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Malaria and Time Poverty in a Rural Nigeria: A Gender Analysis

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Malaria and time poverty in a rural Nigeria: a gender analysis

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Paper for the 32nd Income Association for Research in Income and Wealth (IARIW) General Conference in Boston (August 5th to 11th, 2012)

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Abstract

Malaria remains one of the greatest sources of threat to family welfare in Sub-Saharan Africa (SSA). Incidences of malaria in endemic areas have major implications for the household economy's natural schedule of activities and interactions within the household system. An important element of cost of malaria to families apart from the out of pocket cost is the time spent on care-giving to the sick by female members of the household particularly. The study assesses the time-use dynamics within the households which at least one individual experienced an episode of malaria attack, which was clinically confirmed.

A 24-hour time-use diary was used to capture time-use pattern of 1560 individuals in 300 households that experienced at least a case of clinically confirmed malaria in rural households in Oyo State, in the Western region of Nigeria. Structured household questionnaires were administered to elicit socioeconomic and demographic information. The households were visited within 3 to 17 days after the first medical confirmation of malaria. Activities were grouped into three; System of National Accounts (SNA) productive activities, Non-SNA productive activities and non productive activities.

The analysis extends the knowledge regarding the adverse effect of malaria on households. It is clear that malaria not only pushes the household to tighter income budget but also time constraint all of which has serious implication on welfare and poverty level of the household. The results show a far reaching implication for female members of the households who are the main caregivers in the families. At the peak of malaria attack, female household members shift from SNA-productive activities considerably to Non-SNA productive activities such as care-giving with an average of not less than 3-hours a day. The adverse effect of this time shift extends to non-productive but beneficial activities like leisure and resting which reduced substantially when compared to the male members of the households. The incidence of malaria in the household thus creates additional burden on female members of the household, as they have less time to participate in SNA activities.

Introduction

Malaria remains the greatest source of threat to family welfare out of all tropical diseases in the Sub-Saharan Africa (SSA). The household burden of malaria is not only economical but also social (Sachs and Malaney 2002) with major implications for household economy's natural schedule of activities and interactions within the system in endemic areas. Attacks often mean disruption in fundamental activities which determines members' propensity to earn income and welfare (Alaba 2002; Beegle 2003). Either temporary or permanent impairment in health status of a family member often require resource adjustment by other persons in such system. A fundamental method that can offer a detailed picture of the effect of malaria incidence on household's time allocation, interaction and shifts in resources allocation among household members and the distribution of paid and unpaid work among men and women is the analysis of a time use survey. An important element of cost of malaria to families apart from out of pocket expenditure is time which is a limited resource.

Evidences abound in the literature regarding the impact of malaria on the household economy. In the 1990s, quite a number of studies presented evidences relating to the negative monetary impact of malaria on households and national economies. These attempts were instrumental to the radical improvement in malaria control strategies of the 1990s till date. However, attempts to determine the influence of malaria on detailed functioning within the household system remain very sparse in the literature.

While there is qualitative evidence indicating that women are the primary caregivers at the household and community levels, the literature is surprisingly thin on the impact of illness on women's time allocation patterns. The actual impact of malaria in a high transmission area may therefore be more manifested by looking at the complex cost of caring for sick children and other vulnerable family members (such as pregnant women etc.), which is yet to be thoroughly investigated (Catherine, Coleman et al. 2000). The lack of disaggregated and gender-based analyses on time allocation in times of sickness impedes development of policies that are best suited to help malaria affected households. According to (Klevmarken 1998) time use measurement is expected to give better measures of market work; improve the analysis of labor supply by explicitly including competing activities in the home; make feasible studies of gender differences in market and nonmarket work and thus also improve our understanding of female labour supply; and give better measures of economic well-being and further our knowledge of its distribution. It also gives information on activities not included in the national accounts.

Malaria is very associated with disruptive adverse consequence on affected individual and household, in terms of their income and expenditure. The household income is affected by having to trade labour market participation and earnings for either illness or caregiving, the magnitude of which depends on the status of the sick individual or caregiver in the household system. Also, household budget are affected by the need to adjust component of household expenditure to accommodate the medical bills and transport expenses relating to medical-care seeking. In a rural society with widespread poverty without any form of social protection and health insurance in existence, households are likely to end up with catastrophic health care cost (see (Mills 1998; Xu, Evans et al. 2003; Onwujekwe, Hanson et al. 2010).

A household with optimum capacity to engage in productive work and work efficiently is less likely to be poor than a household with reduced productive time (Akarro 2008). In Sub-Saharan Africa, the issue of time use is especially important because of the high workload carried by many and the relationship between time use and consumption poverty (Bardasi and Wodon 2006). Furthermore, unpaid labour in the non-market production system, particularly caregiving may underpin the functioning of the market economy as identified by (Himmelweit 1995). Time use survey is very useful to analyze individual's economic contribution especially in rural economies where family labour is the dominant factor of production. Thus, each hour devoted to a home production due to the ailment of a member, competes with welfare and impact on alternative activities such as work in the labour market, schooling, work on the farm, etc.

Two key constraints on what people can achieve are time and money. Widely recognized by policy-makers and economist is income constraint in the concern with poverty. However, considering the recent understanding that welfare of individuals and households depend not solely on their income but that individuals need to have the capacity to reach minimum functioning capacity irrespective of whether they actually attain such capacity or not (e.g Sen 1982, 1985a and 1985b) – under the assumption of freedom of time allocation- time-use allocation and constraints as they relate to labour market have implications for the ability of individuals and households to escape poverty.

Thus, the aim of this paper is to investigate household time use and allocation behaviour during and after malaria incidence on household members. The analysis is predicated on a survey of clinically confirmed malaria conducted by the researchers along with time-use dairies and household structured questionnaire. The use of clinically confirmed malaria in survey is very sparse and highly avoided because of the associated heavy cost.

However, in using clinically confirmed malaria instead of subjective malaria, the study is, as much as possible, able to overcome a number of reporting bias associated with self-reports by recall.

Background

MALARIA DISEASE BURDEN

Malaria remains a major public health and development challenge in Nigeria. A well focused malaria prevention and control initiative is important in addressing rising morbidity, mortality, low productivity and poverty in Nigeria. Malaria is endemic throughout the country; it accounts for 50% of outpatient consultation and about 15% of hospital admission and is among the top three causes of death in the country. Approximately 50% of the population experience at least one episode per year, although annual average is as much as four bouts in Nigerian children (see National Malaria Control Plan of action, 1996-2001). The trend is rapidly increasing due to the current malaria resistance to first line anti-malarial drugs (WHO 2000).

More importantly, it is a social and economic problem which consumes about US\$1.5 million in government funding and over US\$3.5 million from other stakeholders in various control attempts in 2009 (World Malaria Report, 2010).

Existing data indicates that malaria is the most prevalent of all major tropical diseases in the country, being responsible for over 90% of reported cases of tropical disease in Nigeria. By implication, the disease may be the largest contributor to total disease burden and productivity losses resulting from major tropical diseases in the country. Evidence on Nigeria given by the World Malaria Report 2010 shows that malaria incidence throughout the country had been on the increase over the years ranging between 1.12 million at the beginning of 1990 and 2.25 million by the turn of the millennium 2000 and 2.61 million to 4.3 million in 2003 and 2009 respectively.

