ECONOMIC COST OF MALARIA ON RURAL HOUSEHOLDS AND WILLINGNESS TO PAY FOR BED NETS:

The Case of Selected Rural Kebeles in Ilu Woreda of Western Shoa Zone

By

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TABLE OF CONTENTS

List of tables

Abstract

Malaria is a global health problem that has a negative influence on the supply and productivity of labour. Apart from its mortality and morbidity consequences, its burden on the society measured in economic terms is significant. One of the objectives of this study was to identify the economic cost of Malaria on rural households using the cost of illness approach. Primary data was collected through structured questionnaire from randomly selected kebeles in Ilu Woreda of West Shoa Zone. It was learned from the survey result that treatment cost was by far higher than prevention cost. This indicated the need for health education and community mobilization so as to enhance malaria prevention and control activities. In an endeavor to control malaria, emphasis should be given to protect individuals against infective mosquito bites. Since the use of insecticide impregnated bednet is one of these protective measures available to households, the second objective of the survey was directed towards estimating households willingness to pay for it. The mean willingness to pay was found to be Birr 44.26. The survey result further indicated that the willingness to pay decision was influenced by households characteristics and burden of malaria on households. Income has been found to be the most important factor in determining the willingness to pay decision. The implication is that the extremely low income of the society limits the use of insecticide impregnated bednet, which calls for a support scheme in order to reduce the burden of malaria on rural households.

Chapter One

Introduction

1.1 Background

Malaria is a global problem that kills over one million people worldwide and results in 300 million cases of illness each year (World Bank, 1999).

According to the 1992 WHO publication on Malaria situation, areas in which malaria never existed or disappeared without specific anti malarial interventions accounts for 27 percent of the world population. Areas in which endemic malaria disappeared after a specific campaign to control, areas in which it was eliminated but was reinstated and areas in which endemic malaria still persists account for 32, 32 and 9 percent respectively.

Malaria is a significant public health concern for many developing countries of Asia, Latin America, the Pacific and Africa. Out of the 5.01 million cases of malaria reported to WHO in 1990 (excluding Africa) 80 percent were concentrated in eleven countries. They are, in decreasing order of total number of reported cases, India, Brazil, Afghanistan, Sri Lanka, Thailand, Indonesia, Vietnam, Cambodia, China, Solomon Islands, and Papua New Guinea (Jamison et al., 1998)

In sub Saharan Africa, where mosquito vectors are abundant and where malaria transmission is very intense, malaria is one of the most important killers, being responsible for nearly one

million deaths and 300-500 million clinical cases every year. Of the global deaths due to malaria about 90 percent now occur in Africa (Martin et al., 1998).

Malaria is a common parasitic disease in Ethiopia in almost all areas below 2500 meters altitude, which is about 75% of the area of the country. According to MOH report (2000) it is the second largest killer disease, affects about 4 to 5 million people annually and of the total 350 DLY's/1000 population lost annually, it accounts for 10.5 percent. The same report depicted that an average of 400,000 to 600,000 cases with positive blood film for malaria is treated annually. It is estimated that the actual number of cases seen at facilities with no microscopic diagnostic service and by community health workers to be 3 to 4 times the number of cases indicated above. In addition, quite a significant number of people who actually suffer from the disease may not visit any formal health facilities due to lack of access to health services, socio-cultural and economic factors. Generally the MOH estimated that about two third of the country's population are at risk of malaria infection (MOH, 1999).

In Ethiopia the transmission of malaria is unstable and many areas are either epidemic prone or moderately endemic with marked seasonality. The main transmission season is closely linked with the rainy seasons, occurring between September to December and April to May.

Since 1958, major epidemics of malaria occurred at intervals of approximately 5 to 8 years (MOH, 1999). However recent trend shows a frequent epidemics in different parts of the country. The first malaria epidemics of the 1958 that was responsible for an estimated 3 million cases and 150,000 deaths in span of 6 months (MOH, 2000) has been expanding since then. This was why the government of Ethiopia committed itself to malaria eradication and control activities starting from the year 1959 up to now. But the problem is not yet resolved

due to many factors including increasing insecticide resistance of malaria vectors, financial constraints, institutional problem and the unstable and seasonal nature of its transmission. Moreover important vector control supplies such as drugs, laboratory and medical supplies and bed nets are not available as required.

The decentralization of the national malaria control programme on the basis of the health sector reform of 1993 has exerted its own impact on the malaria control effort. The drastic reduction of manpower in the Federal malaria control unit and lack of necessary capacity at the level of regions coupled with ecological changes resulted in large-scale malaria epidemic in the country in 1998.

Currently the government is working under the Global Roll Back malaria initiative, which aims at reducing the burden of malaria by 50 percent with in ten years in collaboration with the World Bank, WHO, UNICEF, UNDP and USAID. For the implementation of this objective National Malaria control support team was established and their activities are to be integrated to the national and regional health sector development programs. All these efforts depict that there is a growing awareness to the burden of malaria, which in fact is one of the top priority development problems.

In light of this background the present study tries to examine the economic cost of malaria and willingness to pay for insecticide impregnated bed nets, a case study in selected rural kebeles of Ilu wereda in Western Shoa zone of Oromia region. The second chapter is devoted to literature review, which mainly discusses conceptual framework, and empirical studies on economic cost of malaria and on insecticide impregnated bed nets. The third chapter is on

methodology followed by the fourth chapter, which discusses the findings of the study. Finally a concluding chapter provides some policy implications.

1.2 Statement of the problem

Malaria is one of the country's foremost health problems top ranking among communicable diseases. It is one of the most important causes of mortality and morbidity.

According to the unpublished report of the World Bank mission (1999) that made an assessment of malaria situation in Ethiopia, malaria stands as the number one of the top 15 diseases indicated by the outpatient morbidity statistics of different health facilities providing services to the entire population. From the 10 leading causes for hospitalisation malaria is the 2nd disease and it is the leading cause of outpatient visits (MOH, 2000)

Apart from its mortality and morbidity consequences, malaria exerts an immense negative impact measured in economic terms.

Malaria affects productivity by producing recurrent infections with attacks of fever causing loss of working time and efficiency. Especially in the agricultural sector it leads to late planting and harvesting. Other members of the family spend their time taking care of the malaria affected family member, which exacerbate loss in productivity and leads to reduced household income. The spread of drug resistant malaria is raising the costs of treatment.

Generally the total costs borne by families and individuals include payments for treatment, time and transport costs in seeking treatment, time costs for family members who look after

the patient, and time and money costs of preventive action taken by households and the community (Jamison et al, 1998)

Beyond these short run costs, malaria impedes economic growth and long-term development in many ways. Malaria may impede the flows of trade, foreign investment, and commerce, there by affecting a country's entire population. Malaria tends to hinder a child's physical and cognitive development, and may reduce child's attendance and performance at school. It exposes individuals to chronic malnutrition and to increased vulnerability to other diseases.(Rwegasira, 2000)

In Ethiopia, as it is the case in many African countries, apart from recognizing the disease to be one of the top killers and its expansion from time to time, a systematic study made to capture its economic cost is scanty. Abdulhamid (1995) indicated that the existing studies have many shortcomings that include high degree of generalization, use of inappropriate disease diagnosis criteria, emphasis on wageworkers and macro orientation.

Moreover most of the studies made in the country so far concentrated only on the magnitude of the disease and therapeutic efficacy of anti-malarial drugs. This study, therefore, is proposed to identify the economic cost of malaria on the rural households, thereby contributing to the limited studies made on the area so far.

In addition to estimating the economic cost of malaria on rural households, this study also aims at eliciting the willingness to pay for insecticide impregnated bed nets for which so far there is only one study made in Tigray within the country.

1.3 Objectives of the study

The objectives of the study are:

1. To identify the economic cost of malaria on rural households,
2. To estimate the willingness to pay for insecticide-impregnated bed nets,
3. To identify the determinants of willingness of households to pay for insecticide impregnated bed nets.

1.4 Significance of the study

Human capital is one of the determining factors of development in any country. Health of a population in turn is a form of human capital. The health status of a population is a limiting factor for economic development since it exerts an influence on the supply and productivity of labour. Malaria which is one of the major killer diseases in Ethiopia, not only limited to affecting society's health and well being but also obstructs overall economic development Unless the economic impact of malaria is well understood proper and conscious control interventions may not be up to expectations. In Ethiopia where agriculture is the main stay of the economy, the rural population's health, productivity and efficiency are very critical. Knowledge of economic cost of malaria on the rural households could enhance the possible cost effective control interventions, of which insecticide-impregnated bed nets is one. This study, which is aimed at assessing the economic cost of malaria and estimating willingness to pay for bed net in a particular selected area could give some highlights that would serve as a basis for future country wide research and policy design in countering the prevalence of the disease.

