Malaria Risk and Ecological Change in Gusii: What Can We Learn from Hospital Data and Community Narratives?

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Abstract

Ecological factors have contributed to increased malaria transmission in sub-Sahara Africa. This study was designed to document perceived and actual ecological changes in Gusii over the last three decades; to document changes in the malaria burden and to collect ethnographic data to understand folk causal linkages between environmental change and disease patterns. Over a 12-month period data was collection using malaria focused-ethnographic interviews, historical narratives and a review of statistical health records. A total of 103 people were interviewed. Historical narratives reveal a decline in landholdings over three decades. Hospital health records show that over this period, the burden of malaria has increased. Ethnographic interviews and hospital records show that the period during which malaria is most intense is between May and August, with July as the peak period. Ethnographic data point to weather changes, changes in landholdings and land use as the primary factors in the observed changes in the malaria patterns in Gusii. In conclusion, in the absence of documented data folk knowledge is a useful substitute for constructing trends.

Key words: Malaria transmission, ecological factors, risk perception, Gusii, Kenya

Introduction

Malaria is a devastating disease of the tropics with immense implications on subsistence and commercial agriculture. In sub-Sahara Africa it is responsible for more than one million deaths mostly (>77%) in children aged below five years and it leads to more than 200 million episodes of clinical malaria each year (Snow *et al*. 1999). In Kenya malaria accounts for 30% of all outpatient cases and it causes deaths in over 90 under-5-year olds each day, and has negative effects on other sectors of the national economy as well (Oyediran & Achola 1999). For the school-going age, malaria is responsible for the majority of school days lost due to ill health. More recently, environmental changes such as the El Nino phenomenon and changed rainfall patterns have added to the complicated malaria picture (MoH 1998). In Uganda, Lindblade *et al.* (2000) have observed the effects of change in land use on malaria transmission dynamics. In their study they attribute increased malaria transmission to changes in temperature (Lindblade *et al*. 2000). What is evident is that, with environmental change, new areas which were until now regarded as malaria free are increasingly coming under the threat of malaria. In deed malaria has spread to higher altitudes where indigenous infections were hitherto rare or unknown. This phenomenon, known as highland malaria, has immense consequences on the survival of low-immune communities inhabiting these regions.

