Original Research Article

Risk and Burden of Malaria on Vulnerable Population in Kenya: Socioeconomic effects

Abstract

This paper seeks to explore the significance and impact of malaria on Kenya's economic growth. This will help to understand the impact that malaria has or have had on household economic status especially for the vulnerable population in Kenya and how it has been unfolding slowly over time. This will also seek to understand the coping strategies adopted by the said population and the negative implications that have influenced these household's abilities to withstand malaria and other eventualities that may happen in the future.

Relevant studies for investigating the risk and burden of malaria on vulnerable population have been and its economic effects have been found to be instrumental through search engines such as Google Scholar and PubMed as well as in economics and medical journals. To protect the poor and vulnerable population against these adverse effects of malaria and from malaria itself, there is a great need to draft and enact policies that will be able to control the effects as well as integration development and poverty reduction programs. The future work and focus for government and all stakeholders should be to focus more energy and work on achievable health services that will eliminate the burden of health especially malaria and its effects on Kenyan economic activities undertaken by the vulnerable population and to address the burden and risk of malaria on the productive under privileged within their environment, as well as study the epidemiological and socio-economic geographical dissimilarities of the vulnerable population and the normal population.

Keywords: Malaria, Socio-economic, Risk, Burden, Kenya

1.0 Introduction

Malaria is a vector-borne ailment which not only directly affects individuals' health but also disrupts various sectors of the economy indirectly (WHO 2015). It is a transmittable life-threatening disease which indirectly enters human bodies when the female Anopheles mosquitoes bite which harbors one of five species of parasites belonging to the genus Plasmodium (Fana et al. 2015).Four different species of the Plasmodium parasite have been stated to be the major vectors for the disease. However, the highest number of malaria cases

have been linked to Plasmodium falciparum (Elnour et al. 2023). Malaria does not only contribute adversely to many individuals' poor health in malaria-prone regions but also causes death. In 2013, reported death cases of malaria was estimated to be approximately 584,000 worldwide from which 90% was recorded for Africa (WHO, 2014). Globally, malaria cases reported with its corresponding deaths were 241 million and 627 thousand respectively in 2020. The respective reduction in the malaria case and its mortality between the year 2000 and 2015 were 27% and 60% (WHO, 2021).

In the African continent, studiesy haves shown that approximately 80% of all malaria deaths were mainly occur in mainly from 15 countries. The most vulnerable people to malaria-related mortality and morbidity are pregnant women and children. WHO stated that the death of 9 children out of 10 in Africa could be traced to malaria (WHO, 2003). Rural settlements in Africa suffer malaria transformation than the urban areas resulting from lower housing quality, higher vector density and poor drainage systems (Oladeinde et al. 2012). One of the African countries that was significantly majorly affected is Kenya (NMCP, KNBS and ICF, 2015). Over 70% of Kenyans (25 million out of 34 millions) are estimated to be at malaria risk. In every year, 4000 death cases of children are recorded from the 6.7 million new clinical cases (Halliday et al. 2014). These records placed Kenya among the African countries in which malaria is a major health burden (Kepha et al. 2016). Modeling of Kenya Malaria Indicator Survey, malaria vaccine, school surveys, and climate data conducted between 2000 and 2020 suggests that all counties in the lake endemic region have moved from high to low-to-moderate transmission based on the prevalence of malaria parasites in children less than five years of age.

Kenya is a country situatedlocated in the eEastern part of Africa Continent and borders with Indian Ocean, Ethiopia, Tanzania, Somalia, Uganda and South Sudan in the South-East, North, South, North-East, West and North-west respectively (Juma et al. 2011). It is administratively made up of 47 counties and 302 sub-counties. It has both arid/semi-arid and arable land area of eighty percent and 20 percent respectively. Highlands (located on both sides of the Rift Valley) and lowlands (comprising coastal and lake region) are the two main regions in Kenya. The proximity of Kenya to the Indian Ocean and altitude are the major influential factors for the temperature and rainfall (Degefa et al. 2017). The coastal region of the lowlands is characterized with a tropical climate having both its temperatures and rainfall to be higher throughout the year than the rest of the country. In 2018, the population and population density of Kenya was projected to be 50.8 million and 85.3 per square kilometer. According to the Kenya Health Information System (KHIS), Kenya's projected population in

2022 was 52.37 million (Mugo et al. 2018). All the aforementioned factors (rainfall patterns, altitude and temperature) have greatly influenced the epidemiology of malaria in Kenya.

