Herdsmen: A herdsman is a nomadic person who moves around looking for new pastures for his livestock to graze. When searching for grazing grounds to feed the herds, the herdsman departs from areas of active IDP to another location without active IDP.

6.5 Frequent Transfers of Health Professionals:

Several States or LGAs have experienced a scarcity of trained labour for particular projects as a result of frequent transfers of existing health employees. This has occasionally resulted in health personnel having insufficient or no expertise to solve some operational problems in the project. One potential course of action is to train and hire more healthcare professionals, particularly at facilities that provide direct patient care, to cover any gaps left by transferred personnel.

6.6 Poor Counterpart Financing For CDTI

Initiatives: Executing MDA in endemic communities might occasionally be hampered by inadequate counterpart funding for initiatives at all levels or the existence of bureaucratic bottlenecks restricting the transfer of cash.

Possible interventions include (a) increasing high-level advocacy for leadership and other policymakers using strong and persuasive IEC materials. (b) Attempts should be made to link LF and Oncho eradication actions with other NTDS, as well as with other health initiatives in the States and LGAs, in addition to greater advocacy. The Federal Ministry of Health's Integrated Diseases Surveillance Response (IDSR) system should be linked to the elimination of LF and onchocerciasis.

7.0 Capacity Building Opportunities for Neglected Tropical Diseases Control

1. *European Foundation Initiative for African Research into Neglected Tropical Diseases (EFINTD):* This consists of five European

foundations and aims to combat NTDs by offering funding for postdoctoral fellows from sub-Saharan Africa to pursue scientific careers on their home continents. The initiative also facilitates the creation of collaborative scientific networks linking researchers within Africa and between Northern and African scientists.

2. *The African Research Network for Neglected Tropical Diseases (ARNTD) with support from the U.S. Agency for International Development (USAID), through the Coalition for Operational Research on Neglected Tropical Diseases (COR-NTD):* provides an opportunity for Small Grants to support African researchers in both early and mid/late careers to undertake operational or implementation research aligned with the goals established in the London Declaration on Neglected Tropical Diseases. The grant aims to increase African leadership, involvement, and visibility in neglected tropical disease (NTD) operational and implementation research, including direct engagement with national NTD programs, to contribute to improving the research capacity of an existing cadre of African NTD researchers and strengthen African research institutions in the process by supporting operational and implementation research on locally originated and African-led NTDs, either by junior researchers or experienced researchers ready to take on larger research programs; to improve South-South communication and collaboration among researchers, policymakers, and implementers; and for community participation in research and agenda-setting.
3. *Bill & Melinda Gates Foundation Grant:* The Bill & Melinda Gates Foundation provides opportunities in NTDs which include:
 - a. Support to establish the Mwele Malecela Mentorship Program for Women in NTDs in partnership with the World Health Organization (WHO). The initiative, which is called the memory of scientists and NTD, advocates Mwele Malecela and will support at least 40 women in leveraging mentorship, leadership training, skill-building classes, and networking opportunities to overcome barriers and become leaders in NTD elimination by 2030. African women living

in Africa who are mid-career in their work with NTDs are eligible to apply.

- b. The launch of Accelerate Resilient, Innovative, and Sustainable Elimination of NTDs (ARISE) in collaboration with the Children's Investment Fund Foundation and the ELMA Philanthropies. ARISE is a new philanthropic funding mechanism centred on country priorities and leadership. Specifically, it will support country-led efforts to scale-up interventions and optimize the efficiency and effectiveness of NTD programs.

8.0 Conclusion

NTDs in Nigeria still constitute major public health problems and obstacles to socioeconomic development. Undoubtedly, the elimination and control of NTDs will remain one of the best global public health initiatives. Substantial progress was made by the end of 2020 in the control and elimination of some NTDs in Nigeria. Examples include guinea worm disease (which has been eliminated in Nigeria since 2013), onchocerciasis, lymphatic filariasis, schistosomiasis, and soil-transmitted helminths. A lot more needs to be done for other NTDs like human African trypanosomiasis, trachoma, leprosy, Buruli ulcer, rabies, yaws, leishmaniasis, and snake bites as many of the targets set for them in 2020 were not met. It is expected that greater action/commitment will be taken in the new 2021-2030 road map tagged ***“Ending the neglect to attain the Sustainable Development Goals*** to achieve the set targets for the remaining NTDs by the end of 2030.

In doing so, the government and NTD stakeholders must ensure that crucial interventions and services for the control and elimination of NTDs reach everyone who needs them so that no one is left behind; develop/update/sustain comprehensive multisectoral national action plans; encourage community engagement and empowerment so that the effects of interventions are enhanced and sustained; and improve their surveillance capacity to find new cases and foci of transmission, measure impacts, and document results.

Digital devices have the potential to improve case reporting, surveillance, and mapping of various NTDs in Nigeria. Leveraging these devices will be very beneficial to NTD programs because of their capabilities, especially in the modern era, where

almost everyone uses digital devices.

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Lymphoedema of the Genitalia (Penile and Scrotal) in Male Patients



Lymphoedema of the Limb in a Female Patient



A child-guide leading a blind family member

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