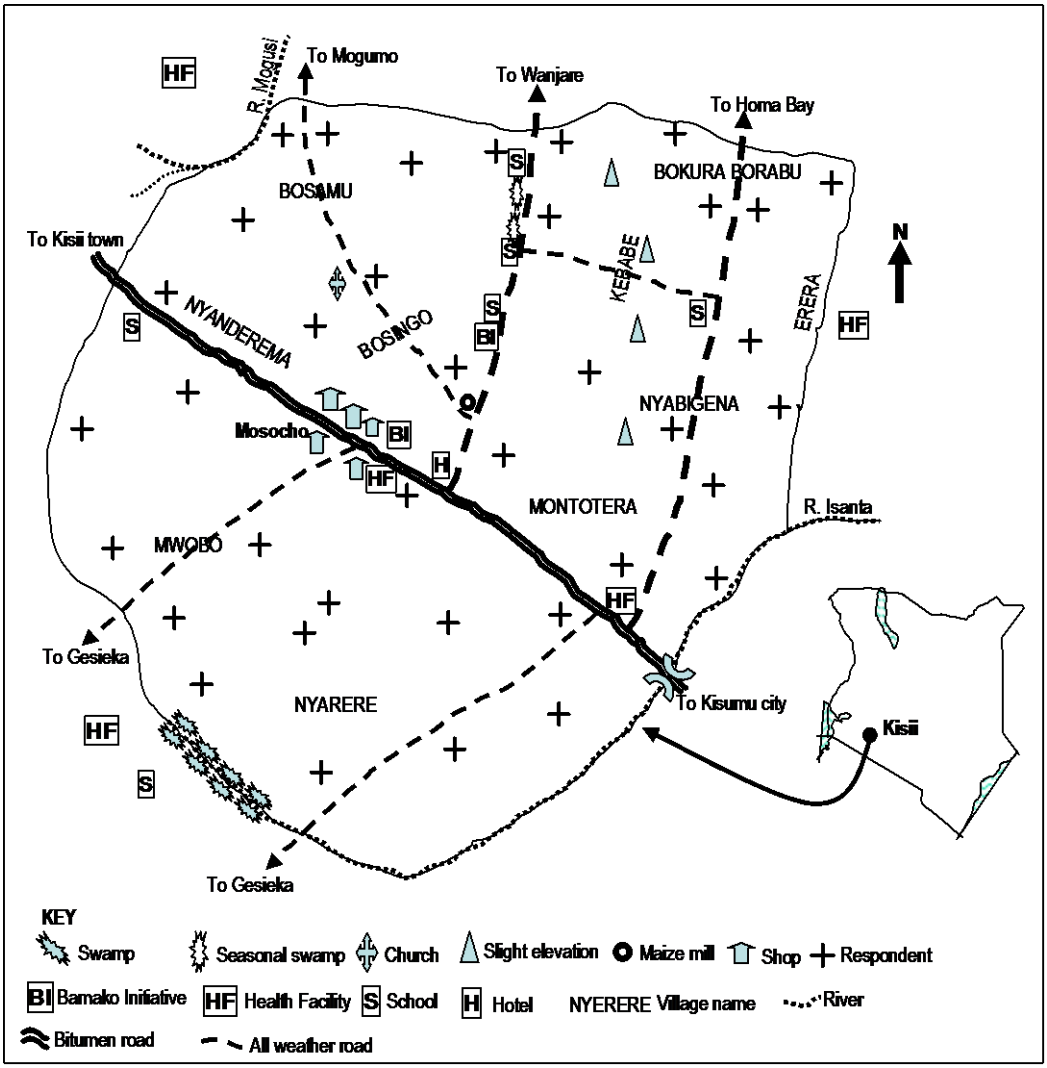
In contrast to Lindblade and colleagues, Small, Goetz & Hay (2003) have shown in their model that precipitation rather than change in temperature (cf. with Lindblade *et al.* 2000) is the prime mover in the transmission of malaria. In Gusii, an area classified as highland, there has been an upsurge of malaria cases in the past 20 years. In 1998 a malaria outbreak led to numerous deaths. Land in this region has been extensively fragmented due to population pressure which has brought about important ecological changes affecting the malaria vector, the mosquito. More important, these changes may have influenced the transmission rate of the malaria parasite leading to an increase in malaria prevalence in the community. As a result, morbidity and mortality resulting from malaria is high. High morbidity reduces labour contribution to agricultural activities and ultimately agricultural output as patients cannot effectively contribute their labour to farm work. Further, the healthy individuals have to take time off to care for the sick and, when death occurs, to bury the dead. In an earlier study on lay people's anti-malaria behaviour (Nyamongo 1998) historical anecdotes suggested an increase in malaria over the years. This increase in malaria according to informants has accelerated in the recent years. I set out to systematically investigate these anecdotes. The aim of this paper is threefold: to document actual and perceived ecological changes in Gusii over the last 30 years; document changes in the burden due to malaria over the same period; and to collect ethnographic data to describe the causal linkages between environmental changes and disease patterns.

Methods

Study Site and Population

The Gusii highlands lie in an area roughly to the east of Lake Victoria. Altitude ranges from 1,500 meters to 2,350 meters above sea level. The variable altitude contributes to variable malaria transmission rates, with more cases being reported in the lower altitude. The study was conducted in Mosocho division of Kisii Central district. The area covers 87 sq. km. and has one of the highest population densities in the district. A social map showing the six study villages is shown in Figure 1.

Figure 1 Social Map of the six study villages



The other set of data comes from malaria morbidity and mortality statistics at the district hospital in Kisii town. The district hospital serves as a referral facility for the greater Gusiiland and from other neighbouring districts. Within the six tiers of Kenya's health system, the Kisii district hospital falls at level five same as the Provincial hospitals. This is due to its coverage and the number of referral cases it handles. Other government health centres and government health institutions within the hospital's catchment area routinely submit data to the facility. Summary data is available for each month, and this can be broken down to weekly data in some cases.

Data collection

The research commenced in November 2001 for a period of 12 months. Initial field preparations were carried out in the month of November 2001 followed by an ethnographic study of the people's perceptions regarding malaria throughout December and the following months. Data collection peaked between March and June 2002 when rainfall is at its peak and when morbidity and mortality due to malaria is relatively high and continued till end of August, 2002. A mixture of data collection methods—historical narratives, malaria focused ethnographic studies, review of statistical data records (Bernard 2000)—worked synergistically. Historical narratives yielded information that made it possible to discuss folk perceptions of ecological and malaria burden trends.

Historical narratives also add to our understanding of socio-cultural changes that have taken place in Gusii over the last thirty years. These data were collected through interviews with 50 key informants (37 men and 13 women). The malaria focused ethnographic study yielded information on people's malaria-lived experiences. Through this I have documented the perceived effects of malaria on human survival from lay people's perspective. Malaria focused ethnographic data were collected from 53 respondents (16 men and 37 women) selected on the basis of their experience with malaria. In addition to malaria focused ethnographic survey, data on weather changes over the last two decades was collected. However, due to lack of proper record keeping it was not possible to go further back in extracting the data from these records. Although it was not possible to access data on temperature patterns, rainfall data was available for some years, however it was not complete.