Figure 1 presents the malaria prevalence map in Kenya (U.S. President's Malaria Initiative Kenya Malaria Profile, 2022). In Kenya, prevalence of all the four *Plasmodium*species that infect humans exist.The most common among is the *Plasmodium falciparum*, which causes the most severe form of the disease contributing to an estimated 95 percent of all malaria infections in the country (Division of National Malaria Programme, 2022).The *Anopheles gambiae* complex (i.e., *An. gambiae* s.s., *An. arabiensis*, and *An. merus*), as well as *An. Funestus* are the primary malaria vectors in Kenya. Climatic factors (especially rainfall and temperature) have been the major determinants for the non-uniformity distribution of malaria vector in the country. The tolerance of *An. Arabiensis*is higher for arid conditionsamong the *An. gambiae* complexwhich makes it to be predominant in much of the country. In western Kenya, particularly within the Lake Victoria basin, the most common member of the *An. gambiae* complex is the *An. Arabiensis*(Amboko et al. 2020). The predominant vector in more highland areas of western Kenya is *An. gambiae* s.s.particularly in counties bordering Uganda. *An. merus*is found only along the coast. *An. funestus*is widespread throughout Kenya but has emerged as the predominant vector in counties bordering Lake Victoria in western Kenya. Table 1 presents malaria epidemiological zones in Kenya and their accorded counties.

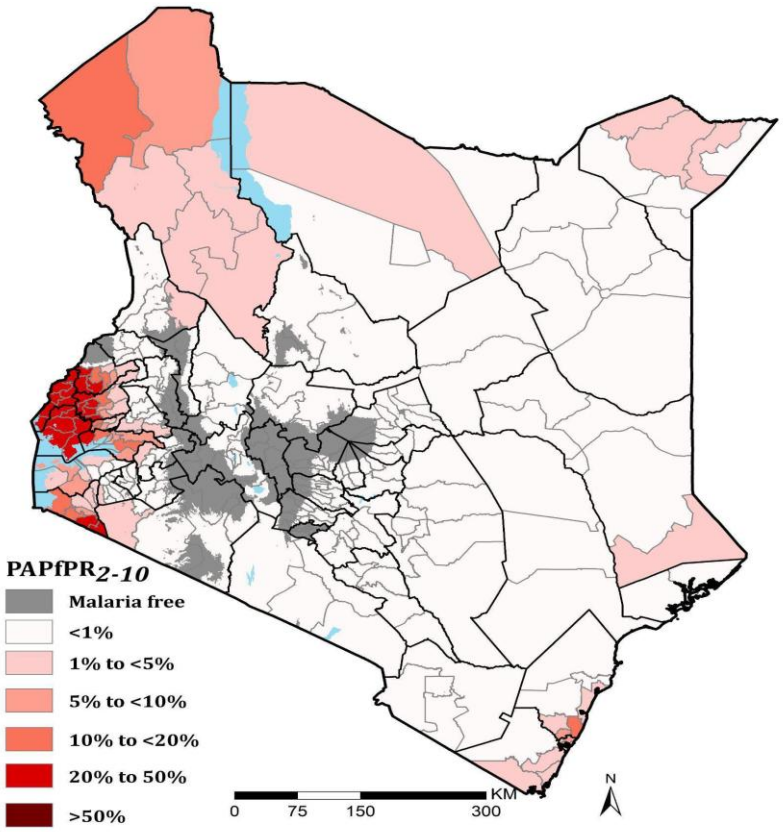

Figure 1: Malaria prevalence map in Kenya (U.S. President's Malaria Initiative Kenya Malaria Profile, 2022)