Chapter Two

Literature review

This Chapter reviews some relevant theoretical and empirical works to the present study. It has two major sub-sections, the first of which deals with conceptual framework. Under this subsection, the epidemiology of malaria and theoretical works on cost of illness methodology are reviewed.

The second sub-section reviews empirical findings of some previous studies conducted on estimating cost of malaria and the willingness to pay for insecticide impregnated bed nets.

2.1 Conceptual Framework

2.1.1 Epidemiology of Malaria

a) Burden of Malaria

Malaria is one of the serious health problems for many countries in the world. It is one of the leading causes of morbidity and mortality. Malaria threatens the lives of 40% of the world's population (UNICEF, 2000).

According to the WHO (1992), areas in which malaria never existed or disappeared without specific anti-malarial interventions accounts for only 27 percent of the world population. The same source depicted that area in which endemic malaria disappeared after specific campaign to control accounted for 32 percent. The rest 41 percent of the areas are those in which malaria was eliminated but reinstated and, an area in which endemic malaria still persists.

Malaria is a significant public health concern for many developing countries of Asia, Latin America, the Pacific and Africa. Out of the 5.01 million cases of malaria reported to WHO in 1990 (excluding Africa) 80 percent were concentrated in eleven countries. They are, in decreasing order of total number of reported cases, India, Brazil, Afghanistan, SriLanka, Thailand, Indonesia, Vietnam, Cambodia, China, Solomon Islands and papua New Guinea (Jamison etal.., 1998). In Sub-Saharan Africa, where the mosquito vectors are abundant and where malaria transmission is very intense, 90 percent of malaria cases in the world are found.

Morbidity and mortality are not the only burden of malaria to human population. There are various ways in which malaria affect the social well being of the society. It has an enormous impact on development. It affects productivity by producing recurrent infections with attacks of fever causing loss of working time and efficiency. Other members of the family spend their time taking care of the malaria affected family member, which exacerbate loss in productivity and leads to reduced house hold income. Malaria prevention actions and treatment measures cost time and money to the households.

Malaria has a negative impact on cognitive development of children apart from missed classes due to the illness. It impedes the flow of tourists, foreign investors and trade to the malaria endemic areas. Local investors and the educated sections of the population may not be willing to move to malaria prone parts of their respective countries. Malaria is a major cause of poverty and chronic malnutrition, which eventually increases vulnerability to other diseases.

The poor are affected most, as they have less access to health care services, information, protection and have fewer opportunities to avoid living and working with in malaria affected

areas (World Bank, 1999). Generally, the economic loss from malaria was estimated at US $ 2 billion (UNICEF, 2000) in Africa alone in 1997.

b) Definition and transmission of malaria

Malaria is a disease caused by the presence in the red blood corpuscles, or in the liver cells, of a unicellular parasite – a protozoon – belonging to the genus of plasmodium (Pampana, 1969).

There are four main species of human malaria parasites: *plasmodium falciparum, plasmodium vivax, plasmodium malariae* and *plasmodium ovale*. Of these four species plasmodium falciparum causes the severest type of malaria. These species together with plasmodium Vivax account for more than 95 percent of the cases of malaria in the world. The rest two cause less severe symptoms.

Malaria is transmitted through the bite of female Anopheles mosquito, which sucks blood from an infected person and eventually transmits to other human beings. Once the sporozoite is inoculated into man they remain undetectable until it can be found in the liver cells. In the liver cells the parasites grow, their nucleus and their cytoplasm divide, and after few days hundreds of daughter forms escape from the remains of the mother cell and the red blood corpuscles and they invade new red corpuscles, repeating the cycle until they are interrupted by drugs or by developing immunity.

The malaria parasite can multiply 10 times every 2 days, destroying the red blood cells and infecting new cells through out the body (UNICEF, 2000)

The incubation period, which is the interval between mosquito bite and the appearance of fever varies from a minimum of 6 to a maximum of 25 days for plasmodium falciparum and from 8 to 27 days for plasmodium vivax infections (Pampana, 1969). Malaria is mostly a disease of hot climate. Anopheles mosquito, which transmits the malaria parasite, thrives in warm and humid climate where a pool of water provides perfect breeding grounds. Hence, the transmission intensity of malaria varies depending on altitude, state of the rainfall, temperature, humidity and other human factors. Based on these factors it can be endemic or epidemic.

Endemic malaria refers to a constant measurable incidence both of cases and of natural transmission over a succession of years. Epidemic on the other hand is a term used to indicate a periodic or occasional sharp increase in the morbidity or mortality due to malaria or acute exacerbation of a disease out of proportion to the normal to which the community is subject.

Endemic malaria commonly shows different kinds of variation in time:

a) **Season:** usually determined by rainfall in tropical areas;
b) **Periodic:** - cycles of several years usually determined by rainfall (and also temperature) and amplified by loss of immunity in periods of low transmission;
c) **Secular:** long-term trends. Epidemics are "Unexpected" increases superimposed on the above more or less expected kinds of variation. In non-endemic areas, any transmission (even few confirmed cases) constitutes an epidemic (MOH, 1999).

Highland, forest and desert fringe areas are particularly likely to experience epidemics, especially when affected by ecological disruption. Epidemics also occur in areas of social, economic and political instability where basic services have disintegrated or do not exist

(WHO, 1993). Increase in density of vectors, frequency of man biting by the vector, humidity (which increase longevity of vectors), temperature and rainfall cause epidemics.

c) *Malaria Diagnosis*

The chief symptom of malaria is fever, periodic bouts of which tend to alternate with days of less or no fever. The classical paroxysm of fever lasts eight to twelve hours, typically in three stages: cold shivering rigor, burning dry skin and drenching sweat that lowers the temperature (Jamison etal, 1998). Children and adults infected with malaria commonly suffer from severe headache, cough, nausea, vomiting, abdominal pain, poor appetite, thirst and diarrhea in addition to high fever.

Malaria may become complicated if not treated in time. The symptoms for complicated malaria include: Very high body temperature, drowsiness, convulsions, shock and coma indicating heavy parasitaemia, severe anemia, hemoglobin urea (black water fever), jaundice, renal failure and respiratory distress. Unless timely treated plasmodium falciparum can lead to death.

The risk of severe malaria is almost exclusively limited to those who are not immune. In highly endemic areas this risk affects children older than three to six months, who have lost the immunity transferred from their mother, up to the age about five years, when surviving children have developed their own immunity (Jamison et al, 1998). Pregnant women are at risk of malaria infection. Hence, plasmodium falciparum could lead to death, abortion, premature delivery or low birth weight. Pregnant women are more easily infected because the placenta is a preferential site for parasite development.

Malaria is an important cause of low birth weight and high neonatal mortality in first and second born children in endemic areas (Jamison et al, 1998).

In addition to children and pregnant women, immigrants, settlers and generally people who move into malaria endemic regions due to various reasons are at high risk for malaria infection. This is because of lack of the required protective immunity, which adults living in malaria endemic areas usually develop.

d) Treatment of malaria

Treatment of malaria aims at preventing the disease from developing into a severe condition, which could be fatal. Treatment could not solve the incidence and prevalence of malaria, since repeated bites by vector is still possible.

Treatment of malaria should be based on the severity of the cases, parasite species, and pattern of drug resistance. For example, management of malaria was developed at three levels by WHO African Region for African countries (WHO, 1992). According to this guideline at level 1, where the community health worker without laboratory facility operates, children below 5 years of age and pregnant women with fever from whatever cause should be treated for malaria in endemic areas. Older children and adults with similar conditions should be screened for causes of fever before treating for malaria.

At level II, where health institution with trained medical staff and at times with microscopic diagnosis exist a more detailed clinical observation and parasitological examination of blood will be carried.

At level III, trained physician, facilities for full clinical assessment and sufficient clinical expertise, materials and drugs are available for the appropriate treatment of malaria conditions. Based on this guideline the uncomplicated or non-severe malaria can be handled at level one, with drugs such as chloroquine (where chloroquine resistance is low) and other second line antimalarial drugs, where chloroquine resistance is high and no longer effective.

Complicated or severe malaria would be referred to level II and level III for a better treatment.

e) Malaria prevention and control

In general there is no single appropriate intervention for all cases of malaria. Interventions are case and place specific. But the most general intervention for the prevention of malaria infection should aim at protecting individuals against infective mosquito bites and transmission control so as to reduce the risk of malaria to entire population.

