



Challenges of Malaria Elimination in Nigeria; A Review

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Abstract: In 2010 deaths from malaria in Nigeria were the highest recorded worldwide. This was a strange phenomenon since so much effort has been geared towards eradicating this dreaded disease in the country, hence the need to critically investigate the reasons for these challenges confronting eradication efforts. There is need to identify some of the setbacks confronting malaria elimination in Nigeria. Some of the challenges x-rayed include: inadequate healthcare infrastructure in the rural areas, poor drug distribution, increases in drug resistant parasites, increase in insecticide resistant mosquitoes, poverty leading to poorly constructed rural dwellings with cracks and crevices, and individuals' non-compliance with the control program due to high level of illiteracy. Much work still need to be done to reduce malaria incidence to a minimum level in Nigeria. No single individual method can be used to achieve a successful malaria control program. Strategic control methods must involve some combination of effective clinical control, vector control, reduction in contact of the mosquito with its human host, improved sanitation, and better health education and malaria prevention programs. If these efforts are sustained, over time Nigeria may succeed in eradicating malaria.

Keywords: Malaria, Elimination, Nigeria, Mosquito, Control

1. Introduction

Malaria has a worldwide distribution, affecting people of all ages, with an enormous burden amounting to 300-500 million clinical cases per year [1]. Globally ten new cases of malaria occur every second, which is a major public health problem in the tropics where about 40% of the world population lives. It is responsible for more than a million deaths each year, of which 90% occur in sub-Saharan Africa [2].

Malaria is caused by four different protozoa in the plasmodium genus: either *Plasmodium vivax*, which is more prevalent in low endemic areas, *P. ovale*, *P. malaria*, and *P. falciparum*, the most dangerous of the four. The *P. falciparum* has a life cycle in the mosquito vector and also in the human host. The *Anopheles gambiae* mosquito is the vector responsible for the transmission of malaria. The prevalence of malaria is dependent on the abundance of the

female anopheles species, the propensity of the mosquito to bite, the rate at which it bites, its longevity and the rate of development of the plasmodium parasite inside the mosquito. When the female mosquito bites and sucks the blood of a person infected with malaria parasites she becomes infected; she then transmits the parasites to the next human host she bites. Malaria incubates in the human host for about eight to ten days. [3]. The spread of malaria needs conditions favorable to the survival of the mosquito and the plasmodium parasite. Temperatures of approximately 70 - 90 degrees Fahrenheit and a relative humidity of at least 60 percent are most conducive for the mosquito [4].

Nigeria is at an alarming pace, as been the most populous country in Africa. The success of its malaria control programs will have a significant impact on the overall control

of malaria in the region. Because a large proportion of the population in Nigeria's rural areas lives in poverty [5], a control plan focused on those areas will be effective. Also, there are factors that are responsible for the increase in the resurgence of malaria that must be addressed in malaria transmission and control. These factors include the large-scale resettlement of people usually associated with ecological changes and conflicts, increasing urbanization disproportionate to the infrastructure, drug resistant malaria, insecticide resistant mosquitoes, inadequate vector control operations and public health practices.

The year 2000 went down in history as the year in which the most influential alliance (till date) in efforts to eradicate malaria converged in Abuja, Nigeria. That was the Roll Back Malaria (RBM) Partnership, and the targets set have come to be known as the "Abuja Targets". One of the goals set by the RBM Partnership was that by 2010, 80% of patients with malaria would be diagnosed and treated with effective antimalarial medicines [33].

Over 1 decade later, malaria remains a public health concern in the world's poorest countries, Nigeria chief among them. As at 2010, deaths from malaria in Nigeria were the highest recorded worldwide [6]. In 2005, artemisinin-based combination therapies (ACTs) were adopted as the first-line treatment for uncomplicated malaria in Nigeria [5]. This is a strange phenomenon since so much effort has been geared towards eradicating this dreaded disease in Nigeria. Hence the need to critically investigate the reasons or challenges confronting eradication efforts of Malaria in Nigeria.