Six mixed focus group discussions were held with men and women from the community. Mixing men and women did not present any problems as malaria is not a sensitive topic that would make participants non-responsive. The composition for each focus group discussion is given in Table 1. The focus group discussions were used to assess community members' perceptions about ecological changes that have taken place since the early 1970s. Specifically, discussions were focused on land size changes, change in rainfall patterns as well as changes in the burden of malaria in the region.

Table 1: Focus Groups on Community Perceptions on Ecological Change

Group	Men	Women	Total
Bosingo Village	6	6	12
Erera Village	6	4	10
Bosamu Village	7	5	12
Kebabe Village	6	5	11
Nyabigena Village	9	4	13
Nyarere Village	6	4	10

The other set of data comes from malaria morbidity and mortality statistics at the district hospital in Kisii town. The district hospital serves as a referral facility for the greater Gusiiland and from other neighbouring districts. Due to its status as a district hospital, government health centres and other government health institutions routinely submit data to the facility. Summary data is available for each month, and this can be broken down to weekly data in some cases.

Findings

Characteristics of Informants

A total of 103 respondents were interviewed. Of these 50 provided historical narratives on malaria and other environmental trends while 53 provided malaria focused ethnographic information. For historical narratives the average age for the respondents was 50.16 years for men (std. dev. = 11.9 years) and 56.7 years for women (std. dev. = 13.5 years). The fact that women are older on average was a deliberate effort so that only women who had lived longer in the area were included. The men had on average 6 years of schooling while women had only 3 years on schooling. For the malaria focused ethnographic interviews men were generally older (mean age for men = 40.37 years, std. dev. = 10.22 years). The mean age for women was 36.0 years (std. dev. = 10.29 years). However, there is no much difference between men and women in their levels of education. In general people in the area practice subsistence agriculture, mainly growing bananas and sugar cane. They also grow crops like maize, sweet potatoes and beans for home consumption. To a lesser extent farmers in the area also grow coffee and tea as cash crops. However, the cultivation of these cash crops is constrained by lack of adequate land and competition from subsistence crops. In a number of cases those settled near areas that have clay soils have resorted to brick making to supplement income from coffee and tea.

Causes and Symptoms of Malaria

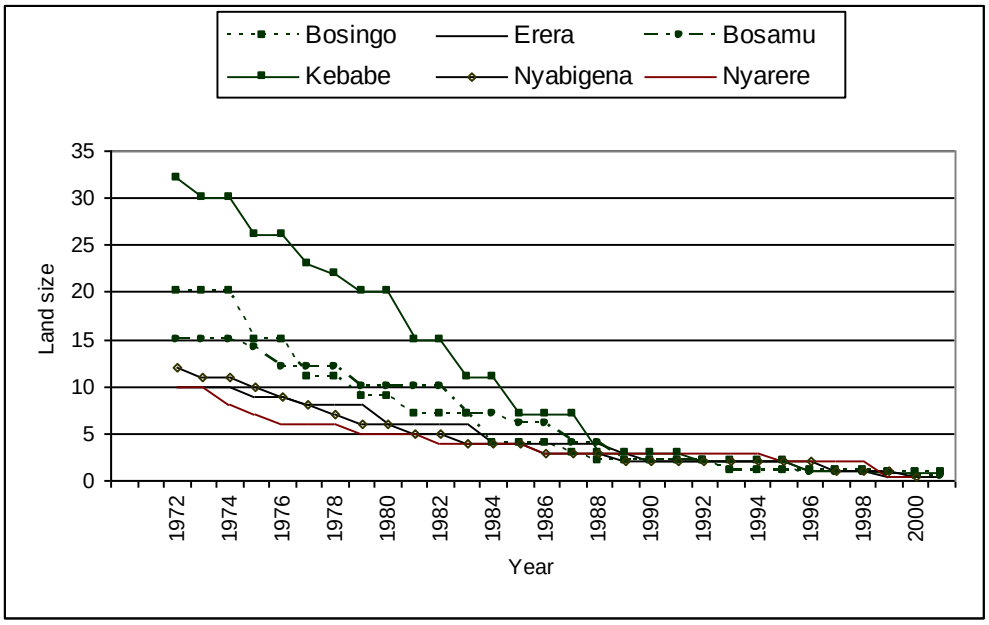
Concepts about malaria causation are varied. However, predominantly the community is clear about the cause of malaria. Close to 98% reported that malaria is caused by mosquitoes. A few reported that malaria can be caused by other factors such as, dirty compound (16%), poor nutrition (8%), dirty water (6%) and cold weather (2%). The symptoms of malaria include: fever, headache, feeling cold, joint pains, vomiting (*esosera*), bitterness in the mouth, dizziness, loss of appetite, general malaise, diarrhea, stomachache and itching. (A detailed account of folk perceptions is covered elsewhere, see Nyamongo 2000 and 2002 and Siso 2003.)