Personal protection can be obtained by a variety of means: protective clothing, repellents, screening of houses, insecticide impregnated bed net and the like. The measure available for control of transmission include the use of chemical insecticides and biological agents and environmental management (WHO, 1993) These malaria transmission control measures include: residual insecticide house and aerial spraying, larviciding, drying of water containers and pools, draining of swaps, environmental sanitation and chemo prophylaxis.

The threat of malaria to human lives and its serious impact on the economy has always necessitated global malaria prevention and control effort. Malaria eradication programme, which later changed to malaria control programme and the Roll Back malaria initiative are among the major global efforts, which aimed at reducing morbidity and mortality caused by malaria infection.

The idea of eradicating malaria, postulated as early as 1916, gained currency after world war II, extended to the world by the World Health assembly in 1955 and a strategy for eradicating was formulated in 1956.

According to the definition given by the World Health Organization Expert committee on malaria: " malaria eradication means the ending of transmission of malaria and the elimination of the reservoir of infective cases, in a campaign limited in time and carried to such a degree of perfection that, when it comes to an end, there is no resumption of transmission" (WHO, 1957).

Based on such principle the eradication campaigns were declared by most countries of the world and achieved promising results in some. In tropical Africa and some parts of south East Asia the programme could not be fully materialized due to high endemicity, primitive state of development, and lack of human and economic resources, including health infrastructure. Hence, annihilation of the malaria parasites from population and vector eradication became extremely difficult and costly. This led to the re-examining of the global strategy of eradication and to the adoption of a strategy of malaria control.

Malaria control has been defined as implying the eradication of the disease to a prevalence where it is no longer a major public health problem and carries the implication that the programme will never end, control having to be maintained by continuous active work (Pampana, 1969).

The thirty first World Health Assembly adopted a strategy of malaria control with the objective of reducing mortality and the negative social and economic effects of the disease, preventing or controlling epidemics, and protecting malaria free areas, with ultimate objective of eradicating the disease whenever feasible (WHO, 1978).

To intensify malaria control efforts, ministerial conference on malaria was held in October 1992 in Amsterdam and adopted a global malaria control strategy with the following four basic technical elements:

1. to provide early diagnosis and prompt treatment
2. to plan and implement selective and sustainable preventive measures, including vector control.
3. to detect early, contain or prevent epidemics; and
4. to strengthen local capacities in basic and applied research to permit and promote the regular assessment of a country's malaria situation, in particular the ecological, social and economic determinants of the disease(WHO, 1993).

Global Initiative to Roll Back malaria, which was launched by World Bank together with partner agencies, WHO, UNICEF and UNDP and which comprises malaria affected countries, UN-agencies, development banks, bilateral donors, OECD countries, the research and control

communities. industry, the private sector and NGOs (WHO, 1999) is a recent global effort against malaria.

Roll Back Malaria Initiative aims at reducing deaths from malaria by 50 percent by the year 2010. It has got six strategies to achieve the stated goal, which include:-

1) early detection
2) rapid treatment
3) multiple means for prevention
4) well coordinated action
5) a dynamic global movement, and
6) focused research (WHO, 1993).

It is evident from this global strategy that the focus is on access to effective prevention, accurate diagnosis and appropriate treatment.

In addition to the stated global strategy, the Roll Back malaria Initiative has a role in mobilizing resources at country level in:

- Persuading malaria affected countries to appropriately prioritize malaria in their own planning, budgeting and use of resources.
- Providing information on effective interventions and their costs, and on international experience and lessons learned,
- Ensuring that external financiers respond to country requests with sufficient resources,

- Enabling countries to identify, mobilize and efficiently and effectively employ existing resources, and
- Fostering communication and information exchange that will enable all countries to benefit from each other's experience, research, lessons learned, and to collaborate in areas where effectiveness and efficiency gains are possible (eg. Joint research, shared training institutions or labs, and cross border collaboration) (World Bank, 1999).

2.1.2 Cost of illness

The share of labour in material income is about two-thirds in most countries. Labour thus constitutes the most important factor of production and changes in its productivity can significantly affect total income. In turn, the productivity of labour is a function of two types of factors. The skills of individuals, derived from their innate physical and mental capabilities, and education, training and other investments in their human capital. Improvements in health can affect labour productivity through both of these channels (Jack, 1999).

The most obvious effects of ill health are immediate subjective suffering of the person who becomes ill or injured or dies and the sympathetic grief of his or her family and friends. The full consequence of adult ill health, however, go beyond this direct suffering and include effects that harm society indirectly over longer periods through production, earnings, investment, consumption and reallocation of labour (Feachman, 1992).

Health conditions influence productivity of labour through physical and mental capabilities. Healthier people tend to be fitter, stronger and more energetic than the diseased. The greater the amount of time spent on illness the less will be the contribution to output.

Poor health in an individual will have an impact on and may pose threats to others. The family of a breadwinner in poor health may suffer the consequences of reduced income, a poorer diet and less good housing. Family members may have to devote time and resources to caring for the sick person. The employer of a workforce in poor health may suffer reduced productivity and hence incur higher average costs. It poses extra costs to the economy and distress to healthier members of the society (Crewer and David, 1998).

The standard approach used to evaluate the Micro-economic burden of disease is the cost of illness (COI) approach. It is among the first economic studies used in health economics to evaluate the cost of particular illness.

Traditionally cost of illness Studies examined:

a) **Direct Costs**:- borne by the health care system, community and family addressing the problem,

b) Indirect **Costs**:- mainly productivity losses caused by the disease, borne by the individual, family, society, or by the employer, and

c) Intangible **Costs**:- usually the costs of pain, grief, suffering and loss of leisure time. (Jefferson etal, 1996).

Two alternative strategies are used to collect cost data: incidence and prevalence strategies. The former estimates costs of case from their onset to their disappearance for whatever reason, usually cure or death. The latter estimates costs of all cases in a short period irrespective of the stage they are at.

The incidence strategy is more precise but has greater information needs, is costly, and is used mainly for those diseases, which have short duration and fluctuation of incidence. The prevalence strategy relies on more assumptions, but is the only practicable way to cost chronic diseases.

In general cost of illness studies are concerned with defining the value of resources directly used up by the illness.

Cost of illness calculation procedures have bifurcated along two alternate approaches that are often referred to as human capital method and the willingness to pay approach (World Bank, 2000)

a) Human capital method (HCM)

The Human capital method tries to capture the economic cost of a disease through the following standard formula.

COI = Private medical cost + Non-private medical costs + forgone income + pain and suffering. (World Bank, 2000)

Based on this formula the total cost of a disease is the summation of both direct and indirect costs. Direct cost includes costs of preventing and treating the disease, which is a payment

from all sources i.e. personal and non-personal medical care costs. Personal costs include expenditures on prevention, diagnosis, treatment, travel cost and costs for accompanying members.

Non-personal medical care costs are public expenditures on health facilities, education, research, vaccination and vector control.

The indirect cost refers to the value of the healthy years of life lost due to a disease or more specifically the value of the production forgone due to the disease related morbidity and mortality. In the case of mortality, the value of life lost is equal to the discounted sum of the individuals' future lifetime earnings. It is calculated based on age projected incomes for different age groups, basic longevity data and specific mortality rate. In deducting the deceased's future consumption from his future earnings, net human capital can be estimated (Jefferson etal 1996).

The indirect cost of morbidity includes both the value of forgone workdays and the time cost of people caring for a diseased person.

In LDC'S estimation of direct and indirect costs may be cumbersome since unit costs of time and other non-monetary resources are difficult to value and valuing non-marketed production needs special data collection. Moreover measuring the pain and suffering is difficult in human capital methodology.

The other difficulty with human capital methodology is that it does not consider the value of lost leisure and household activities since they do not have market Price. Inaddition the true extent of lost productivity may not be captured as a result of coping mechanisms of

household members and the difficulty of measuring the debilitating productivity.

The methodology is also often subject to criticism since by implication it assumes th of the life of pensioners and others who are unable to work to be zero. It also ignores the pleasure of living as such.

b) The willingness to pay approach

In contrast to the human capital approach, the concept of willingness to pay is firmly rooted in the axiomatic of subjective valuation. The preferences of the persons affected and possibly their relatives are focus of interest (Zweifel, 1997)

Originally, the contingent valuation method was designed to elicit individual preferences through a survey by asking a sample of households what they would be willing to pay to support an environmental improvement or prevent an environmental deterioration. Alternatively households may be asked to state the minimum amount they would be willing to accept to forgo an improvement or compensate for deterioration. These Questions are usually asked in situations where payments are not made or received (Abelson, 1996).

