Acta Parasitologica Globalis 7 (1): 01-06, 2016
ISSN 2079-2018

DOI: 10.5829/idosi.apg.2016.7.1.10273

Current Status of Malaria in Ethiopia: Evaluation of the Burden, Factors for Transmission and Prevention Methods

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Abstract: Malaria is a sever disease in Ethiopia, 75% of the land are malarias' areas and more than 54 million people are vulnerable. Plasmodium falciparum and P. vivax are commonly known species in Ethiopia are to cause malaria accounting for 60% and 40%, respectively. The transmission is unstable and seasonal from September to December and April to May. The burdens of malaria in Ethiopia are lost productive personnel due to illness, school absenteeism, medical costs and other indirect costs including adult laborers are infected by malaria and stop working. Burdens are increased by absolute poverty of the country that cannot protect themselves from the bite of mosquito. Ethiopian government works for eradicating these things by providing technical and material resources. Health service extension program was introduced starting from 2003 in Ethiopia as part of primary personal health care service. But malaria in Ethiopia is still prevalence in every season of huge rain in relatively low lands of Ethiopia. Traditional malaria preventing techniques are effective for temporarily reducing the severity of the disease. Environmental management activities such as destroying mosquito breeding sites by clearing stagnant water, disposing waste either damping or burning and using toilets properly.

Key words: Malaria · Mosquito · Preventing Techniques · Transmission

INTRODUCTION

Malaria is one of the most severe public health problems worldwide with 300 to 500 million cases and about one million deaths reported to date, 90% of which were reported from Sub Saharan African countries. It is the fourth leading cause of death of children under the age of five years in developing countries [1]. It is one of the major diseases of poor people in developing countries and one of the leading causes of avoidable death, especially in children and pregnant women. Sub-Saharan Africa carries the bulk of the global malaria burden, with 71% of cases and 86% of global deaths. A person in Africa dies of malaria every 10 seconds [2]. Women and young children are most at risk affects five times as many people as AIDS, leprosy, measles and tuberculosis combined [2, 3]. 30 million African women are pregnant yearly malaria is more frequent and complicated during pregnancy. Currently, it is one of the major tropical diseases adversely affecting the health of the peoples and the economic development of many developing countries, particularly in sub-Saharan Africa [1, 4, 5].

Malaria is one of the main public health problems in Ethiopia. Bimodal type of transmission: Major: September to December, following the main rainy season from June to August and Minor: April to May, following a short rainy season from February to March. Focal outbreaks are common and the distribution varies from place to place depending on climate and altitude [2, 4]. Malaria is a major concern in the country since it is one of the leading causes of morbidity and mortality. Despite the current efforts to control malaria in Ethiopia, the situation has not improved mainly due to the increasing problems of parasite resistance to the relatively cheaper anti-malarial drugs, vector resistance to insecticides, low coverage of malaria preventive services, poor access to health care, rudimentary health service infrastructure, large population movements and limited financial and human resources [6]. The main aim of this review paper is to update knowledge on the current status, epidemiology and burden, prevention and controlling techniques of malaria in Ethiopia.

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Malaria Epidemiology in Ethiopia: The epidemiology of malaria in Ethiopia is well described in national documents demonstrating the threat to larger number of the population from both Plasmodium falciparum and p. vivax; the major Anopheles arabiensis vector and the high variability across different transmission strata. This variability is produced in part by geography and climate and in part by recent scale up of control measures. This variability requires that the country address very different situations with prevention and control tools, but it also provides the opportunity to actively create and extend malaria free areas [1, 6].

Malaria is pervasive to Ethiopia; 75% of the landscape areas below 2000 m above sea level is malarious which is fertile low land areas and suitable for agriculture. More than 54 million populations live in these areas and are at risk of malaria. The transmission is unstable and seasonal from September to December and April to May which is coincide with major planting and harvesting season for farmers - aggravate economic loss [1, 3].

In Ethiopia major epidemics occur every 5 - 8 years, but focal epidemics were occurring every year. Plasmodium falciparum and P. vivax are the two species commonly known to cause malaria in Ethiopia accounting for 60% and 40% proportion, respectively [7]. The main malaria vector is Anopheles arabiansis and A. pharoensis, A. nili and A. funesteus are secondary vectors [8]. Resistance to anti-malarial drug in P. falciparum is well known since its first report on chloroquine in 1998. The resistance to chloroquine necessitated a change to sulphadoxine-pyrimethamine as first-line antimalarial in Ethiopia. However, recent data has showed high mean sulphadoxine-pyrimethamine treatment failure with 72% rate in some areas. Consequently, making another change to artemether- lumefantrine was suggested in 2004. Until now there has been no report on the parasites resistance to the last drug [1].

