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Original Research Paper

Overview of malaria prevention and treatment management in The Gambia: a descriptive study

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Abstract

Malaria is a significant public health problem in The Gambia, a country in West Africa with a population of about 2.4 million people. The disease is endemic in the country and is a major cause of morbidity and mortality, especially among children under five. Malaria prevention strategies are essential in The Gambia. Although not totally but significantly, several techniques have been implemented in The Gambia to combat the spread of malaria to prevent and control the disease. This study aims to explore and provide an overview of strategies implemented in The Gambia to prevent and manage malaria in children under five. The study was a descriptive study using situational analysis with an extension of the basic guidelines established by WHO to prevent malaria by analyzing the latest developments on the progress made in The Gambia. The Gambia has made significant progress in preventing and controlling malaria through strategies, including insecticide-treated nets (ITNs), indoor residual spraying (IRS), antimalarial treatment, education and awareness, and environmental management. Sustained efforts and investments in these strategies are critical to reducing the population burden of malaria and achieving the goal of malaria elimination.

Keywords: control; malaria; management; prevention; the gambia

1. Introduction

Many people in the world live in areas where malaria is common. There are 627,000 malaria-related deaths worldwide and a projected 241 million cases by 2020 (World Health Organization, 2022; World Malaria Report, 2021). Most malaria deaths in sub-Saharan Africa are caused by *P. falciparum,* and more than half occur in children under five. *P. vivax is* increasingly recognized as the leading cause of malaria in children and newborns in the Asia-Pacific region and the Americas, with high morbidity and mortality. *P. falciparum is* still the most common malaria parasite in all regions outside the Americas (Ashley & Poespoprodjo, 2020). Uncomplicated or severe disease manifestations are reported. Clinical diagnosis is unreliable as uncomplicated malaria shows non-specific symptoms such as fever, chills, headache, myalgia, cough, vomiting, and diarrhea. Diagnosis, made by laboratory testing, requires a high index of suspicion in all visitors to endemic areas who develop a fever. Any child with a fever who has traveled to a place where malaria is endemic should be checked for the disease for up to one year after return (Abbas et al., 2023; Jawo et al., 2022).

P. falciparum, P. vivax, and *P. knowlesi* are the most common causes of severe malaria, with P. *vivax* and *P. knowlesi* rarely causing severe malaria in non-endemic areas or in returning travelers. Cerebral malaria, severe anemia, metabolic acidosis, and hypoglycemia are the most frequent symptoms

of severe malaria in children; jaundice, renal failure, and acute pulmonary edema are rare. In highly endemic areas such as sub-Saharan Africa, where survivors are more likely to have neurological and cognitive abnormalities, behavioral problems, and seizures, cerebral malaria is the leading cause of neurological disability in children (Olasope et al., 2023; Ashley & Poespoprodjo, 2020). Malaria is diagnosed by identifying parasites in peripheral blood using molecular and rapid diagnostic microscopic techniques. Particularly in endemic settings, parasitological diagnosis ensures appropriate treatment and, if negative, directs practitioners to alternative diagnoses. Rapid same-day diagnosis is essential as severe malaria can progress rapidly, especially in children under five years of age (Carrasco et al., 2023; Onosakaponome et al., 2020).

Plasmodium malaria is a significant public health problem in The Gambia, a country in West Africa with a population of approximately 2.4 million people. It is endemic in the country and is a major cause of morbidity and mortality, especially among children under five. Malaria is caused by a parasite called Plasmodium, transmitted to humans through the bite of an infected female Anopheles mosquito. So far, not many studies have discussed malaria cases in The Gambia despite the high incidence of malaria. In The Gambia, two species of malaria parasites, Plasmodium falciparum, and Plasmodium malaria, are responsible for the majority of malaria cases. Malaria transmission in The Gambia is seasonal, with the highest infection rates occurring during the rainy season, which runs from June to October. During this time, increased humidity and rainfall provide ideal breeding conditions for mosquitoes, increasing the number of infected mosquitoes.

