Environmental Management for Malaria Control: Knowledge & Practices in Mvomero District, Tanzania

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ABSTRACT

Malaria is the leading cause of death in Tanzania, killing 100,000-125,000 people annually, the majority of which are children under five. Environmental conditions play an important role in transmission of the disease, and therefore regulating these conditions can help to reduce disease burden. Environmental management practices for disease control (e.g. draining stagnant water and eliminating mosquito breeding habitats) can be implemented at the community level as a complement to other malaria control methods. This study assesses current knowledge and practices related to mosquito ecology and environmental management in Mvomero District, a rural, agricultural area in Tanzania.

A total of 408 household surveys, 4 focus group discussions, and 3 in-depth interviews were conducted in 10 villages in the district. Results indicate that while most respondents understand the link between mosquitoes and malaria, many do not have an in-depth understanding of mosquito ecology. For example, 30% of respondents did not know where mosquito larvae live and nearly 40% incorrectly believed that cutting grasses and bushes around the home reduces mosquito abundance. Regarding environmental management practices, 50% of respondents reported cleaning residential surroundings to protect themselves from malaria and 18% drained stagnant water. Respondents with greater knowledge of mosquito ecology and environmental management were significantly more likely to perform these practices. Qualitative results highlighted community beliefs that environmental management is an important method for malaria control, and that education is necessary to increase community participation in these activities.

The findings indicate that an educational program highlighting mosquito ecology and effective environmental management techniques would be an important step in increasing community participation in environmental management for malaria control in the region.

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INTRODUCTION

Background

Malaria is the leading cause of death of both adults and children in Tanzania, killing 100,000-125,000 people annually (CDC 2005). Malaria transmission is endemic in the majority of the country, as sustained transmission of the disease occurs either throughout the year or seasonally (MARA/ARMA 2002). Numerous factors interact to influence transmission levels in a given area including macro- and micro-environmental conditions, socioeconomic factors, vector abundance and parasite loads, and level of compliance with malaria control policies. Environmental conditions play an important role in the transmission of malaria, as the amount of stagnant or slow-moving water in an area is a strong determinant of abundance of the *Anopheles* mosquito vector. The presence and amount of water in an area is dependent on both macro-environmental factors such as climatic conditions (temperature and rainfall), and micro-environmental factors such as local topography, and human land use and management (for example irrigation systems). Environmental management is a promising technique for vector control, as it alters these micro-environmental conditions in order to decrease the available breeding habitat for mosquitoes by removing stagnant or slow-moving water sources (Ault 1994). It is estimated that 42% of the malaria burden in Sub-Saharan Africa could be prevented by environmental management (Pruss-Ustun & Corvalan 2006).

Human activities play an important role in influencing the transmission of infectious diseases, including malaria (Patz *et al* 2004; Sattenspiel 2000; Weiss & McMichael 2004). Human-induced micro-environmental changes, such as the

construction of irrigation schemes and dams, have been shown to dramatically increase mosquito populations in an area by creating new breeding habitat (Ijumba *et al* 2002; Mutero *et al* 2004). Malaria is thus a particular problem in agricultural areas, as land use changes implemented to improve crop yields often result in an increased presence of surface water. Environmental management is an important component of malaria control, as it can be used to regulate these micro-environmental conditions, reducing the amount of slow-moving water present in an area, and thus creating land less suitable for sustaining mosquito populations. This method has been successful in reducing the malaria burden in many different ecological, socioeconomic, and epidemiological conditions (Utzinger *et al* 2001). Environmental management was first used on a large-scale basis in the early 1900's, fell out of practice in the 1940's with the onset of DDT spraying, and only began to be implemented again for malaria in the 1980's (Ault 1994).

The purpose of this study is to assess knowledge and practices related to environmental management for malaria control in Mvomero District, a rural agricultural region of Tanzania. This information will provide baseline data which can be used in the development of an environmental management educational program for the district.

Environmental Management and Malaria

Environmental management consists of installing and maintaining drains, removing pools of stagnant water, managing vegetation, irrigating intermittently, and altering rivers to create more fast flowing water (Keiser *et al* 2005). In Ethiopia, reduction of mosquito breeding grounds through environmental management has been shown to significantly reduce mosquito abundance in surrounding areas (Yohannes *et al* 2005). A study in a rice-growing area of Sri Lanka found that after the implementation

of a community-based ecosystem management program to control mosquitoes, the abundance of adult *Anopheles* was significantly lowered during the rainy season (Yasuoka *et al* 2006a). Additionally, in Zambia it has been shown that shortly after the implementation of a large-scale environmental management program, annual incidence of malaria was halved among the affected community (Ault 1994). This form of malaria control is relatively inexpensive, is simple for local communities to implement and maintain, and is not harmful to the local environment or human (Keiser *et al* 2005). Additionally, community approval and involvement has been seen as a necessary component of malaria control in today's more democratic Africa (Mukabana *et al* 2006). Community-implemented environmental management programs are therefore an important bottom-up component to the largely top-down system of disease control, acting as a beneficial addition to methods such as insecticide-treated net (ITN) use and indoor residual spraying (IRS).

Effects of Knowledge on Malaria-Prevention Behavior

One key factor in combating the burden of malaria is decreasing exposure to the disease, both by reducing vector populations and by lowering contact between humans and infected mosquitoes. Additionally, increasing people's use of healthcare facilities and anti-malarial drugs are important to decreasing malaria morbidity and mortality. People's knowledge and perception of malaria influence both prevention and treatment-seeking behaviors (Comoro *et al* 2003; Minja *et al* 2001; Nuwaha 2002; Oberlander & Elverdan 2000). A study in Zimbabwe concluded that there is a significant relationship between people's knowledge of the causes of malaria and their preventative measures taken against it, and that a household's level of understanding of the purpose of an

insecticide spraying program is directly correlated with their compliance with having their house sprayed (Vundule & Mharakurwa 1996).

Local knowledge and perceptions of malaria are likely to influence the success of environmental management programs as well. If people have a comprehensive understanding of the mosquito life cycle and habitat requirements, it is likely that they will be more effective in controlling these habitats to reduce mosquito populations. For example, in East Africa people often state that they clear grasses and bushes around the home to prevent malaria. This practice was introduced to Tanzania by the British colonial government as a general hygienic measure in order to keep the household free of rats, snakes, and mosquitoes, and while it does not necessarily lower malaria risk, it may reduce the number of mosquitoes resting in vegetation (Mutero, Personal Communication, 2008). Few studies have examined the efficacy of this practice, but the little evidence that exists indicates that this practice is ineffective in reducing populations of *Anopheles* mosquitoes (Opiyo *et al* 2007; Ribbands 1946). Additionally, different species of *Anopheles* tend to exhibit either exophilic (outdoor) or endophilic (indoor) resting behavior. The two primary vectors in the study area, *A. gambiae* and *A. funestus* are both highly endophilic (Hargreaves *et al* 2000; White *et al* 1972). Thus, clearing vegetation outdoors is likely to have minimal effects on resting behavior, and therefore would be ineffective as a mosquito control technique. The belief that clearing vegetation decreases mosquito populations results in management methods that are less helpful for malaria control. Performing activities that do result in a lower mosquito burden is therefore a more efficient use of a household's time and resources.

Additionally, a case study of an integrated vector management program in Kenya showed that among 67 community malaria control volunteers, no one knew what larval mosquitoes looked like, or what habitat they lived in (Mukabana *et al* 2006). In another study of 1,451 households in Kenya, 65% of respondents stated that they did not know what mosquito larvae look like (Opiyo *et al* 2007). Therefore, the first step in the introduction of an environmental management campaign is to ensure that communities understand the processes of vector ecology, how these processes are linked to their surrounding micro-environment, and how performing management techniques will impact malaria in their community. If properly implemented, environmental management is a promising approach. It is a method that a community can take ownership of, maintain through participation and cooperation, and sustain through continual education of community members.

Community Participation and Education

In order for environmental management techniques to succeed in reducing the malaria burden in an area, widespread community participation is essential. If only a small percentage of people destroy breeding habitats around their homes, mosquitoes will simply breed in nearby bodies of water and no reduction in the total mosquito population will occur. Therefore, a threshold amount of stagnant water must be drained in order for mosquito populations to be significantly reduced in a community. This highlights the importance of viewing environmental-based malaria control as a collective action problem. In this situation, if the majority of people in a community contribute a small amount of time to performing environmental management, the entire community will benefit from reduced malaria incidence. Collective action is important for other forms of

malaria control as well, particularly those that focus on reducing vector populations. For example, in Burkina Faso the collective use of insecticide-treated nets reduced malaria incidence by 90% for all community members, even those not sleeping under nets (Carnevale *et al* 1988). The high net usage was sufficient to decrease the number of malaria-infected mosquitoes enough so that malaria rates in the entire area were reduced. It is only with extensive participation from community members that a significant reduction in mosquitoes, and thus malaria burden will occur.

Educational programs have been used in many situations to increase community understanding and participation in malaria control activities. In India, one program used folk theater to teach people about malaria control and prevention (Ghosh *et al* 2006). This activity led to a significant increase in knowledge and participation in bio-environmental malaria control activities. In Sri Lanka participatory exercises were conducted in the field to identify mosquito breeding sites (Yasuoka *et al* 2006b). An integrated vector management program in Kenya taught community volunteers how to identify larval mosquitoes using live specimens (Mukabana *et al* 2006). Additionally, the Farmer Field School is an important example of a successful integrated vector management education program targeting agricultural areas. The Field School curriculum includes participatory exercises to identify breeding habitat, sample and identify adult mosquitoes, observe larval mosquitoes, learn techniques for source reduction and suppression of mosquito breeding, and map the village to identify areas on which to focus coordinated environmental management efforts (van den Berg & Knols 2006). All of the above programs were all successful in increasing community knowledge and participation in effective malaria control techniques.

In order to develop and implement a successful educational campaign, it is fundamental to conduct an a priori assessment of the community's knowledge, attitudes, and practices related to the issue. This baseline data on existing community perceptions and actions helps in the development of the content of an educational program. There are two primary objectives of this project. The first is to assess rural Tanzanian people's knowledge and understanding about the relationship between local environmental conditions and mosquitoes, as well as their knowledge and practices related to how one can alter the environment to reduce mosquito populations. The second is to examine the diversity of knowledge and practices along demographic lines, such as age, gender, formal education, religion, and socioeconomic status. Therefore these data will provide a preliminary picture as to the existing knowledge and practices related to environmental management for malaria control. This can then be used in order to inform the design and implementation of an educational campaign to promote effective environmental management techniques among communities in Mvomero District, Tanzania.

