

Challenges to Achieving Malaria Elimination in Nigeria

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Abstract Malaria remains the most important public health parasitic disease and a major global health problem with the greatest burden in sub-Saharan Africa. Over 90% of all malaria deaths still occur in Africa where it kills over half a million children less than 5 years of age each year. Nigeria accounts for 25 percent of the world's malaria burden. Apart from the health burden, the socio-economic consequences of malaria are enormous such that it was part of the Millennium Development Goals (MDGs). Following the end of MDG target to halt and reverse the incidence of malaria by 2015 which was considered a success, a new global target has been set. The new global strategy aims to reduce the global disease burden of malaria by 40% by 2020, and by at least 90% by 2030. It also aims to eliminate malaria in at least 35 new countries by 2030. Nigeria remains endemic for malaria and has the ambition to eliminate malaria. There are however challenges to confront in order to make the desired progress. Drug resistance, treatment failure, insecticide resistance, global warming and change in climate, conflicts, insurgency, and internally displaced persons, migration, lack of political will, inadequate malaria leadership, funding, and adequate local research constitute the challenges. Addressing these challenges is central to achieving malaria elimination.

Keywords: malaria, elimination, challenges, Nigeria

Cite This Article: Aribodor D. N., Ugwuanyi I. K., and Aribodor O. B., "Challenges to Achieving Malaria Elimination in Nigeria." *American Journal of Public Health Research*, vol. 4, no. 1 (2016): 38-41. doi: 10.12691/ajphr-4-1-6.

1. Introduction

Malaria remains the world most important parasitic disease of public health importance. The Roll Back Malaria (RBM) Initiative was launched in 1998 with the aim to markedly reduce malaria morbidity and mortality. In the year 2000, the world launched Millennium Development Goals (MDGs) and Goal 6C was to halt and reverse the incidence of malaria by 2015 [1]. Following the end of MDG, the World Health Organization member states, Nigeria inclusive, on 20th May, 2015 agreed a new global malaria strategy for 2016-2030 [2]. The strategy aims to reduce the global disease burden by 40% by 2020, and by at least 90% by 2030. It also aims to eliminate malaria in at least 35 new countries by 2030.

Between 2000 and 2013, the global malaria mortality rate dropped by 47% [3]. A major expansion of the WHO-recommended core package of measures – vector control, chemoprevention, diagnostic testing and treatment – proved both cost effective and efficient. Nevertheless, millions of people are still unable to access malaria prevention and treatment, and most cases and deaths continue to go unregistered and unreported. In 2013, malaria killed an estimated 584 000 people with over 2 million cases [3]. Nigeria is reported to have the unenviable record of contributing about 25% of the world malaria burden [4]. Nigeria also has the ambition to achieve malaria elimination and has rebranded the National Malaria Control Programme (NMCP) to National Malaria Elimination Programme (NMEP). But beyond the change in nomenclature are

important issues and challenges that need to be confronted in order to achieve malaria elimination. These are discussed and addressing these challenges is central to achieving malaria elimination in Nigeria.

2. Notable Challenges in Achieving Malaria Elimination in Nigeria

1. Drug Resistance and Treatment Failure

Malaria drugs are meant to clear malaria parasites from the blood of an infected person and in the process diminish sources of infection in the community. Drug resistance defined as the ability of a parasite strain to survive and or multiply despite the administration and absorption of drug given in doses equal to or higher than those usually recommended but within the tolerance of the subject [5], is a major challenge in the fight against malaria. Chloroquine used to be the drug of choice against malaria but chloroquine resistance that swept across endemic countries in the 1980s was the reason for treatment policy change that gave rise to the use of Artemisinin-based combination therapy (ACT) as the current drug of choice. ACT has played a major part in reducing the number of deaths due to malaria over the past decade [6]. However, Artemisinin-resistant *Plasmodium falciparum* has recently spread across large parts of southeast Asia, and now threatens to destabilise malaria control worldwide [5-10]. With suspected cases of treatment failures which drug resistance could be a factor, it is doubtful if Nigeria has research-based data on the

status of ACT, vis-à-vis resistance to *P. falciparum* and any role in treatment failures, hence a challenge to overcome.