Efforts to control and prevent malaria in The Gambia require sustained and coordinated efforts by the government, healthcare providers, and community members. Improving access to health services and preventive measures, investing in research and development of new malaria control methods, and improving surveillance and response systems are important steps in the fight against this deadly disease. The Gambia has made significant progress in the fight against malaria in recent years, with a substantial decrease in the incidence of the disease. This progress can be attributed to implementing various malaria control measures, including distributing insecticide-treated bed nets, indoor residual spraying to kill mosquitoes, and providing prompt diagnosis and effective treatment for malaria cases. Despite these efforts, malaria remains a significant health challenge in The Gambia, especially in rural areas with limited access to health services and preventive measures. In addition, the emergence of drug-resistant strains of malaria threatens the effectiveness of current treatment methods. This study aims to explore and describe the management of malaria treatment and prevention in The Gambia.

2. Research Methods

This study used a situation analysis approach, which basically examines and evaluates the current situation or context in which malaria exists and how it is handled in a specific age group (under-fives). The following steps were taken in the situation analysis approach during the research: Defining the research problem: The first step we took was to clearly define the research problem or question that needed to be answered (malaria) and the population at risk of complications and death. This provided a focus for the analysis and guided the selection of data sources and methods used in the study. We then identified relevant factors: In this step, the research problem had been defined; what we did was identify key factors that could affect the malaria situation, especially among vulnerable groups. These factors include economic, political, social, technological, environmental, cultural, and political factors where the distribution of health infrastructure is concentrated. We then collected data: qualitative data collection was conducted based on the identified factors using various sources, such as surveys in six health facilities across health regions in the country and several interviews conducted to gather information. This data helped provide a comprehensive understanding of the malaria situation in The Gambia.

Data analysis: The data collected were analyzed to identify patterns, trends, and relationships compared to situation reports provided by the government. This helped identify strengths, weaknesses, opportunities, and threats (SWOT) relevant to malaria research in The Gambia. The researchers then developed a SWOT analysis: We used the data analysis to create a SWOT analysis, which summarized the key findings of the situation analysis on Malaria reform and management in The Gambia. This has helped identify the most important internal and external factors for malaria among children under five and government strategies to alleviate the problem, especially at the field level. Finally, the data were interpreted as research results. We interpreted the situation analysis results, summarizing the factors most relevant to malaria in The Gambia, especially successful interventions. This forms the basis for developing future challenges of malaria in The Gambia.

Overall, the situation analysis approach has helped the researchers comprehensively understand the current malaria situation in The Gambia and identify relevant factors.

3. Results and Discussion

Based on the results of the analysis and interpretation carried out by the research team, several descriptions were obtained related to the management of malaria prevention and treatment in The Gambia, which focused on Malaria Prevention and treatment in general, prevention and treatment of malaria in children under five years old and prevention and treatment of transmission in tourists as below:

3.1. Overview of Malaria Prevention and Management

The type of Plasmodium parasite, the region where malaria is contracted, the clinical condition of the patient, and previous use of antimalarial prophylaxis are factors that influence the course of treatment. The drugs selected depend on local availability and national legislation (Cirera et al., 2023; Nascimento et al., 2023; Paaijmans & Huijben, 2020). While this is only sometimes possible, treatment should ideally wait until laboratory testing verifies malaria diagnosis. It is recommended that all children suspected or found to have falciparum malaria be hospitalized for at least 24 hours, as progression to severe malaria can occur rapidly in The Gambia.

All blood-stage infections of Plasmodium species should be eradicated using schizonocide drugs. In contrast, liver-stage infections of *P. vivax* and *P. ovale* should be eradicated using hypnozoitocide drugs to prevent relapse. Children and adults should receive a 3-day artemisinin-based combination treatment for uncomplicated *P. falciparum* malaria (Olapew et al., 2023; World Health Organization, 2022). Other therapies include quinine sulfate, atovaquone-proguanil, and doxycycline/clinician. Combination therapy based on artemisinin is increasingly used to treat all uncomplicated infections and is highly effective against all species, simplifying malaria treatment. Continuation of 14 days of primaquine treatment is recommended in infants older than six months for *P. vivax* and *P. ovale infections (*or mixed infections where both species are poorly eliminated) (Forgan et al., 2014; Lalloo et al., 2016). This will help prevent relapse. A G6PD deficiency test should precede the administration of primaquine, and if the patient has G6PD deficiency, it is necessary to consult a pediatric infectious disease specialist.