METHODS

Study Area

The study was conducted in Mvomero District, a malaria endemic area located between 8 - 10º S and 28 – 37º E in the Morogoro region of east-central Tanzania (Mboera *et al* 2007). Morogoro is the third largest region in Tanzania, occupying 8.2% of the country's mainland area and with a population of 1,759,809 persons (United Republic of Tanzania 2002). The region has much climatic variation, with average annual temperatures ranging from 18ºC in the mountains to 30ºC in lowland areas (United Republic of Tanzania 1997). Agriculture accounts for 80-90% of the region's economic activity, which consists of small and large scale farms as well as sugarcane and sisal plantations (United Republic of Tanzania 1997). Other sources of economic activity in the region include livestock keeping, fishing, beekeeping, mining, manufacturing, and wildlife viewing and hunting (United Republic of Tanzania 1997).

Mvomero, one of five districts in the Morogoro reigion, is a rural district composed of 101 villages with a total population of 260,535 (Mboera *et al* 2007). The district varies greatly in its topography and climate. Mountains and highlands are located in the northwest, lowland rainforest in the north and central areas, and drier woodlands in the south. Rainfall in the district is bimodal, with a long wet season from March to May and a short wet season from October to December. Average annual temperatures in Mvomero range from 20-30ºC (Mlozi *et al* 2006). The northern area has a humid to sub-humid climate, and annual rainfall ranges from 1500 to 2000 mm (Lyimo *et al* 2004) while the southern part of the district is much drier, with annual rainfall between 600 and 1200 mm (Karimuribo *et al* 2005).

The majority of the district's economic activity is derived from agricultural crop production, but the southern region is composed primarily of pastoralist livestock-keeping. Main crops in the district include rice, maize, cassava, fruits, and vegetables, as well as large-scale sugarcane and sisal plantations. Figure 1 shows the main types of agricultural production in the district, as well as the location of the 10 study villages. The primary malaria vectors in this district are *A. gambiae* and *A. funestus* (Mboera *et al* 2007). There are 45 health facilities in the district including 3 hospitals, 3 health centers, and 39 dispensaries (Mlozi *et al* 2006).

Figure 1: Map of Morogoro Region and Mvomero District with 10 study villages

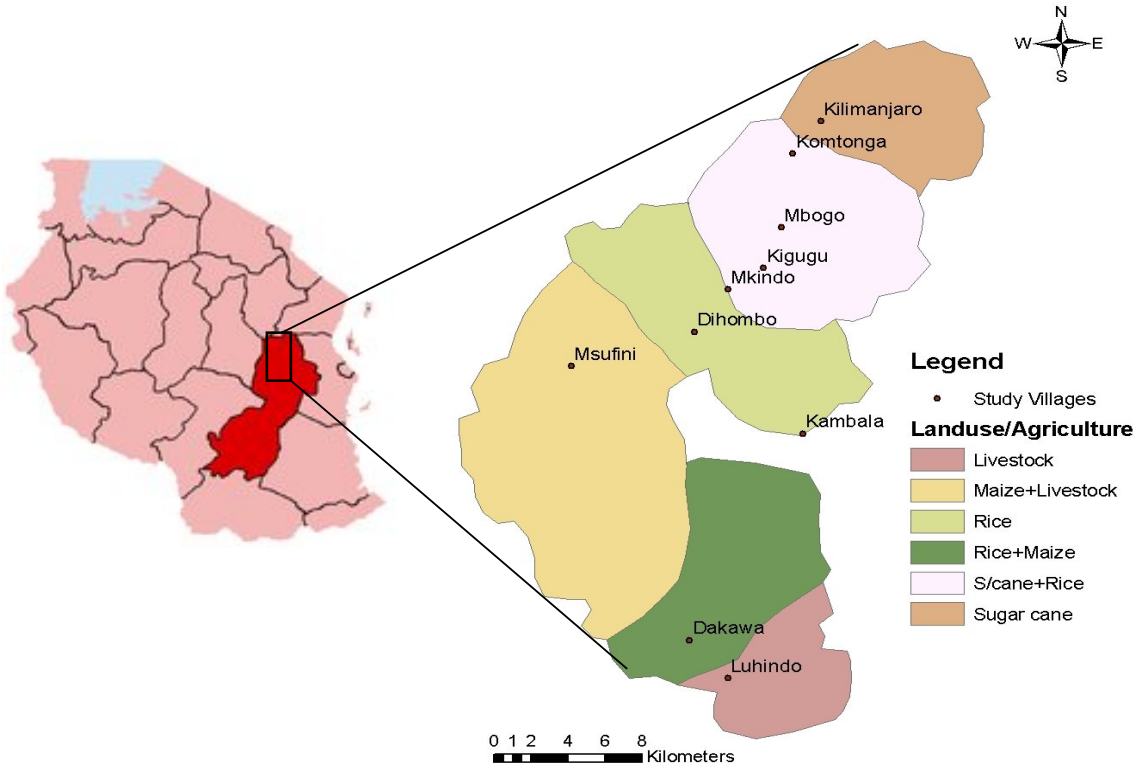

Table 1 displays the ten villages included in the study as well as the primary agroecological practices in Mvomero District. Five villages were selected because they had been involved in a prior malaria study (Mboera *et al* 2007). These villages

(Komtonga, Mbogo, Mkindo, Dihombo, and Luhindo) were chosen for the previous study on the basis of main economic activity (e.g. type of agriculture practiced or livestock-keeping), method of irrigation practiced, and proximity to main roads. During this earlier study a number of research activities were conducted in the villages, and public meetings were held in order to communicate to the villagers the malaria situation, research findings, and the need for participatory involvement in malaria control activities. Five additional villages that had not participated in the public meetings (Kilimanjaro, Kigugu, Dakawa, Msufini, and Kambala) were included in the current study. These villages were selected through a comparison process that matched them to the initial five villages on main economic activity and irrigation method.

Table 1: Characteristics of study villages in Mvomero District

Village	Ward	Population	Number of Households	Primary Schools	Secondary Schools	Distance to nearest hospital (km)	Distance to nearest dispensary (km)
Dakawa	Mvomero	9857	1308	2	1	40	0
Luhindo	Mvomero	2420	439	1	0	40	2
Mkindo	Hembeti	6204	1401	2	0	8	0
Kambala	Hembeti	2980	649	1	0	15	0
Dihombo	Hembeti	2536	840	1	1	20	10
Msufini	Hembeti	1885	450	1	0	25	5
Kilimanjaro	Sungaji	3335	503	2	0	1.75	1
Kigugu	Sungaji	3015	259	1	1	0	3
Mbogo	Sungaji	2800	500	2	1	1	5
Komtonga	Sungaji	2595	470	1	0	14	7
Average	--	3763	682	1.4	0.4	16.5	3.3

Study Design

The study was conducted in collaboration with a larger research team, which included Katherine Dickinson, a PhD candidate at Duke University, and Elizabeth Shayo, a medical sociologist at the National Institute for Medical Research (NIMR) in Dar es Salaam, Tanzania. Research activities were carried out during June 2007 and employed both quantitative and qualitative methods in order to describe knowledge and practices

related to malaria, mosquito ecology, and environmental management among the study communities. For quantitative analysis, a survey instrument was developed based on a prior household survey conducted in Mvomero District by NIMR, a preliminary visit to the study site by other members of the research team in June 2006, and consultation with agricultural and health experts familiar with the area. Qualitative methods included focus group discussions (FGDs) and in-depth interviews (IDIs).

The survey instrument was initially translated from English to Swahili by Ms. Shayo. A four-day training session including a preliminary FGD was then held with 5 experienced enumerators at NIMR in Dar es Salaam in order to review survey methodology and ethics, and to refine the translation and wording of the survey. In the FGD, each question was read aloud by an enumerator in Swahili and then translated back into English by the group. A discussion was held after each question in order to determine whether modification of the Swahili version was needed in order to retain the intended meaning of the question. The survey was then edited to incorporate the changes suggested during the FGD.

A formal pretest of the survey was conducted on June 4, 2007 in Miswe Chini, a rural village in the Kibaha district, approximately 64 km west of Dar es Salaam. Miswe Chini is a lowland, agricultural village with a population of 619 people. Located 12 km from the nearest tarmac, the village contains 1 dispensary, 1 primary school, and has a latrine ownership rate of 85% of households. Agricultural crops consist of rice, cassava, maize, tomatoes, sorghum, bananas, millet, potatoes, oranges, and pineapples. Pump irrigation is used primarily in small gardens, but is also used for rice crops. Miswe Chini

was selected for the pretest because of its similarity to the majority of the study villages in environmental, agricultural, and socioeconomic characteristics.

Names were randomly selected for the pretest from the village household roster, which was provided by the village chairman. A total of 13 surveys were completed by the 5 enumerators, approximately half of which were conducted with male heads of households and half with female primary caregivers. Additionally, a FGD was held to further refine the survey pre-coded answer choices as well as to test the topic areas for the official FGDs. The discussion was conducted in the village government office and consisted of 11 adult women participants, as well as a moderator, note-taker, and translator. The main topic areas covered in the FGD were risk perception, malaria and mosquito knowledge, malaria prevention and treatment, land use and irrigation, information sources and socials networks, and priorities and time expenditure. The majority of participants were active in contributing to the discussion, and responses provided useful information for pre-testing purposes.

A number of alterations were made to the survey as a result of the pre-testing activities. One important change was revising the Swahili translation of "water bodies" to indicate surface water (lakes, rivers, wetlands, etc.) as opposed to simply "sources of water", which can include wells and pumps. Additionally, changes were made to the pre-coded answer choices for types of crops grown as well as methods of irrigation to better suit the local area. A question regarding priorities over monetary spending was changed from an amount of Tsh 5,000 to Tsh 10,000 in order to provide a monetary value more appropriate for the question. Lastly a question on the topic of time expenditure during the day and night was changed to only include times when malaria-transmitting

mosquitoes bite (evening through morning), and pre-coded answer choices for the question were changed to more accurately depict activities that local communities may be partaking in. After making these changes as well as further improving Swahili wording to clarify the meaning of a number of questions, the survey was finalized and prepared for implementation.