Community Perception of Ecological Change

From the focus group discussions, it is evident that land tenure has undergone changes over the last 30 years. In the early 1970s land was communally owned i.e. there were no clearly marked boundaries.

Anyone could utilize the freely available land. After community members became conscious of the need to clearly demarcate the land and as a result of population pressure and the cultural requirement that a father bequeaths his sons part of the family land, subdivisions became common and the need to have title deeds as proof of ownership became critical. With each subsequent subdivision, land sizes steadily reduced over time from an average of about 20 acres in early 1970s to less than one acre in late 1990s. These changes in land sizes are captured by community derived land sizes spanning over the last three decades (Figure 2).

Figure 2: Community perceptions of land size changes since 1972



Community members attribute this reduction of plot sizes to three main factors. First, the reduction of land was attributed to increase in population of the local people. The population of the area currently stands at 63,247 persons, with a population density of 727 persons per square kilometer (CBS 2001). It is one of the highest in Kisii central district. In 1989 population density in the area was 513 persons per square km. (CBS 1994). Over the years, the population density in the area as increased. The second factor is linked to the immigration of people, who moved in and bought land hived off from that of original owners. Lastly, reallocation of land for development purposes such as for the construction of schools, shopping centers, churches, health care facilities and other public utilities is linked to reduction of plot sizes. Informants linked these new developments to increased demand for bricks for building which, in turn, has led to an increase in the number of holes dug for purposes of obtaining clay for brick making. Since these holes are rarely re-filled, water collects in them during the rainy season giving rise to more mosquito breeding sites.

The community links the reduction in land size to the increase in reported malaria cases in at least four different ways. First, the reduced land size has led to a reduction in food crop production per household leading to a strain on the family's available food resources. Consequently, the communities experience seasonal food shortages. Another consequence of reduced land size is that it has also resulted in the disappearance of traditional food crops which are thought by the local people to "prevent" malaria. These foods are believed to have medicinal properties. Further, lack of proper nutrition makes people weak and less likely to withstand infections, including malaria.

Second, the reduction in land size has reduced distances between homesteads. Consequently the mosquitoes can fly with ease from one homestead to the next. Thus infected mosquitoes have a chance of infecting new people. Respondents link the reduced inter-homestead distance to an increase in the rate of malaria transmission from infected to healthy individuals and from one homestead to the next.

Third, due to reduced land, the cropping pattern has changed. Many people, in an attempt to increase food production for the family, are forced to plant crops, especially maize and bananas throughout the year. These crops often are planted close to the homes. The shade and protection from the crops provide a protective environment for mosquitoes.

Lastly, a decrease in land size coupled with rapid population increase has forced people to settle in areas traditionally considered inhospitable. These are areas close to swamps where mosquitoes breed. In the past, people used to settle far from these places, largely to keep away from the mosquito nuisance.

But population pressure has changed the scenario. This new settlement pattern has contributed to an increase in man-vector contact with a concomitant increase in malaria cases.