The extent to which individuals care about the environment is likely to depend on a number of characteristics, such as income, level of education and age (Rogat, 1998). Freerman (1993), put the same idea in a very comprehensive way. He stated that many studies of direct expression of value include regression analyses of revealed values as a function of the

characteristics of the good being valued and characteristics of the respondent. For example, values should be an increasing function of income.

The contingent valuation method is based on classical welfare theory particularly on the Hicksian demand function where the techniques of compensating variation and equivalent variation are employed.

According to this welfare theory of valuation the objective of consumers is to maximize utility subject to budget constraint. Hence, the utility function for a given individual is:

$$\text{Max } U = U(x,q)$$

$$\text{Subject to: } \sum p_i x_i = M \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where X is a vector of private goods quantities ($X=x_1,\ldots, x_i,\ldots, x_n$), q is a vector of environmental goods, P is a vector of private goods prices ($P=p_1,\ldots\ldots, p_i,\ldots, p_n$) and M is money income.

The solution to this problem yields a set of ordinary demand functions (Marshallian demand function)

$$X_i = x_i(p,m,q) \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

The dual to the utility maximization problem can be stated as minimize expenditure ($\sum i$ pi xi) subject to the constraint that utility equal to or exceed some stated level, say U^o, i.e.

$$\text{Min} \sum P_i X_i$$

Subject to: $U(x,q) = U^0$ .....(3)

The solution to this expenditure function with respect to any price gives the Hicksian compensated demand function as follows.

$$\overline{X}_i = X_i (p,u,q) \text{ .....(4)}$$

By substituting Xi into equation (3) above we can obtain indirect utility function.

$$U = V (m,p,q) \text{ ..... (5)}$$

The marginal willingness to pay can be obtained by setting the total differential of the indirect utility function equal to zero and solving for the compensating change in income associated with change in q as follows:-

$$du = \frac{\partial v}{\partial m} . dm + \frac{\partial v}{\partial q} . dq = 0 \text{ .....(6)}$$

$$\frac{dm}{dq} = \frac{\partial v/\partial q}{\partial v/\partial m}$$

Where dp is zero by assumption

The derivative of expenditure function $e(p,q,u^o) = M$ with respect to q gives the Hicks compensated inverse demand function or marginal willingness to pay for changes in q. Let Wq be the marginal willingness to pay or marginal demand price for q. in

$$Wq = - \partial e (p,q,u^o)/ \partial q \text{ .....(7)}$$

Let Wrepresent the benefit to the individual of non-marginal increase in the supply of q. W is the integral of this function:

$$W = -\int_{q'}^{q''} eq\,(p,q,u)\,dq$$

$$= e\,(p,q^{I},u) - e\,(p,q'',u) \quad \ldots\ldots\ldots\ldots\ldots\ldots(8)$$

This is either a compensating surplus or equivalent surplus measure of welfare change depending on the level of utility at which (8) is evaluated.

It is also possible to measure welfare changes associated with change in prices if income does not change using the concept of compensation variation and equivalent variation.

Compensating Variation (CV), gives the maximum (minimum) amount of money that can be taken from (must be given to) a household while leaving it just as well off as it was before a fall (rise) in price.

Equivalent Variation (EV) gives the minimum (maximum) amount of money that must be given to (taken from) a household to make it as well off as it would have been after a fall (rise) in prices.

Therefore, CV and EV are derived as follows:-

$$CV = e(P_1,q,Uo) - e(Po,q,Uo) \quad \ldots\ldots(9)$$

$$EV = e(P_1,q,U_1) - e(Po,q,U1) \quad \ldots\ldots(10)$$

It is in such a way that compensating variation and equivalent variation are used as a measure of welfare in contingent valuation method.

By the same token contingent valuation method, which was initially designed to measure the value of environmental amenity, is now widely used in health areas. Households are assumed to choose a bundle of goods and services that maximizes their welfare as follows:

$$M_{ax}\ U = U(x,z)$$

Subject to: $\Sigma P_i x_i = M$

Where x is a vector of goods quantities ($x = x_1 - - - , x_i, - - - , x_n$), z is vector of health producing goods and services, p is a vector of private goods prices ($P = p_1, - - -, P_i, - - - , P_n$) and M is money income.

The solution to this maximization problem follow the same step that was previously shown for environmental goods, which finally leads to the derivation of compensating variation and equivalent variation.

Contingent valuation method basically uses survey questions to elicit from a sample of consumers their willingness to pay or willingness to accept for a change in the level of environmental goods or services, in a carefully structured hypothetical market. It is hypothetical because the stated preferences are not backed up by real economic commitments (Abelson, 1996).

Contingent valuation involves designing and administering of the CV survey, empirical analysis of responses, estimating and aggregating benefits i.e. WTP or WTA and evaluating the contingent valuation exercises.

The questionnaire designed for this purpose should include a detailed description of the good being valued and the hypothetical circumstance under which it is made available to the respondent, questions which could elicit the respondents' willingness to pay for the good and questions about respondents' characteristics.

Values are elicited in contingent valuation method through various techniques including open ended questions, payment card method, the bidding game technique and close ended or referendum method.

In general, there is no consensus as to which technique of eliciting is most appropriate or superior among researchers. Every technique has its own pros and cons.

In open ended questions, individuals are asked to state their maximum WTP or minimum WTA amount, with no value being suggested to them. The advantage of this method is that it gives maximum WTP or minimum WTA directly, without requiring any starting values, which could be one source of bias. The problem associated with this technique is that many people find it difficult to answer such question if they have no previous experience and can lead to a large non-response rate.

In the case of payment card respondents are provided with a range of values to select from, which simplifies the issue for respondents. This technique requires literate respondents and range of values provided can influence respondent's decisions.

In the case of bidding game technique individuals are asked to respond to increasing figures until they reach the maximum willingness to pay amount or reducing figures if they are unwilling to pay the initially suggested figure. Though the technique is advantageous in giving a better information on maximum WTP, it may be boring, and may lead to compliance and starting point bias.

In closed - ended technique or referendum method individuals are usually presented with single payment, which they are asked to accept or reject. Hence, it is easier to answer, but may lead to yes saying tendency of respondents and requires large samples for the estimation of benefits.

In open ended, payment card and bidding game techniques before an average WTP is calculated, extreme low and high responses need to be eliminated.

Estimation of an average value in the referendum model is more complex because respondents have not given their maximum WTP figures. In this case logit equation relating the probability of a yes answer to each proposed amount is estimated. The area under the logit curve gives the total WTP amount (Abelson, 1996).

The other problems that arise in contingent valuation studies are the biases caused by survey design, respondents behavior and the hypothetical nature of the survey.

Strategic bias occurs when respondents lie about their WTP either to reduce their liability to pay in case of public good or to over state when proposed payments are notional so as to deliberately influence the provision of environmental amenity or health producing goods and services.

Hypothetical bias on the other hand occurs when respondents are asked to value unfamiliar and non-marketed goods.

Information biases arise when the information provided by the interviewer is not clear to respondents, while compliance bias arises when respondents some how give a WTP amount that differ with their true WTP in an attempt to please the interviewer.

Although there are the stated biases, contingent valuation method is the only one that can measure non-use values. The method is more comprehensive, easier to implement and various such studies have shown consistency with market based valuation studies.

The contingent valuation method, especially the WTP approach, which was originally developed to estimate the value of environmental change, is now widely used in the area of health.

The true cost of a given disease on the welfare of the household can be determined by the value that they would be willing to pay to prevent the disease, it would presumably capture the burden to the household of treatment costs and the lost productivity, as well as the value

of the leisure time given up and the cost of pain and suffering associated wit'
other intangible costs which are difficult to price (World Bank, 2000).

According to Jefferson et al (1996) WTP approach relies on questioning an individuals willingness to pay to diminish the probability of health state (usually adverse) coming into being. WTP has been used to value preventive technologies such as devices to lower the risk of injuries in traffic accidents, treatment and services such as community scheme to visit elderly residents or a reduction in pain following surgery and health states such as people's WTP to be rid of symptoms such as nausea, coughing, and so on.

WTP approach is superior to other methods in capturing value of leisure, cost of pain and suffering and lost household activity, which are not usually priced by the market.

2.2 Empirical Literature Review.

Malaria is a classic example of a debilitating disease that impairs productivity. As the most prevalent disease in the poorest rural areas, malaria produces recurrent infections with attacks of fever in the warm and rainy seasons, when most workers are needed to collect crops. Often, affected people also suffer from malnutrition and other infections and lack of medical care. In areas subject to epidemics, these also tend to strike at times of peak demand for agricultural work (Jamison et al, 1998).