Quantitative Research

A total of 408 household surveys were conducted in the 10 study villages in Mvomero District between June 12 and June 29, 2007. A population-weighted random sampling methodology was used to generate the study sample. The sample was first stratified in order to conduct an equal number of surveys in the two village groups (those involved in public meetings and those not involved). Household rosters were collected in each study village to be used as a sampling frame to generate the sample population. The total number of households per village was determined by the village's population. A random number was then generated to determine a starting household in the village rosters, and an interval was computed by dividing the total number of households by the number of sampled households needed. Starting at the randomly selected first household, names of heads of household were selected from the village rosters using the calculated interval.

The enumerators visited each selected household using a local village sub-leader as a guide. Half of the surveys were conducted with male heads of household and half with female primary caregivers. If a survey could not be completed with a particular household, that household was substituted with the household located directly to its right. This substitution procedure was continued until an available household was obtained.

Each survey took approximately 1 hour to complete, and the main topic areas covered in the questionnaire included risk perceptions and knowledge, malaria perceptions and knowledge, land use and irrigation, information sources and social networks, priority setting and time expenditure, and demographics.

Qualitative Research

Qualitative data collection activities were held in 8 of the 10 study villages. Four FGDs were conducted with village members in order to discuss the topic matter contained in the surveys in more detail. Village leaders were asked to recruit groups of 8 – 10 adult men or women for the discussions, which were held in primary schools in the villages. FGDs were conducted with women in Komtonga and Msufini and with men in Kambala and Mkindo. The length of discussions ranged from 2 to 3 hours, and the topics covered included risk perceptions and knowledge, malaria perceptions and knowledge, land use and irrigation, information sources and social networks, and priority setting and time expenditure. The discussion was led by a moderator and was tape recorded, while a translator assisted the investigators. Each FGD was then transcribed and translated from Swahili to English.

Four IDIs were conducted with key informants (village chairmen and community health workers), in Mbogo, Dihombo, and Dakawa. These interviews assessed health problems in the village, malaria knowledge, prevention, and treatment, use of and opinions on various antimalarial drugs, priorities of villagers, community programs, and environmental management for malaria control. The interviews were conducted by the investigators with the help of a translator, and were transcribed and translated into English.

Ethical approval was granted by the Institutional Review Board of Duke University in Durham, NC, USA and the National Institute for Medical Research (NIMR) in Dar es Salaam, Tanzania. Research clearance was granted by Tanzania's Commission for Science and Technology (COSTECH).

Analysis

The survey data were coded and entered into machine readable format by a group of staff members at NIMR, supervised by the Institute's statistician. One enumerator from the research team was included in the data entry group in order to clarify any questions about the survey instrument and minimize data entry errors. After entry, the group conducted data cleaning activities to further minimize any errors made during data entry. The data were then analyzed using Stata IC/10.0 for Macintosh.

Descriptive statistics were used to illustrate the demographic and socioeconomic characteristics of the study population. Key indicators included age, gender, religion, education, occupation, and housing size. Additionally, a "knowledge" index was constructed in order to provide a more comprehensive measure of respondent knowledge related to mosquito ecology and environmental management. The main knowledge categories focused on stagnant water and mosquitoes/malaria, and environmental cleanliness and mosquitoes/malaria. Though it was not specified in the survey what specifically constituted "cleaning one's environment", discussions during the FGDs and IDIs pointed out that these practices concentrate on reducing available mosquito breeding habitat (stagnant water). Respondents indicated that cleaning the environment focused on removing objects that collect water (e.g. tin cans and empty coconut shells). Therefore, for the purposes of the knowledge index, responses related to environmental cleanliness

were included as "positive" indicators. Knowledge scores were calculated based on respondent answers to a number of survey questions. Six knowledge categories were developed, each composed of one or more survey question related to the topic of the category. One point was allotted when a respondent answered correctly one or more of the questions within each knowledge category. For example, in the "stagnant water and mosquito abundance" category, a respondent was assigned one point if he/she either stated that the amount of stagnant water affects mosquito abundance *or* that draining stagnant water can reduce mosquito abundance. Table 2 displays the main components of the index. Index values for respondents ranged from 0 to 6, with an average knowledge score of 3.6.

Table 2: Components of knowledge index

Knowledge Categories	Points allotted
Stagnant water and mosquito abundance:	1
Amount of stagnant water affects mosquito abundance	
Draining stagnant water can reduce mosquito abundance	
Environmental cleanliness and mosquito abundance:	1
Cleanliness of surroundings affects mosquito abundance	
Cleaning the environment around the home can reduce mosquito abundance	
Mosquito larvae and stagnant water:	1
Mosquito larvae can be found in stagnant water/irrigation ditches	
Mosquito larvae can be found in irrigation canals	
Draining stagnant water can reduce the number of mosquito larvae	
Reducing the number of mosquito larvae helps to reduce malaria	1
One can drain stagnant water to protect themselves from malaria	1
One can clean residential surroundings to protect themselves from malaria	1
Index Range	**0 to 6**

Household wealth is another important factor to examine in relation to respondents' knowledge and practices. In addition to housing size, two wealth indices were constructed to use as proxies for socioeconomic status of respondents. A "durables" index was created by adding up a number of consumer goods owned by the household (car, tractor, plough, motorcycle, sewing machine, radio, television, sofa set, and cell phone). Durable ownership was low among the study population, as average ownership

was less than one of the above items (0.97), and 31% of respondents owned none of the durables listed. A "housing quality" index was creating by assigning values to different wall, window, and roof materials. Walls constructed of burnt bricks, concrete bricks, or wood were assigned a value of 1 while walls made of mud were given a zero. Windows with mosquito screens were assigned a 1, while other windows were given a zero. Roofs made of tile, iron, or tin were given a 1, and thatched roofs were given a zero. Housing quality index values ranged from zero to three. The mean index value was 1.24, with 36% of respondents living in homes with values of zero.

Chi-square tests were used to test for statistical differences in the proportion of respondents reporting various knowledge variables. Indicators used in the test included gender, age, education, housing size, and religion. This method was used in order to examine simple, bi-variate relationships between the indicators and knowledge variables. A more complex analysis was used to determine the relative effects of numerous indicators on environmental management practices. Multivariate analysis using probit regressions was used to determine the correlation between a number of indicators (knowledge, gender, religion, education, housing size, durables, and housing quality) and two environmental management practices (draining stagnant water and cleaning the environment around the home). Analyzing data in a multivariate context allows one to control for the relative importance of the different variables in predicting practices.

RESULTS

Study Population

Table 3 summarizes key demographic and socioeconomic characteristics of survey respondents. As intended, the sample was split fairly evenly between males and females, and the average age of respondents was 42 years. Approximately two-thirds of respondents listed Islam as their religion, while one-third listed Christianity. Educational attainment was quite low, as 40% of respondents had no education and 53% had only a primary school education. The majority of the sample (83%) engaged in crop farming as their main occupation, 7% were pastoralists or mixed farmers (crops and livestock keeping), and 5% were employed in business activities. Among farmers, one-third practiced irrigated rice agriculture, one-half practiced non-irrigated rice agriculture, and three-quarters farmed maize. Two-thirds of respondents lived in houses consisting of 2 - 3 rooms, 19% lived in houses with 4 or more rooms, and 17% lived in single-room houses.

Knowledge of Malaria, Mosquito Ecology, and the Environment

Nearly all respondents (97%) listed mosquitoes as a cause of malaria. In addition to mosquitoes, other common responses included an unclean environment (30%), and bad water (18%). Eighty-seven percent of respondents believed that greater rainfall during the wet season increases mosquito populations, and 90% believed that reducing the population of mosquitoes reduces malaria.

Overall, cleanliness around the home was believed to have the largest effect on mosquito abundance. Two-thirds of respondents believed that the level of cleanliness

Table 3. Demographic & socioeconomic characteristics of respondents (n= 408)

Variable	% of Respondents
Age (years)	
17 – 29	19
30 – 49	51
50 – 69	20
70 - 95	10
Gender	
Male	49
Female	51
Religion	
Christian	35
Muslim	65
Education	
None	40
Primary School	53
Secondary School or above	7
Occupation	
Crop Farming	83
Pastoralist/mixed farming	7
Business owner/employee	5
Student	0
Other	4
Too young/old to work	<1
Agricultural Practices[1]	
Rice (Irrigated)	33
Rice (Non-irrigated)	53
Maize	75
Cassava	22
Banana	10
Sugarcane	10
Other crops	27
Housing size	
4 or more rooms	19
2 – 3 rooms	64
1 room	17

[1] The majority of respondents who practiced agriculture farmed multiple crops, therefore the percentages of different agricultural practices adds up to greater than 100.

influences the number of mosquitoes in the community. Other common responses were the presence of stagnant water (64%), and amount of rainfall (51%). Environmental cleanliness was also a common theme when respondents were asked about methods to reduce mosquito populations (see Table 4). Cleaning the environment around one's home was the most commonly listed method (50%), followed by using bednets (40%), clearing vegetation around the home (39%), and draining stagnant water (33%). Though one-third of respondents practice irrigated rice farming, only 2% of respondents listed draining rice fields as a method to reduce mosquito abundance.

Table 4. Methods to reduce mosquito populations in the community[2]

Response	% of Respondents
Clean environment around home	50
Use mosquito nets	40
Clear vegetation around home	39
Drain stagnant water around home	33
Spray insecticides inside home	31
Spray insecticides outside of home	29
Use larvicides	13
Drain rice fields	2
I don't know	5

While knowledge of mosquito ecology and the link between mosquitoes and malaria was relatively high among respondents, knowledge related specifically to mosquito larvae was generally lower. When asked whether reducing the population of mosquito larvae reduces malaria, 75% of respondents said yes, 5% said no, and 20% said that they did not know. There was also a wide range of responses when asked about locations where mosquito larvae can be found. While most respondents correctly stated that larvae

[2] Again, for many questions, respondents were able to check multiple categories, so percentages may exceed 100.

can be found in stagnant water (65%), 20% believed that they can be found in vegetation around the house or in the forest, and nearly 30% of stated that they did not know where larvae can be found (see Table 5).