The distribution and transmission of malaria in Ethiopia varies from place to place. For example, the distribution of malaria in Ethiopia is largely determined by altitude. Altitude affects the pattern of malaria distribution in Ethiopia through its effect on temperature [3]. Risk of malaria is highest in the western lowlands of Oromia, Amhara, Tigray and almost the entire regions of Gambella and Benishangul Gumuz regions. The midlands of Ethiopia between 1,000 and 2,200 meters altitude experience seasonal transmission of malaria with sporadic epidemics every few years. In the eastern lowlands of Ethiopia (primarily Afar and Somali), malaria is endemic only along the rivers, as this part of the country is largely dry away from rivers. Transmission is limited by the lack of water collections for mosquito breeding and low humidity due to low rainfall and sparse vegetation. The central highlands of Ethiopia are free of malaria mainly due to the low temperatures, which slows the development of the vector and the parasite [5].

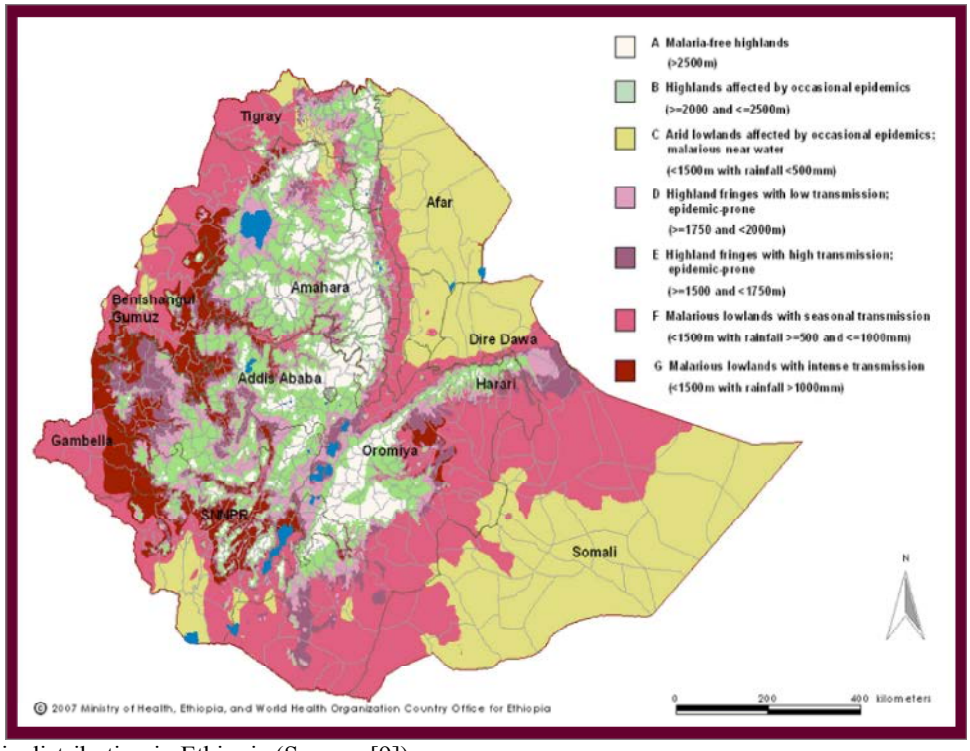

Fig. 1: Malaria distribution in Ethiopia (Source: [9])

The exact number of people getting sick and dying of malaria every year in Ethiopia is not known. However, it is known that millions of people get sick and tens of thousands of people die due to malaria every year and that rates of mortality (death) and morbidity (illness) dramatically increase during epidemics. The distribution of malaria in Ethiopia is not uniform. There are areas where the risk of malaria is high and there are areas where the risk is low. There are even areas, 25% of the country, that are malaria free [6, 10].

Factors of Malaria Transmission and Disease Burden: Malaria transmission intensity, along with its temporal and spatial distribution in Ethiopia, is mainly determined by the diverse eco-climatic conditions. Climatic factors such as temperature, rainfall and humidity show high variability mainly as a function of altitude and are the most important variables that influence malaria transmission [11].Malaria transmission varies among communities largely due to environmental factors, such as proximity to breeding sites. Many water resources development and management projects result in local outbreaks of malaria and other vector-borne diseases such as schistosomiasis, lymphatic filariasis and Japanese encephalitis. These outbreaks can be attributed to an increase in the number of breeding sites for mosquitoes, an extended breeding season and longevity of mosquitoes, relocation of local populations to high-risk reservoir shorelines and the arrival of migrant populations seeking a livelihood around the newly created reservoirs [12].