Though the impact of malaria on economic growth and development remained immense, studies made on the area are few and did not concentrate on rural households. Even those

studies, which exist so far, are heterogeneous in their purpose, design and result, as indicated by Abdulhamid (1995). With in this limit it is tried to present review of some of the studies conducted on the economic impact of malaria.

During the period 1965 - 1990, highly malarious countries suffered a growth penalty of more than one percentage point per year (Compared with countries with out malaria), even after taking into account the effects of economic policy and other factors that also influence economic growth. The annual loss of growth from malaria is estimated to range as high as 1.3 percentage points per year. If this loss is compounded for fifteen years, the GNP level in the fifteenth year is reduced by nearly a fifth, and the toll continues to mount with time (Rwegasira, 2000).

According to African Development Report (1998) an estimated direct and indirect costs of malaria in Africa was US $ 1.8 billion by 1995.

Shepard et al as cited by(World Bank 2000) conducted a household survey in Malawi focusing on costs of malaria for low income households, that estimated average annual expenditure on malaria treatment to be $ 11.07, representing 9.6% of household income. Further more the study depicted malaria morbidity to account for a loss of 2 - 3 days of work and days of lower productivity to approximate $ 2.70 per household.

In Ethiopia, the study made on the effect of malaria on peasant production (Case study on two villages) by Abdulhamid (1995) found that the occurrence of malaria has affected the total output of teff.

In Gahana, Health assessment team found recurring disability from clinical attacks of malaria averaging 7 days of illness per year (Nimo et al, 1981). Based on human capital method Khan (1966) has made a study on economic cost of malaria in Pakistan. His finding showed that the annual economic cost of malaria was 81 million Rupees. Generally the burden of malaria demands appropriate control measures. According to Rewagasira (2000) no single biological, economic or political reason can be adduced for the observed patterns and trends in malaria transmission. No single intervention, therefore, is appropriate in all contexts. Interventions should be adapted to specific local ecological, epidemiological, economic and social conditions.

Timely care seeking, combined with a health system capable of diagnosing and treating malaria case, could significantly reduce the burden of malaria, and is essential to sustaining a reduction (World Bank, 1999).

There are various malaria control mechanisms including, spraying of residual insecticides, the use of insecticide - impregnated bed net, space or aerial spraying, larvaciding and source reduction.

Insecticide - impregnated nets have been proved by a range of trials in different countries to offer one of the best malaria control measures available. It has contributed to substantial reduction in malaria in many parts of China. In Africa the number of clinical attacks of malaria in children protected by treated bed nets was reduced by 30% to 60%. In Gambia overall child mortality was reduced by more than 60 percent. In subsequent trials else where in Africa mortality was reduced by between 15 percent and 33 percent (Target, 1998).

According to Cheristain Lengeler et al,(1996). Insecticide impregnated net use substantially affects the frequency and severity of clinical episodes of malaria. Their view was supported with some study results shown in the following table to depict the impact of insecticide – treated mosquito nets on malaria morbidity in African children based on selected trials.

Table 1. Impact of insecticide – Impregnated bed net on African Children

Country	Morbidity reduction (%)	Year
Gambia	63	1988
Kenya	40	1993
Guinea Bissau	29	1994
Seirra Leone	49	1995
Tanzania	55	1995

Although insecticide - treated mosquito nets provide a cost effective means of ameliorating the effects of malaria, this measure will be expensive if large human populations must be protected (Rwegasira, 2000).

There are various sources that indicate the problem of availability and affordability of insecticide - impregnated bed nets. In countries where they are produced, where private markets for nets prevail and where government subsidy exists, they are widely used.

For example, a recent unpublished study of London School of Hygiene and Tropical Medicine (2000) revealed that in Tanzania, Kenya and Zimbabwe where active net markets and large scale commercial production exists, there is high level of net ownership. It was estimated in

1993 that 62% of households in Dare Salaam owned a mosquito net and around 35% of households were found to own net in Burkina Faso. In the same study it is indicated that in China and Vietnam where private markets exist the coverage is high.

In Ethiopia insecticide - treated mosquito nets have been introduced on a trail basis in several areas, notably in the Tigray region, as part of community based malaria control with some success. Currently mosquito nets are taxed a combined rate of 62% (World Bank et al, 1999).

In this situation where exposure to the use of bed nets is limited and where it is highly taxed, the willingness and the ability to pay for it by most agricultural households need thorough assessment.

In 1997, a study that examined bed net afordability and community willingness to buy bed nets which was conducted in Tigray, where there is highest malaria prevalence on a sample of 100 households in a resettlement community estimated the mean amount a family could spend for one bed net to be $ 1.80 (13 Birr). Out of the total respondents 22 percent stated they would try to purchase nets if they were at a time when cash is available, while 17% stated they were too poor to buy them. 61 percent responded they would buy if provided by the government at a balanced cost (WHO, 1999).

Chapter Three

Description of the study area and methodology:-

3.1 Description of the study area

3.1.1 General

Oromia is among the regions in which malaria is one of the top ranking health problems. Out of the 180 Weredas in the region 158 (88%) are at the risk of malaria transmission. All the 12 zones of the region are not free from the risk of malaria infection. About 60% of the people and 74 % the total area of the region is under a threat of malaria infection. According to the 1987 E.C. regional health bureau report malaria is the first cause of morbidity and mortality. Malaria accounted for 6% of all diagnosis in hospitals and health centers and 12% all cause of hospital deaths. It is also the first cause of hospitalization for children under 14 years of age in the region.

Western Shoa is one of the zones under Oromia region where malaria is highly endemic. It is because of this high endemicity that two malaria sector offices exist in the zone on top of the malaria control team under health department of the zone. The main duty of the malaria sector office before the health sector reform was varied, including entmology, parasitology and spraying operation. The entmology section used to conduct periodical surveillance, which helped to take actions before malaria epidemic breaks out. But after the reform the activity of the malaria sector office is limited to spraying operation only whenever the outbreak of malaria transmission is exhibited. Presently health personnel with specialization on malaria vector control activity do not exist at the Wereda health office level.

Concerning malaria endemic Ilu wereda (the present study area) is 100 percent malarious and is the first priority wereda in malaria control activities in the zone.

3.1.2 Ilu Wereda (The Study Area)

Ilu wereda is found in Western Shoa zone of Oromiya region 55kms away from Addis Ababa on the road to Jima. This Wereda is divided into 18 peasant associations (rural kebeles) and 2 town kebeles. The total population of the Wereda is 53,700 out of which 48,700 (90.7%) live in the rural Kebeles.

Agriculture is the only activity of the population in these rural Kebeles, where Teff, Wheat, Chickpeas, Vetch, Lentil, Sorghum, Maize, Bean, Peas and Nueg crops are mainly produced in that order. There is only one crop season in a year(meher season). There is neither off farm activity nor cash crop, other than limited sale of eucalyptus tree. Except four rural kebeles that are frequently flooded by Awash River during kiremt season, other farmers use fertilizer for Teff and wheat production.

The climate of the Wereda is 100% weyna dega with mean annual rainfall of 625 ml. The altitude ranges between 2060 - 2070 above sea level.

The temperature is between 15oC - 24oC. According to the wereda agriculture office report, the total area of the wereda is 37,294 hectare out of which 79% is cultivated, 6.5% is for grazing and 2.2% is used for growing back yard eucalyptus tree. The rest 12.3% hectare are

construction sites (the towns in the wereda), swampy areas and rivers. 95% the soil is black and the remaining 5% is aluvile soil type.

Since this wereda is very close to Addis Abeba and is the number one priority wereda in the zone regarding malaria control activity it is relatively in a better position concerning the distribution of health facilities. It has 2 health stations situated at Teji, the main town of the wereda and yaya, some 22 KMS to the north west of Teji town. There are also three private clinics. The health stations provide treatment service through diagnosing the disease based on the symptoms. But two of the three private clinics provide laboratory test services. In 1991E.C.the wereda health station with the assistance of MSF Holland NGO has trained 17 community malaria workers, whose duties mainly are to mobilize the community on malaria prevention activity, health education, environmental management, diagnosis and treatment. These community malaria workers are provided with chloroquine and Fansider tablets to treat malaria patients in the rural population. Though the role of these community malaria workers is very important they lack any incentive that could motivate them accomplish their task efficiently.