Table 5. Locations where mosquito larvae can be found

Response	% of Respondents
Stagnant water (e.g. irrigation ditches, puddles, swamps)	65
Vegetation around the house	12
In the forest	8
In the house	2
Other	7
I don't know	29

When asked what one can do to reduce populations of mosquito larvae in the community, both "spraying insecticides" as well as "draining stagnant water" were the most commonly stated methods, with 40% of respondents listing each (see Table 6). Other commonly stated methods were "using larvicides" (35%) and "clearing vegetation around the house" (32%). Again, a high percentage of respondents did not appear to have an extensive understating of mosquito ecology, as nearly one-quarter of respondents stated that they did not know how to reduce larval abundance in their community.

Table 6. Methods to reduce mosquito larvae in the community

Response	% of Respondents
Spray insecticides	40
Drain stagnant water	40
Use larvicides	35
Clear vegetation around house	32
Remove garbage/clean environment	4
Drain rice fields	3
Use traditional plants	<1
I don't know	23

Environmental Management Practices for Malaria Control

Study participants were asked the question, "What can people do to protect themselves from malaria?" For each method listed by a particular respondent, a follow-

up question was asked to determine whether the respondent practiced that method for his or her own malaria prevention. Table 7 lists the methods used by respondents to prevent malaria.

Table 7. Practices used by respondents to protect themselves from malaria

Response	% of Respondents
Use a mosquito net	87
Clean residential surroundings	50
Clear grass/bushes around the home	32
Drain stagnant water	18
Clean residential surroundings & drain stagnant water	15
Spray insecticides inside or outside home	11
Take anti-malarial drugs intermittently	10
Use mosquito coils	7
Other	7

Mosquito net use was extremely high among respondents, as 87% stated that they used nets for malaria prevention. The next most widespread technique was "cleaning residential surroundings" (50%), followed by "clearing grasses and bushes around the home" (32%) and "draining stagnant water" (18%). Only 15% of respondents reported that they clean their surroundings *and* drain stagnant water to protect themselves from malaria.

Correlation Between Demographics and Knowledge of Malaria & Mosquito Ecology

Table 8 displays the variation in respondent knowledge of mosquito ecology and the link between mosquitoes and malaria based on chi-square tests. Six knowledge variables were examined along a number of demographic lines in order to test for statistically significant differences in responses between demographic groups. Formal education was most highly correlated with knowledge. Respondents with primary education or above were significantly more likely than those without formal education to provide correct responses to five of the six questions examining mosquito ecology

knowledge. In particular, formal education appears to be a strong predictor for knowledge related to larval mosquitoes.

Gender was also significantly correlated with a number of knowledge variables. Females were less knowledgeable than males in three of the six knowledge categories, but were significantly more likely than males to state that cleaning the environment can reduce mosquito abundance. Religion was significantly correlated with the belief that cleaning one's environment can reduce mosquito abundance, as Muslim respondents were more likely to state this than Christian respondents. House size was significantly correlated with respondents stating that mosquito larvae can be found in stagnant water, and respondent age showed no correlation with any knowledge variables.

Factors Correlated with Environmental Management Practices

It is clear that a number of socio-demographic characteristics act as indicators of respondent knowledge related to mosquito ecology and environmental management. Yet ultimately, it is how these socio-demographic factors interact to influence environmental management practices which is of most importance. Thus, multivariate analysis was used to determine the relative influence of different socio-demographic characteristics on two presumably effective environmental management practices. The two dependent variables, cleaning the environment around the home and draining stagnant water, were considered effective as they both generally act to reduce mosquito-breeding habitat. A third practice, clearing grasses and bushes, was not included in the analysis because evidence indicates that it is most likely ineffective in reducing malaria burden in a Tanzanian context (Mutero, Personal Communication, 2008). Independent variables included the same variables examined in the chi-square tests, score on the knowledge

Table 8. Chi-square tests for relationships between demographic characteristics & mosquito ecology knowledge

Demographic Characteristics	Knowledge variables					
	Amount of stagnant water affects mosquito abundance	Draining stagnant water can reduce mosquito abundance	Cleaning the environment around the home can reduce mosquito abundance	Mosquito larvae can be found in stagnant water	Reducing the abundance of mosquito larvae can help reduce malaria	One can reduce mosquito larvae by draining stagnant water
Gender						
Male	**0.68**	0.33	**0.45**	**0.71**	**0.83**	0.41
Female	**0.59**	0.33	**0.55**	**0.59**	**0.66**	0.38
Chi square statistic	**3.5812 ***	0.0317	**3.934 ****	**6.43 ****	**16.228 *****	0.361
Age						
17 - 29 years	0.64	0.3	0.51	0.62	0.66	0.37
30 - 49 years	0.64	0.34	0.52	0.65	0.78	0.38
50 - 69 years	0.66	0.31	0.41	0.64	0.77	0.38
70 - 95 years	0.54	0.38	0.54	0.69	0.69	0.51
Chi square statistic	1.9324	1.3457	3.6417	0.6676	5.0052	2.6834
Education						
No education	**0.55**	0.31	**0.44**	**0.54**	**0.62**	**0.32**
Primary or above	**0.7**	0.35	**0.53**	**0.72**	**0.83**	**0.44**
Chi square statistic	**9.015 ****	0.7701	**2.914 ***	**14.29 *****	**22.915 *****	**6.112 ****
House Size						
Large	0.66	0.41	0.57	**0.76**	0.76	0.46
Medium	0.63	0.32	0.49	**0.63**	0.76	0.38
Small	0.63	0.32	0.46	**0.57**	0.69	0.34
Chi square statistic	0.2436	2.304	1.973	**6.3874 ****	1.385	2.382
Religion						
Christian	0.62	0.38	**0.41**	**0.58**	0.74	0.35
Muslim	0.65	0.31	**0.55**	**0.68**	0.75	0.42
Chi square statistic	0.3549	1.956	**6.867 *****	**3.57 ****	0.0946	1.885

*** significant at p< 0.01 ** significant at p < 0.05 * significant at p < 0.1

index, as well as 2 additional wealth indicators (durable ownership and housing quality).

Table 9 presents the marginal effects of a probit regression testing for correlations between a number of socioeconomic and demographic characteristics and the two environmental management practices. The marginal effects coefficient indicates the effects on the probability of performing either practice resulting form the given

independent variables. For example, the data indicate that females are 19.44% more likely than males to clean the environment around the house in order to prevent malaria (p = 0.002).

Table 9. Factors associated with environmental management practices: marginal effects from probit regression

Demographic & Socioeconomic Characteristics	Respondent cleans environment around the house		Respondent drains stagnant water	
	Pseudo R2 = 0.301		Pseudo R2 = 0.4422	
	coefficient	p-value	coefficient	p-value
Knowledge score	**0.2580**	**0.0000**	**0.0820**	**0.000**
Gender	**0.1944**	**0.0020**	0.0122	0.508
Age	0.0009	0.6480	0.0006	0.306
Religion	0.0400	0.5280	0.0210	0.273
Education	-0.0021	0.9690	**0.0256**	**0.093**
Housing Quality	**0.0637**	**0.0380**	-0.0015	0.856
House Size	**-0.1072**	**0.0610**	0.0218	0.197
Durables	-0.0265	0.4710	0.0071	0.485

The first regression is intended to identify factors that influence the practice of cleaning the environment around one's house. Knowledge of mosquito ecology and environmental management was a significant predictor of this practice. With each point increase in score on the knowledge index, a respondent is 25.8% more likely to perform this practice (p = 0.000). As mentioned above, gender was also significantly correlated with this practice, as was housing quality. As housing quality increased by each point, the respondent was 6.37% more likely to clean around the house (p = 0.038). Additionally, there was a weak negative correlation between housing size and this practice. As house size increases, one is 10.7% less likely to clean around their house (p = 0.0610). Age, religion, education, and durables were not significant factors in this regression.

The second regression reported in Table 9 examines factors that influence the practice of draining stagnant water. Knowledge of mosquito ecology and environmental management was also a highly significant predictor of draining stagnant water to prevent malaria. As the score increases by each point on the knowledge index, a survey respondent is 8.2% more likely to perform this practice ($p = 0.000$). The only other marginally significant variable was education, as respondents with primary education or above were 2.56% more likely to drain stagnant water than those with no education ($p = 0.093$). Gender, age, religion, house size, housing quality, and durables were not significant variables in this regression.

Qualitative Results

Qualitative data from the FGDs and IDIs are presented in order to further illustrate some of the trends expressed in the surveys, as well as to highlight some important information not covered through quantitative data collection. During the FGDs and IDIs, respondents were asked to discuss what measures one can take to reduce the abundance of mosquitoes. The most common responses among participants were cleaning the environment around the home and cutting grasses and bushes. For example, during an FGD in Msufini village, a respondent stated, “Generally it is environmental cleanliness, to destroy all mosquito breeding places like filling with sands all areas with stagnated water, slashing all tall grasses around our houses and so on.” Many other community members echoed similar sentiments during discussions, highlighting the significant influence of environmental conditions on malaria burden in a given area.

The belief that tall grasses and bushes foster mosquito breeding was pervasive among community members as well as among community leaders and health workers.

Focus group participants as well as key informants made numerous references to this issue. For example, the village chairman of Mbogo stated, "[I]n my house, the surrounding environment has many grasses, and this favor[s] mosquito breeding." Additionally, a community health worker in in Dakawa stated, "During rain seasons there [is] stagnated water all over the area, and most of the people have maize farms close to their houses, thus the grasses in the farms contribute to mosquitoes."

Another important issue mentioned in the FGDs and IDIs was the belief that increased community participation is crucial for the success of environmental management practices. A participant in the Msufini FGD stated, "I think when we go out of here we should be models to others, clean our environments, destroy coconut shells and cans." The village chairman of Mbogo stated, "[U]p to this moment only few people [drain stagnant water] which is about 5-10%, hence this cannot help to reduce mosquitoes, thus collaboration is mostly needed." He then proceeded to state, "I suggest that there should be a program emphasizing on cleanliness of the environment. Few people should attend seminar concerning environmental sanitation who will later visit house to house to provide education on cleanliness of the environment. I suggest that these people should come from this village."