According to the former minister of health in his report (see National Malaria Control Plan of action, 2006-2010); Malaria control needs to be addressed, not as a separate, vertical, disease-specific intervention, but as part of a health systems strengthening effort to provide holistic services in all facets of care, and as part of a larger community-development effort.

Review of Literature

Gender, time use pattern and poverty

Evidence suggests that there are marked differences in how men and women allocate their time between market and non-market work. Although some of these differences in

time allocation can be explained through economic indicators such as wages, non-wage income, and the functioning of labor and goods markets. In many societies however, impact of non-economic factors is significant in determining time use patterns (Ilahi 2000). In many traditional societies social and cultural norms often underpin division of labor with some tasks strictly viewed as "men's work" and others as "women's work" (Cagatay 1998).

Societal norms tend to assign duties such as care for children , care-giving of the sick and the elderly, as well as household chores including food preparation, cleaning , and collection of fuel and water, to women, while men are viewed as working primarily outside the domestic sphere and are seen as the main breadwinners of their households; thus their activities are included in the System of National Accounts(SNA) while the female labor time, in economic terms, is invisible and are therefore classified as Non-SNA activities or non-productive activities. System of National Accounts (SNA) defines work in terms of formal and informal market work and non-market subsistence work for production of goods, and is the basis for calculating the GDP. This approach excludes non-market work producing services for own-consumption within the household and a whole lot of other things and these are classified as non-SNA activities and non-productive activities. However, the fact that some labor time is allocated according to non-economic criteria that do not necessarily reflect responses to market or price signal, has implications for ability to account accurately for productive or labour activities, and labour market functioning. The traditional gender-based classification of patterns of activities also means that the capacity of individuals to reallocate their labor in response to economic incentives and to maximize productivity and efficiency may be very limited.

(Gurley-Calvez, Harper et al. 2009) using the American time use survey, of 2003 to 2006, observed a significant difference between the time-use patterns of self-employed women and those of men and wage and salary employed women. More time is spent providing child care by self-employed women compared to other groups. Similar to this, (McGinnity and Russell 2008) using the Irish National Time-Use Survey of 2005 found that time distribution is highly gender-biased with regards to paid and unpaid work as well as the type of unpaid work. The study indicated a higher workload for women and an average of forty minutes longer per day when compared to the men in both paid and unpaid labour.

Some factors that have been found to affect time variability in the household are family composition; including presence of children and age distribution of the children. The number of older children in the household, particularly girls, reduces the time spent by women on various reproductive work activities. Female children are expected to be women's

main helpers in tasks such as water and fuel collection and care duties. The presence of other female adults in the household also reduces the time each one allocates to various household tasks and increases the likelihood of their involvement in wage employment (Nankhuni 2004). However, in literature the issue of variability due to the presence of children has attracted specific interest. Some literature excludes the care/presence of children (Brines 1994) while others decided to include it (Bittman, England et al. 2003). This may be due to the conceptual and measurement challenges associated with child care (Aguilar and Hurst 2007).

An emerging area of application of time use survey is the attempt to determine the multidimensionality concept of poverty. Time use has in recent years become an important issue in explaining extended dimensions of poverty. (Aguilar and Hurst 2007) applying various time use survey of the United of States of America found all measurement of leisure to have increased for both men and women between 1965 and 2003 after controlling for demographic differences; 6.2hours per week for males and the females by 4.9 hours per week. However, the adjustment that allowed for greater satisfaction (leisure) with the time budget constraint differs significantly. While men increased their leisure by allocating less time to the market sector, for women, leisure time increased simultaneously with market labour and the time allocated to home production reduced drastically. Though, it as not been empirically tested, reduction in time allocated to home-production may have a negative effect on child outcome.

Time use data is of immense benefit to policymaking in countries where it is currently being applied. Countries where time-use data is currently available for research and policy purposes in Sub-Saharan Africa include Benin, South Africa, Madagascar, and Mauritius, as well as the time use module of the Ghana Living Measurement Survey.

Malaria and Household behavior

Coping with malaria within the household may produce a number of dynamic effects; including direct collective make-up of labour time loss/output of the sick and in many cases hiring labour to fill the gap during sensitive periods. In a study of 250-Sudanese tenant families for instance, work days loss is often partly compensated for by other members of agricultural households (Conly 1975; Nur and Mahnam 1986; Castro and Mokate 1988). Some household units can afford to hire labour to make up for the activities meant for the sick persons. In that case, loss of productivity to the household would be estimated through the extra expenses on the hired substitute for the sick persons.

(Attanayake, Fox-Rusgby et al. 2000) found that the loss of output, loss of wages or income due to caregiving; including the need to accompany malaria patient for treatment, cost to neighbors and friends who helped out during sickness and the opportunity cost of labour substitution among household members to cover the unattended productive work of the sick; is about for 76 percent of the household cost per fully recovered patient from malaria.

Though time use surveys have been applied in accounting for the comprehensive impact of sickness in other types of diseases, however we are not aware of its application to malaria studies. One important disease where time-use surveys have been applied is HIV/AIDS. The time use data reveals that the impact of HIV/AIDS in Sub-Saharan Africa is not fully taken account of by focusing on the impact of market work only and neglecting fundamental activities in the family which enables long term production for the market economy. A comprehensive impact of the disease can only be known if the largely invisible and often unaccounted household activities are considered in determining the full impact of HIV/AIDS. Having a family member with HIV/AIDS increases the burden of other domestic activities such as housework, shopping, and transportation (Akintola 2005). While, (Bollinger, Stover et al. 1999) finds that the most time- consuming activity for women in HIV/AIDS-affected households is nursing at home, which amounts to 50.2 hours per week on average. The study highlights the tradeoff between women's childcare responsibilities and nursing duties. Women in non-AIDS affected households spend 25.7 hours per week caring for children while women in AIDS affected households spend between 1.9 and 13.1 hours per week on childcare. Evidence of intergenerational impact of care-giving was found in rural Kenya by (Yamano and Jayne 2004). In their study of working age adult mortality and primary school attendance, the authors find that adult mortality negatively affects children's, particularly girls', schooling especially during the pre-mortality period. This was attributed to the children share in the burden of care-giving.

(Hansen, Woelk et al. 1998) study four home care programs in Zimbabwe and estimated the cost incurred by households in caring for a bedridden patient for three months. The study concludes that the time spent on caring, diverted from other activities such as food production, employment, education and care of other household members, is the highest cost burden incurred by these households. Therefore, actions (public or private) towards reducing burden of disease and improving quality of people's life must take into consideration the dynamic effect of the disease (malaria) on the households and the complexity of interactions within the family.

Conceptual Framework

The conceptual framework we considered appropriate in explaining the link between malaria, intra-household functioning and welfare is the frame similar to Bardasi and Wodon (2006). The modified version of the framework explores the linkages between health status-malaria and time allocation.