Table 1: Malaria Epidemiological Zones in Kenya and their accorded Counties (U.S. President's Malaria Initiative Kenya Malaria Profile, 2022)

Endemicity Class	Counties	Total projected population 2022	% of total population	Cumulative % of total population
High transmission (≥ 30%)	Busia, Siaya	2,062,561	3.90%	3.90%
Moderate transmission (10% to 30%)	Bungoma, Kakamega, Kisumu, Migori	6,415,712	12.30%	16.20%
Low-moderate transmission (5% to <10%)	Mombasa, Turkana, Vihiga	3,020,334	5.80%	21.90%
Low transmission (1% to <5%)	Homa Bay, Kilifi, Kwale	3,827,281	7.30%	29.20%
Very low transmission (<1%) or malaria free[a*]	Baringo, Bomet, Elgeyo-Marakwet, Embu, Garissa, Isiolo, Kajiado, Kericho, Kiambu, Kirinyaga, Kisii, Kitui, Laikipia, Lamu, Machakos, Makueni, Mandera, Marsabit, Meru, Murang'a, Nairobi, Nakuru, Nandi, Narok, Nyamira, Nyandarua, Nyeri, Samburu, Taita Taveta, Tana River, Tharaka-Nithi, Trans Nzoia, Uasin Gishu, Wajir, West Pokot	37,040,662	70.70%	100.00%
Total		**52,366,550**	**100.00%**	

1.1 How malaria affects economic growth?

There are usually lower growth rates and minimal prosperity in a society where malaria thrives. It significantly impacts the economic well-being and health of individuals and nations

(Chima et al. 2003). Malaria has been recognized as instrument and a disease of poverty in sub-Saharan Africa. It has substantial indirect and direct costs.Therefore, it is a major constraint and a key factor to economic growth. In developing economies, the disparity in growth between countries with malaria and countries without malaria has continued to rise over the years. The study conducted by Gallup et al.(2001) revealed a decline in growth of about 1.3 percent yearly in some African countries as a result of malaria. The decline led to significant differences in Gross Domestic Product between countries with and without malaria when aggregated over some period of time. This eventually constrained the economic growth of the whole region.

Mortality and morbidity of malaria comes along with control, treatment and prevention costs. This establishesa substantial economic burden which causes reduction in economic growth via reduction in labor force. Nonetheless, malaria causes health care spending at both public and private levels. Consequently, malaria restrains long-term economic growth and sustainable development. This has simultaneously increased the interest of government to review her economic and health intervention policies resulting from the economic costs of malaria (Elnour et al. 2023). Thus, thorough economy-wide assessments of malaria costs are imperative. These provide an adequate information on how malaria affects the economic growth and development and may help policymakers in implementing measures that would eradicate malaria. Such economy-wide assessment does not yet exist for Kenya.

2.0 Significance of malaria burden and risk in Kenya

Statistics according to Kenya's USAID malaria fact sheet 2021 report indicates that an estimated 5.3 million malaria treatment doses were procured to be distributed to Kenyan health facilities in the year 2020 of which out of that, 7.4 million were rapid diagnostic tests which were purchased to be distributed to health facilities. Another 1.8 million people were protected from malaria through indoor residual spraying according to the survey. This analysis is based on data that was gathered by the Welfare Monitoring Surveys (WMS) and presented by the Government of Kenya. Some key areas that this data was seeking to address were the evidence on individual and household socio-economic traits, sources of wage earnings, the settlement of the sampled vulnerable population, and community variables using activities such as time taken to collect water and firewood during the wet and dry seasons. The analytic samples were constructed, a full possibility sample comprising households inflicted with malaria and other diseases and a sub-sample of healthy individuals and those having no malaria.

