Chapter 4

Challenges of Managing Childhood Malaria in a Developing Country: The Case of Nigeria

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Additional information is available at the end of the chapter

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Abstract

Malaria still remains one of the highest childhood killer diseases, especially in the developing countries of Africa, Southeast Asia, and Eastern Mediterranean regions. With an estimated 100 million cases and 300,000 deaths from malaria annually, Nigeria has one of the highest burdens of malaria in the world, with children mostly affected. It accounts for 60% of outpatient visits, 30% hospitalization among children under 5 years of age. Great efforts and huge funding have been committed globally towards the fight for malaria, but malaria continues to be a major challenge in these developing countries, especially countries in Sub-Saharan Africa. The World Health Organisation adopted a cost-effective intervention strategy, which comprises a three-pronged approach: vector control, chemoprophylaxis, and case management. Case management involves early diagnosis and treatment. This chapter looks at the challenges militating against the achievement of this important aspect of malaria control in children as well as efforts that have been made or not made to overcome these challenges using Nigeria as a case study.

Keywords: malaria, childhood, challenges, managing, Nigeria

1. Introduction

Malaria still remains one of the highest childhood killer diseases, especially in the developing countries of Africa, Southeast Asia, and Eastern Mediterranean regions. In Africa, it is estimated that malaria kills one child every 2 minutes [1]. According to the latest estimates from the World Health Organisation (WHO), there were 214 million new cases of malaria worldwide in 2015 with an estimated 438 000 malaria deaths [1]. Most of these cases (88%) and deaths (90%) were recorded in the African region [1]. Nigeria and the Democratic Republic

of Congo, both in African region, accounted for about 40% of the total estimated malaria deaths worldwide. The Southeast Asia and the Eastern Mediterranean regions account for the few remaining cases in that order. The denominator in all these regions, apart from the favourable weather conditions for the breeding of malaria parasite-carrying mosquitoes, is the widespread poverty and systemic inadequacies: lack of political will and poor health systems in many of the countries that make up the regions. In parts of the world where malaria is endemic, severe malaria is mainly a disease of children under the age of 5 years due to the acquisition of specific immunity against plasmodium; the malaria-causing parasite as the child gets older, providing some protection (though incomplete) against malaria [2]. Malaria is endemic in most countries of Sub-Saharan Africa with the children and pregnant women population being the most vulnerable to the disease. Of the estimated 438,000 malaria deaths worldwide, children under the age of 5 years constitute 306,000 (70%) [1].

Despite these seemingly very high figures, there has been marked decline in the mortality from malaria. The global cases of malaria declined by 18% from an estimated 262 million in the year 2000 to 214 million in 2015. The death rate decreased by 48% from a global estimate of 839,000 in year 2000 to 438,000 in 2015. In children under the age of 5 years, the number of malaria deaths fell from an estimated 723,000 in year2000 to 306,000 in 2015, a decrease of about 58% (**Table 1**). This has come through the combined efforts of the World Health Organisation, its Rollback Malaria Partners and the various governments in the different countries afflicted by the malaria scourge.

WHO region	Estimated malaria deaths by year				Percentage reduction
	2000	2005	2010	2015	2000–2015
Africa	694,000	5910,000	410,000	292,000	−58%
Americas	400	300	300	100	−66%
Eastern Mediterranean	5300	5200	2000	2200	−58%
European	0	0	0	0	0
Southeast Asia	19,000	16,000	14,000	10,000	−49%
Western Pacific	4,700	2,000	1,600	1,500	−68%
World	723,000	614,000	428,000	306,000	−58%

Source: World Malaria Report 2015.

Table 1. Estimated number of malaria deaths in children under the age of 5 years from year 2000 to 2015 by the WHO region.

To achieve this, the WHO adopted a cost-effective intervention strategy, which comprises a three-pronged approach: vector control, chemoprophylaxis, and case management. The vector control involves the prevention of mosquitoes from acquiring or transmitting infection through the use of long lasting insecticidal nets (LLIN) and indoor residual spray (IRS). Chemoprophylaxis involves the use of antimalarial drugs to suppress and prevent the establishment of

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infection in the human, whereas case management involves the prompt diagnosis and treatment of malaria.

Although these strategies are said to be cost effective, the achievements recorded in the fight against malaria has not come at a cheap price. The global cost of fighting malaria increased from the sum of US$ 960 million in year 2000 to a whopping US$ 2.5 billion in 2014 [1]. The majority of these funds were contributed by international partners (donor agencies). In spite of these global efforts and huge funding for malaria control, malaria continues to be a major challenge in these developing countries, especially countries in Sub-Saharan Africa. These challenges in the fight against malaria, with particular attention to case management, are discussed below using Nigeria as a case study.