The only antimalarials effective against all stages of the parasite's life cycle, including adult gametocytes, the form that infects mosquitoes, are Artemether + lumefantrine (80mg + 480mg) and primaquine. Primacaine (0.25 mg/kg) should be given as a single dose as a *P. falciparum* gametocide in environments with low transmission levels. However, it will also be helpful in malaria-free areas with Anopheles mosquitoes where imported cases may cause small local outbreaks. Since this dose, although effective as a gametocide, is not sufficient to produce toxicity in individuals who have G6PD variation, it is not important to know the G6PD status of the patient in this case. (Gadji et al., 2023, Mbye et al., 2022).

Due to the possibility of death within hours of hospital admission, severe malaria is a medical emergency. Assessment of the respiratory, circulatory, and neurological systems as well as the measurement of glucose, hemoglobin, and parasitemia, are part of the first treatment (Cirera et al., 2023). It is crucial to differentiate cerebral malaria from other coma-causing conditions, such as bacterial meningitis and hypoglycemia associated with malaria. Blood should be drawn for later testing, and anti-malarial drugs should be started immediately if severe malaria is strongly suspected, but laboratory diagnosis is unavailable. The preferred treatment for severe malaria, regardless of the infecting species, is parenteral artesunate. Weekly checks for symptoms of hemolytic anemia should be performed in all children receiving IV artesunates. (Ashley & Poespoprodjo, 2020, Idro et al., 2022).

3.2. Management of malaria prevention and treatment in children under five

The management and prevention of malaria in children under five years of age in The Gambia is an important issue that various organizations have addressed. According to UNICEF data, in 2021, there were 247 million malaria cases worldwide, leading to 619,000 deaths in total, with 77% of those deaths being children under the age of five (Sarfo et al., 2022). The World Health Organization (WHO) reported that in 2015, The Gambia achieved the Millennium Development Goals for infant mortality, under-five mortality, immunization coverage, and the proportion of children under five sleeping under insecticide-treated nets (WHO, 2016). UNICEF data also reported that 49% of children under five in The Gambia had low transmission rates, increasing to 54% in 2005-2006 and then decreasing to 50% in 2010 (NMCP 2019).

The government of The Gambia, through the national malaria control program (NMCP) in collaboration with Catholic Relief Services (CRS), has ensured that every under-five child in The Gambia receives at least one long-lasting insecticide-treated bed net (LLIN) each malaria season, which can last for six months. Indoor residual spraying (IRS) is another malaria prevention strategy developed to reduce malaria incidence among under-fives and pregnant women, especially in rural areas. It significantly reduces the frequency of mosquito bites and the length of time mosquitoes stay indoors, leaving them with nowhere to rest or hide. Another important intervention is that the Gambian government has also established a network of health facilities across the country through the NMCP where caregivers can bring children suspected of having malaria for diagnosis and treatment. Rapid diagnostic tests confirm the presence of malaria, and antimalarial drugs are prescribed to treat the infection as quickly as possible. Early diagnosis and treatment are essential to prevent severe malaria and its complications, and this is a measure adopted by the Gambian government.

In locations where malaria is endemic, prevention includes controlling vectors, treating patients who are already sick and preventing more cases, and, starting in 2021, immunizing young children against *P. falciparum.* (Battle et al., 2019, Kariuki et al., 2022).. WHO advises using insecticide-treated bed nets or indoor residual spraying for vector control in places where malaria transmission still exists. Larval control is mainly done by managing water bodies. There are three chemoprevention protocols, namely (1) intermittent sulfadoxine-pyrimethamine (SP) treatment for pregnant women; (2) ongoing SP treatment for infants and children; and (3) seasonal SP treatment plus amodiaquine for children at high risk of severe malaria. Malaria control efforts in endemic areas are hampered by problems with health facilities and health care delivery systems, vector resistance to insecticides (such as pyrethroids), and increasing anti-malarial drug resistance of Plasmodium spp. (CDC, 2023).