The other problem in malaria control activity is that other than the necessary drugs from the zonal health office the wereda health stations do not have any budget allocated for malaria prevention and control.

Finally the following figures are presented to show how malaria is a serious health problem in the wereda.

Table 2 : Malaria patients treated in the survey wereda (1991 – 1993 EC)

Year (EC)	Number of malaria patients treated		
	By wereda health stations	By community malaria workers	Total
1991	2896	5601	8497
1992	1277	8461	9738
1993	401	4053	4454

Furthermore, during the 1991EC epidemics a mobile laboratory, which was sent from zonal malaria team to the wereda between Nov. 4, 1991 to Nov. 16, 1991 EC, have conducted a sample laboratory test. Out of the 782blood film taken 550(70%) were found to be malaria positive. The result also showed that 378 were infected by P. vivax, 154 by P. phalcipharum and 17 the mixture of both.

3.2 Methodology

3.2.1 Data Source and Type

The main data source of this study is primary and cross sectional, which was collected through structured questionnaire from systematically selected rural households of randomly selected Kebeles in Ilu Wereda in Oromia region.

Relevant departments in the Ministry of Heallth, Oromia Health Bureau, Health departments of western shoa Zone and Health station in Ilu wereda were approached for additional information. Previous studies on the area and other necessary documents were also reviewed as supplementary source.

3.2.2 Survey Design

The survey was designed in such a way that the economic cost of malaria and the willingness to pay for insecticide-impregnated bed net could be measured at the rural household level.

For this purpose Oromia Region that is very close to Addis Abeba was considered for reasons of cost effectiveness and administrative convenience. From the 158 malaria endemic weredas of the region Ilu wereda, which is again the nearest wereda to Addis Abeba and which is the number one priority wereda in western shoa zone concerning endemicity of malaria was selected for the survey.

3.2.3 Sampling Design (Procedure)

A two stage sampling procedure was adopted: the selection of rural kebeles at the first stage and the selection of household at the second stage.

On the basis of the resource and the time available 300 households were considered to be sufficient to capture all the required information.

From the 18 rural kebeles with a population size of 48, 700, samples of 5 kebeles with a population size of 11,986 were randomly selected. It is evident from this that the sample population is 25 percent of the total rural population of the selected wereda.

To select sample households, the lists of households have to be obtained. Hence, the enumerators were given a task of listing households in the selected kebeles during a pre testing exercise of the questionnaire. Based on the list of households the required 300 sample households were proportionally distributed to each kebele, so as to guarantee equal chance of being included in the sample for each and every house hold as shown below:

Table 3: Number of households in sample kebeles and amount of sample households in each kebele.

No.	Name of the Kebele	No. of HHS in the Kebele	Percent to the total Household	Sample households	
				Amount	Percent
1.	Bili	350	16	48	16
2.	Mida Jigdu	390	18	54	18
3.	Weserbi Besi	311	14	42	14
4.	Alengo Tulu	595	28	84	28
5.	Wererso Kelina	519	24	72	24
Total		**2165**	**100%**	**300**	**100%**

3.2.4 Method Of Data Collection

Structured questionnaire was designed to collect the required information. The questionnaire is composed of three major sections. The first section tries to capture household characteristics, the second section is devoted to measuring economic cost of malaria and the third section is on the WTP for insecticide impregnated bed nets. The technique used to elicit the WTP for the bed nets is open-ended, considering its advantage in directly eliciting the maximum willingness to pay and to avoid the use of starting values, which could be a source of bias.

Income, asset ownership, economic cost of malaria and other related variables are collected for five consecutive years (1989-1993 EC), so that the average could be used for the analysis. The objective is to avoid specific yearly variations that might occur due to peculiar situations.

The English version of the questionnaire was translated into Amharic so that enumerators may not have difficulty in collecting the required data and to safe guard reliability.

To conduct the survey 10 enumerators were hired from the wereda town, Teji. All enumerators have completed grade 12 and have a GPA of more than 2.0 in ESLCE. Some of them are university students who were there for vacation and some have prior experience in data collection. These enumerators were given a one day training on the questionnaire and data collection techniques and approaches.

Right after the training they were sent for the pre-testing of the survey questionnaire and fresh listing of households in the rural kebeles. The questionnaire was then revised on the basis of the pre-testing exercise, which was finally used to collect the necessary data.

3.2.5 Fieldwork

The fieldwork of the survey was conducted between January 24, 2001 and February 4, 2001. Since the main activity of the rural household during this period is mainly threshing, it was not difficult to get respondents in the selected sample households. Respondents were very cooperative in responding to the questions posed by interviewers from the questionnaire. Hence it was possible to conduct the survey as planned.

3.2.6 Method of data analysis.

The information collected through structured questionnaire was compiled, analyzed and interpreted in such a way that economic cost of malaria and willingness to pay for insecticide impregnated bed nets could be captured. Both descriptive statistics and multivariate statistical techniques were used. SPSS (statistical package for social scientists) was employed for data entry and analysis.

3.2.7 Model Specification

The study focuses on two main areas: the economic cost of malaria on rural households and willingness to pay for insecticide impregnated bed nets. In general the cost of illness approach is the methodology used in revealing economic cost of malaria and contingent valuation method is used in estimating the willingness to pay for bed net. The specific approaches are the human capital and WTP approaches respectively.

a) *The human capital approach*

In the human capital approach the model used for estimating both direct and indirect costs of a disease is.

$$TC = DC + IC$$

Where TC is total cost

DC is direct cost and

IC is indirect cost.

$$DC = P + T + N$$

Where p is average household malaria prevention cost

T is average household malaria treatment medical cost in Modern health institutions and traditional healers including travel cost

N is average malaria treatment cost in non-modern sector which include special treatment at home, Tsebel, Vow to churches and sorcerer.

$$IC = (sw) + (tw)$$

Where s - is average number of working days spent on sickness and which is not compensated by other family members,

t - is average number of working days spent by individuals who took Care of the malaria patients and which is not compensated by other family members.

w – average wage rate paid to hired labour to cover the lost working days by patients and care takers that are not covered by other family members.

b) *Willingness to pay for insecticide impregnated bednets.*

Based on the households maximum willingness to pay responses average WTP can be calculated and the model below is used to see the extent to which it relates to the explanatory variables. The general multiple regression model assuming that it contains k explanatory variables can be stated in the form

$$Y = f(x_1, x_2 \ldots . x_k) + U.$$

Where y is the dependent variable

$x_1, x_2 \ldots . x_k$ are the explanatory variables

U is the random or error term.

In this study the maximum willingness to pay (MWTP) is the dependent variable and household characteristics and other relevant variables that determine WTP are the explanatory variables. Such explanatory variables include sex of the household head, age of the household head, educational level of the household head, family size of the household, size of family members infected in the last five years by malaria and total economic cost of malaria incurred by households.

Based on this the functional form of the model that is regressed using ordinary least squares (OLS) method is:-

$$MWTP = B_0 + B_1\ SXHH + B_2\ AHH + B_3\ EDUHH + B_4\ FSZH + B_5\ SZLOH + B_6 + NOXOH\ B_7\ INCH + B_8\ SZMIMH + B_9\ TCMH + U$$

The OLS estimation with its basic assumption of normally distributed error term with mean zero and constant variance is used, since there were only 12 households that were not willing to buy from 300 sample households.

3.2.8 Description and hypothesized relationship of the explanatory variables.

The following table depicts the description and hypothesized relationship of the explanatory variables included in the econometric model that determine the maximum willingness to pay for insecticide impregnated bed nets.

Table 4 - Description and hypothesized relationship of the explanatory variables.

Variable	Description of the variable	Hypothesized relationship
SXHH	Sex of the household head. **Dummy variable** 1 if head is female 0 other wise	Women household heads are expected to be highly cautious for the health of their family. It is also assumed that women suffer more in taking care of the diseased household member. They are expected to react actively to the prevention and treatment of malaria, hence their willingness to pay for bed nets is hypothesized to be greater than men household heads.
AHH	Age of the household head	Younger household heads are expected to

		have better preference for modern means of health care facilities than older ones. Hence the willingness to pay for bed nets may get lower and lower with increasing ages.
EDUHH	Educational level of the household head **Dummy variable** 1 if literate 0 otherwise	The more educated the household head the greater the awareness for health of the household members. Hence the greater will be the WTP for bed nets.
FSZH	Family size of the household	Other things remaining the same, household consumption expenditure is inevitably higher in the households with higher family size. Therefore due to higher household expenditure on the one hand and the increased amount of bed nets that might be needed for the whole household members on the other, the willingness to pay for bed nets is expected to be lower with increased number of family size.