2. Nigeria and malaria burden

As the most populous country in Africa, Nigeria contributes the majority of the Africa malaria burden. The country has an estimated total population of approximately 172 million (2014 estimate) with an annual growth rate of about 2.7% and a GDP per capita of US$1091.64 (2014) and inflation rate of 9.0% (2015) [3]. The public health sector in Nigeria is run by the three tiers of government: federal, state, and local governments. The federal government co-ordinates the affairs of the tertiary health facilities and provides overall policy and technical support to the health sector. The state government co-ordinates those of the secondary centres and some state-owned tertiary centres and also lend support to the primary health sector. The local government takes care of the primary health centres, which have gone moribund in many parts of the country. The annual health budget is usually well below 10% of the total budget. For instance; in 2015, it was 6.3%, whereas in 2016, it dropped to about 3.7%. In general, the country's health system may be described as weak due to inadequate funding and supervision.

Nigeria, being a tropical country, has one of the best combinations of adequate rainfall, temperature, and humidity, allowing for the breeding and survival of the female anopheline mosquitoes, the malaria vector. Most (97%) of the malaria in Nigeria are mainly due to *Plasmodium falciparum*, with *Plasmodium ovale* and *Plasmodium malariae* affecting only a few persons. Although, severe malaria is mostly caused by *P. falciparum*, *Plasmodium vivax,*and *Plasmodium knowlesi* have also been indicated in causing severe disease [2]. However, *P. vivax* does not occur in indigenous Nigerians [4], and there is no documentation of *P. knowlesi* in any Nigeria.

Malaria remains a major public health problem in Nigeria. It accounts for more cases and deaths than in any other country in the world. There are an estimated 100 million malaria cases with over 300,000 deaths per year in Nigeria [5]. Malaria accounts for 60% of outpatient visits and 30% of hospitalizations among children under 5 years of age in Nigeria [5]. This implies a huge loss in terms of financial resources and man hours and in the case of the school age child, loss of school hours [6–8].

In line with the World Health Organization recommendation, the country has adopted the Test, Treat, and Track (3T) strategy with all suspected cases of malaria properly diagnosed

using Rapid Diagnostic Tests or microscopy, treated promptly with recommended artemisinin-based combination therapy (ACT) if the result is positive and documented [4].

3. Malaria diagnosis

3.1. Clinical diagnosis

WHO has identified early diagnosis as the first step in the treatment of malaria. This is necessary to prevent progression of the disease to severe forms. Malaria does not have any specific symptoms and signs and as such may mimic several tropical childhood illnesses [9]. These include bacterial sepsis, enteric fever, pneumonia, meningitis, urinary tract infection, otitis media, and pharyngitis. This makes the specificity of clinical diagnosis of malaria very poor and thus gives room for indiscriminate use of antimalarials especially in endemic areas. In some cases, malaria may co-exist with any of these other conditions [10–13], necessitating more competent health personnel in the management. Studies [14–16] have shown that treatment based on clinical information alone leads to over diagnosis and over treatment of malaria. In addition, there may be increased morbidity and possible death from the neglected disease causing the child's symptoms.

Even with the unreliability and consequences of reliance on clinical information alone for malaria diagnosis, a large proportion of healthcare providers in Nigeria still treat malaria presumptively [14, 17, 18]. The 2013 Nigeria Demographic and Health Survey indicated that the average rate of antigen or parasite detection in children before treatment was 11.1% [19]. Reasons adduced for the presumptive diagnosis by the healthcare providers included delay in getting a blood microscopy from hospital laboratories, unavailability of malaria rapid diagnostic test (mRDT), reliance on blood tests create an impression of incompetence of the health personnel, as well as malaria being the first suspect in any child with fever since malaria is endemic in Nigeria [17]. According to WHO, less than half of the suspected malaria cases in most malaria endemic regions are truly infected with malaria parasite, hence their insistence on laboratory confirmation before treatment [1].

3.2. Parasite detection

In line with the WHO policy, the national malaria guideline of Nigeria recommends the confirmation of all suspected cases of malaria by parasitological testing either with microscopy or by the use of mRDT. This is particularly important as accurate diagnosis before treatment will enhance a more targeted therapy, reduce the duration of illness, and may even prevent death from treatment of another disease as malaria. It will help prevent drug resistance and also enhance the diagnosis and case management of other diseases that may mimic malaria in children since the exclusion of malaria will mean a search for the cause of illness. Apart from saving lives, both money and man hours are saved.