Due to the unstable and seasonal pattern of malaria transmission, the protective immunity of the population is generally low and all age groups are at risk of infection and disease. Some small-scale studies have documented on malaria parasite prevalence between 10.4–13.5% in Gambella; 7.6–14.1% in Tigray; 4.6% in Amhara, 0.9% in Oromiya and 5.4% in Southern Nations, Nationalities and People's Region in all age groups [13]. Malaria case a lot of costs on the population not only lives lost, but also in medical costs, lost income and reduced economic output [3]. More than 600,000 confirmed and more than 9 million clinical cases each year and cause about 70,000 deaths in all age stages each year in Ethiopia [14].

Malaria is frequently referred to as a disease of the poor or a disease of poverty. Even a cursory examination of the global distribution of malaria is sufficient to accept this claim on a macro scale, given the concentration of malaria in the world's poorest continents and countries. While only 0.2% of global malaria deaths are found in the world's richest population quintile, 57.9% of global malaria deaths are concentrated among the world's poorest population quintile [14]. In Ethiopia malaria burden includes lost productivity due to illness, school absenteeism and permanent neurological and other damage [15].

Malaria transmission peaks during the harvesting seasons bi-annually from September to December and April to May with serious consequences for the subsistence Economy of Ethiopia's countryside and for the nation in general. The overall trend is one of a gradual progression from around four-fifths of a million confirmed cases a year in 1990 to almost a million and a half in the year 2005/06 reporting period. This represents an increase of about 80 percent. The turn of the century (1999-2000) marked the worst decade of malarial infections in recent history with the number of confirmed cases exceeding one and a half million a year. Approximately 4-5 million cases of malaria are reported annually in Ethiopia and putting over 50 million people at risk. Malaria accounts for seven percent of outpatient visits and represents the largest single cause of morbidity. It is estimated that only 20 percent of children under five years of age that contract malaria are treated at existing health facilities [16].

Management of Human Resources to Minimize Malaria: The governmental responsibilities are provision of technical and material assistance to regions for epidemic control; coordinate overall regional capacity building in manpower, logistics and finance, so that the control of malaria can be effectively implemented at all levels; monitoring, evaluation and follow up of the implementation of the national malaria control strategies; and dissemination of meteorological information to regional levels for early warning and epidemic forecasting purposes [17]. Health Services Extension Program was introduced in Ethiopia in 2003 as part of the primary health care service. The program aims for the universal coverage of primary healthcare through focusing on the prevention and control of priority communicable diseases with active community participation. As of 2007/2008, 24,571 health extension workers have been trained and deployed in different parts of the country [14]. The Ethiopian government has achieved an effective people oriented health service system. This is exemplified by the nationwide Health Extension Program which achieves a new level of access for community and households [18].

Ethiopia has significantly scaled up human resources for health. For example, in 2005 there were just 2,737 health extension workers in health posts and 776 health officers

in health centers, rising to over 30,000 HEWs and 1,606 health officers by 2009. Over this same period, 3,000 Health Extension Programme supervisors have been recruited. It is essential that health staff training, integrated refresher training and supportive supervision (including for malaria skills) are rolled out nationally to enhance skills, quality and retention among staff [17, 18]. Leadership at the Federal level should strongly consider how to complement the existing system and ensure that the unmet federal responsibilities are addressed efficiently with an accessible point with authority, responsibility and accountability for decision making [14]. It is possible that this could be addressed within the existing system with designation of the required authority/responsibility/accountability or that an additional small team with strong and capable leadership be responsible and accountable for technical oversight, representation, coordination and leadership across malaria control issues, including leading such efforts as resource mobilization and proposal application processes [18].