A similar desire for educational programs were expressed by the community health workers. In Dakawa, the health worker stated, "I think more education to the community is needed to fill in the holes which allows stagnation of water in the areas and to collect cans and coconut shells," and in Dihombo, the health worker stated that in order to increase participation in environmental management among community members, "It is just to educate them [because] most people don't know how mosquitoes

breed." These comments highlight two important issues: there is a general belief among community leaders that a formal educational program on environmental management practices is necessary for its success, and that this program should be implemented by trained community members, not by outside educators.

DISCUSSION:

The results of the survey, focus groups, and interviews indicate that most community members in the district believe that environmental conditions play a prominent role in influencing malaria burden. Nearly all respondents understood that mosquitoes cause malaria. Approximately two-thirds of respondents stated that environmental cleanliness affects mosquito abundance, and the same percentage believed that the amount of stagnant water influences the population of mosquitoes. Yet practices did not correlate closely with these beliefs, as only 50% of respondents reported cleaning their surrounding environment to prevent malaria and 18% reported draining stagnant water for that purpose. In order for household-level environmental management practices to effectively reduce the burden of malaria in the district, it is likely that a higher level of community participation is necessary.

With adequate participation, environmental management for malaria control has been proven to be effective in both reducing the abundance of mosquitoes (Yasuoka *et al* 2006a; Yohannes *et al* 2005) and in directly lowering the incidence of malaria (Utzinger *et al* 2001). Though this method is often overlooked in favor of in favor of more top-down control techniques, the reduction of vector abundance through community-based larval control needs to be considered more widely as a potentially effective, sustainable component of malaria control.

It is important to note that environmental management will inevitably have varying levels of efficacy in different locations. Even if high participation levels are achieved, the effectiveness of environmental management in reducing mosquito populations is likely to vary among different areas based on their macro-environmental

conditions. It is probable that villages in drier or mountainous parts of the district would experience a greater reduction in mosquito populations than would low-lying villages. Villages located in lower altitudes tend to be warmer, and have rivers, swamps, and flooded rice fields located within close proximity to homes. These large, permanent water bodies favor mosquito breeding, thus eliminating small breeding areas through environmental management techniques will not impact the mosquitoes which breed in the larger habitats. Therefore, techniques such as cleaning the surrounding environment and draining stagnant water may be sufficient for reducing mosquito populations in drier or mountainous villages, but only marginally effective in low-lying areas. Lowland areas may benefit from a combination of these environmental management techniques and other forms of management to control breeding in the large water bodies, such as introducing larvicides and fish that eat larvae.

Regression analyses revealed that knowledge of mosquito ecology is highly correlated with environmental management practices. With every point of increase in knowledge index score, a local resident is 25.8% more likely to clean their surrounding environment ($p = 0.000$) and 8.2% more likely to drain stagnant water ($p = 0.000$). These data indicate that increased levels of mosquito ecology knowledge could result in greater community participation in environmental management for malaria control. This study therefore demonstrates that creating and implementing an educational program in the district could lead to significant increases in the use of environmental management practices for malaria control. If sufficient levels of participation are reached, environmental management could lead to substantial reductions in malaria burden in villages of Mvomero District.

Formal education was correlated with knowledge of mosquito ecology, as respondents with primary education or above were significantly more likely than those without education to state that the amount of stagnant water affects mosquito abundance, cleaning one's environment can reduce mosquito abundance, mosquito larvae can be found in stagnant water, reducing mosquito larvae can help to reduce malaria, and draining stagnant water can help to reduce the abundance of mosquito larvae. This correlation may have important implications for the development of an educational program for adult community members, as 40% of the study population had no formal education. If resource and/or time limitations do not allow an educational program to target the all community members, an option might be to focus the program on adults who have not been formally educated.

According to village leaders, the vast majority of children in the district are currently enrolled in primary or secondary school. Therefore, the educational disparities in knowledge observed among the adult respondents would likely not be as pronounced among children. Additionally, this has important implications for program design, as a school-based program would be an appropriate means for reaching most of the district's children. An educational program focusing on mosquito ecology and environmental management could be incorporated into the curriculums of primary and secondary schools, ensuring that the majority of children would be educated on these topics before finishing their schooling.

Another important issue revealed by the study is the prevailing belief that tall grass and bushes around the home favor mosquito breeding. It is likely that this belief was ingrained in the minds of many Tanzanians during British colonial rule, as they were

told to keep their houses clean and free from large vegetation in order to prevent diseases and keep away pests (Mutero, C, Personal Communication, 2008). In this study, clearing vegetation was cited by nearly 40% of respondents as a method to reduce mosquito abundance. Additionally, one-third of respondents stated that this practice could reduce the abundance of mosquito larvae, and one-third stated that they actively cleared grasses and bushes around their homes to protect themselves from malaria. The practice of cutting grass and bushes may effectively reduce malaria burden in areas where the particular species of mosquito vectors are exophilic (prefer to rest outdoors). Removing vegetation would limit locations near the homes where adult mosquitoes could rest, and could therefore reduce mosquito abundance near houses. Yet the two vectors in Mvomero District, *A. gambiae* and *A. funestus* are both highly endophilic, as they primarily rest inside houses. This practice would therefore likely have limited, if any effect on reducing malaria burden in this area. Clearing grass and bushes is not a harmful practice and likely provides other benefits to a household. Yet if one's goal is protection from malaria, it is important to focus time and resources on techniques which are effective in reducing breeding habitat. Thus, one component of an educational program should focus on identifying the environmental management techniques which are effective for malaria control, and clarifying common misconceptions about the efficacy of other techniques.

Interviews with key informants revealed the desire for educational outreach to come from within the community, as opposed to having outsiders directly educating community members. It is important that the educators are seen as trustworthy, and that community members believe that the information they are being provided with is

accurate. If people are already familiar with those who are conducting the educational campaign (e.g. community health workers or prominent community members), they will be more likely to respond positively to the program. Therefore, a training program could be conducted to educate select members of each village on environmental management and mosquito ecology. These community members could then conduct the educational programs with other members of their community to increase awareness and use of effective mosquito control practices.

This study highlights the potential usefulness of community-level environmental management as a component of malaria control. The findings serve as a baseline indicator of current knowledge and practices among residents of Mvomero District, illustrating that many people believe that environmental conditions are an important factor in determining malaria burden. While most respondents understand that there is a link between micro-environmental conditions and malaria, it is apparent that encouraging a higher level of community participation in environmental management techniques is necessary for more effective reduction of mosquito abundance. Because knowledge of mosquito ecology was highly correlated with one's participation in environmental management for malaria control, the creation of an educational program on this topic could lead to significant increases in community participation. The program should concentrate on teaching participants about mosquito ecology, clarifying which environmental management techniques effectively lower mosquito abundance versus those that are ineffective, and stressing the importance of community participation and cooperation in the success of this form of malaria control. With greater knowledge and

participation, environmental management could lead to lasting, sustainable reductions in malaria burden for many communities in Mvomero District.

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APPENDIX A: SURVEY INSTRUMENT

Understanding Households' Knowledge, Concerns, and Behaviours Related to Malaria and Other Problems Household Survey – Mvomero District – June 2007

Introduction

My name is …….., and I am working for Duke University (USA) and the National Institute for Medical Research (Tanzania). We are interested in understanding households' knowledge, concerns, and behaviours related to malaria and other problems. We do not plan to talk to all residents in this area, but have selected several to ask to represent views of all residents in this area. You are one of those selected to give your views, if you are willing, for our research. The answers we get from you and several others will be analyzed to get the general residents' knowledge and opinions concerning the main problems households face and what can be done to address these. This survey will take approximately one hour to complete. If you decide to participate in our study, we will need to connect your name to the information you give us, but only for a short time—while we are gathering information from many households. After that, we will save the information and report what we learn using numbers, not names. Only we, the researchers, will ever see the surveys with people's names. If you choose not to participate in this study, that is fine too. If you participate, you are free to skip any questions you do not wish to answer or to stop any time.

Do you wish to participate? ☐ Yes ☐ No

If "Yes," proceed with survey. If "No," thank the respondent and go on to the next household.

QUESTIONS

Questionnaire number_____

DATE _____

Name of interviewer _____

Name of the village _____

Name of ward_____

Time start:_____ Time finish_____

I. Demographics

1. For each member of the household, record the following:

List of members	1a. Name	1b. Age (in years)	1c. Sex (1) Male (2) Female	1d. Relation to head of HH (1) Head (2) Wife (3) Child (4) Brother/sister (5) Parent [95]Other	1e. Marital Status (1) Married (2) Single (3) Cohabitating (4) Separated (5) Divorced (6) Widowed	1f. Highest level of education attained (1) Not gone to school at all (2) Universal Adult Education (3) Primary School (4) Secondary School (5) Post-secondary/vocational (6) University (-9) Don't know	1g. Main Occupation [1] Crop farming [2] Pastoralist [3] Mixed farming (crop+livestock) [4] Business [5] Employee [6] Other personal jobs/self employed [7] Traditional healer [8] Student [9] Housewife [10] Unemployed [11] Not Applicable
1*			1 2	1 2 3 4 5 95	1 2 3 4 5 6	1 2 3 4 5 6 -9	
2			1 2	1 2 3 4 5 95	1 2 3 4 5 6	1 2 3 4 5 6 -9	
3			1 2	1 2 3 4 5 95	1 2 3 4 5 6	1 2 3 4 5 6 -9	
4			1 2	1 2 3 4 5 95	1 2 3 4 5 6	1 2 3 4 5 6 -9	
5			1 2	1 2 3 4 5 95	1 2 3 4 5 6	1 2 3 4 5 6 -9	
6			1 2	1 2 3 4 5 95	1 2 3 4 5 6	1 2 3 4 5 6 -9	
7			1 2	1 2 3 4 5 95	1 2 3 4 5 6	1 2 3 4 5 6 -9	
8			1 2	1 2 3 4 5 95	1 2 3 4 5 6	1 2 3 4 5 6 -9	
9			1 2	1 2 3 4 5 95	1 2 3 4 5 6	1 2 3 4 5 6 -9	
10			1 2	1 2 3 4 5 95	1 2 3 4 5 6	1 2 3 4 5 6 -9	