1.1. Global Malaria Burden

About 107 countries and territories involving about 3.2 billion people are still at risk of malaria attack as at 2004 [6]. Present estimates suggest that around 350–500 million clinical disease episodes occur annually [7]. Around 60% of clinical cases and over 80% of the deaths due to malaria occur in Africa south of the Sahara [8]. It is the second leading cause of death from infectious diseases in Africa, after HIV/AIDS and is also a leading cause of mortality in under-five children accounting for 20% of death and constitutes 10% of the total disease burden of African continent [9]. Malaria kills a child somewhere in the world every 30 seconds. Over 90% of the malaria burden occurs in Sub-Saharan Africa [10–11]. In endemic areas, malaria infection in pregnancy is believed to account for up to a quarter of all cases of severe maternal anemia and for 10–20% of low birth weight babies [10].

Each year more than 500,000 women die during pregnancy or childbirth [12] and more than four million babies die in the first 28 days of life, accounting for 38% of mortality in children five years of age or under worldwide [13–14]. Maternal malaria infection is estimated to account for three to eight percent of all infant deaths [15]. Nigeria, Democratic Republic of Congo (DRC), Ethiopia, Sudan and Uganda account for nearly 50% of the global malaria deaths [16]. High rates of maternal and prenatal mortality have been observed in the different regions of Sudan; both malaria and anemia were the major causes of these high levels of mortality [17–19].

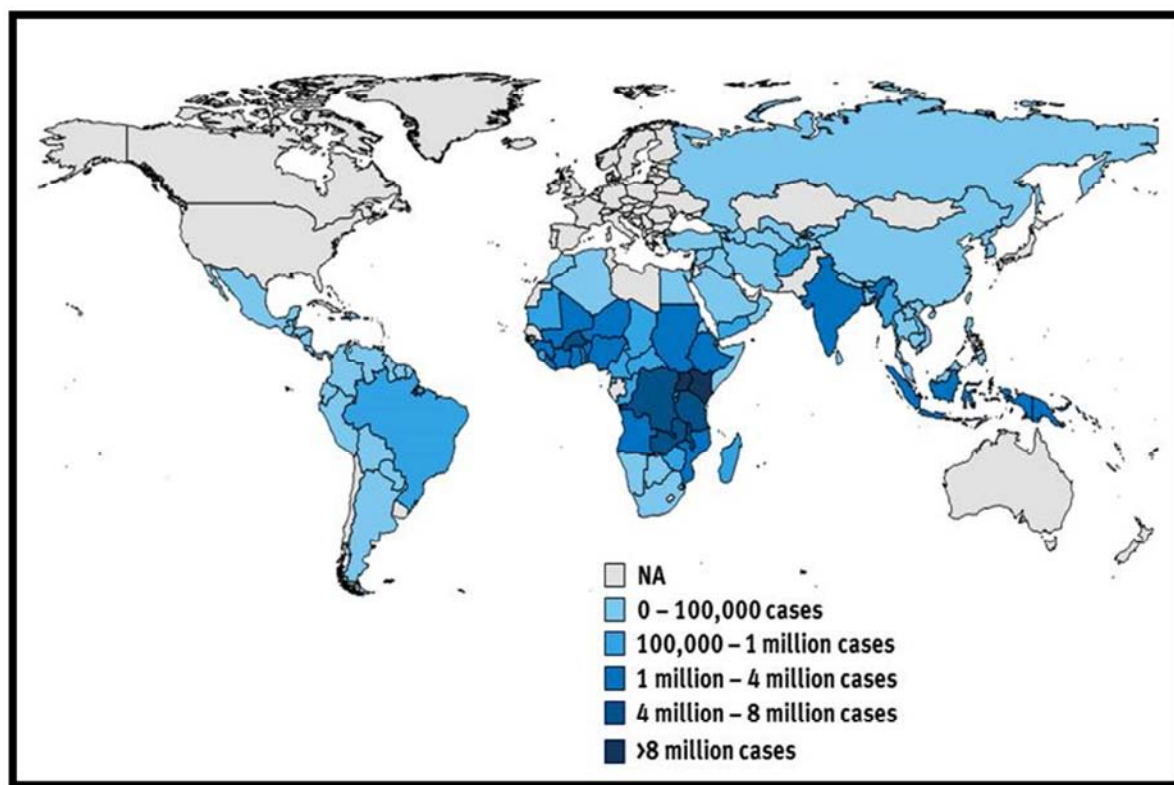


Figure 1. Global Map of Malaria Endemicity, 2010. (WHO, 2010; World Malaria Report 2010).