Related to drug resistance is treatment failure. A failure to clear malaria parasites or resolve clinical disease following drug treatment could be a function of non-patency and not necessarily drug resistance as not all cases of treatment failure is a function of drug resistance. Many factors can contribute to malaria treatment failure including incorrect dosing, non-compliance with the duration of dosing regimen, poor drug quality, drug interaction, and improper or misdiagnosis. The role of each of these in malaria treatment failures in Nigeria is not known and need to be studied in the effort to eliminate the disease.

2. Insecticide resistance

Anopheles mosquitoes are vectors of malaria parasites. Control of Anopheline vectors of malaria relies on the use of Long-Lasting Insecticide Nets (LLINs) and Indoor Residual Spraying (IRS). The benefits of the use of these methods have been noted in many countries [11]. However, this success is being impeded by the development and spread of insecticide resistance malaria vectors in Africa, which may compromise the use of these vector control strategies. Only 4 classes of insecticide (carbamates, organophosphates, organochlorines and pyrethroids) are available for IRS, whereas the use of LLINs depends exclusively on pyrethroids. In Nigeria, Anopheline vector resistance to DDT and pyrethroids have been reported [12-17]. The emergence of pyrethroid and DDT resistance in the major Afro-tropical malaria vectors would have considerable implications for the success of vector intervention and the monitoring of ongoing control programmes. Hence, there is a strong need for the development of appropriate tools to monitor resistance in field populations of Anopheline mosquitoes in order to benefit from the contributions of the appropriate use of chemical insecticides in malaria elimination in Nigeria.

3. Global Warming and Climate Change

Available data suggest that the temperature of the world is increasing, with the last decade recorded as having the highest temperature [18,19,20,21]. This increase in global temperature mainly as a result of human activities, including burning of fossil fuel and deforestation, is known as global warming. Global warming changes the climate, and climatic factors play important roles in the spatial and temporal distribution of malaria [22,23]. The relationship between climatic variables and malaria transmission has been reported in many countries [21-25]. Malaria has been identified as one of the most climate sensitive diseases [26], with studies suggesting significant associations between temperature and malaria incidence [27]. Relative humidity [26,27] and rainfall [19,28] have also been associated with malaria transmission. The spatial limits of the distribution and seasonal activity are sensitive to climatic factors, as well as the local capacity to control the disease. Climate change expressed through changes in temperature and precipitation influences habitat suitability and can potentially shift the geographical range of malaria. Warmer temperatures accelerate physiological processes of the mosquito vector, leading to increased activity such as biting rate, growth, development and reproduction. Extreme temperatures may also decrease survivorship of vectors, leading to a convex relationship between temperature and mosquito performance [29]. In particular, temperature plays a key limiting role on

malaria at the edge of the altitudinal distribution of the disease in highland regions, where the parasite is not likely to complete development during the lifetime of its vector [29]. Climate change and drug resistance have been typically addressed as independent drivers of malaria trends, and have been considered as alternative explanations for the exacerbation of the disease in East African highlands [30,31]. Drivers of malaria control and elimination need information to guide vector control challenges in an era of climate changes. Therefore, there is work to be done in this regard.

4. Conflicts, terrorism, insurgency, internally displaced persons and migration

Civil wars have many negative consequences which include the destruction of civil infrastructures and the loss of human lives. There are many other important consequences related with the health status of the surviving victims of the civil war which can have very long lasting effects on the productivity of the economy and the health conditions of the country. The infection with the malaria parasite is one of these circumstances. The massive movement of non-immune people across areas infested with the malaria vector is one of the consequences of civil wars. A typical example is the decades of war in Sudan which destroyed physical infrastructure, social structures and virtually collapsed the health system [32]. The malaria control situation is threatened by the impact of refugees, returnees, internally displaced populations, and natural disasters, i.e. flooding, that put added strain on an already weakened system from years of conflict and that may destabilize whatever gains that have been made. The situation is aggravated by an increase in population due to refugees, returnees and internally displaced persons. Accordingly, the country experiences exceedingly high malaria transmission intensities with inherent high morbidity and mortality rates [33].

Nigeria today is plagued by conflicts, terrorism, insurgency, migration and internally displaced persons. Virtually all regions of the country are affected with the northeast bearing the highest burden. Every effort is needed to understand the dynamics of this issue in the effort to control and eliminate malaria.