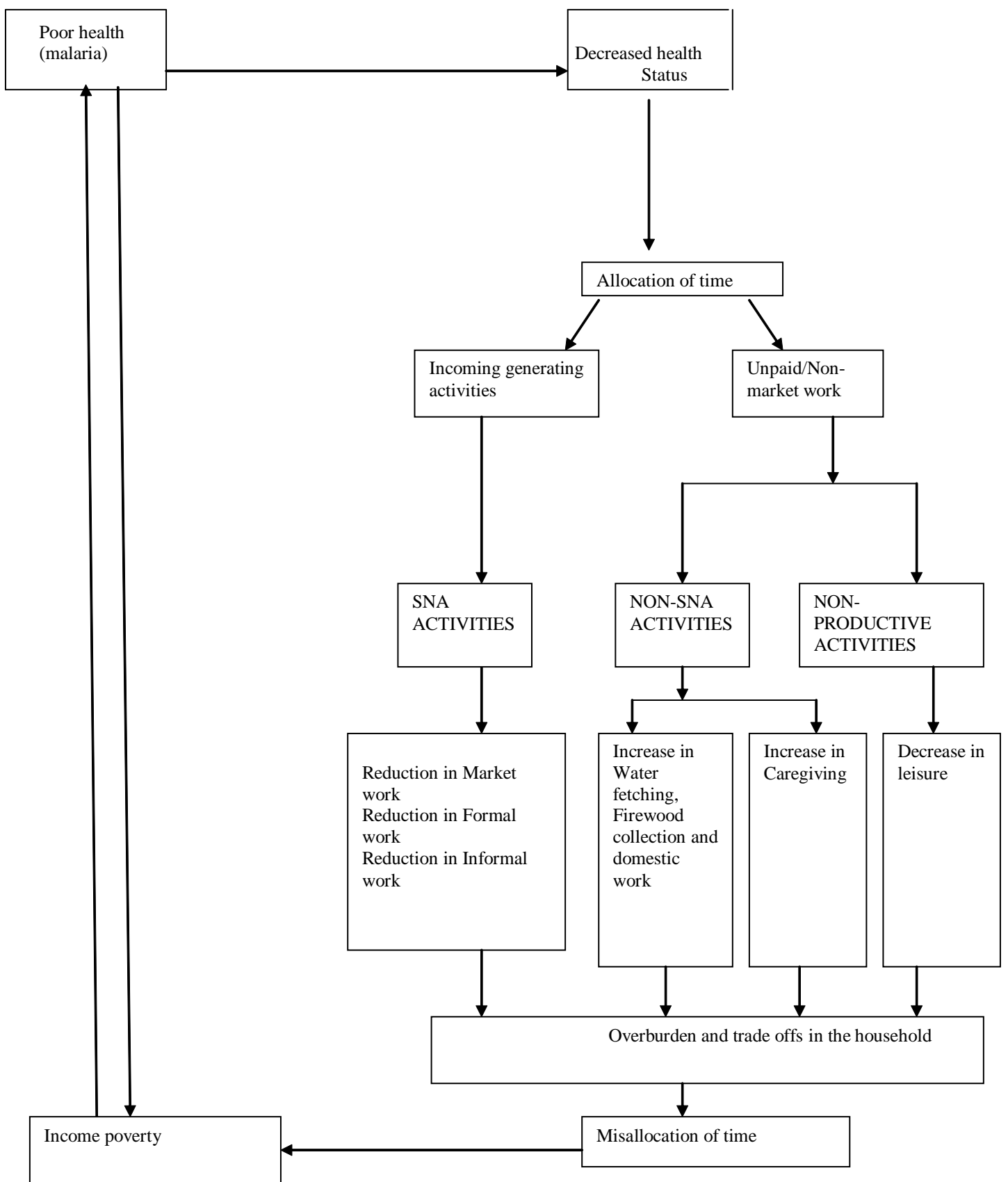


Figure.1: Malaria, time-use and welfare

Source: Modification of Bardasi and Wodon (2006) time poverty framework

According to the conceptual framework figure (Figure 1) poor health through the attack of malaria directly affects individual's physiological status, which impairs ability to withstand demands of work and productive capacity. Response to this includes time and financial allocation to confront the condition of the sick by seeking necessary care. Time allocation affects both income generating activities and non-market activities. This may translate into reduced income and lead to poverty, which directly cycles back to poorer health status. In (Catherine, Coleman et al. 2000), loss productivity include inability to work to maximum daily capacity, total absence from work, reduce hours of work at the beginning of sickness and debilitating period. In the literature, three major variables that determine productivity include education, which is quite important in acquisition of skills; work experience; and health status (Schultz and Tansel 1993; Dercon and Krishnan 1997).

As depicted in figure 1, households depend heavily on their members' time and labor for the provision of goods and services that are essential for their well-being and survival. When faced with severe time constraints, or time competing situations, the households may have to resort to making tradeoffs between activities which may directly affect members' well-being. These may be short-term intersectoral and inter activity tradeoffs as well as intergenerational tradeoffs with far reaching consequences. The negative impact of these tradeoffs may result in various dimensions of "human poverty" such as food insecurity, child malnutrition, health impairment, and low level of education.

For instance, time that has to be allocated to care responsibilities may cause individuals to forego certain responsibilities in subsistence agricultural production which may adversely affect agricultural output and consequently threaten household food security and compromise child nutrition and health. Conversely, time spent on agricultural production shaped particularly around seasonal labor requirements may lead to tradeoffs in the form of less time on care and domestic work. This may impede, among other things, the timely preparation and consumption of adequate food and adversely affect household and particularly children's nutrition. Finally, household time poverty may require children to contribute time and labor to various tasks and therefore forego education, which in turn perpetuates the intergenerational transmission of poverty, and undermines efforts to meet the Millennium Development Goals.

Misallocation of time or stress on time can exacerbate income poverty in poor households in several ways. First, low-productivity in many non-market tasks due to ill-health renders these activities time-and labor-intensive, thus reducing the availability of time to participate in more economically productive activities. Second, due to the inherent gender

based division of labor that causes poor substitutability of labor allocation in non-market work, individuals, particularly women, are unable to take full advantage of economic opportunities and participate in income-generating activities. Third, stress on time also impedes individuals' ability to expand capabilities through education and skills development, thereby enhancing economic returns in the market place.

Analytical Framework

Authors have at one time or the other explored methods which enables capturing of impact of disease on household production³ and overall well being (Bremen 2001). However, keeping diary of time use is an important tool that can augment other research tools. Time use diary is a very useful tool; not only does it enable households to account for the pattern of time allocation between activities, (Juster and Stafford 1991), it measures contribution of specific individuals to the systemic functioning, of the household. According to Becker's original model,⁴ households combine market goods and time to produce basic commodities. Becker acknowledged that the consumer maximizes utility subject, not only to a budget constraint, but also to a *time* constraint.

The traditional and most frequently used approach to measuring time allocation and changes in time allocation is to interview the subject to recall his/her activities and that of the households recalled (Bernard et al. 1984). Engle and Lumpkin (1992) found that among middle-class U.S. and Guatemalan mothers, it was more common for activities to be remembered than for the durations to be re-called accurately. However, Engle et al. (1997) recognizes that time spent could be a good indicator of contribution to caregiving. The authors however suggests that if such time is to be used as an indicator of care, it should be measure by direct observation, which in addition to getting accurate measure of time allocation, allows specific changes in individual activities to be recorded. The time use diary provides information on the following:

Total time use (min/hours): $TA = \sum A_{\alpha}$ (with a period of 1 day: less or equal to 24 hours)

³ For an excellent review of literature on household production theory, see Pitt and Rosenzweig (1986)

⁴ Time was introduced to economic analysis of household by Gary Becker in a series of seminal articles. For original articles see Becker, G. S. (1965). "A theory of the allocation of time." Journal of Political Economy **75**(299): 493-517.