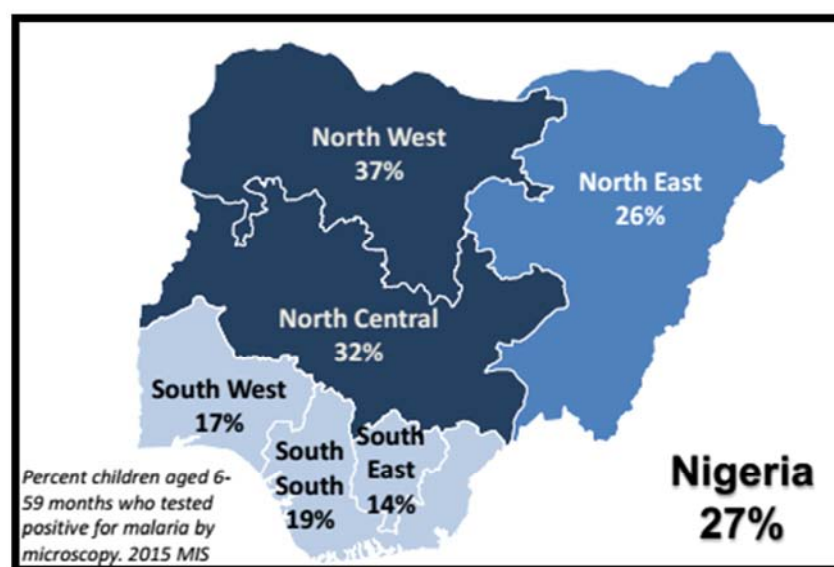


Figure 2. Prevalence of Malaria in Nigeria (WHO, 2016).

1.2. Distribution of Malaria Vector in Nigeria

Correct analysis of the distribution of specific malaria vectors is one of the prerequisites for meaningful epidemiological studies and for planning and monitoring of successful malaria control or eradication programmes [20]. Many *Anopheles* species has been reported in Nigeria. *An. gambiae* and *An. funestus* complexes has been reported as the two major *Anopheles* species in Southern Nigeria that are vectors of malaria with *An. moucheti* and *An. nili* [21-20]. The *An. gambiae* group consists of at least seven species which includes *An. gambiae* and *An. arabiensis* which are good vectors of malaria and are known to coexist in most part of West Africa [20].

In Northern Nigeria, *An. gambiae* was reported as the only *Anopheles* species in Sokoto metropolis [23] also *An. gambiae*, *An. arabiensis* and *An. funestus* was reported as the mosquito species in Kastina metropolis, Katsina state [24], while in Yola, the dry season mosquito collection for anophelines were; *An. gambiae* complex (64%), *An. funestus* complex (17%), *An. pharoensis* (9%) and *An. rhodesiensis* (5%) and the wet season collections were; *An. gambiae* complex (56%), *An. funestus* complex (19.6%), *An. pharoensis* (11.4%) and *An. rhodesiensis* (7%) [25]. In a

survey of mosquito in mid-western Nigeria, 3 *Anopheles* species (*An. gambiae*, *An. Pseudopunctipennis* and *An. funestus*) was reported [26]. In a study at Ajumoni Estate, a peri urban area of Ogun state, Southwest, Nigeria, *Anopheles* mosquito constituted 18.85% of all captured mosquito [27]. Two *Anopheles* species; *An. gambiae* and *An. funestus* were reported in Enugu, Southeast Nigeria [28].

1.3. Malaria Vector Control Practices in Nigeria

There are many factors that affect the control of malaria in Nigeria. This varies from region to region, depending on human knowledge, attitude and method of control. Ignorance as well as illiteracy (especially among rural dwellers) and financial impoverishment are part of these factors [29].

Studies have revealed that human knowledge, attitude and adoption of the various recommended applicable methods of personal and household protection against mosquito vary remarkably in different endemic regions of tropical countries [30-31]. Also, from a descriptive cross sectional study in two rural farming communities in Oyo state, using a pre-tested semi-structured questionnaire, the following findings were made [32] (table 1).

Table 1. Methods respondents used for prevention of mosquito bites in their homes.