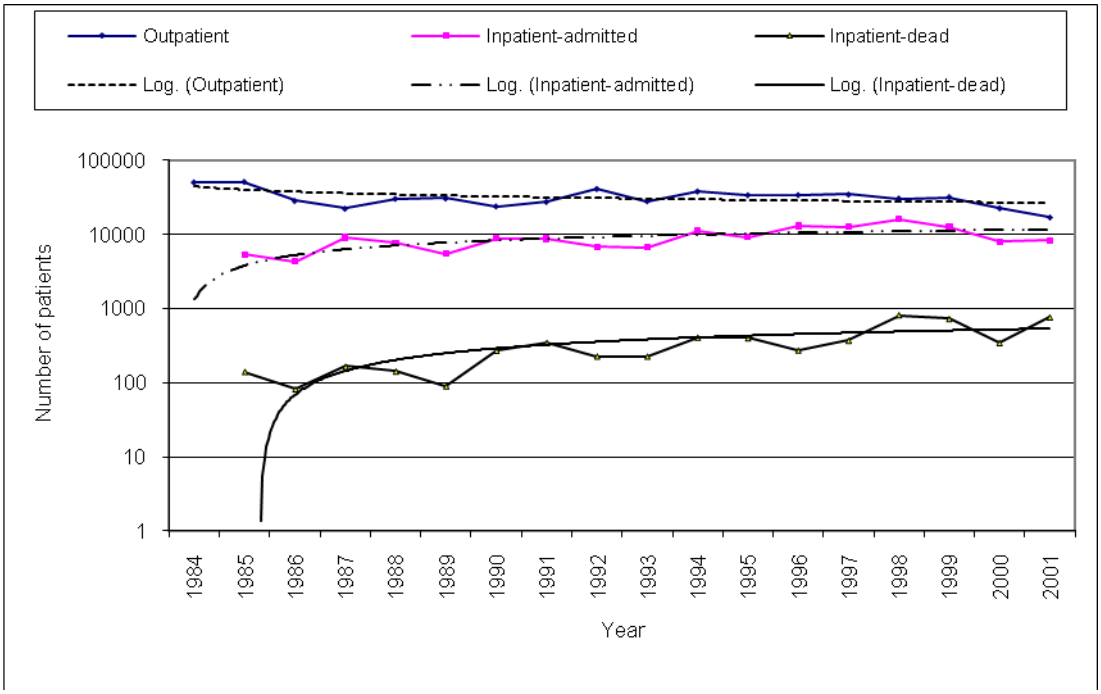
Furthermore, the community reports a "new" type of mosquito which "causes" malaria that is difficult to treat. This perception is linked to insecticide resistant mosquitoes and drug resistant *Plasmodium* parasites. According to some people, the burden of malaria has got worse starting in late 1980s/early 1990s. Resistance is perceived in terms of the ease with which malaria is treated. The few people who got sick in the 1970s were easily and inexpensively treated using chloroquine, the drug of choice then. However, resistance as an issue was not identified in all the six focus group discussions.

These are not the only reasons why people perceive an increase in malaria. In one of the FGDs, six participants felt that witchcraft contributed to the incidence of malaria in the community. This view is not unique to this area; it has been reported elsewhere in Gusii (Nyamongo 2002). While, others argued that poverty could lead to poor management of disease leading to complications.

Health Statistics

Data on malaria morbidity and mortality trends since 1984 is given in Figure 3. These data have certain inherent problems. First, complete data were missing for a number of years. Second, in some cases diagnosis was not indicated, and therefore it was difficult to tell from the available records what the patients actually suffered. Lastly, it was impossible to get data prior to 1984. These problems notwithstanding, the data available indicates that malaria has generally increased, confirming perceptions held by the community. This is more clearly demonstrated by the inpatient malaria data (both from admitted and records of those who died).

Figure 3: Malaria trends since 1984

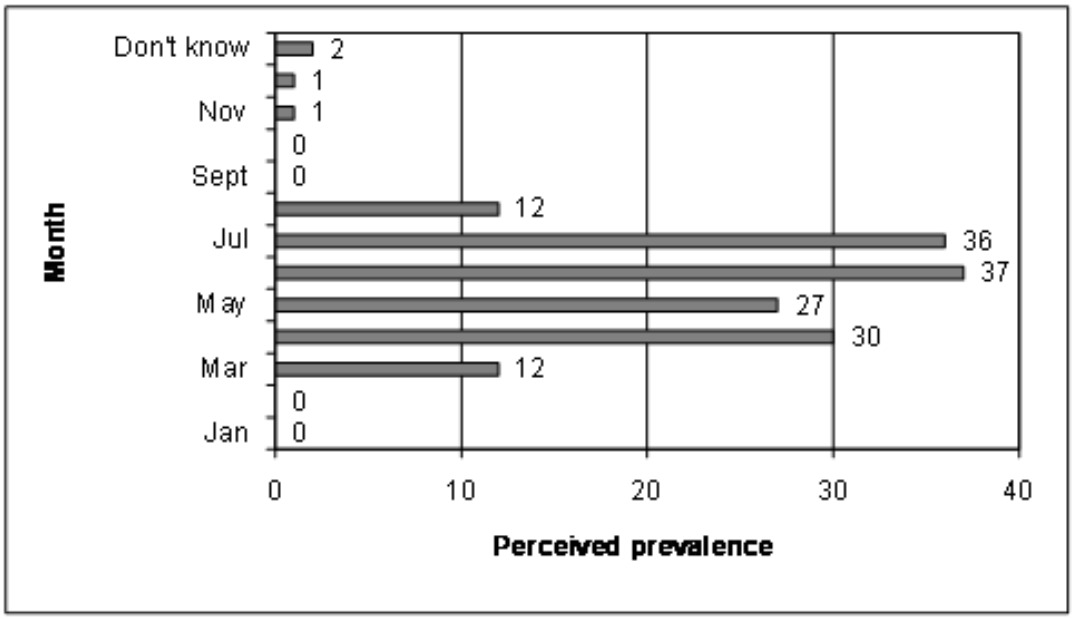


Hospital records reveal an increasing trend in the number of patients admitted and dying in the facility (Figure 3). On the other hand, from the records the number of outpatients appears to be largely constant, albeit with a slight reduction in the number of people visiting as outpatients.