(1965) and Pollak (2003) for critical evaluation of Becker's theories

Where A represents the time a member of the household engage in activities α , e.g care-giving, cooking, reading, e.t.c. The number of activities in the open diary is numerous and therefore, there is need for further aggregation and reclassification. The activities/ work were further grouped into SNA activities and Non-SNA activities. By separating the SNA activities from NON_SNA activities, we thus, formulated the following expressions for the SNA time use:

$$TA_{SNA} = \sum A_m$$

Where A is the time spent by a household member on m SNA activities

And, Non-SNA activities time use is:

$$TA_{Non-SNA} = \sum A$$

Where A is the time spent by a household member on the Non-SNA activities
Peculiar to time-use surveys is the large number of zero responses. There are two sources for zero observations that reflect the nature of the data. One source is that there are those individuals who never do an activity and therefore zero is recorded in the diary. The other source is that although this activity is usually done, for some reason, it was not done during the recording period.

There are a number of methods to try to account for the prevalence of zero observations in time-use surveys (see Flood and Grasjo,1999) but the commonly used methods are either Tobit model, Heckman Selection model or double-hurdle model. Given the censor nature of time-use the Tobit model also called censored regression model was employed to estimate the probability of engaging in SNA activities and to explain the determinants of the intensity of the time spent on SNA activities. Tobit models are useful when there is a bunching in a base value, like zero and afterwards the dependent variable is like a continuous variable. Applying an OLS to the censored dependent variable will result into a bias parameter estimates. However, a consistent and asymptotically efficient estimation can be obtained using the maximum likelihood estimation procedure of Tobit analysis (Tobin 1958; Amemiya 1973).

The specification is given below.

The SNA regime is determined by a standard binary choice model, where the latent variable m^* , SNA function is assumed to be linear in the parameters and the error term is normally and independently distributed as given in equation 1

$$m^* = BX + \mu \text{-----} (1)$$

m^* = latent variable that is observed for values greater than τ and censored otherwise⁵

m = the observed counterpart

Following standard convention,

we observe $m = 1 = m^*$ if $m^* \geq 0$.

Two marginal effects on the observed m can be generated as given below:

$$\partial E(m) / \partial X = F(z)B \text{ Where } F \text{ is the probability cumulative density function-----} (2)$$

Equation 2 is gives the marginal effect with the information that the observed variable is positive. It can also be referred to as unconditional marginal effect.

$$\partial E(m / m^* > 0) / \partial X = B(1 - (z)\lambda - \lambda^2) \text{ where } \lambda = f(z) / F(z), \text{ and } z = B'X / \sigma \text{--}(3)$$

f is the probability and σ is the standard error of the error term. Equation 3 above gives the marginal effects without the information that the observed variable is positive and this is referred to as conditional marginal effect.

In the preceding equation, X represents the independent variables that consist of various household and individual level factors affecting the amount of time allocated to SNA activities, duration m . In this context, we adopted a reduced form approach in the empirical analysis.

The independent variables used in the analysis are made up of binary and continuous variables. The binary variables are sex, education, and marriage, presence of relative and presence of malaria. The continuous variables are income, length of stay at job. The presence of

⁵ The tobit model can be generalized to take account of below and upper censoring. In this case we assume τ is equal to 0. i.e. the data are censored at 0.

a relative in the household can be considered as a kind of social support which can affect not only participation in the labour market but also intensity of time spent in the labour market when a member of the household is ill. (See Appendix 1 to see the detailed definition of variables).

Defining poverty in general is quite a complicated matter because being poor differs dramatically across countries. Since the publication of its Human Development Report (1997), the United Nations has defined poverty as “denial of choices and opportunities most basic to human development-to lead a long, healthy, creative life and enjoy a decent standard of living, freedom, self-esteem and the respect of others.” Typically, income/consumption poverty measurements have been developed overtime while time poverty measurement is still evolving. (Bardasi and Wodon 2006), applying consumption poverty literature to time use in an attempt to determine time poverty concluded that time is a limited commodity, more time spent working in the labour market, for domestic work or other activities means less leisure and rest time and therefore higher “time poverty”. A case where individuals are extremely pressed for time and are not able to allocate sufficient time for important activities, but are forced to make compromising trade-offs can also be seen as time poverty.

Methods

Study Setting & Design

This study was carried out in a malaria holo-endemic local government area of Oyo State, Nigeria. The survey was conducted using a structured household questionnaire between August and the beginning of October, 2007. The household survey was carried out in three villages namely, Olosun, Ogundeji and Orisunmbare, all of Akinyele Local Government Area of Oyo State.

Sampling method

Our sampling procedure utilizes a multi-stage sampling method process. In order to select villages to be surveyed a random sampling method was utilized. Taking into cognizance that the focus of the study is clinically confirmed malaria at the household level, choice of sampling method at this stage was complicated. Thus, the following options were considered: sampling of all the households in the villages and carrying out malaria test for all members of the household using microscopic test or sample households that report malaria related symptoms and have clinically confirmed malaria. Though as researchers, we would

have preferred random sampling, however, this limitation is difficult to overcome, given the practicality of field based testing. We therefore, decided to opt for a non-probability purposive sampling method for two reasons. One, it is less expensive and more ethical to operationalize compared to the first option. Two, activities of household members who did not report attack is unlikely to be affected by supposedly suspected incidence.

In the case of non-probability purposive sampling, the basic order is to verify whether the respondent meet the criteria for being in the sample (William, 2006) which in this case is whether the household have a minimum of one person with clinically confirmed malaria. Thus, considering the fact that the main purpose of this study is to study the dynamics of households who had malaria that was tested positive using the microscope, a purposive non-probability sampling method was eventually applied. Blood samples were taken from 1500 individuals from 500 households with symptoms relating to malaria for laboratory confirmation. The results from the laboratory confirmation reduced the sample to 300 households with 825 individuals having clinically confirmed malaria. The total household members are 1560. These households where visited within 3 to 17 days randomly after the first medical confirmation of malaria. We felt first visit within 3 days was appropriate in order to have accurate time information during malaria episode. The study showed that all the 300 households still had a malaria patient by that time. By the 17th day 98% of the households' had no malaria case.

The Questionnaire

Alongside a 24 hours activity/time diary for all members of the households a household questionnaire including detailed questions about household structure and family characteristics, labour market activity and income, as well as socio-demographic characteristics was administered.

TIME USE DIARY

Time-use can be measured in three basic ways (Juster 1999); the first, and most popular is the 24-hour time diary, where respondents are asked to filling their time use for the previous day or same day. The second is the use of stylized questions about time-use in a typical day or typical week. The third method is to collect time-use information on randomly selected moments of time signaled by a beeper within 24-hours of the day.

The diary in which activities are recorded sequentially has been found to be the most reliable method of collecting information on time-use (Robinson and Godbey 1997; Juster

1999; Gershuny 2000). The number of ways available to collect diary information from respondents can be fixed intervals, for example every 30minutes or 1hr period, where the respondent fills in the activities he/she was involved in.