The challenge with this confirmation test is mainly that of availability and willingness to go for test before treatment. Microscopy, which still remains the gold standard, is fast disappearing

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from many health facilities. The reasons range from inability to acquire new or replace old and damaged microscopes to absence of a qualified microscopist. In addition, ready availability of reagents and slides for use with the microscopes, where available may be a problem. There is also the need for quality assurance, which is virtually non-existence in most health facilities in the country. Another important consideration is the need for electrical power, which is a big issue in the country. The alternative is the mRDT, which is an antigen detection test. Three antigens: *Plasmodium falciparum* histidine-rich protein 2 (*Pf*HRP2), plasmodial aldolase, and plasmodial lactate dehydrogenase (pLDH) are currently used for mRDTs. The *pf*HRP2 mRDTs are the most commonly available types in Nigeria and seem most suited for the country as up to 97% of the malaria cases are due to *P. falciparum*. The test is easier to conduct and requires neither power supply nor any expertise. It is usually available as a pre-packed ready-to-use kit with a single container of buffer solution in every box of kits. Since the adoption of the mRDT by the WHO, the number of the products has continued to increase rapidly with over 200 different products available in the market worldwide [20]. This rapid proliferation of brands also lead to increase in the number of substandard products, which easily find their way into developing countries like Nigeria with less stringent quality control. Reviews and studies show that the commercially available MRDTs show wide variability in diagnostic sensitivity and specificity [21–25]. To stem this "influx," WHO has continued to conduct testing of the products and issuing guidelines to assist countries adopt the mRDT for use [20].

Since the introduction of RDT kits, there has been increased knowledge of mRDT by healthcare givers and increasing availability at health facilities, but its regular utilization to confirm suspected cases of malaria by these health workers prior to treatment is not encouraging [17, 26]. Another major concern is the fact that a good number of these mRDTs have high false negative results at lower antigen titre (200–500 parasites/ml) [20, 23]. For the detection of *P. falciparum* in all transmission settings, WHO recommended the panel detection score against *P. falciparum* samples should be at least 75% at 200 parasites/μL [27]. The Nigerian malaria treatment guideline recommends the use of an alternate diagnostic test where continued suspicion exists after a negative test [4]. Some authors have recommended the combined use of two methods to confirm the diagnosis of malaria [22]. This invariably adds to the cost of treatment as well as time spent at the health facility, which many healthcare givers and patients will evade. Also, quality and performance check of the mRDTs is partly absent or non-existent in malaria-endemic countries, including Nigeria [20]. The quality of the mRDT may be affected the very high temperatures (above 40°C) such as can be found in some parts of the country. It is important to note that although mRDT may constitute an extra cost to the case management of malaria, it is no doubt a cost-effective innovation, even more cost effective than microscopy [28]. Despite these challenges with the use of mRDT and microscopy, they are still very useful components of malaria case management.

4. Malaria treatment

In consonance with the WHO recommendation on the treatment of malaria, the Nigerian government adopted the use of artemether-lumefantrine (AL) for the treatment of uncompli-

cated malaria and artesunate-amodiaquine (AA) as alternative [4]. For severe falciparum malaria treatment, the drug of choice is intravenous artesunate with parenteral artemether or quinine as alternatives where intravenous artesunate is not available. For settings where a complete treatment of severe malaria is not feasible, a pre-referral treatment with intramuscular or rectal artesunate or intramuscular quinine in this order of preference is recommended.

Although the Nigerian government had adopted AL and AA as the first and second line respectively, several brands of other ACTs are widely available and used in the country. These include artesunate-mefloquine, dihydroartemisinin-piperaquine, artemisinin-piperaquine, and artesunate-sulfadoxine pyrimethamine. Regardless of the constellation of ACT antimalarial drugs available, many children still receive monotherapy notably chloroquine and sulfadoxine-pyrimethamine especially among the lower socioeconomic class and those with uneducated or under educated parents [17, 29]. Other commonly used antimalarial monotherapy in children include oral artesunate, amodiaquine, halofantrine, and oral quinine and paludrine [29, 30]. The drawback in this practice is the progression to severe malaria with its consequences, which include prolonged hospitalization, increased cost of treatment, avoidable blood transfusions, and even death. The frequent prescription of concomitant medications in the form of different antipyretics, sometimes multiple, haematinics, multivitamin preparations, and antibiotics, which are mostly inappropriate also add to the cost of treatment and burden of medications for the child [29]. In Sub-Saharan Africa, the proportion of children aged under 5 years, who received an ACT, is estimated to have increased from less than 1% in 2005 to 16% in 2014, but still falls substantially short of the target of universal access for malaria case management [1]. One important reason for this poor situation is that a greater proportion of children with fever are treated outside the health sector.