Perception of Risk vs. Malaria Data

From indepth interviews with community members malaria is generally thought to occur throughout the year. The largest number of malaria cases were reported to occur in the months of April, May, June and July (Figure 4), with the highest number of malaria cases perceived to occur in June and July. Two of the respondents did not know when malaria is most prevalent.

Figure 4 : Perceived malaria prevalence during the 12 months of the year



These perceptions closely mirror malaria morbidity and mortality records from the Kisii General Hospital (Figure 5a and Figure 5b). Records show that admissions are highest during the months of May, June and July. For instance, over the five years represented, 1999 was the worst in terms of morbidity and mortality due to malaria. Morbidity and mortality reduced over the next two years only to increase in 2002 and 2003. Recorded deaths from hospital records (Figure 5b) follow the morbidity trends (Figure 5a). The observed reduction in morbidity and mortality post-1999 is largely due to massive indoor residual emergency spraying by Merlin (an international health sector NGO) following the 1999 malaria outbreak.

Figure 5a: Malaria In-patient admissions for Kisii District Hospital (1999 – 2003)

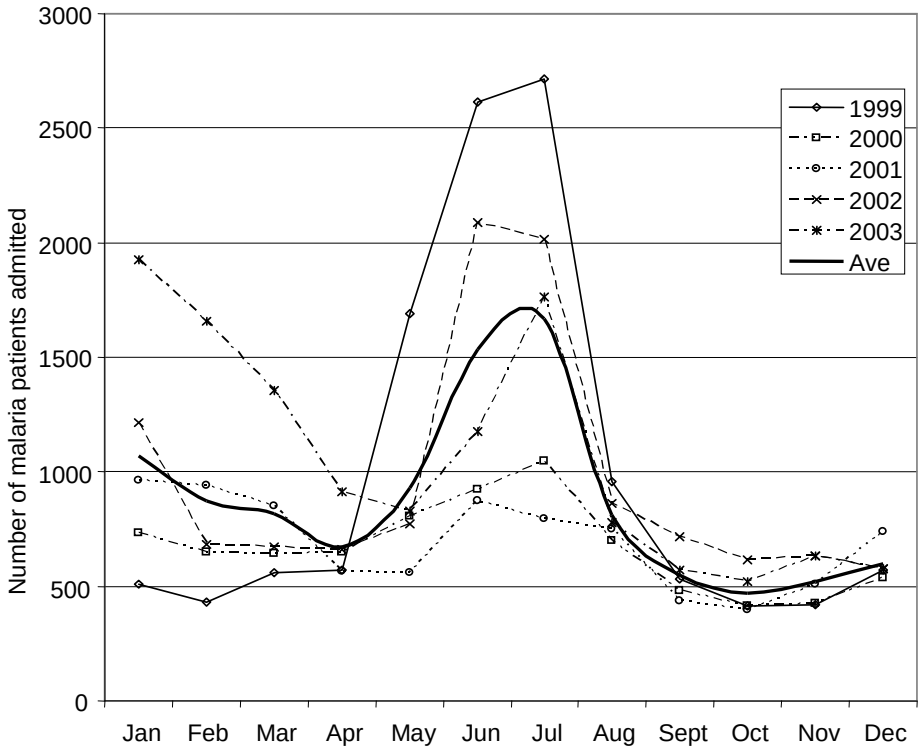
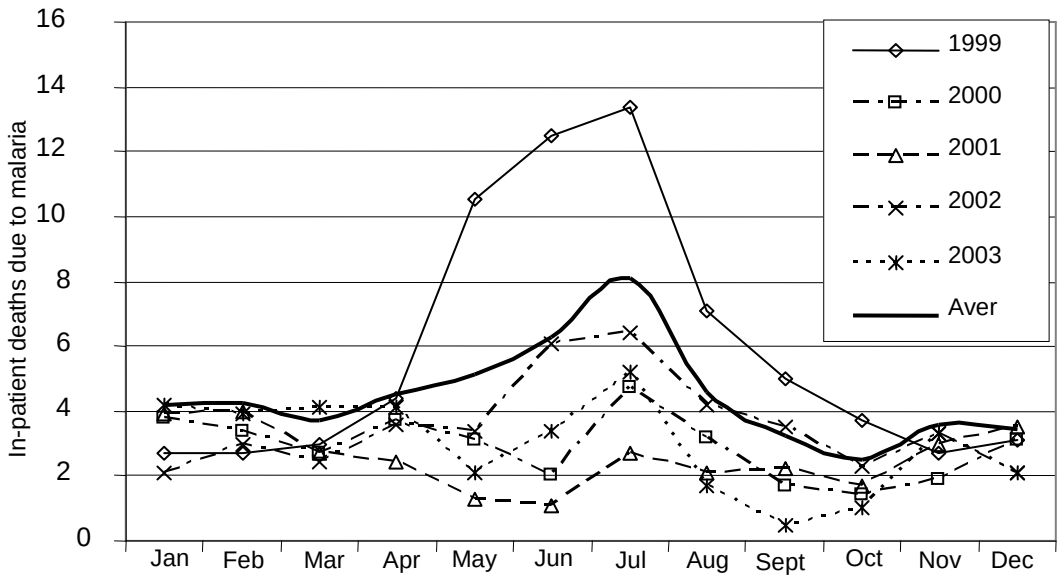