* Respondent

2. Religion?
    [1] Christian
    [2] Muslim
    [3] No religion/pagan
    [95] Other _____

3. What tribe does this household belong to? _____

II. Risk Perceptions and Knowledge

4. What are the main economic, social and environmental risks/worries/problems that you face? ***(Do not read answers, circle all that apply)***
   [1] Lack of employment
   [2] Lack of food
   [3] Flood
   [4] Drought
   [5] Witchcraft
   [6] Health problems
   [7] Agricultural tools
   [8] Harmful animals
   [9] Lack of clean water
   [95] Other _____

5. What are the main health worries/risks/problems that you face? ***(Do not read answers, circle all that apply)***
   [1] Malaria
   [2] HIV/AIDS
   [3] Malnutrition
   [4] Diarrhea
   [5] Unsafe water
   [6] Environmental pollution
   [7] Worms
   [8] Schistosomiasis
   [9] Lack of latrines
   [10] High blood pressure
   [11] TB
   [12] Lymphatic filiariasis
   [95] Other _____

6. For each risk identified in questions 2 and 3, indicate the following: ***(Only ask for issues mentioned in Q4 and Q5, read answers, circle only one response)***

SN	6a. Circle risks mentioned in Q2 or Q3	Risk type	6b. In your opinion, how likely is it that your family will face this problem in the next year? (1) Definitely will not happen (2) There is a small chance that this will happen (3) This could happen (4) There is a good chance that this will happen (5) Our family will definitely face this problem	6c. How big of a problem would it be if your family experienced this problem? (1) Very minor inconvenience (2) Small problem (3) Moderate problem (4) Big problem (5) Devastating	6d. Overall, how concerned are you about this problem? (1) Not at all concerned (2) Somewhat concerned (3) Moderately concerned (4) Very concerned (5) Most concerned
1	1	Lack of employment	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
2	1	Not enough food	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
3	1	Flood	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
4	1	Drought	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
5	1	Witchcraft	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
6	1	Malaria	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
7	1	Agricultural tools	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
8	1	Harmful animals	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
9	1	Lack of clean water	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
10	1	Malaria	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
11	1	HIV/AIDS	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
12	1	Malnutrition	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
13	1	Diarrhea	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
14	1	Poor sanitation	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
15	1	Worms	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
16	1	Schistosomiasis	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
17	1	Lack of latrines	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
18	1	High blood pressure	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
19	1	TB	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
20	1	Lymphatic filiariasis	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

III. Malaria Perceptions and Knowledge

A. MALARIA KNOWLEDGE

7. What do you think causes malaria? ***(Do not read answers, circle all that apply)***
   [1] Mosquitoes
   [2] Bad water
   [3] Evil Spirits
   [4] Playing in the rain
   [5] Flea/Tick bite
   [6] Unclean environment
   [95] Other _____
   [-9] Don't know

8. Are mosquitoes present in your household or community?
   [1] Yes
   [2] No *(Go to Q14)*
   [-9] Don't know

If yes, continue to sub-questions:

9. What factors do you think affect the mosquitoes in your community and around your home? ***(Do not read answers, circle all that apply)***
   [1] Amount of rainfall
   [2] Amount of stagnant water
   [3] Farming methods
   [4] Cleanliness of village or household surroundings/dirty environment
   [5] Temperature
   [95] Other _____
   [-9] I don't know

10. How does increased rain during the wet season affect mosquito populations? ***(Do not read answers, circle only one)***
    [1] It increases their population due to more stagnant water
    [2] It increases their population due to more vegetation
    [3] It increases their population due to warmer temperatures
    [3] It does not affect their population
    [4] It decreases their population
    [95] Other _____
    [-9] I don't know

11. Does reducing the population of mosquitoes help to reduce malaria?
    [1] Yes
    [2] No
    [-9] I don't know

12. What can be done to reduce the number of mosquitoes in your community?
(Do not read answers, circle all that apply)
[1] Drain stagnant water around the home
[2] Drain rice fields
[3] Clearing grass and bushes around the home
[4] Use bed nets
[5] Spray insecticides inside home
[6] Spray insecticides outside home
[7] Use larvicides
[8] Clean the environment around the home
[95] Other _____
[-9] I don't know

13. Where can mosquito larvae be found? ***(Do not read answers, circle all that apply)***
[1] In stagnant water/irrigation ditches
[2] Irrigation canals
[3] In farmland/near cattle
[4] In the forest
[5] In the house
[6] In vegetation around the house
[95] Other _____
[-9] I don't know

14. Does reducing the mosquito larvae help to reduce malaria?
[1] Yes
[2] No
[-9] I don't know

15. What can be done to reduce the mosquito larvae in your community?
(Do not read answers, circle all that apply)
[1] Clear vegetation around your house
[2] Drain stagnant water
[3] Drain rice fields
[4] Spray insecticides
[5] Use commercial larvicides
[6] Use traditional plants
[95] Other _____
[-9] I don't know

B. MALARIA PREVENTION

16. What can people do to protect themselves from malaria?

SN	Method	16a. [1] Yes ***(Do not read answers, circle all that apply)***	16b. Do you do this? [1] Yes [2] No ***(Skip to next method)***	16c. How often do you do this? ***(Read answers, circle only one)*** [1] Daily [2] At least once per week [3] At least once per month [4] At least once every 3 months [5] At least once every 6 months [6] At least once per year [7] Less than one time per year	16d. How much time and/or money does it cost each time you do [METHOD]? ***(Enter -9 for "I don't know")***		16e. Which of these methods do you think is most effective at preventing malaria? ***(Read answers listed in 16a, circle only one)***
					Money	Time	
1	Use a mosquito net	1	1 2				1
2	Use mosquito insecticide coils	1	1 2	1 2 3 4 5 6 7	TSh_____		1
3	Spray insecticides inside or outside home	1	1 2	1 2 3 4 5 6 7	TSh_____	_____min	1
4	Burn local plants/herbs	1	1 2	1 2 3 4 5 6 7		_____min	1
5	Drain stagnant water	1	1 2	1 2 3 4 5 6 7		_____min	1
6	Clear grass and bushes around the home	1	1 2	1 2 3 4 5 6 7		_____min	1
7	Burn animal dung	1	1 2	1 2 3 4 5 6 7		_____min	1
8	Take antimalarials intermittently	1	1 2	1 2 3 4 5 6 7	TSh_____		
9	Clean residential surroundings	1	1 2	1 2 3 4 5 6 7		_____min	1
10	To filter/treat drinking water	1	1 2	1 2 3 4 5 6 7	TSh_____	_____min	1
11	Other _____	1	1 2	1 2 3 4 5 6 7	TSh_____	_____min	1

17. Do you have mosquito nets in this household?
[1] Yes ***(Go to Q19)***
[2] No ***(Go to Q18)***

18. How much would it cost your household to buy a mosquito net? Tsh._____
(Go to Q24)

19. Who in your household uses a mosquito net? ***(Do not read answers, circle all that apply)***
[1] Children under 5
[2] Pregnant women
[3] Children and women
[4] Men
[5] Everyone
[6] No one ***(Go to Q24)***
[-9] Don't know

20. How frequently do you (your family) sleep under these nets? (***Read answers, circle only one)***
[1] Throughout the year
[2] Rainy season
[3] Dry season
[-9] I don't know ***(Go to Q24)***

21. Please complete the table below.
Fill in names from part 1

	Name	**21a. Slept under mosquito net last night?** **[1] Yes** **[2] No** **[-9] Don't know/not sure**
1*		1 2 -9
2		1 2 -9
3		1 2 -9
4		1 2 -9
5		1 2 -9
6		1 2 -9
7		1 2 -9
8		1 2 -9
9		1 2 -9
10		1 2 -9

*Respondent

22. Could I please see your mosquito net(s)?
[1] Yes
[2] No ***(Go to Q24)***

23. For each net, record the following:

Net	23a. Is the net hanging over a bet/mat? [1] Yes [2] No	23b. What is the condition of the net? ***(Observe, don't ask)*** [1] Intact [2] With small holes [3] Large holes/torn	23c. How much did this net cost?	23d. Was it subsidized under a certain project? [1] Yes [2] No [-9] Don't know	23e. Is this a permanent/long-lasting insecticide treated net? [1] Yes ***(Go to next net)*** [2] No [-9] I don't know	23e. Was this net ever treated with insecticide? [1] Yes [2] No ***(Go to next net)*** [-9] Don't know	23f. Was the net re-treated in the past six months? [1] Yes [2] No [-9] Don't know	23g. How much did it cost to retreat the net?
Net 1	1 2	1 2 3		1 2 -9	1 2 -9	1 2 -9	1 2 -9	
Net 2	1 2	1 2 3		1 2 -9	1 2 -9	1 2 -9	1 2 -9	
Net 3	1 2	1 2 3		1 2 -9	1 2 -9	1 2 -9	1 2 -9	
Net 4	1 2	1 2 3		1 2 -9	1 2 -9	1 2 -9	1 2 -9	
Net 5	1 2	1 2 3		1 2 -9	1 2 -9	1 2 -9	1 2 -9	
Net 6	1 2	1 2 3		1 2 -9	1 2 -9	1 2 -9	1 2 -9	
Net 7	1 2	1 2 3		1 2 -9	1 2 -9	1 2 -9	1 2 -9	
Net 8	1 2	1 2 3		1 2 -9	1 2 -9	1 2 -9	1 2 -9	
Net 9	1 2	1 2 3		1 2 -9	1 2 -9	1 2 -9	1 2 -9	

C. MALARIA ILLNESS AND TREATMENT

24. What are the symptoms/ signs of malaria? ***(Do not read answers, circle all that apply)***
    [1] Fever
    [2] Headache
    [3] Joint pains
    [4] Convulsions
    [5] Nausea/vomiting
    [6] Anaemia
    [7] Diarrhea
    [95] Others_____
    [-9] Don't know

25. In this village, when do most people get sick from malaria? (***Read answers, circle only one)***
    [1] Rainy season
    [2] Dry season
    [3] Throughout the year
    [-9] Don't know

26. Which age group is most affected by malaria in this community? (***Read answers, circle only one)***
    [1] 0-5 years
    [2] 6-10 years
    [3] 11-15 years
    [4] 16-30 years
    [5] 31-45 years
    [6] 46-60 years
    [7] Over 60 years
    [8] All groups are equally affected
    [-9] I don't know

27. If you compare pregnant women with women who are not pregnant, who suffers from malaria more? **(*Read answers, circle only one)***
    [1] Pregnant women
    [2] Women who are not pregnant
    [3] There is no difference
    [-9] I don't know