SZLOH	Size of land owned by the household	One of the ways to estimate the wealth of rural households could be the size of land holding by a given household. Households with greater amount of plot of land are expected to have a better income and relatively better standard of living. Such households are hypothesized to have a greater WTP for bed nets
NOXOH	Number of oxen owned by the household.	Ownership of oxen is one of the proxies for asset ownership. Those who own oxen not only can effectively cultivate their plots of land but also can lease land from those who do not own oxen, female house hold Heads and other aged households who can not plough on their own. Such households therefore would relatively be in a better position to have greater willingness to pay for bed nets.

INCH	Income of the household	The higher the income the greater will be the ability to pay for health facilities .Hence, the greater will be the WTP for bed nets.
SZMIMH	Size of malaria infected members of the household in the last five years.	The higher the size of family members infected by malaria the greater the suffering of the household. Hence such households are assumed to be highly willing to take any malaria prevention action. Therefore it Is hypothesized that WTP for bed nets will be greater with increased number of household members who were infected by malaria.
TCMH	Total economic cost incurred for the prevention and treatment of malaria.	Household with higher expenditure for prevention and treatment of malaria, would have more WTP for any intervention that could protect malaria infection so as to reduce the burden of its infection. Therefore it is hypothesized that such households will have greater WTP for bed nets.

3.2.9 Limitations of the study

The value of the healthy years of life lost due to malaria related mortality and the ill feel that malaria patients suffer are not included in the estimation of economic cost of malaria, due to the difficulty in the valuation of these costs. In the case of mortality calculating age projected rural incomes for different age groups is cumbersome.

Chapter Four

4. Findings of the Survey

This chapter is devoted to presenting the empirical survey results, both on the economic cost of malaria and the willingness to pay for insecticide-impregnated bed-nets of rural households. It consists of two sections, the first of which presents descriptive statistical results of the survey. The second section examines the multivariate statistical estimation results of WTP.

4.1 Descriptive Analysis

a) Characteristics of Households

Out of the total 300 sample households interviewed, 230 (76.7%) are male headed, while the rest 70(23.3%) are female-headed households (Refer Annex 1).

The proportion of younger household heads between 18 to 30 years of age constitutes 21.3% of the total sample households. Those between 31 to45, 46 to 65 and greater than 65 years of age accounted for 37.7, 28 and 13 percents respectively.

The majority of the household heads (56.8%) are illiterate, and those who can only read and write accounted for 15.9%. Household heads with primary and secondary education constitute 23 and 4.4 percents respectively.

The average family size in all the five sample kebeles does not show significant variation, the lowest being 6.06 and the largest 6.81. The overall average family size is 6.31. In general out of the 300 sample households interviewed 9(3%) have a family size of 1 to 2,118(39.3%) have 3 to 5 family members and 173 (57.7%) have a family size of greater than 5.

Average size of land holding is 2.83 hectare per household, which is by far better than the national average. Of all the interviewees only 5(1.7%) reported that they have no land of their own.

The proportion of landless households is relatively low due to elderly voluntary redistribution of land to their own youth family members. From the total number of households covered by the survey 16(5.5%) own less than one hectare of land, 70(237%) own between 1.01 to 2 hectares 130(44%) between 2.01 to 3 hectares and 79(26.8%) own greater than three hectares. The land less group rent or lease land from those who could not plough on their own due to various reasons.

Oxen are one of the important assets for agricultural households in Ethiopia, since almost all rural households earn their livelihood from farming. From the total sample population only 6(2.2%) households do not own oxen. The response of the vast majority revealed ownership of one or more oxen, of which 47(17.2%) households own one, 143(52.4%) own two and 77(28.2%) own more than 3 oxen.

The main source of household income is agricultural production, predominantly Teff and chickpeas. Other sources of household income include remittance and sales of livestock, honey, hen and eggs. Income from dairy product is not included since most households failed

to express their incomes from this source. Off farm activity, mainly petty trade and sale of local Araki was also reported as additional source of income. Overall the mean income of households from agricultural production is Birr 1971.71 and mean income from other sources is Birr 62.13. The total household average income, therefore, is Birr 2033.84.Significant variation has been observed among kebeles concerning income, predominantly due to the differences in flooding of the area by Awash river, which seriously affect land preparation and sowing time.

As to the range of income, the survey result depicted that 76(25.3%) households earn less than Birr 1000, 122 (40.7%) households earn between Birr 1001 to Birr 2000 and 102(34%) earn more than Birr 2,001 (Table 18). The relatively higher household income can be ascribed to Teff production that can command higher price than many other types of grain excluding Lentil.

b) Malaria Situation and Its Burden

Respondents were asked whether any member of their family has been ill with malaria in the last five years and 276(92.6%) of them responded in the affirmative.

The vast majority of the households, 271(97.1%) have taken household members ill with malaria to modern health facilities at various levels, predominantly to the nearest clinic (62.5%) for treatment. Treatment at the hospital level is low (5%) as compared to the traditional health facilities, which constitute 12.4 percent of the treatment actions.

The number of household members infected by malaria varies from household to household and from year to year. If we consider the last five years (1989-1993 E.C), 55 households

(19.6%) reported that one to two family members were infected by malaria. The rest 146(52%), and 80(28.5%) reported that the disease respectively, infected 3 to 5 and greater than 5 family members.

The trend of malaria infection has exhibited variations. Of the total number of people reported to be infected by the disease in the last five years, 11.3% of the infection was in 1989, 22.1% in 1990, 43.4% in 1991, 15.8% in 1992 and 7.3% in 1993 (all in E.C). The lowest malaria infection is exhibited in 1993 primarily because of DDT spraying in the preceding year and partly because of change in the intensity of rainfall.

Though the survey confirms that the victims of malaria were from all age groups the proportion of adult infection was higher. Of those who were infected by malaria 53(7.2%) were children below the age of five, 190(25.7%) were between ages 5 to 15, 452(61.1%) between ages 15 to 65 and 45(6.1%) were above 65 years of age (See Table 19). Adult male infection rate is higher than female and children probably because male adults usually stay outside home late in the evening to feed their oxen during which mosquito bite is highly expected. Female household members are busy in the kitchen and children mostly stay with them at home which has lowered their probability of being infected with malaria. The higher rate of adult infection suggests that low to moderate malaria endemic in the area, where immunity is not yet developed. From the point of view of sex male household members were more exposed (54.5%) to malaria infection than female (45.5%) household members.

The average length of sick days due to malaria infection was found to be 34, of which 28 days (82%) were lost working days (See Table 20). Months of morbidity lie between August to November for 74 percent of the cases and between April to June for 8 percent of the cases. The rest was a scattered response among the remaining months.

Important agricultural activities to be performed during the malaria transmission months (morbidity months due to malaria infection) were ploughing, weeding and harvesting as depicted by 30.9, 31.4 and 28.6 percents of the responses respectively.

The fact that male adult household members were more exposed to malaria infection from the survey result, when they are needed for such important agricultural activities, depicts how serious is the impact of malaria on productivity.

Working days lost due to malaria morbidity is compensated through various means. The majority of the respondents, 179(57.7%) reported that the lost working days were covered by hired labour. Other family members also substituted the ill household member as reported by 33(10.6%) respondents. 31.6 percent of the lost working days were covered by relatives and friends outside the family, by social institutions, such as Idir and Debo and others (See Table 24).

In addition to malaria infected household members for 190(65.3%) households other healthy family members who could have contributed to production were forced to stay at home in taking care of patients. The average number of working days lost per household for such purpose was 23. In the majority of the cases (70%) the caretakers were female, of which wives and mothers constituted 25 and 27 percent respectively. Women also highly participate in agricultural activities performed during this malaria infection period. Weeding and harvesting are the activities in which men and women equally engage. In the case of ploughing women still assist men in picking weeds and preparing the soil for sowing. This again can indicate the impact of malaria on agricultural production.

The role of fathers as care takers was lower than mothers; constituting only 10 percent of the total care takers. Daughters (12%) and sons (7.5%) were the next important family members in taking care of the diseased.

Mortality caused by malaria is lower, compared to the higher rate of morbidity. Out of the total sample households only 39(13%) reported deaths of family members as a result of malaria infection in the last five years. The total number of people who died of malaria in the last five years was 43, of which 16 (37.2%) were children under 5 years of age. Female death was dominant than male that accounted for 60.5%, mainly because women are less resistant to develop immunity.