5. Attitude and Behaviour Change

Perceptions about malaria illness, particularly households' perceived susceptibility and beliefs about the seriousness of the disease, are important preceding factors for decision-making concerning preventive and curative actions [34]. The understanding of the possible causes, modes of transmission, and individual preference and decision-making about the adoption of preventive and control measures vary from community to community and among individual households [35]. Misconceptions concerning malaria still exist [36] and practices for the control of malaria have been unsatisfactory [36,37,38,39]. Attitudes and practices about malaria and the effective use of intervention tools by households and individuals contribute immensely to sustainable control of the disease.

It is important in Nigeria to understand the culture and traditions of malaria endemic communities, as these form the basis of community members' values, which shape community members' attitudes on topics like malaria control and elimination. Often these local beliefs influence community members' action or inactions more than any other factor in the fight against the disease.

6. Political will, leadership and funding

An important action for mobilizing and encouraging governments to continue to support malaria programmes is to generate political will. Since 2000, there has been an increasing political drive to eliminate malaria [40]. The transition from sustained control, once achieved, to elimination demands a shift in focus. It requires significant national commitment, and sustained investment and financial support [41]. To maintain a malaria-free status, a country must show that it has the necessary political will and vision, has created the required legislative and regulatory framework and has adequate financial and administrative resources, personnel and technological capacity [42]. Effective and sustained control is an important prerequisite for elimination. An ongoing poll on the most important factor to progress to malaria global eradication, produced political will as the most critical factor with 74% of respondents voting for the option. Other responses were vaccine (20%), get new and effective public health insecticides (4%), get the next generation of drugs (3%) [42]. Hence the most important challenge in battle against malaria in Nigeria is the lack of political will. Until this is overcome, achieving elimination may be a mirage.

When there is the desired political will, effective leadership will emerge to coordinate elimination efforts. Nigeria needs to take up leadership roles in all aspects of malaria control and elimination, galvanize support and direction operations. Political leaders should muster the political will to create an enabling environment within which strategies to support elimination would operate: appropriate research, a well functioning health system, community participation, sustainable financing, a national and regional legal framework, and political stability are all crucial [43]. Politicians and policy makers need to understand that malaria elimination is a duty Nigeria should perform. It is important that the community should take responsibility for their own health and that community leaders should be involved in malaria prevention campaigns [44].

A certain level of financial support is required to achieve elimination, prevent resurgence and support larger goals of regional elimination and global eradication. Funding for malaria prevention in Africa over the past decade has had a substantial impact on reducing the burden of malaria [45]. These successes have been made possible by a marked increase in international and domestic funding for malaria control. Unfortunately, the donor funding has spawned dependency and expectation among its recipients. Interventions that are externally funded are not sustainable [41]. Should it disappear, or radically diminish, donor-dependent countries would be hard-pressed to finance malaria control efforts and the consequences will be severe. Internal funding, therefore, should always represent the ultimate goal of local malaria interventions to ensure that such interventions are sustainable in the long term.

7. Research

Local governments, states, regional and country-wide research studies in various aspects of malaria are desired for malaria elimination in Nigeria. Local produce or novel intervention tools are imperatives for malaria elimination. The malaria elimination surveillance research and development agenda needs to develop tools and strategies for active and prompt detection of infection. The capacity to assess trends and respond without delay will need to be

developed, so that surveillance itself becomes an intervention. Research is needed to develop sensitive field tests that can detect low levels of parasitaemia and/or evidence of recent infection [46]. Residual and outdoor transmission, falling out of reach of currently available prevention measures, particularly for mobile people, constitute another emerging challenge for which new tools and strategies are urgently needed [47,48].

3. Conclusion

Malaria elimination in Nigeria is a realistic possibility. Sustained efforts are critical to addressing the identified challenges. Local effort is the key and individual person the target. Surveillance systems must be refined and regularly updated for targeted interventions and to ensure the information required to inform an elimination agenda are routinely collected. Stakeholders should therefore act with a shared and focused goal; to create a Nigeria where no one dies of malaria.

Acknowledgements

We would like to acknowledge the many local and non-local persons who have devoted their effort and time in combating malaria as a public health challenge in Nigeria.

Competing Interests

The authors declare that they have no competing interests.

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