In Nigeria, only about 35% of children receive treatment at government health facilities [19]. The rest are treated by the patent medicine vendors (PMV), pharmacy shops, private health facilities, or by traditional medicine practitioners. In the light of this, the government of Nigeria with the assistance of Roll back Malaria partners and donor agencies tried to scale up the treatment of malaria through the engagement of the private sectors, especially the PMVs whom they have trained in some states of the federation and the provision of pre-packaged, age-specific antimalarials for easier dosing [19]. A study by Berendes et al. [31] in the northern part of Nigeria showed that patent medicine vendors are not reliable in the treatment of malaria because most PMVs were ignorant of and lacked training about new treatment guidelines that had endorsed ACTs as first-line treatment for uncomplicated malaria. They stocked and dispensed monotherapy to patients with suspected malaria. However, another study [32] in the southern part of the country showed an improved knowledge of ACT by PMVs, but yet other non-recommended antimalarial drugs such as chloroquine were still sold to customers without prescription. Another worrisome trend is the prevalent use of various forms of herbal medications in the treatment of malaria even in urban areas [7, 33, 34]. Some of these herbal preparations, which mostly do not have standard dosage, have the potential to cause liver or kidney damage [35].

The cost of malaria treatment is also a contributing factor to the non-use of ACT because this remains high for the average Nigerian. In 2009, the cost of treating a child was about US$6.58,

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which was mostly on out of pocket expenses [8]. Although a national health insurance scheme is available, only a very small percentage of the population, mainly federal civil servants and staff of big companies, have access to it.

Another major challenge with the treatment of malaria in Nigerian children is the high rate of fake and substandard antimalarial drugs [36, 37]. This brought about a lot of confusion to the healthcare provider regarding the possibility of co-morbidities when the child failed to respond to the proper treatment. This may lead to the administration of unwarranted antibiotics while the child deteriorates from untreated malaria. However, the situation has improved significantly in recent times [36]. The rate of fake and substandard drugs in the country improved from about 41% in 2002 to about 10% in 2010 [36]. The fight is still ongoing by the country's National Agency for Food and Drug Administration and Control (NAFDAC) to eradicate fake drugs from the country.

5. Other challenges

5.1. Co-morbidity with chronic diseases

Nigeria being a developing country has its fair share of children with chronic diseases, such as malnutrition, HIV/AIDS, and sickle cell anaemia. These children equally suffer from malaria, which is usually more severe than in the normal child [38–40]. Managing such children could pose a great challenge. Apart from the complications such as severe anaemia, which are more prevalent in these children [38–40], concurrent management of the underlying disease in the face of challenging finances often result in difficult decisions.

5.2. Blood transfusion

Children with severe malaria anaemia suffer greatly due to the difficulty in obtaining safe blood for transfusion. The primary health facilities and many private facilities do not have logistics to store blood. Patients requiring blood transfusions in these facilities are either referred to tertiary centres or made to purchase blood from private blood banks at very exorbitant prizes, some of which the safety are not guaranteed. In some cases, the child may be unable to make it alive to the referred centre. Those who do often face many logistic challenges ranging from cost of processing to provision of donor to replace the transfused blood.

5.3. Delayed presentation

Late presentation usually results in delay in initiation of the right and adequate treatment. No doubt this contributes significantly to the malaria mortality in children. Factors responsible may include poverty, inadequate home treatment, and lack of access to standard treatment centres. Certain traditional beliefs such as association of fever with teething and growth may also delay presentation. Likewise, the increasing belief in unorthodox treatment such as herbal medications and faith-based healing may also lead to delays in presentation.

5.4. Geographic inequality of health facilities and personnel

Although majority of Nigerians reside in the rural areas, only a small proportion of health facilities are located there and these are mainly primary and secondary care facilities. Likewise, fewer personnel are available in these rural communities. As a result, most patients with severe forms of malaria will need to travel some distance with all the attendant challenges such as bad roads.

6. Conclusion

Despite all these numerous challenges plaguing the management of malaria in Nigerian children, there have been significant gains in the fight against malaria as evidenced by the improved indices. Thanks to all the Rollback Malaria partners operating in the country. However, a lot of commitment and willingness to translate what is on paper to action is still expected from the Nigerian government.

First is to strengthen the health systems at all levels from primary to tertiary in order to restore the hopes of the numerous Nigerians who die because they cannot afford standard private health facility treatments. This should include the recruitment and adequate training and retraining of healthcare personnel in all the primary and secondary care centres to be able to make proper diagnosis and treat malaria cases. Also, adequate equipping of all the government health facilities with diagnostic facilities and eradication of the "out of stock syndrome" for antimalarial drugs.

There should be strengthening of the already on-going awareness creation through the media to sensitize the public on the need to seek care early and at government approved health facilities.

There should be continuous appraisal of the antimalarial drugs and mRDTs in the country with a view of identifying and expunging the substandard and fake ones. The large number of different brands of ACTs and in the country need to be pruned down to just a few quality and trusted brands.

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