For this study, we made use of time diary asking respondents for a detailed chronology of 24 hour preceding the onset of confirmed cases of malaria and various time spanned within 17 days. The diary was divided into one hour time slots. Respondents were asked open-ended questions pertaining to the one hour time slots. The activities reported were classified according to the new activity classification system developed by the United Nations (UN) Statistical Division. According to this classification, activities can be grouped into fifteen broad categories, namely:

1. Work for corporations/quasi-corporations, non-profit institutions and government (formal sector work)
2. Work for household in primary production activities
3. Work for household in non-primary production activities
4. Work for household in construction activities
5. Work for household providing services for income
6. Providing unpaid domestic services for own final use within household
7. Providing unpaid care giving services to household members
8. Providing community services and help to other households
9. Learning
10. Socializing and community participation
11. Attending/visiting cultural, entertainment and sports events/venues
12. Hobbies, games and other pastime activities
13. Indoor and outdoor sports participation and related courses
14. Mass media
15. Personal care and maintenance

This classification enables further grouping according to how the activities are treated in the System of National Accounts (SNA). Activities categories 1 to 5 are considered as productive activities and are referred to as System of National Accounts (SNA) work/activities. Activity categories 6 to 9 though recognized as productive, they are however not paid for and are therefore referred to as Non-SNA activities. The remaining categories are referred to as Non-productive activities.

However, for this study, activities were aggregated to 7 categories; name, Marketable work, housework, caregiving, sick, leisure, personal care and sleeping and finally others. Marketable work includes work for pay/earning including market work, farm work, and formal jobs; this is seen as productive activities and is thus classified further as System of National Accounts work or activities. Under Non-SNA activities for this study, we have housework which is made up of various household chores (house cleaning, cooking, fetching water and food preservation) including child-caregiving and care-giving of the sick.. Caregiving in this study refer to time allocated to take care of the sick. Sick is the time actually redundant because of malaria, leisure includes the activities of relaxation like visiting friends and watching the television, sports, and entertainment, and sleeping include personal grooming time and eating while the final category is the others and it includes every other activities like religious work and community service. System of National Accounts (SNA) defines work in terms of formal and informal market work and non-market subsistence work for production of goods, and is the basis for calculating the GDP. This approach excludes non-market work producing services for own-consumption within the household and a whole lot of other things. Details can be found in UN Statistics.

FINDINGS

CHARACTERISTICS OF THE SAMPLED POPULATION

Socio-Economic Characteristics

The average household size given by our sample is 5.67, and the average age of the household heads in the sample is 43.98 years. The distribution of the household heads show that 62.88 percent of the households are male headed, while female-headed households are 37.12 percent. The primary activities in the communities involved are a mix of subsistence, commercial agriculture and trading. Using the main activity of the household head to classify the households we find that, over 70.77 percent of the heads are farmers, 23.08 percent are traders and only 6.16 are involved in other things apart from these two. According to the survey, the household monthly mean income is N7666.35 and the average malaria attack is 6.3 days.

Household Structure

Structure of household is important in determining the effect of malaria and intra-household responses to malaria attack on a member of the system. The structure of households involved in the survey is given in table 1

Table1 **HOUSEHOLD STRUCTURE (%)**

Structure	Female	Male	Sample(%)
Children (0-5)	47.06	52.94	501 (32.12)
Children(6-12)	55.56	44.44	318 (20.39)
Teens (13-16)	55.50	44.50	209 (13.40)
Adults (17 +)	51.95	48.05	532 (34.10)
Sample(n)	805	755	1560 (100.0)

Sources: Survey, 2007

Table one shows that adults constitute the largest proportion of the household memberships. On the aggregate adult population is about 34.10 percent of the total household membership in the survey. About 32.12 per cent are children below age six, with 20.39 percent between ages six and twelve while only 13.40 are teenagers. This disaggregation by age is important in partitioning differential impact of malaria on activities within the households, level of endurance (for instance, sick adult can still to an extent manage to participate in labour activities), time allocation and financial burden bearing.

Figure 1: Marital Status of Head of Households by Sex (N=300)

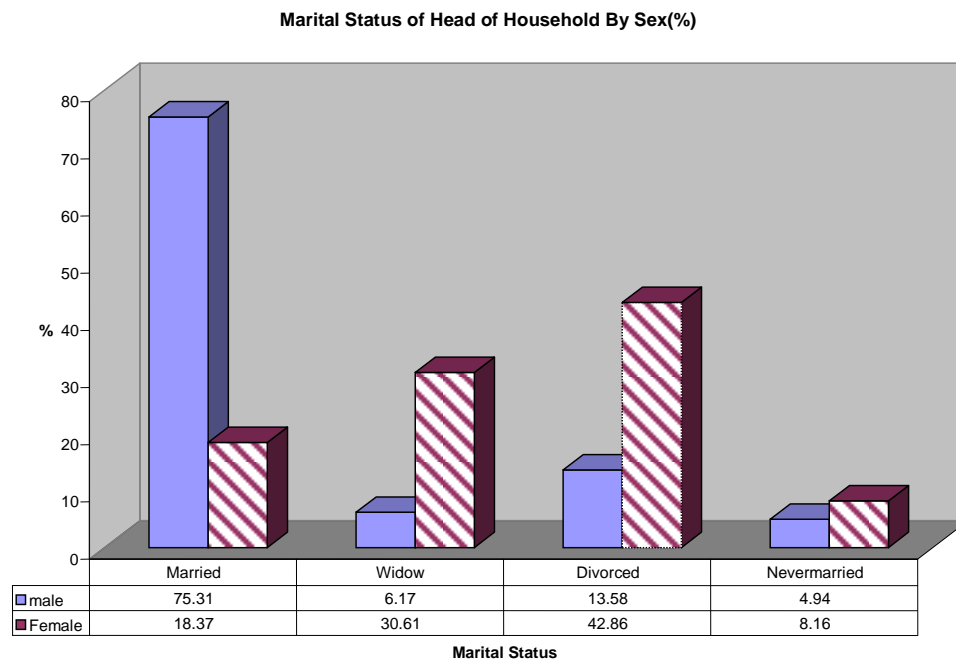


Figure one indicates that majority of the household heads are married followed by divorced heads, widowed and never married. A further breakdown into sex reveals that females constitute the bulk of headship of the “vulnerable” group as defined in the literature. The literature suggests that households with circumstantial heads, especially females; widowed and divorced; are usually vulnerable. In all the “vulnerable” groups the females are more than three times the males except for heads that are never married which is just twice of the males. According to World Bank a female headed household is more vulnerable to poverty than a male headed household and much more when single, divorced or widowed.