28. Apart from pregnant women, which group suffers from malaria more? **(*Read answers, circle only one)***
    [1] Women who are NOT pregnant
    [2] Men
    [3] There is no difference
    [-9] I don't know

Fill in names from part 1

29. Malaria history

	Name	29a. Did this person suffer from malaria in the past 3 months? [1] Yes [2] No ***(Go to next person)*** [-9] Don't know ***(Go to next person)***	29b. How did you know it was malaria? ***(Do not read answers, circle one for each family member)*** [1] Went to the health facility and took blood samples [2] Diagnosed by health worker at the health facility, no blood sample [3] Diagnosed by traditional healer [4] Friend or relative diagnosed it [5] We diagnosed it ourselves based on the symptoms	29c. What were the sources of medications used to treat this person's malaria? ***(Do not read answers, circle all that apply)*** [1] No medications were used [2] Health facility [3] Traditional healer [4] Drug store [5] Used local herbs [6] Leftovers from previous sick person
1*		1 2 -9	1 2 3 4 5	1 2 3 4 5 6
2		1 2 -9	1 2 3 4 5	1 2 3 4 5 6
3		1 2 -9	1 2 3 4 5	1 2 3 4 5 6
4		1 2 -9	1 2 3 4 5	1 2 3 4 5 6
5		1 2 -9	1 2 3 4 5	1 2 3 4 5 6
6		1 2 -9	1 2 3 4 5	1 2 3 4 5 6
7		1 2 -9	1 2 3 4 5	1 2 3 4 5 6
8		1 2 -9	1 2 3 4 5	1 2 3 4 5 6
9		1 2 -9	1 2 3 4 5	1 2 3 4 5 6
10		1 2 -9	1 2 3 4 5	1 2 3 4 5 6

*Respondent

30. Where do you usually go to seek care when you suspect that you or a member of the family suffers from malaria? ***(Do not read answers, circle only one)***
    [1] We treat the person at home
    [2] Buy drugs from pharmacy/drug shop
    [3] Contact health facilities (HFs)
    [4] Contact traditional healers

31. Are anti-malarial drugs always available from the nearest public health facilities?
    [1] Yes
    [2] No
    [-9] Don't know

32. Which drug(s) do you use when you get malaria? ***(Do not read answers, circle all that apply)***
    [1] SP/Fansidar/Orodar/Sulphadar/Metakelfin
    [2] Chloroquine/ Shellyquine/ Homaquine
    [3] Amodiaquine/Camoquine
    [4] Quinine
    [5] ALU (Artemether Lumefantrine) ***(Go to Q34)***
    [6] Traditional medicine
    [95] Others _____
    [-9] I don't know

33. Has a member of your household ever used ALU to treat malaria?
    [1] Yes
    [2] No ***(Go to Q35)***
    [-9] I don't know ***(Go to Q35)***

34. How effective is SP in the cure of malaria compared to ALU? ***(Read answers, circle only one)***
    [1] SP is more effective than ALU
    [2] ALU is more effective than SP
    [3] They are equally effective
    [4] Neither one is effective
    [5] I have never used SP
    [-9] Don't know

IV. Land Use and Irrigation

35. Crops and irrigation

Crop type	35a. Do you grow this crop? [1] Yes [2] No ***(Go to next crop)*** [-9] Don't know ***(Go to next crop)***	35b. Do you irrigate this crop? [1] Yes [2] No ***(Go to next crop)*** [-9] Don't know ***(Go to next crop)***	35c. For each irrigated crop, what methods do you use for irrigation? ***(Read answers, circle only one)*** [1] Flooding irrigation [2] Canal irrigation [3] Sprinkler irrigation [95] Other _____ [-9] Don't know	35d. For each irrigated crop, how long have you been practicing this form of irrigation? ***(Do not read answers, circle only one for each crop)*** [1] < 5 years [2] 6 – 10 years [3] 10 – 20 years [4] > 20 years [-9] I don't know	35e. For each irrigated crop, do you believe that irrigation has increased yields? [1] Yes [2] No [-9] Don't know
Rice	1 2 -9	1 2 -9	1 2 3 -9	1 2 3 4 -9	1 2 -9
Maize	1 2 -9	1 2 -9	1 2 3 -9	1 2 3 4 -9	1 2 -9
Sugarcane	1 2 -9	1 2 -9	1 2 3 -9	1 2 3 4 -9	1 2 -9
Bean	1 2 -9	1 2 -9	1 2 3 -9	1 2 3 4 -9	1 2 -9
Sorghum	1 2 -9	1 2 -9	1 2 3 -9	1 2 3 4 -9	1 2 -9
Banana/Plantain	1 2 -9	1 2 -9	1 2 3 -9	1 2 3 4 -9	1 2 -9
Cassava	1 2 -9	1 2 -9	1 2 3 -9	1 2 3 4 -9	1 2 -9
Ground nut	1 2 -9	1 2 -9	1 2 3 -9	1 2 3 4 -9	1 2 -9
Tomato	1 2 -9	1 2 -9	1 2 3 -9	1 2 3 4 -9	1 2 -9
Cabbage	1 2 -9	1 2 -9	1 2 3 -9	1 2 3 4 -9	1 2 -9
Cocoa	1 2 -9	1 2 -9	1 2 3 -9	1 2 3 4 -9	1 2 -9
Other_____	1 2 -9	1 2 -9	1 2 3 -9	1 2 3 4 -9	1 2 -9

36. During which of the following farming activities do most people get malaria? ***(Read answers, circle only one)***
    [1] Land Preparation
    [2] Planting
    [3] Weeding
    [4] Flowering/fruiting/watching over the harmful animals
    [5] Harvesting
    [6] Throughout the farming season
    [95] Other _____
    [-9] I don't know

37. Which of the following agricultural practices increase the population of mosquitoes? ***(Read answers, circle all that apply)***
    [1] Making ridges
    [2] Irrigation
    [3] Growing rice paddy in bunds
    [4] Growing rice paddy in lowlands (without irrigation)
    [-9] Don't know

38. Do you own any livestock?
    [1] Yes
    [2] No ***(Go to Q40)***

39. What kind of livestock do you own? ***(Read answers, fill in information for each type of livestock)***

SN	Type	39a. Number
1	Cattle	
2	Sheep	
3	Goats	
4	Pigs	
5	Ducks	
6	Chicken	
7	Donkey	
8	Cat	

40. What types of livestock create a favorable habitat for mosquito breeding? ***(Do not read answers, circle all that apply)***
    [1] Cattle
    [2] Sheep
    [3] Goats
    [4] Pigs
    [5] Ducks
    [6] Chicken
    [7] Donkey
    [8] Cat
    [-9] I don't know

41. Does keeping livestock near the house increase or decrease the number of mosquitoes biting people in and around the home? ***(Read answers, circle only one)***
    [1] Increase
    [2] Decrease
    [3] No effect
    [-9] I don't know

42. What kinds of water bodies do you have around your home? ***(Do not read answers, circle all that apply***)
    [1] Ponds
    [2] Wells
    [3] Streams
    [4] Canals
    [5] Rivers
    [6] Wetlands/Swamps
    [95] Other _____

43. How far from your home is the closest water body (e.g., pond, stream, river, swamp or canal)?
    a. Distance _____
    b. Units
        [1] Metres
        [2] Kilometres
        [3] Walking time (minutes)

44. Is the closest body of water flowing or stagnant?
    [1] Flowing
    [2] Stagnant

45. Is the closest water body present year-round, or just during the rainy season?
    [1] Year Round
    [2] Rainy Season

46. Are there any living organisms in this body of water?
    [1] Yes
    [2] No ***(Go to section V)***

47. What kind of living organisms have you seen in the water? ***(Do not read answers, circle all that apply)***

[1] Plants
[2] Fish
[3] Insects ***(Go to Q47a)***
[4] Snails
[5] Large animals
[6] Snakes
[7] Frogs
[8] Larva ***(Go to Q47a)***
[95] Other _____

If insects or larvae were mentioned, ask:

47a. What kinds of insects or larvae live in the body of water? ***(Do not read answers, circle [1] if mbu is mentioned. Only record [95] other if mbu is not mentioned)***

[1] Mosquitoes
[95] Other _____

V. Information Sources and Social Network

48. Where do you usually get information about health issues? ***(Do not read answers, circle all that apply)***
    [1] Family members
    [2] Friends
    [3] Health workers
    [4] District or national government officials
    [5] Poster/billboards
    [6] Radio
    [7] Newspaper
    [8] TV
    [9] Scientists/researchers
    [10] NGOs/CBOs/Faith-based groups
    [11] Church/mosque/temple/school
    [12] Community leaders through public meetings
    [13] School
    [95] Other_____

49. Where do you usually get information about malaria in particular? ***(Do not read answers, circle all that apply)***
    [1] Family members
    [2] Friends
    [3] Health workers
    [4] District or national government officials
    [5] Poster/billboards
    [6] Radio
    [7] Newspaper
    [8] TV
    [9] Scientists/researchers
    [10] NGOs/CBOs/Faith-based groups
    [11] Church/mosque/temple/school
    [12] Community leaders through public meetings
    [13] School
    [95] Other_____

50. Social network – Please tell me about your social contacts.

SN	Outside of your own household, please tell me who you go to most frequently for advice about:	50a. Name	50b. Relation [1] Relative [2] Friend [3] Village elder [4] Local government official [5] Traditional healer [6] Health worker [7] Leader of community group	50c. Is this person of the same religion as you? [1] Yes [2] No [-9] I don't know	50d. Does this person belong to the same tribe as you? [1] Yes [2] No [-9] I don't know	50e. Does this person live in this village or in another village? [1] In the village ***(Go to next person)*** [2] In another village	50f. Which village does this person belong to? *Enter name of village below*
1	Economic matters		1 2 3 4 5 6	1 2 -9	1 2 -9		
2	Health matters		1 2 3 4 5 6	1 2 -9	1 2 -9		
3	Social matters		1 2 3 4 5 6	1 2 -9	1 2 -9		

51. Social network – Now I would like to ask you whether or not you talk to specific households in your village.

Enumerator: Enter names of head of households and sub-village/hamlet in columns 3 and 4 PRIOR TO BEGINNING HOUSEHOLD SURVEY.