Figure 5b : In-patient malaria deaths for Kisii District Hospital (1999 – 2003)



Effect of Malaria on Individuals/Community

Malaria disrupts farming activities; it leads to increased poverty in the community as resources are redirected to the management of the disease while production decreases. In addition, people die as a result of malaria leading to lost agricultural labor-pool and money used for treatment impacts on the families' savings. Victims usually suffer for periods ranging from a few days to as long as a month depending on when treatment commences and the type of treatment given. Shops play an important role in the management of malaria as this is where a majority of those suffering get their first treatment. First line malaria drugs and antipyretics such as Panadol are bought from shops and without prescription. These drugs are widely used in the community. People classify these drugs into anti-malaria drugs, antipyretics as well as those drugs that can be used by adults and children (Nyamongo 1999). Unfortunately, in the majority of cases patients often underdose themselves, thus contributing to the growing problem of drug resistance.

Marsh *et al.* (1999), for example, have shown in Kilifi that only four percent of children patients received an adequate dose of shop-purchased anti-malaria medication. And, in an earlier study in rural western Kenya, only about 12% of the patients were given the correct dose (Reubush *et al*. 1995). In addition to using shop-purchased medication, patients also go to private clinics as well as to government facilities for treatment. Despite the use of all three sources (shops, private clinics and government facilities), patients preferred the government facilities because more of the later provide laboratory services so blood slide diagnostic tests can be done to confirm the presence of malaria parasites. Although the private clinics are rated well by the community, these clinics are poorly equipped with diagnostic tools and they are generally regarded by people as expensive, thus limiting the number of would be users. Nevertheless, a patient is more likely to get medication in a private clinic because they usually operate as one-stop facilities (with consultation, prescription and dispensing services).