Distribution of Malaria Incidence in the Households

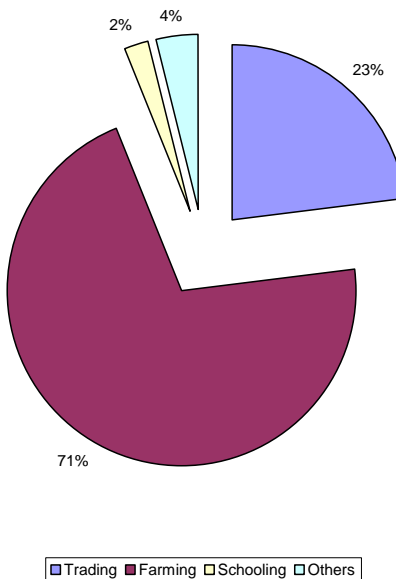
Analysis of the data shows that 52.89 percent of the household members had clinically confirmed malaria in various degrees. This suggests a total of 825 individuals with malaria and an average of 2.75 malaria patients per household. Analysis of malaria patients by age distribution reveals that the adults have more malaria with 45 percent followed by children below age five, given as 35 percent of the sick. Children between ages 6 and 12 and teenagers constitutes 7% and 3% respectively. The implications of this distribution on adult productivity will be high for two reasons; one, the population of adult with different grades of attack is high; two the number of children attacked and requires care is also high. Therefore, time and resources are required to care for self and sick children.

Intra-Household Relationships and Caregiving

The survey reveals that most members that constitute the households in our sample are biological relations. In the sample only about 42 percent of households' record presence of members who are either not biologically related to the household heads or they are distant relations. The burden of caregiving falls mainly on the woman of the house with 56.38 percent while the rest is made of males. Analysis of primary caregivers by primary productive activities shows that most of the caregivers are engaged in farming. Figure 2 below describes the distribution of caregivers by productive activities they are engaged in.

Figure 2: Caregivers profile by primary productive activities

Caregivers profile by primary productive activity (%)



The figure 2 above reveals that 71% of the 350 individuals who were classified as primary care givers are fully involved in farming, with 23 percent in trading and only 2 percent in schooling and 4 percent in other productive activities. This implies that the adults productive force are the primary care-givers whose opportunity cost of taking care of the sick is not

only in time but also loss of participation in the labors market and ultimately reduction in income.

Activities forgone by Caregivers

The study went a step further to determine the activities traded for caregiving. We aggregated the various activities into four, namely schooling activities, income generating activities, household chores and finally leisure which consist of social engagements and various relaxation activities. Figure 3 shows distribution of activities traded for caregiving.

Figure3: Activities forgone by caregivers

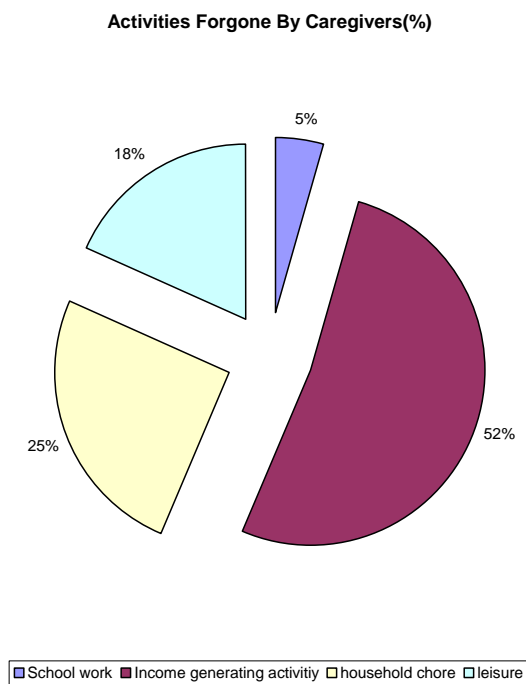


Figure 3 confirms that the opportunity cost of taking care of the sick is skewed towards income generating activities. This is not surprising seeing that the average age of the primary caregivers is 27 years of age, which is the prime of productive year. The figure shows that more than 50 percent of primary caregivers traded time meant for income generating

activities for caregiving. Also, about 25 percent of caregivers had to leave the household chores undone in order to take care of the sick, while about 18 percent of the caregivers had to forgo social engagements and leisure to provide necessary care for the sick. The rest and the least in the category are students whose school works were affected.

Malaria and time-use pattern

Table 2: Mean Time (hours per day) spent by category of activities in Malaria households

Category of activities	First Visit			2 nd visit(the 3 rd day)			3 rd Visit The 17 th day)		
	Males (n=755)	Females (n=805)	Total (N=1560)	Males (n=755)	Females (n=805)	Total (N=1560)	Males (n=755)	Females (n=805)	Total (N=1560)
Marketable work	3.09	2.23	2.65	5.92	2.72	4.27	6.68	5.3	5.97
Housework	1.32	5.21	3.33	1.1	5.67	3.46	1.38	2.93	2.18
Caregiving	1.21	2.88	2.07	1.03	2.41	1.74	0.42	1.22	0.83
Sick	2.5	1.33	1.9	1.64	1.66	1.65	0.3	0.14	0.22
Leisure	0.04	0	0.02	0.32	0.1	0.21	2.53	1.46	1.98
Personal care+sleeping	10.7	9.31	9.98	11.2	7.77	9.43	10.7	10.3	10.49
Others	5.14	3.04	4.06	2.81	3.67	3.25	2.02	2.69	2.37

Table 3: Mean Time (hours per day) spent by SNA Category in Malaria households

Category of activities	First Visit			2 nd visit(the 3 rd day)			3 rd Visit The 17 th day)		
	Males (n=755)	Females (n=805)	Total (N=1560)	Males (n=755)	Females (n=805)	Total (N=1560)	Males (n=755)	Females (n=805)	Total (N=1560)
SNA PRODUCTION ⁶	3.09	2.23	2.65	5.92	2.72	4.27	6.68	5.3	5.97
NON-SNA PRODUCTION ⁷	2.53	8.09	5.40	2.13	8.08	5.20	1.80	4.15	3.01
NON- PRODUCTIVE ACTIVITIES ⁴	18.38	13.68	15.96	15.97	13.2	14.54	15.55	14.59	15.06

Table 2 and 3 presents the time use patterns of both males and females and the total population in three periods. The time-use in table 2 shows the average number of hours per day, spent on work and other 5 categories of activities. The first visit shows that on market related work, the average hours spent by men was 3.09 hours per day compared to the females with 2.23 with a total average of 2.65 hours per day. Though the aggregate hours per day spent on market work increases at the second visit to 4.27 hours per day, the disaggregation by sex reveals an increase in time allocated to marketable work for both sex; males to 5.92 hours per day and females a meager increase to 2.72 hours per day. There is a slight drop in the care-giving time and a slight increase in housework. The third visit seems to reveal the optimal levels of allocation of time in cases where there is no disruption in the household. The average hours allocated to marketable work is 5.97 hours per day with the males allocating the highest with 6.68 hours per day, the females increased drastically to 5.30 hours per day. The leisure time for females actually increased to 1.46 hrs per day, though for

⁶ SNA Production activities include marketable work

⁷ Non-SNA production activities is the summation of housework and care-giving; Non-productive activities is the summation of sick, leisure, personal care and sleeping and others