A 4-dose regimen of RTS, S (Mosquirix) malaria vaccine is currently recommended to prevent *P. falciparum* malaria in children over five months of age living in moderate to high transmission areas after four decades of research and clinical trials. According to WHO, the vaccine, which consists of *P. falciparum* circumsporozoite protein combined with HBV surface antigen, can prevent severe disease in 30% of children. Follow-up results show that protection is temporary and depends on the transmission

strength. Patients still contracted the disease through mosquitoes because vaccination did not produce sterile or anti-gametocyte immunity; consequently, transmission and endemicity were unaffected. Studies show an increase in recurrent malaria episodes in children who receive RTS and S vaccination and are therefore protected after 3-6 years (Forgan et al., 2014). This increase may be related to a weakened immune response of vaccine recipients to the blood stages of the parasite. Thus, it is becoming widely accepted that vaccination should also trigger an anti-blood stage immune response, although pre-erythrocytic vaccination is an important first step.

3.3. Management of malaria prevention and control in travelers

The ABCDE principles serve as a guide to malaria prevention for visitors to endemic areas. Travelers should be aware of the potential for malaria on their trips. Bite prevention: To avoid mosquito bites between dusk and dawn, wear protective clothing, apply insect repellent to the skin, ideally containing less than 30 percent DEET, and sleep under a mosquito net. Atovaquone/proguanil, mefloquine, and doxycycline are the most commonly used chemoprophylactic drugs (Table 1). No antimalarial drug provides full protection. Travelers should be aware of the signs of malaria, seek medical attention as soon as possible, and exercise caution for up to one year after leaving malaria-endemic areas. Travelers are advised to carry a full complement of antimalarial drugs to use in case of infection.

Table 1. Chemoprophylaxis for Malaria in Travelers in The Gambia and Other Malaria Endemic Areas

		Prophylactic doses by age and comments based on Gambian standards			
Area	***Medicines***	***Adults***	***Children***	***Regime***	***Description***
Areas with little or no resistance to chloroquine	Chloroquine	300 mg base two tablets	5 mg base/kg weekly <6kg ¼ tab; 6-9kg ½ tab; 10-15kg ¾ tab; 16-24kg 1 tab; 25-44kg 1 ½; >45kg 2 tabs	Weekly One week before departure to four weeks after return	It may be given together with proguanil. Not for use in those with a history of epilepsy It may aggravate psoriasis and myasthenia gravis
	Proguanil	100 mg 2 tablets	<6kg ¼ tab; 6-9kg ½ tab; 10-15kg ¾ tab; 16-24kg 1 tab; 25-44kg 1 ½; >45kg 2 tabs	Every day One week before departure to four weeks after return	To be taken with food Antacids and adsorbents may reduce absorption.
Areas of chloroquine-resistant Plasmodium falciparum	Atovaquone/ Proguanil (Malarone)	250/100 mg 1 tablet	4/1.6 mg/kg daily 5-7kg ½ tab ped; 8-9kg ¾ tab ped; 10-19kg 1 tab ped; 20-29kg 2 tab ped; 30-39kg 3 tab ped; >40kg 1 tab adult	Every day 1-2 days before departure to seven days after return	Not recommended in children <5 kg
	Doxycycline	100 mg 2 tablets	1.5 mg/kg daily 25-44kg 1 tab (from 12 years of age); >45kg one tab	Every day 1-2 days before departure to four weeks after return	Contraindicated for children <12 years of age. Not recommended for those <25kg

Table 1. (Continued)

Area	Prophylactic doses by age and comments based on Gambian standards				
	Medicines	***Adults***	***Children***	***Regime***	***Description***
Areas with little or no resistance to chloroquine	Mefloquine	250 mg base two tablets	5mg base/kg/week 6-9 kg ¼ tab; 10-15kg ¼ tab; 16-24kg ½ tab; 25-44kg ¾ tab; >45kg 1 tab	Weekly 2-3 weeks before departure to four weeks after return	Resistance of *P. falciparum* to mefloquine is found in some areas of Southeast Asia and other parts of South America, reported sporadically from the Amazon basin. Not recommended in children <5 kg