The burden and risk of malaria varies from different perspectives. Economists and epidemiologists have always used quantitative approach in measuring some of the risk factors associated with the outcome of this disease. Some of the recorded burdens of malaria have clearly indicated the sociocultural context in which the risks have existed. Most of the time, this wider concept of burden is infrequently undertaken, and this has been due to misunderstanding or lack of it, especially when talking about the social burden of malaria where a concept needs to describe the anthropologic perspective. The focus of this paper is to enlighten government agencies, non-governmental agencies and other stakeholders on the plight of these vulnerable population and provide knowledge and understanding for policy makers to enact policies that will provide better facilities and services that will enhance their social and economic life a factor that the vulnerable population is going through and that has led to the burden and risk of malaria and how this affects the Kenyan economy as well as the interventions that should be in place for to lessen this burden.Figure 2 shows the epidemiology, risk and burden of malaria in Kenya.

It is true that many attempts have been made to compute this burden, but it seems that none of these efforts have tried to address how urbanization has affected this especially the urban vulnerable population especially the slum dwellers, and how the growth of this urban slum dwellers have increased the infection, transmission and the outcome raising the mortality and morbidity rate. Due to urbanization and the rural – urban migration, close to 40% of the Africa's population were already living in the urban setting and majority live in the informal settlement. It is believed that by the year 2030, close to 60% of the entire population are expected to be in urban setting which will really strain the service delivery especially for the vulnerable population (Yerushalmi et al. 2019). Entomologists and parasitologists while investigating the effects of malaria on urbanization in Africa, found out that the impact transmission and association especially on preventive and curative measures have posed great risk which has resulted to the increase of mortality rates (Ayieko et al. 2009).

There is evidence linking malaria and poverty. The global distribution of the economic per capita gross domestic product has evidently shown the correlation between poverty and malaria especially in most malaria endemic countries where there are lower rates of economic growth and slower development. In these countries where malaria prospers most, there is least prosperity among people. As a disease, malaria has been confirmed through many sources that it hinders development in many ways and creating lasting risks such as worker/employee productiveness, impact on fertility, population increase, saving and

investment, absenteeism, premature mortality, economic and social burden, and medical costs as well as its effects on foreign direct investment.