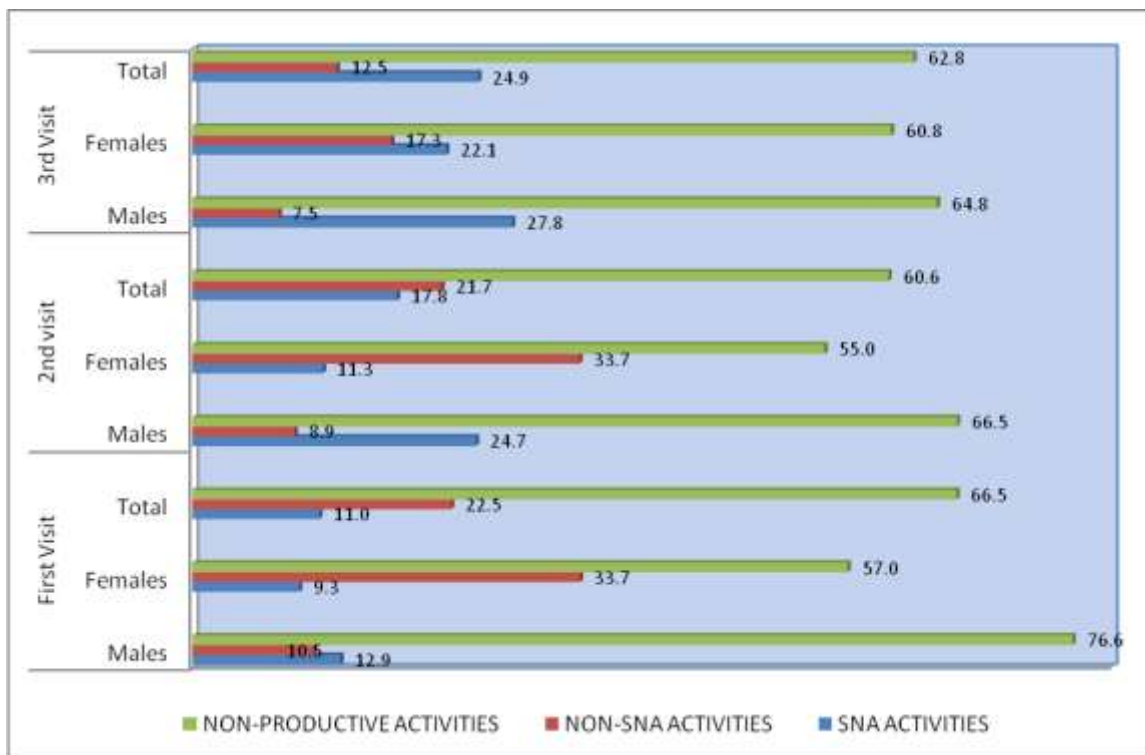
males the time allocated to leisure was 2.53 hours per day. An interesting observation during the first visit was that the females in the household allocated no time for leisure.

Table 3 is by SNA category and it is very glaring that the time allocated by women to marketable work is low compared to the males at all visits.

Time poverty

The time poverty as indicated by the percentage distribution of time to SNA activities is given in figure 4

Figure 4: Percentage distribution of time in a day by visit, sex and SNA category(indicator of time poverty)



From the figure above, time poverty is substantially higher among females as compared to males in all visits with regards to SNA productive activities. This is more obvious during the

second visit which is classified as the “peak” of malaria attack with females forced to spend less proportion of their time on SNA productive activities and more in non-SNA production activities which include housework and care-giving.

Empirical Analysis

Table 4 presents the maximum likelihood Tobit estimation results of our full sample, the associated unconditional marginal effects and the marginal effects conditional on positive duration of time in the labour market for two visits; within day 3 and around day 17 according to the equations above.

Table 4: Determinants of participating in SNA activities during two visits: Tobit marginal effects

	Visit 2-day 3	Visit 3-day 17
Sex	0.44* (0.08)	0.58*** (0.34)
Education	0.61 (0.43)	0.23*** (0.13)
Height	0.03 (0.12)	0.10 (0.34)
Marriage	1.65*** (0.68)	0.07** (0.02)
Income	1.01*** (0.49)	1.48* (0.25)
Malaria	-0.79* (0.21)	-0.03 (0.01)
Length in job	0.10** (0.031)	0.15 (0.57)
relative	0.23*** (0.12)	0.11*** (0.05)
Observation	1560	1560

(+) dy/dx is for discrete change of dummy variable from 0 to 1

* significant at 1%, ** significant at 5% , *** significant at 10%

Standard error in parenthesis

As expected, malaria is negatively associated with the demand for SNA time peaking at visit 2 with a marginal effect of 0.79. On the 3rd visit (17th day) it is not surprising to observe a decline in the impact of the disease on individuals hours contributed to the SNA activities.

This behavior of the variable at the third visit could be attributed to negligible cases of malaria remaining by that period. The marginal effect of sex was positively significant in both visits. Although the marginal effect in visit 2 was low compared to visit 3, the visit-three indicates that intensity of participation in the labour market for males is 58% more likely than females when malaria attack has resided. The presence of a relative in the house positively influences intensity of hours put in the labour market. Income as an indicator of household economic status is a very important determinant of participation and amount of work being done. It is also interesting to note that the length of being in an occupation is positively associated with participating in the SNA activities even though it was not significant on the 3rd visit.

CONCLUSIONS

The study attempted an often avoided approach to determine the impact of malaria on intra-household functioning. The approach adopted is a useful return from the traditional method which often relies on self reported malaria in terms of incidence and impact on the household system. The approach enabled us to determine whether the disease is actually malaria and visit to the household to explore time use pattern is a more precise way of impact determination unlike the usual four weeks re-call method. The study significantly contributes to malaria literature and the ability of experts and policymakers to be able to determine in a more specific term the impact of malaria on the systemic interactions of activities within the household.

The study has thus highlighted that a number of important adjustments take place within the household system during attacks of malaria. The relevant adjustments affect activities ranging from leisure to household chores and income generating activities, with the results showing the greatest effects on income generating activities. This analysis reveals gender sensitivity of burden generated by malaria attack in rural Nigeria. It is noted from our survey that females in the household systems share the biggest proportion of physical burden during malaria attacks by the proportion of time they are forced to reduce from productive activities and leisure in order to give care to the sick. Thus, female quality of life is questionable while contributing positively to the household.

Finally, the analysis provides some useful insights into intra-household time use patterns and how these are affected by the incidence of malaria. It is clear from this analysis that malaria pushes the households to tighter budget, income and time constraints, all of which have serious implications for poverty and welfare in rural Nigeria. Specifically, the

Millennium Development Goal 3: to address gender inequality by increasing the proportion of women in wage employment; the negative impact on females' productive activities time attributable to malaria incidence may undermine this effort.

The study is not without its limitations. Firstly due to the sampling strategy, the data collection was not absolutely random. Therefore, we may not be able to generalize the result neither could we compare households without malaria. However, how main interest is the variability that occurs in malaria households and not non-malaria households. Secondly, time-use diary is quite subjective when it comes to aggregating activities. The more the aggregation the less the variability observed. Furthermore, grouping of an activity is also subjected to the researcher. For instance, not all leisure can be categorized as a non-productive activity. Thirdly, this study has excluded multitasking from its analysis and has only taken into consideration the primary activity on which bulk of individual's time is allocated. Future research, however, must strive to apply random sampling as much as possible to provide a more complete picture of the economic and social impact of malaria on household well-being.