Methods Used for Prevention of Mosquito Bites in Home	Fasola Community (N=199) (%)	Soku Community (N=204) (%)	Total (%)
Killing of mosquito with broom	79 (21.9)	125 (128.0)	204 (25.3)
Mosquito coil	93 (25.8)	100 (22.3)	193 (23.9)
Electric fan	54 (15.0)	97 (21.7)	151 (18.7)
Insecticide sprays	63 (17.0)	33 (7.4)	96 (11.9)
Window/door screen	33 (9.2)	49 (11.0)	82 (10.2)
Insect repellent body cradle	14 (3.9)	25 (5.8)	39 (4.8)
Insecticide treated bed nets (ITNs)	22 (6.1)	17 (3.8)	39 (4.8)
Mosquito cradle	2 (0.6)	1 (0.2)	3 (0.4)

Source: (Oladejo *et al.*, 2010).

His findings also revealed that only few of the respondents (11.2%) had the knowledge about the cause of malaria.

Majority of the respondents stated its causes to be consumption of contaminated food and water, staying long in the sun and dirty surrounding. As part of its effort to reduce and eliminate malaria incidence, and for each country to achieve the United Nations Millennium Development Goals, the WHO Global Malaria Programme (WHO/GMP) recommends the following:

- (1) Diagnosis of malaria cases and treatment with effective medicines.
- (2) Distribution of insecticide-treated nets (ITNs), more specifically long-lasting insecticidal nets (LLINs), to achieve full coverage of populations at risk of malaria.
- (3) Indoor residual spraying (IRS) to reduce and eliminate malaria transmission.

2. Challenges of Malarial Control in Nigeria

The major challenges to malaria control and prevention intervention are basically grouped into behavioural and non-behaviour factors. The behavioural factors relate to cultural practices which promote mosquito breeding and mosquito access to the people as well as failure of the risk populations to use technologies proven to be effective for the treatment, control and prevention of malaria promptly and appropriately. The main non-behavioural factors include geographical or ecological peculiarities, which also includes the tropical and subtropical condition; rainfall, high humidity and relative high temperature, the availability of mosquitoes and the presence of plasmodia [33]. In Nigeria, some factors that are actively contributing to the resurgence of malaria include;

- (1) Rapid spread of resistance of malaria parasites to chloroquine and other quinolines
- (2) Frequent armed conflicts and civil unrest
- (3) High Vector abundance and transmission potential caused by climate changes as well as water development projects including dams and irrigation
- (4) Poverty
- (5) Misconceptions about Malaria
- (6) Counterfeit and substandard drugs and Lack of access to good health care systems
- (7) Low Rate of Insecticide treated Net ownership and Use.

2.1. Anti-malarial Drug Are Becoming Less Effective as the Plasmodium Parasite Develops Resistance to Common Drugs

Resistance to drugs like artemisinin (a vital component of drugs used in the treatment of *P. falciparum* malaria) has been reported in a growing number of countries in Africa [34], pyrethroids, and the insecticides used in ITNs has been reported in 27 countries in Africa and 41 countries worldwide of becoming less effective [35]. Unless properly managed, such resistance potentially threatens future progress in malaria control in Nigeria.

2.2. Displacement of a Population Due to Communal Clashes, Conflicts and Insurgency

Large non-immune populations to endemic areas, resettlement of refugees to deteriorated environments that favour vector breeding (e.g., inadequate sanitation, marginal land), disruption of disease control programmes, breakdown of health systems [36-37], and impeded access to populations for timely delivery of medical supplies [38-40]. There is virtually no city in Nigeria that is not affected by communal clashes leading to a breakdown of health systems and impedes efforts in combating malaria.

2.3. Favorable Climatic Condition for Vector Breeding

Tropical areas such as Nigeria have the best combination of adequate rainfall, temperature and humidity allowing for breeding and survival of *Anopheles* mosquitoes. Temperature is an important factor which through its effect on the development of the malaria parasite and the vector greatly influences the geographical distribution of malaria transmission in general and malaria parasite species in particular. The development of *P. falciparum* in the female adult *Anopheles* requires a minimum temperature of 20°C whereas the other human malaria species can develop at temperature down to a minimum of 16°C. Higher than the minimum temperature, the development of the parasite in the vector accelerate with increasing Temperature [41].