SN	51a. HH ID	51b. Name of head of household	51c. Name of sub-village/hamlet	51d. Do you know this household? [1] Yes [2] No ***(skip to next HH)***	51e. Do you ever talk with anyone in this household? [1] Yes [2] No ***(skip to next HH)***	51f. Do you ever talk with anyone in this household about health issues? [1] Yes [2] No	51g. Do you ever talk with anyone in this household about economic matters? [1] Yes [2] No
HH 1:				1 2	1 2	1 2	1 2
HH 2:				1 2	1 2	1 2	1 2
HH 3:				1 2	1 2	1 2	1 2
HH 4:				1 2	1 2	1 2	1 2
HH 5:				1 2	1 2	1 2	1 2
HH 6:				1 2	1 2	1 2	1 2
HH 7:				1 2	1 2	1 2	1 2

VI. Priority Setting and Time Expenditure

52. Imagine someone gave your household a gift of Tsh. 10,000.
52a. In your household, who decides how this money will be spent? (***Read answers, circle only one)***

[1] Head of household decides alone
[2] Primary caregiver/mother decides alone
[3] Father and mother decide together
[4] Other household member (e.g., eldest member) decides
[5] Family members decide together

52b. What would your household do with this money? ***(Do not read answers, circle only one)***

[1] Food
[2] Jewelry
[3] Clothes
[4] School supplies/fees
[5] Bed net
[6] Mosquito coils
[7] Medicine (specify: _____)
[8] Religious objects
[9] Entertainment
[10] Donation to church/mosque/charitable group
[11] Savings
[95] Other _____

52c. Now imagine this person gave your household ANOTHER Tsh. 10,000! What would your household do next? ***(Do not read answers, circle only one)***

[1] Food
[2] Jewelry
[3] Clothes
[4] School supplies/fees
[5] Bed net
[6] Mosquito coils
[7] Medicine (specify: _____)
[8] Religious objects
[9] Entertainment
[10] Donation to church/mosque/charitable group
[11] Savings
[95] Other _____

52d. Now this person is very nice and gives your household ANOTHER Tsh. 10,000. What would your household do next? ***(Do not read answers, circle only one)***

[1] Food
[2] Jewelry
[3] Clothes
[4] School supplies/fees
[5] Bed net
[6] Mosquito coils
[7] Medicine (specify: _____)
[8] Religious objects
[9] Entertainment
[10] Donation to church/mosque/charitable group
[11] Savings
[95] Other _____

53. Please rank the following in terms of the amount of time and money you spend purchasing or producing each of them ***(Read answers, circle one rank for each item. 1 means they would spend the most time and money)***:

SN	**Item**	**Rank**
1	Food	1 2 3 4 5 6 7 8
2	Jewelry	1 2 3 4 5 6 7 8
3	Clothes	1 2 3 4 5 6 7 8
4	School supplies	1 2 3 4 5 6 7 8
5	Malaria prevention and control	1 2 3 4 5 6 7 8
6	Medicine	1 2 3 4 5 6 7 8
7	Religious object and activities	1 2 3 4 5 6 7 8
8	Entertainment	1 2 3 4 5 6 7 8

54. In a typical work day, please tell me how the members of your household spend their time:

SN	Time	Activity [1] Working outdoors [2] Working in the house [3] Attending funeral ceremonies [4] Traditional dances [5] Watching over crops to protect against pests (birds and animals) [6] Hunting [7] Guarding/other night jobs [8] Playing/Socialising outdoors [9] Playing/Socialising indoors [10] Sleeping [11] Eating [95] Other [-9] Don't know									
		Household Member (Refer to Roster)									
		1	2	3	4	5	6	7	8	9	10
1	6:00 pm - 8:00 pm										
2	8:00 pm -10:00 pm										
3	10:00 pm-12:00 am										
4	12:00 am-5:00 am										
5	5:00 am-7:00 am										

VII. Housing Quality and Socio-Economic Indicators

For Q55-58: Observe

55. Size of house: ***(Observe, don't ask)***
    [1] Large (4 and above rooms)
    [2] Medium (2 to 3 rooms)
    [3] Small (1 room)

56. Type of wall: ***(Observe, don't ask)***
    [1] Thatch
    [2] Wood
    [3] Mud or mud bricks
    [4] Burnt bricks
    [5] Concrete bricks
    [95] Other

57. Type of window: ***(Observe, don't ask)***
    [1] No windows
    [2] Uncovered windows (window but no shutters)
    [3] Window with wooden shutter
    [4] Window with glass shutter
    [5] Window with mosquito screen
    [6] Window with mosquito screen and shutters
    [95] Other

58. Type of roof: ***(Observe, don't ask)***
    [1] Thatch
    [2] Tile
    [3] Corrugated iron
    [4] Tin (debe)
    [95] Other

59. Is your house: ***(Read answers, circle only one)***
    [1] Rented
    [2] Owned
    [3] Family owned (inherited house)
    [95] Other_____

60. Do you own any land?
    [1] Yes
    [2] No ***(Go to Q62)***

61. Please tell me about all of the plots of land you own, including the plot your house is on. ***(Enumerator: Record the distance to the plot as 0 (zero) if plot is house plot.)***

Plot number	Distance from household		Area (Ha)
	Distance	Units [1] Km [2] Walking min	
1			
2			
3			
4			
Total			

62. Please tell me how many of the following assets you own

SN	Item	52a. Quantity	52b. When bought/built	52c. Expected useful life	52d. Price when bought/built
1	Shop				
2	Car				
3	Tractor				
4	Plough				
5	Motorcycle				
6	Bicycle				
7	Sewing machine				
8	Radio				
9	Radio cassette				
10	Television				
11	Sofa sets				
12	Telephone (landline)				
13	Mobile telephone				
95	Other 1				
96	Other 2				
97	Other 3				

APPENDIX B: FOCUS GROUP SCRIPT

Understanding Social and Behavioral Aspects of Malaria Control - Mvomero District – June 2007

Guiding questions for Focus Groups

Informed Consent Statements:
My name is …….., and I am working for Duke University (USA) and the National Institute for Medical Research (Tanzania). We are interested in understanding the community's knowledge, concerns, and behaviours related to malaria and other problems. You have been invited to participate in a discussion group that is part of our study.

This focus group discussion will consist of two researchers (note taker and a moderator) and 8-10 people from your village. The discussion will take about 75 minutes. During the group discussion you will be asked to share your opinions. There is no right or wrong answer to anything that will be discussed in the group. To protect your privacy, no names or personal information will be used in any of the reports or papers we write about the discussion group. It is completely up to you whether to participate. You are free to not answer any questions and to stop your participation at any time.

What questions do you have for me right now?
You may ask more questions any time during or after our discussion.
Do you agree to participate in the focus group?

Topic Area 1 - Perceptions and Knowledge about Risks:

1. What are the main risks and problems that you and other community members face?
    a. Which of these risks are you most concerned about?
    b. For the risks mentioned, how likely is the community to experience each risk in the next year?

2. What are the main health problems that your community faces?
    a. Which of these problems are you most concerned about?
    b. For the health problems mentioned, how likely is the community to experience each health problem in the next year?

Topic Area 2 – Malaria and Mosquito Knowledge:

1. What do you think transmits malaria?
2. What are the symptoms and signs of malaria?
3. How do mosquitoes transmit malaria to humans?

4. What factors affect the number of mosquitoes in your community?
5. What can be done to reduce the population of adult mosquitoes in your community?
6. Where can you find immature mosquitoes?
    a. What can be done to reduce the population of immature mosquitoes?

Topic Area 3 – Malaria Prevention and Treatment:

1. What can be done to protect yourself or other community members from malaria?
    a. How much would each of these actions/methods cost?
    b. How much time would it take to perform each of these actions?
2. Which of these methods do you feel is most effective at preventing malaria?
3. How do people in your community generally determine whether or not someone has malaria? Do people diagnose themselves, or do they visit health facilities to determine whether or not they have malaria?
4. Which drugs do people use to treat malaria in this community? Where do people obtain antimalarial drugs? How effective are the drugs that people use?
5. Where do most of the community members prefer to seek treatment for malaria?

Topic Area 4 – Land Use and Irrigation:

1. What kinds of crops do you grow?
    a. Which of these crops do you irrigate?
    b. What irrigation methods do you use on these crops?
    c. How long have you been irrigating these crops?
2. What kinds of water bodies do you have around your home and in your community?
    a. What kinds of plants and/or animals do you see in these bodies of water?
    b. What kinds of insects live in these bodies of water?
3. What types of agricultural practices do you feel increase or decrease the populations of mosquitoes?
4. During which farming seasons are people most likely to get malaria?

Topic Area 5 – Environmental Management and Community Participation:

1. Have you ever performed any of the following activities in order to reduce mosquito populations?
        i. Install drains
        ii. Remove stagnant water
        iii. Manage vegetation
        iv. Change irrigation techniques
    a. If yes, do you feel the technique(s) are effective?
    b. If no, would you consider performing any of these activities for future malaria control?
2. Let's say that a malaria control program was started in your community which required everyone to manage vegetation and remove stagnant water from the area

around their homes. If the majority of households participated, this program would help to reduce mosquito populations in the village.

   i. Would you be willing to participate in this program? Why or why not?
   ii. Do you feel that other members of your community would participate in a program like this? Why or why not?
   iii. What factors would make a person in your community more/less likely to participate in a program like this?

3. Does your village currently perform any other activities (health, education, social, economic, etc.) which require most or all of the community members to participate?
4. Would you say your community is composed mainly of people whose families have lived in the village for many generations, or is there a lot of immigration/emigration in the village?

Topic Area 6: Information Sources and Social Networks:

1. Where do you usually get information about health issues?
2. Where do you usually get information about malaria in particular?
3. What type of information do you get and how often?

Topic Area 7: Priorities and Time Expenditure:

1. Imagine that there is someone in your community who is very, very poor. If this person was given a little bit of money, what would he or she spend it on?
   a. If the person is given a little more money, what does s/he spend it on next? Let's make a list of items.
   b. Does it make a difference if this person is male or female?
   c. Does it make a difference how old the person is?

2. What are the main priorities of this community when allocating resources and why? What criteria are used to set priorities?
3. Basing on your experience, who is the final decision maker in how household income is used in this community? Does this vary a lot among households, or is it fairly constant across households?
4. What activities do community members generally spend time doing throughout the day and night?