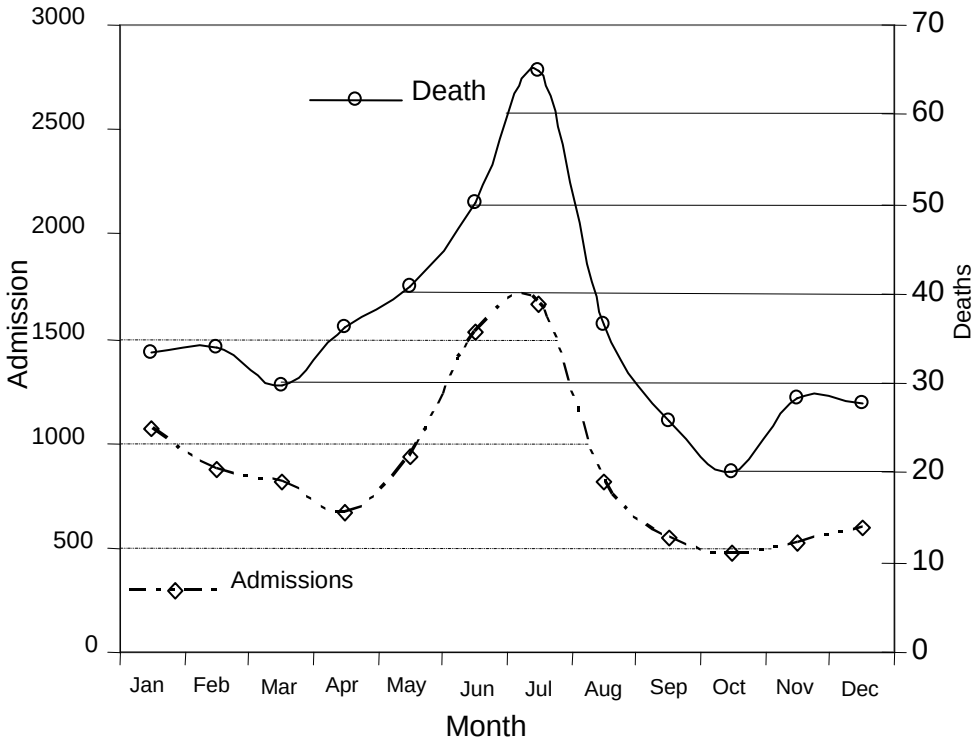
Discussion and Conclusion

The rise of malaria in sub-Sahara Africa has been widely debated and this debate is far from being settled. Explanations offered for the observed rise point to the possible effects of increased parasite resistance to the first-line drugs, increased poverty levels and decline in health care services due to budget cutbacks (see Nchinda (1998) for a detailed discussion on this). Other factors include increased migration and change in agricultural activities (e.g. Craig *et al*. 2004). The current study underscores the value of local perceptions regarding variable transmission rates and the rising cases of malaria. This has the potential to influence what people do in order to reduce the risk of malaria and in reducing its impact on people. In Tanzania, Winch *et al*. (1994) have pointed that lay risk perception could influence utilization of malaria prevention tools. Specifically, the use of insecticide treated nets could be linked to perceptions of seasonal susceptibility to malaria as well as to geographical variability in mosquito densities (Winch *et al*. 1994). Community narratives from Gusii reveal that people link malaria increase to changes in the weather patterns, changes in land holdings (especially a reduction in plot sizes), changes in vector and parasite characteristics. However, at this point, using the available data it is not possible to pinpoint one critical factor that accounts for the increase in malaria cases.

Despite the reported increase in malaria cases, dynamics of the utilization of health care services vary. For example, a reduction in the number of outpatients is observed. This reduction may be attributed to a number of factors. First, the government has over the last several years established satellite health care facilities. These facilities absorb patients who only require minor attention. The patients would be expected to utilize these facilities more as it would eliminate transport cost that might otherwise be incurred by the patients. Second, with liberalization in the health care sector more private clinics have been established. The private facilities provide further avenues of care-seeking for the patients (Nyamongo 2002 and Siso 2003). Finally, the introduction in the 1990s of cost-sharing in government facilities may have negatively affected the use of the facilities. This fact has been established elsewhere (e.g. Mwabu *et al*. 1995 in Kenya and Yoder, 1989 in Swaziland). Expectedly, the number of people using the services might be limited to only the serious cases that end up in the hospital when their condition gets serious.

In Swaziland, following an increase of up to 400% in hospital user fees at the government hospitals, average attendance in all health care facilities dropped by about 17%. Up to 34% of the overall decline in attendance was among patients who had previously paid the least for health care (Yoder 1989). In Kenya, Mwabu et al. (1995) reveal a similar trend in health care utilization. After introducing cost sharing in government health facilities, patient attendance dropped by 50%. When these charges were suspended patients moved to government facilities from the private health sector over the next 7 months. Furthermore, people's perceptions appear to closely mirror data from the health care facilities. Clearly the morbidity and mortality data from the district hospital reveal that lay people's perception of risk is correctly reflected in the actual data (compare Figure 4 and Figure 6). The data shows that morbidity and mortality risk were elevated during the months of May to August (Figure 6). Evidently, folk perception of risk cannot be overlooked.

Figure 6: Average Monthly Trends of Kisii Hospital Admissions and Deaths over a 5-year period (1999 – 2003)



In conclusion, it is apparent from the ethnographic data and the hospital records presented here that there is an association between perceived risk as measured from lay people's risk perception and the actual risk of malaria as measured from hospital records of admissions and deaths obtained from the health facilities. Thus in the absence of documented data, ethnographic data can be used as proxy and to formulate community-based risk prediction indicators, particularly in areas that suffer from epidemics and where population groups might only have partial immunity as a result. Such prediction indicators would help prepare the communities well in advance to take pre-emptive measures before they experience malaria outbreaks.

Acknowledgement

This study was funded by the Toyota Foundation of Japan for financial assistance through Grant No. D01-A-062. The University of Nairobi provided logistical support. The research was reviewed and given ethical approved by the Institute of Anthropology, Gender and African Studies, University of Nairobi and a research permit issued by the Ministry of Education, Science and Technology. Thanks are also due to Jared Siso and Edna Masita who assisted in field work and to the many individuals who provided information on which this paper is based. Any errors of interpretation are my own.

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