2.4. Financial Status also Contributes to the Less Effective Control and Prevention of Malaria in Nigeria [42 and 43]

At the household level, poor housing exposes people to contact with infective mosquitoes, as insecticide treated nets are unaffordable to the poorest if they must pay for them, and lack of resources prevents people from seeking timely healthcare [5]. Studies have revealed that a substantially higher prevalence of malaria infection occurs among the poorest population group [44], and that the poorest were most susceptible to contracting malaria [45].

2.5. Lack of Knowledge About the Causes and Control of Malaria

Misconceptions about the cause of malaria are reported in researches from all over the globe [46]. A study in Benue state, Nigeria showed that residents of both urban and rural areas still have misconceptions about the cause of malaria. Some attributed malaria to spirits/charm, poor nutrition and stress [47]. These are major socio-cultural setbacks in malaria treatment and control. All these contribute to the discrepancies in health seeking behavior and may cause delay in seeking appropriate treatment.

2.6. Availability and Access to Standard Health Care System and Drugs

Lack of good roads to the health centers, poorly equipped centers, inadequate drugs for malaria treatment, substandard

antimalarial medicines and as well as available ratio of patients to a doctor is alarmingly high. As a result of this, this is encouraging patients to seek treatment from unauthorized local service providers, which often lead to further complications.

2.7. Insecticide Treated Nets (ITNs) and Its Use

Prevalence of mosquito net ownership varies greatly by residence and region. According to the 2003 Nigeria Demographic and Health Surveys (NDHS), only 12% of households reported owning at least a net while 2% of households report that they own an ITN [48]. Similarly in the 2008 (NDHS), data collected on measures to prevent malaria, shows that 17% of household nationwide own at least a net of any type, while 8% own at least an ITN. This shows that ownership of mosquito nets is not widespread in Nigeria. Financial status, unavailability, body reaction, alternative barriers and ignorance also affects the wide spread of ITNs in Nigeria [49]. The success of malaria control with ITNs has been bogged down by problems of delivery, distribution, usage and even acceptability of this method in Nigeria [50]. Public awareness and acceptance of insecticide treated nets varies from community to community in countries where this method of malaria control has been adopted.

3. The Way Out

(1) Accessibility to affordable primary health care centers with standard equipment and drugs must be guaranteed. Units within primary health care centers should be set up to diagnose, treat and monitor malaria cases.

(2) Epidemiological surveillance is highly essential in any control strategy, and is an essential guide in developing a multi-dimensional approach. The malarial control units set up should keep data on the epidemiological surveillance and the information should be sent to the national malaria control center.

(3) During seasonal outbreaks anti-malarial prophylaxis should be provided for children under five and pregnant mothers.

(4) Vector control using the barrier methods like bed nets and wearing protective clothes should be encouraged. It is important that people are also taught how to use and treat the bed nets.

(5) Workers should be trained on how to spray the various sites such as inner walls of houses and the surrounding environment. Wearing protective clothes and noise mask are very important during spraying and also residual spraying should be done at least every six months

(6) There are some indigenous plants and trees which indigenous people claim to contain anti-mosquito properties, the National Agency for Food and Drug Administration and Control should conduct research to verify such claims.

(7) More awareness and campaigns on fighting against malaria, side effects of self-medication, making environment clean, removing any structures and container that can aids the breeding of mosquitoes, clearing of bush near house and mud

houses should be plastered and painted white.

(8) Individuals should approach the nearest health clinic center for treatment

4. Conclusion

Much works still need to be done to reduce malaria incidence to a minimum level in Nigeria. Presently, evidence base strategies and action are on its prevention, diagnosis and treatment, surveillance and research, and social mobilization. The advance in the fight against malaria is largely due to the mass distribution of treated mosquito nets, especially the long lasting insecticide nets. A strategic plan to guide the scale-up of larviciding nationwide has been prepared for IRS (Indoor Residual Spray), and this was supported by Federal government, state government, World Bank and other international organizations. The Nigerian National Malaria Control Policy and guidelines for the diagnosis and treatment of malaria are also in place, especially for new guidelines on parasite-based diagnosis and the use of Rapid Diagnostic Technics to complement microscopy. This also focuses on making it affordable and available at a low cost. Media are raising awareness to educate, disseminate and advocate for policy to fight against malaria. Journalists from all zones have been trained to conduct in-depth reporting on malaria, and radio and television broadcasts have been prepared and disseminated nationwide. If these efforts are sustained, over time Nigeria may succeed in eradicating malaria.

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