Prevention and Control Malaria

Malaria Prevention: Individuals can protect themselves against malaria by wearing protective clothing and using insect repellents and bed nets. According to Zerihun *et al*. [14] field trials indicate that insecticide-treated bed nets and curtains have the potential to reduce childhood mortality by 15 percent to 35 percent. Despite their proven efficacy, fewer than 2 percent of African children sleep under protective bed nets. Drugs are used to prevent (chemoprophylaxis) and treat infection in individuals. However, given increasing levels of chloroquine-resistant malaria, new drugs are needed. User-friendly drug packaging helps ensure that patients take their medicine correctly. Better compliance helps prevent the development of drug-resistant malaria. While many new antimalarial drugs have been developed in the last 20 years (mefloquine, halofantrine, artmisinin, malarone, atovaquone and proguanil, co-artemether), there is still need for an affordable, effective, safe alternative to chloroquine [19].

Traditional Malaria Preventive Activities: These are eating garlic with green paper, drink gourd juice and avoiding eating vegetables such as tomato during rainy season to prevent malaria. These have both curative and preventive effect. There is also a home remedy called “haregresa”, this is a root of a small plant, they drink its juice. There are also local plants such as “Dumuga” and “Endode” used to prevent malaria. When malaria epidemic arise they smoke “Dombaya” and “Goetzenni” leaf [1, 20].

Environmental Management: Environmental management was the most popular malaria prevention method in Ethiopia. Communities are destroying mosquito breeding sites; clearing stagnant water, covering spring water, eradicating dirt from the compound [19]. If accumulated water could not be removed, spraying “used motor oil” has preventive effect. Some mentioned they disposed off waste, by burning or burying it, in holes dug far from their house. They also prepared toilet properly, as a toilet which was not dug properly could accumulate water and thus be a good breading site for mosquito [21]. In addition, they separated their house from their cattle’s/livestock since fecal matter from animals results in favorable environment for mosquito breeding. In addition to environmental management, some considered keeping personal hygiene as a good malaria preventive mechanism [5, 20].

Vector Control: In Ethiopia controlling malaria vector has a long history of more than 50 years, but malaria remains a major cause of morbidity and mortality in Ethiopia [5, 22]. Currently the main goal of vector control in Ethiopia is to reduce the level of malaria transmission. The main focus is: Improved targeting of localities for coverage and quality of indoor residual spraying, introduction, expansion and scaling up the use of ITNs and Application of environmental management and chemical larval control in areas where it could be cost effective [1,10]. Public and individual measures- include: wearing long sleeves and pants during the dusk-to-dawn period; sanitary improvements, such as filling and draining areas of impounded water; installing screens and using bed nets; particularly the use of impregnated bed nets increases the effectiveness of the bed net; larvicides and biological control, for example using larvivours fish; and nightly spraying of screened living and sleeping quarters with insecticides [9].

According to Ethiopian Federal Ministry of Health malarias are defined as being located <2,000 m altitude. Of 5,083 surveyed households, 3,282 (65.6%) owned at least one ITN. In ITN-owning households, 53.2% of all persons had slept under an ITN the prior night, including 60.1% children <5 years of age, 60.9% of women 15 - 49 years of age and 65.7% of pregnant women. Overall, 20.0% households reported to have had IRS in the past 12 months. Of 747 children with reported fever in the two weeks preceding the survey, 131 or 16.3% sought medical attention within 24 hours. Of those with fever, 11.9% took an anti-malarial drug and 4.7% took it within 24 hours of fever onset [17].

Insecticide-Treated Bed Nets (ITNs): Insecticide-treated bed nets are nets dipped in a pyrethroid insecticide solution. This treatment creates a physical barrier, or a "halo," around the net, repelling or killing the mosquitoes. Each ITN can last up to 12 months before needing to be re-treated with insecticide. Long-lasting insecticide-treated nets (LLITNs) are increasingly popular, as they last longer than traditional ITNs, repelling mosquitoes for up to four years. With LLITNs, the insecticide is woven into the fabric of the nets, causing it to self-replenish with each wash, by bringing the insecticide to the surface of the net [21, 23]. Mosquitoes that carry malaria are most active at night and in the early morning; bed nets are particularly vital during these times. Studies show that sleeping under a bed net can reduce child mortality from malaria by as much as 20%. The repellent in the nets can also reduce the number of mosquitoes in the surrounding area [19]. When 80% of households use bed nets in a community, studies suggest that mortality from malaria for those living within 300 meters is significantly reduced [20].

Ethiopia has produced tremendous results in its fight against malaria. The country's national malaria control program conducted mass distributions of LLITNs in 2005 and 2006. By the end of 2007, 20 million LLITNs had been distributed. Approximately, half of this total (9.4 million) was financed by the Global Fund. This distribution resulted in an estimated coverage of almost two LLITNs per household in the malaria endemic regions of the country [23].

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