3.4. Follow-up efforts and future challenges of malaria management for The Gambia

Malaria control initiatives continue hampered by parasite resistance to antimalarial drugs and vector resistance to insecticides. Southeast Asia now has high levels of artemisinin resistance in *P. falciparum* and piperaquine, and mefloquine. The loss of first-line drugs has increased the likelihood of treating malaria with three-drug combinations and highlighted the need for new antimalarials. Thirteen as-yet unknown antimalarial drugs, including cipargamin and ganaplacide, two compounds unrelated to artemisinin, artefenomel, and arterolane, are now being tested in clinical settings. The widespread use of long-lasting insecticidal nets has coincided with the emergence of pyrethroid-resistant vectors. Recent clinical study results for a new long-lasting insecticidal net impregnated with chlorfenapyr have been reported; this method of countering resistance involves combining two or more compounds from different pesticide classes into a single product.

The first malaria vaccine to receive government approval was RTS, S. This historic decision was eagerly welcomed as it could significantly affect the number of lives saved and malaria episodes avoided; however, it remains unclear how these vaccines will be integrated into malaria control strategies. Although pre-erythrocytic stage vaccines such as RTS and S are a significant first step in the right direction, most malaria experts argue that multi-stage vaccines that induce anti-sporozoite and anti-blood immune responses will have the most significant impact on malaria infection, morbidity, and transmission. There are currently nine other potential vaccines in various stages of research.

The first step towards eliminating malaria, reducing case incidence and mortality rates by 40% globally by 2020, was not achieved; the two most recent World Malaria Reports show an increase in cases and deaths after 2019. According to the WHO, the global target of reducing malaria case incidence and mortality rates by at least 90% by 2030 will also not be achieved. Even before the Covid-19 pandemic overwhelmed health systems globally, the failure of malaria control efforts was already a concern. In a worst-case scenario, the continued diversion of resources due to COVID-19 could result in the return of malaria, putting the lives of hundreds of thousands of people at risk. Therefore, the case

for a worldwide commitment to strengthen, fund, and collaborate globally on health systems is strong, given that malaria eradication is still a long way off, even with a new vaccine.

4. Conclusion

Malaria prevention strategies are critical in The Gambia, a country where the disease is endemic and represents a significant public health challenge. Several approaches have been implemented in The Gambia to combat the spread of malaria to prevent and control the disease in children under five, adults, and travelers. Insecticide-treated nets (ITNs): One of the most effective malaria prevention strategies in The Gambia is the use of ITNs. These nets are treated with an insecticide that can kill or repel mosquitoes, thus preventing them from biting humans while sleeping. The Gambia has made significant progress in distributing ITNs, especially to pregnant women and children under five, who are most vulnerable to malaria. Indoor residual spraying (IRS): IRS involves spraying insecticides on the walls and ceilings of homes to kill mosquitoes that can transmit malaria. This strategy is advantageous in areas with high transmission rates, such as during the rainy season. The Gambia has implemented IRS in some areas of the country, but the strategy is not widely used due to high costs and logistical challenges. Antimalarial treatment: The Gambia provides prompt and effective treatment for malaria cases. This includes using artemisinin-based combination therapy (ACT), the recommended treatment for uncomplicated malaria. The government has also implemented a free treatment policy for all malaria cases, which helps reduce the disease burden on the population. Education and awareness: Education and awareness campaigns are critical in preventing the spread of malaria in The Gambia. The government and other stakeholders conduct community-based education campaigns to teach people about the signs and symptoms of malaria and the importance of using ITNs and seeking immediate treatment. Environmental management: Environmental management measures can also help reduce malaria transmission in The Gambia. This includes eliminating mosquito breeding sites, such as stagnant water, through drainage and sanitation measures. The Gambia has made significant progress in preventing and controlling malaria through various strategies, including ITN, IRS, antimalarial treatment, education and awareness, and environmental management. Continued efforts and investments in these strategies are critical to reducing the burden of malaria on the population and achieving the goal of malaria elimination.

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