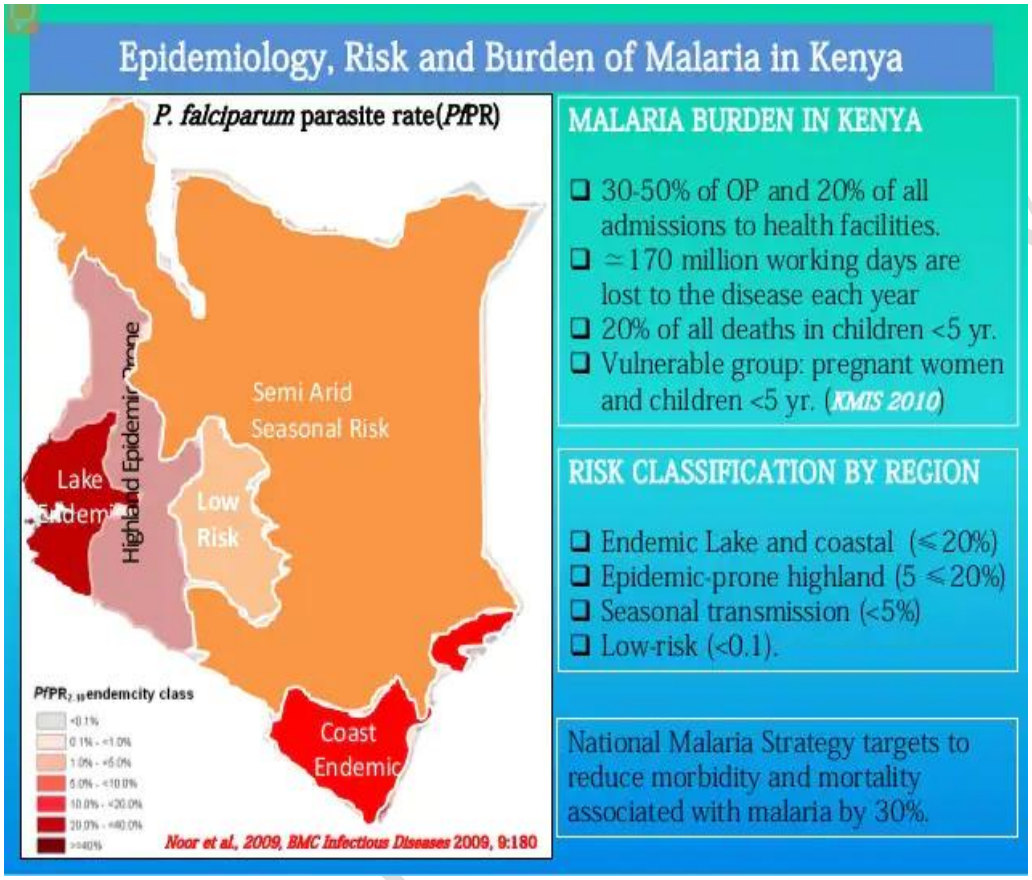

Figure 2: Epidemiology, risk and burden of malaria in Kenya (KNBS, 2018)

3.0 The effects of malaria burden and risk on the socio-economic growth of Kenya

3.1 Worker/employee productivity

Within the East African community, Kenya is the fourth largest economy in Sub-Saharan Africa, but even with these statistics still 60% of Kenyan families live still live below the standard (Bello-Bravo et al. 2013). The swift rise in prices have drastically reduced the economic growth and have worsened the poverty levels for most if not all citizens of Kenya. The agrarian/agricultural sphere remains the main stability or the backbone of Kenya's economy and almost the entire country depends on improvements of the agricultural sector for any economic development. The main staple food in Kenya is basically corn which is known as maize and this accounts to approximately 70% of the total staple food caloric intake (Chegeet al. 2020). These statistics have put Kenyan government on the spot and forced the government to work hard and reduce poverty at all levels and because this should

be done by Kenyan workers, malaria disrupts these efforts by causing sickness to a level where the workers will miss work.

Workers are a great asset in Kenya especially those working on the farmlands because Kenya is known to be dependent on locally grown and produced food. One of the things that the government is trying to do is to develop food security and nutrition programs (which includes fresh fruits and vegetables) that help the vulnerable fight malaria. The last few years, the government of Kenya have tried to invest in food security, poverty reduction, transformation of agricultural sector from subsistence to commercial agricultural and agribusiness, markets, efficient use of agricultural products but still this has been unachievable because the government relies on community labor for the annual crop production and due to high malaria infections, the government keeps missing the mark. It is high time for the government and the stakeholders to monitor the co-relation between these labor requirements and the pattern of adult morbidity caused by malaria if productivity is going to be achieved. There must be a clear separation of malaria as a disease, from malaria as an infection, eliminate the underestimated efforts of the effect of the disease on agricultural production (Onyia et al. 2020).

3.2 Premature mortality

Of all the continents of the world, it is Africa that has been the hotspot for malaria (even though there are still other countries in Asia, parts of middle East, parts of Europe and Latin America that still struggles with transmission) but Africa accounts to more than 90% of the transmission and deaths from malaria that occur every year (Endoet al. 2017). Due to their financial status, it is evident that the poorest of these vulnerable population is likely not to seek medical attention due the many factors that prevent them from gaining access to the medical intervention. Most of these factors are not well known but the contributing factor remains economic hardships. Even though the national government of Kenya and other governments in Africa in collaboration with international partners are trying to make plans for subsidized Artemisinin based Combination Therapy (ACT).There is still the urgency of identifying the working policies that would quickly promote and enable the poor and vulnerable population and communities the access to these interventions, by ensuring all individuals from the poor and vulnerable communities who are affected by malaria to have prompt access to effective treatment and to empower these healthcare system and services to be in positions of meeting the needs of these constraining population. These can be done if and only if the government has the will for it and are ready to design policies to address the multiple barriers of access such as access dimensions which should include broad

interventions to revitalize the public health care system. If further efforts are not employed and focused on confronting these obstacles among the poor and vulnerable, the malaria will continue threaten morbidity and mortality of the poor vulnerable within our societies (Alonso et al. 2019).