References

- Aguiar, M. and E. Hurst (2007). "Measuring trends in leisure: the allocation of time over five decades." The Quarterly Journal of Economics **CXXII**(3): 969-1006.
- Akarro, R. (2008). "The impact of time use differentials on poverty levels in the Eastern and Northern Zones of Tanzania." European Journal of Economics, Finance and Administrative Sciences(13): 108-120.
- Akintola, O. (2005). "Unpaid HIV/AIDS Care in Southern Africa: Nature, Contexts and Implications." presented at Global Conference on Unpaid Work and the Economy: Gender, Poverty, and the Millennium Development Goals, October 1-3, Bard College, Annandale-On hudson, NY. UNDP and Levy Economics Institute Bureau for Development Policy.
- Alaba, O. A. (2002). Malaria in children: economic burden and treatment strategies in Nigeria, AERC for the Collaborative Project on Malaria and Poverty in Africa.
- Amemiya, T. (1973). "Regression Analysis when the Dependent Variable is Truncated Normal." Econometrica **41**(6): 997-1016.
- Attanayake, N., J. Fox-Rusgby, et al. (2000). "Household costs of 'malaria' morbidity: a study in Matale district, Sri Lanke." Tropical Medicine and International Health **5**(9): 595-606.
- Bardasi, E. and Q. Wodon (2006). Measuring Time Poverty and analyzing its determinants: Concepts and Applications in Guinea. Gender, Time Use and Poverty in Sub-Saharan Africa. C. M. Blackden and Q. Wodon, World Bank working paper No 73: 75-95.
- Becker, G. S. (1965). "A theory of the allocation of time." Journal of Political Economy **75**(299): 493-517.
- Beegle, K. (2003). "Labour Effects of Adult Mortality in Tanzanian Households." World Bank Policy Research Working Paper **3062**.
- Bittman, M., P. England, et al. (2003). "When does gender trump money? Bargaining and time in household work." American Journal of Sociology **109**(1): 186-214.
- Bollinger, L., J. Stover, et al. (1999). "The Economic Impact of AIDS in Ethiopia." The Policy Project.
- Bremen, J. (2001). "The ears of the hippopotamus: manifestations, determinants, and estimates of the malaria burden." American Journal of Tropical Medicine and Hygiene **64**(1,2 supplements): 1-11.
- Brines, J. (1994). "Economic dependency, gender, and the division of labor at home." American Journal of Sociology **100**(3): 652-688.
- Cagatay, N. (1998). "Gender and Poverty." United Nations Development Programme, Social Development and Poverty Elimination Division, Working Paper 5.
- Castro, E. B. and K. M. Mokate (1988). Malaria and Its Socio-Economic Meanings: The Study of Cunlay in Columbia. Economics, Health and Tropical Disease. N. H. Alandro and P. Rossenfield, Manila Univ. of Phillipines.
- Catherine, G., P. Coleman, et al. (2000). "Economic Analysis of Malaria Control in Sub Saharan Africa." Global Forum for Health Research, Switzerland.
- Conly, G. N. (1975). "The Impact of Malaria on Economic Development: A Case Study." Scientific Publication, Washington D.C. Pan American Health Organisation **297**.

- Dercon, S. and Krishnan (1997). "In Sickness and In Health: Risk Sharing Within Households in Rural Ethiopia " Working Paper Series WPS/97.
- Gershuny, J. (2000). *Changing Times Work and Leisure in Post-industrial Society*, Oxford University Press, Oxford.
- Gurley-Calvez, T., K. Harper, et al. (2009). "Self-Employed Women and Time Use." A report submitted to ABS under contract no SBAHQ-07-M-0409.
- Hansen, K., G. Woelk, et al. (1998). "The cost of home-based care for HIV/AIDS patients in Zimbabwe." AIDS CARE **10**(6).
- Himmelweit, S. (1995). "The discovery of "unpaid work"." Feminist Economics **1**(2): 1-20.
- Ilahi, N. (2000). "The Intra-household Allocation of Time and Tasks: What have we learnt from the empirical Literature." Policy Research Report on Gender and Development, Working Paper Series **13**.
- Juster, T. (1999). The Future of Research on Time-use. Time-use Research, Data and Policy. J. Merz and M. Ehling, Totschungsinstitut Freie Berufe Univers Titat Luneurg and Nomos Verlagsgesellschaft, Baden-Baden.
- Juster, T. and F. Stafford (1991). "The Allocation of Time: Empirical Findings, Behavioral Models and Problems of Measurement." Journal of Economic Literature **29**(2).
- Klevmarcken, N. A. (1998). Microeconomic Analysis of Time-use Data: Did we reach the Promised Land?'. Time-use Research, Data and Policy. J. Merz and M. Ehling, Totschungsinstitut Freie Berufe Univers Titat Luneurg and Nomos Verlagsgesellschaft, Baden-Baden.
- McGinnity, F. and H. Russell (2008). "Gender Inequalities in Time Use: The Distribution of Caring, Housework and Employment Among Women and Men in Ireland." Retrieved 16 July, 2011, from www.esri.ie/publications/latest_publications/view/index.xml?id=2576.
- Mills, A. (1998). "Operational Research on the Economics of Insecticide-Treated Mosquito Nets: Lesson of Experience." Annal of tropical medicine and Parasitology **92**(4).
- Nur, E. T. and H. Mahnam (1986). The Effects of Health on Agricultural Labour Supply: A Theoretical and empirical investigation. Economics, Health and Tropical Disease. N. H. Alandro and P. Rossenfield, Manila Univ. of Phillipines.
- Onwujekwe, O., K. Hanson, et al. (2010). "Are malaria treatment expenditures castastrophic to different socio-economic and geographic groups and how do they cope with payment? A study in southeast Nigeria." A European Journal of Tropical Medicine and International Health **15**(1): 18-25.
- Robinson, J. and J. Godbey (1997). *Time for life-The Surprising Ways Americans Use their Time*, Pennsylvania State University Press, University Park.
- Sachs, J. and P. Malaney (2002). "The economic and social burden of malaria." NATURE **415**: 680-685.
- Schultz, T. and A. Tansel (1993). "Measurement of Return to Adult Health: Morbidity Effects on wage rate in Cote d'ivoire and Ghana." LSMS working Paper **95** (April).
- Tobin, J. (1958). "Estimation of Relationships for Limited Dependent Variables." Econometrica **26**(1): 24-36.
- Xu, K., D. Evans, et al. (2003). "Household catastrophic health expenditure: a multicountry analysis." The Lancet **362**.
- Yamano, T. and T. S. Jayne (2004). "Measuring the Impacts of Working-Age Adult Mortality on Small Scale Farm Households in Kenya." World Development **32**(1): 91-119.

Appendix 1: Description of variables

Variables	Description of variables	Type of variable
Income	Gross monthly household income	Continuous variable
Education	Education	Binary variable: 1: Educated 0: not educated (base category)
Sex	Sex	Binary variable: 1: male 0: female (base category)
Height	Height in meters	Continuous variables
Marriage	Marital status	Binary variable: 1: married 0: single (base category)
Length in job	No of years involved in a primary occupation	Continuous variable
Relative	The presence of any relative in the household	Binary variable: 1: yes 0: No (base category)
Malaria	The presence of confirmed case of malaria in the household	Binary variable: 1: yes 0: No (base category)