3.3 Medical costs

The most affected population is the vulnerable who are majorly living in the rural or in the urban slums. This population hardly makes enough even for their daily basic needs such as food, housing, and clothing. Malaria imposes major costs on households that are struggling to make the ends meet (Shretta et al. 2016). There should be several short-term and long-term policies and programs in place to improve access to healthcare or malaria medicines that can enhance quality of life for these slum residents. There is need for partnerships between private healthcare practitioners, community-based organizations, and the government especially by enhancing skills, supplying resources, and providing supportive supervision with the goal of improving healthcare access to these vulnerable community. By so doing, their productivity and contribution to the economic development increases. The Kenyan government through their healthcare insurance plan called National Hospital Insurance Fund (NHIF), is encouraging all Kenyans to join the plan and get access to healthcare service but unfortunately, it is likely that the poor Kenyans or these vulnerable population might wait for years to fully benefit from the planned health insurance scheme because of the poor healthcare conditions in Kenya and especially among the vulnerable population which dwells within the informal settlement (Sicuri et al. 2013).

Another reason would be because this insurance scheme has a monthly payment plan which is unaffordable to most vulnerable population. This monthly payment has penalties in case of any default which increases the chances of the vulnerable to ignore the plan altogether. What this means is that there must be means of improving the economic base and income for the vulnerable to enable them to conquer the economic hurdles as they seek basic medical healthcare. The policies should also focus on making the insurance scheme free for the vulnerable population living in the rural and urban slums to lift the financial burden on health especially malaria and to enhance their economic productivity. This also should revive and improve the chronically disabled health services. The improvement and revival of these health services will require the enhancing management of service delivery as well as improve

the conditions of care and revamping health centers with essential drugs and medical equipment. (Hailu et al. 2017).

3.4 Economic and social burden

Effects on economy can be felt due to the surge in malaria. The impact on vulnerable households and individuals is progressively becoming a subject matter of great concern especially among policy makers and researchers who evidently say that malaria endemic countries are already losing a lot of money in their national income because of malaria disease and death. In countries such as Kenya, reports have indicated that malaria is the leading cause of deaths accounting for close to 20% per cent of hospital admissions and another 50% of all other outpatient cases seeking medical assistance in public health hospitals, health centers and clinics. There is already devastating effect of malaria on the economy and on farm output and household incomes and as a result, the economic burden attributed to malaria is considerably bigger than the burden inflicted by other diseases (Andrade et al. 2022).

Critical findings are that the government expenditures on malaria control and schooling have huge diminishing impact on malaria burden which confirms that malaria reducing poverty in any malaria environment in a country is possible if the control activities are put in place and well implemented. Good investment on malaria control programs have always shown major economic returns because with a healthy population, economic productivity tends to increase. The reason we can see definite explanations on the returns is because controlling malaria can make an immediate contribution to a production and/or revenue increase by creating quantity and quality of labor and especially through reducing sickness, death, weakness because of malaria and every absenteeism from work (Head et al. 2017).

3.5 Effects of malaria on fertility

There are many documented and undocumented aggressive concerns for pregnant women residing in malaria endemic areas. The most talked about is maternal anemia, accumulation of parasites in the placenta and low birth weight which is a result of prematurity and intrauterine growth obstruction, embryonic parasite exposure, newborn deaths, and genetic infectivity. All of these have been linked to a preterm low birth weight. Reports and researchers have indicated that about 80,000 to 220,000 infant mortalities are directly associated and linked to malaria during pregnancy (Botto-Menezes et al. 2016). These have raised a cause for alarm and pushes the need to employ efficient antimalarial interventions that will not impact pregnant women throughout their antenatal care. Many people within these vulnerable population are cognizant of the risks inflicted on them by malaria and

particularly on their fertility thus creating need for numerous ways on how prevention can be exercised. It is evident that the most affected population within this vulnerable population are expectant women and children below the age of five years.

One of the many ways that governments from malaria endemic areas have employed to fight malaria is the launch of insecticide treated nets (ITNs) as means of fighting malaria. Their advantages on lowering this load of malaria on expectant women and children have been seen, however, the reports indicate that there is minimal usage of these ITNs and other preventive measures and intervention within this vulnerable community. This has been attributed to the cost of private buying of these ITNs and so the governments are encouraged to source for help and provide these ITNs for free especially within the vulnerable population. Other reasons attributed to minimal usage can be the negative opinions on the chemicals used to treat them. On the other hand, inadequate use of health essential services, especially prenatal care, and delivery care, leading to lost opportunities (Mbonye et al. 2006).

3.6 Effects of malaria on foreign direct investments

Researchers throughout history have established the suppression of financial links between malaria endemic and non-malaria endemic zones which has created a negative isolation effect. When foreign investors make measurable decisions on why they should not invest in a country due to the impact of a disease such as malaria, the most affected people are the vulnerable within these regions which affects the growth of the economy within those regions. All these happens when investors shun these malaria endemic zones having concern that they would contract the disease, and this concern is a sad reality, but it affects the economy and the lively hoods of those vulnerable population that would have depended on the investment. It is clearer that where there is attempt to encourage foreign investors to come and invest in these malaria endemic areas, there will be little to no success whether the investment sort is in production such as in mining, agriculture and manufacturing and this cripple the economy especially when the labor force experiences the heavy burden of malaria as a disease. Because of economic development of the global south especially in sub Saharan Africa, countries need to encourage international trade for development, therefore finance is critical component for any economic development to take shape, any hostile condition for any foreign investor is likely to affect the economic growth of any particular country in a great way and thus affect the household income (Moreno-Gutierrez et al. 2020).

4.0 Conclusions and Recommendations

4.1 Conclusions

The reality is that there is enough proof that malaria as a disease has major effects on the agility and population growth as well as noticeable impact on economic growth and development. People who permanently reside in malaria endemic regions have somehow developed some sort of disease controlling immunity that have at some point reduce malaria related diseases and death. Nevertheless, the cases of migrants or people going back to their original endemic homes have heightened the threat of death and/or increased disease infection. The status of attained adult immunity in protecting against malaria sickness and death possibly hinders the development of labor between malaria endemic and non-malaria endemic zones. This implies an economic cost because human movement permits labor to move to regions where it is most beneficial and practically needed. If such movement are hindered by malaria, then it limits and hinders needed skills for a particular region and thus restrain maximization of worker productivity. Moreover, motivations to enlarge markets into malaria endemic zones of the world will be lost if trade and commercialization exposes people to a bigger threat and liability of malaria, an aspect that can dissuade long-term economic development.

This study has found the significant burden of malaria on a country's economic development. Even though there are measures that the government of Kenya and the international community has put in place to fight malaria and increase productivity which will lead to economic development. The global malaria strategy of the World Health Organization promotes regular chemoprophylaxis for expectant mothers in malaria endemic areas, though this is still limited in Sub Saharan Africa.

4.1 Recommendations

The study has demonstrated that there are significant risks and burden of malaria experienced among the vulnerable population in Kenya and based on these findings, the following recommendations have been made for further actions:

- There is need for innovative involvement and education to bring about a change in behavior.~~in change of behavior change.~~
- Government should communicate to the citizens concerning the dangers of malaria and the primary, secondary and tertiary prevention programs through radios, televisions, posters, and fliers at any local health facilities or identified public places.
- The c~~C~~reation of stakeholder groups involves~~,~~ interventions through aquitable~~dequate~~ distribution of Insecticide Treated Nets to households with a poor socioeconomic status.
- Recommendation include the implementation of e~~E~~ducation and awareness programs on malaria.~~ are recommended.~~

- Encouraginge the vulnerable populations to engagebe involved] in income generating activities such as poultry raising, farming, and small-scale businesses among the rural poor—community, which can enhance their financial. This, in turn facilitates the acquisition of preventive measuresmeans that can aid them in buying safety measuresto control malaria.

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