Death has been low due to the following two reasons. First as indicated under the title description of the study area, the species of malaria parasite that infected the people was confirmed to be plasmodium vivax through sample laboratory test and plasmodium vivax less likely cause death. Secondly the great majority of malaria patients (97.1%) were taken to modern health facilities for treatment as a result of which the probability of death has been lowered. One of the measures to reduce the burden of malaria is to take necessary preventive actions. Recognizing this some rural households and the government have taken some preventive actions. The most dominant traditional preventive action taken by households is smoking the area. 150(36.8%) of the respondents reported that they have taken such an action. Screening of houses and drying of water ponds and swaps, as preventive actions were taken by 55(13.5%) and 82(20%) households respectively. About 115(28.2%) households did not take any prevention action.

In addition to these household preventive actions the government has also intervened to prevent malaria transmission in the area through spraying DDT mainly in 1991 and 1992 E.C.

Respondents were asked how they identify malaria infection from other diseases before they visit any health facility. Multiple responses were obtained to the question, which includes: - shivering 259 (17.8%) coldness 221(15.2%), severe headache 204 (14%), thirst 194 (13.3%) and fever 185(12.7%). Other symptoms such as pain on joints, poor appetite, Nausea and vomiting and sweating were reported by 112(7.7%), 102(7%), 80(5.5%) and 72(4.9%) households respectively (Table 26). The survey attempted to capture what traditional actions were available to take care of patients at home. 171(42.8%) of the respondents reported that provision of hot fluid and soup was the dominant home care action. Feeding Garlic, fatty food items and providing local Araki (caticala) were reported by 66 (16.5%), 38 (9.5%) and 20 (5%) of the respondents respectively.

C) Cost of Malaria

This section is devoted to estimating the economic cost of malaria to rural households. The cost of illness methodology, particularly the Human capital approach was the method used. The survey attempted to capture direct cost, which included both prevention and treatment costs incurred by households, and the indirect cost, which is mainly the productive time lost by both patients and care takers.

Since 42.3 % of the lost working days were compensated by uninfected family members, relatives, friends and other social institutions, the value of forgone workdays by patients, considered only the cost incurred by households to hire labour for the remaining uncovered working days. This is because, in the survey area hiring labour in from neighbouring regions

but not hiring labour out is practiced and due to limited land holding size disguised unemployment exists. Therefore the opportunity cost of these family members is only the leisure forgone, which is difficult to estimate in the cost of illness method. Moreover the average time cost of household members caring for malaria patients was also included in the indirect cost of malaria. The survey depicted significant variation in the average total cost of malaria on rural households. About 82 (29.6%) households reported an average cost of less than Birr25, while for 61(22%) and 134(48.4%) the cost was between Birr26 to 50 and greater than Birr 51 respectively.

The survey result further showed that the average malaria prevention cost was Birr 13.21, and the mean malaria treatment cost was Birr 85.58. The sum of the two gives us the average direct cost of malaria, which is Birr 98.79 per household. The estimated average indirect cost is Birr 59.99. Hence, the average total cost of malaria per household in the survey wereda reached Birr 158.78 as depicted in the table below.

Table 5 - Average costs of malaria per household.

	Type of Costs	Average cost per household (In Birr)
Direct cost	Prevention Cost	13.21
	Treatment cost in modern facility	60.49
	Traditional treatment cost	25.09
	Average direct cost	**98.79**
Indirect cost	Value of lost working days by patient (Which is compensated by hired labour)	27.77
	Value of lost working days by care takers (which covered by hired labour)	32.22
	Average indirect cost	**59.99**
Average total cost per household		**158.78**

From the mean values given it is visible that the direct cost surpassed the indirect cost. The indirect cost was lower than the direct cost predominantly because of the prevailing disguised unemployment and relatively larger family size in the survey area that have enabled households to compensate lost working days by both patients and care takers. Much of the would be lost productivity was saved through such labour substitution mechanisms. Hence,

the indirect cost of malaria on rural households has been lowered. The direct cost itself would have been greater than what was estimated by the survey hadn't much of it was covered by the government through free treatment service at public health facilities. This direct cost which was covered by the government includes: freely distributed anti-malarial drugs, DDT sprayed in the area, salaries of health station workers and other over head costs, for which households were provided free service. Had the households were required to pay for malaria treatment services provided at the public health facilities, the direct cost would have been by far higher than the present estimate.

Though the government provides free treatment service for malaria infection,
there are times in which drugs are not available at public health facilities and hence they are forced to buy from private sector.

Moreover since health stations in the area lack laboratory service households have to incur cost in the private sector for such service. In case of serious severity patients are usually referred to higher facilities for which they have to incur transport cost, food and lodging cost for accompanying family member and for registration.

What can further be concluded from the figures obtained is that 59.7 percent of the average total cost incurred by each household constituted the direct cost, while the remaining 40.3 percent is the indirect cost.

Moreover, if cost is seen from the point of view of the mean annual income of households (Birr 2033.84), the average total cost incurred by households accounted for 7.8 percent of

their annual mean income. This is not a small amount of money if viewed from the various types of expenditures that rural households are expected to make. Such expenditures include expenditure on food, clothing, repayment for fertilizer obtained on credit, land use fee, income tax, seed, and other regional and social contributions. It might also mean that income is diverted either from consumption or saving or both due to malaria infection by 7.8 percent.

The survey has attempted to compare the burden of malaria vis-à-vis all other diseases that have infected the people in the area. Households were therefore asked whether other diseases infected any member of their families in the last five years. Out of the total sample households interviewed 144(48%) have given a " yes" response. Concerning the type of diseases that infected their family members, 40(27.5%) respondents have said it was communicable diseases, 22(15.3%) reported respiratory diseases,30(20.3%) Stomach problems. The rest 59(36%) reported various other types of diseases with lower frequencies (Table 30). The average total treatment cost incurred for all types of these diseases was Birr 38.64 per household, which is less than the average treatment and prevention cost incurred for malaria (Birr 98.79). This together with the proportion of average annual income (7.8%) lost due to malaria infection reveals the heavy burden that malaria exerts on the rural households.

d) Willingness To Pay

Reduction of man mosquito contact is one of the malaria control measures suggested by professionals in the area. The usage of insecticide-impregnated bed net is a protective measure available to reduce man mosquito contact. This was why this study focused on estimating the maximum amount that rural households are willing to pay for insecticide-impregnated bed-nets.

The survey questionnaire was designed in such a way that the information and knowledge that households had, concerning insecticide impregnated bed-nets could be investigated before the willingness to pay questions were posed. To this end household heads were asked if they have any information on bed nets.96.7% of them indicated the absence of any information on bed nets. 99% of the respondents have said that they have no prior experience in using the bed net and 97% of them have not totally seen it. Recognizing the difficulty that respondents may face in answering willingness to pay questions they were given a comprehensive explanation on insecticide impregnated bed net, its importance and the results obtained in reducing malaria morbidity and mortality in many parts of the world. Posters and some items with which the rural households are familiar (for example Netela) were used to visually demonstrate bed nets. This approach has assisted us to ease the difficulties that respondents would have encountered in responding to the open ended willingness to pay questions.

Right after it was believed that respondents have grasped sufficient information on bed net, they were asked whether they are willing to buy or not if it were available in the market. About 286(96%) household heads have positively responded to the willingness to buy question. Those who have shown unwillingness to buy were only 12(4%). These groups of respondents were asked as to why they are not willing to buy the stated bed net. Eight of them (72.7%) said they cannot afford it, however, lack of confidence in the bed net and absence of much bothering for malaria were reported by single respondent in each case.

Those who were willing to buy stated the maximum amount that they are willing to pay for bed net as shown in the table below.

Table 6 - Willingness to pay data from a survey.

WTP intervals	Mid point WTP	Frequency	Relative frequency	Cumulative frequency
5-25	15	93	32.1	32.1
26-50	38	142	49.0	81.0
51-75	63	20	6.9	87.9
76-100	88	24	8.3	96.2
101-125	113	3	1.0	97.2
126-150	138	3	1.0	98.3
151-200	175.50	5	1.7	100
Total		**290**	**100**	

As can be learned from table 6, 81 percent of the respondents were willing to pay up to Birr 50, for a medium sized rectangular bed net. Household heads that were willing to pay between Birr 51 to 100 accounted for 15.2 percent, while those who have reported a willingness to pay above Birr 100 constituted only 3.7 percent.

In general, the overall mean willingness to pay for bed net sold in cash was found to be Birr 44.26 as against Birr 65.05 if availed on credit basis.

Concerning the amount of bed nets that each household could be willing to buy under the two scenarios: in cash and on credit, was one and two respectively.

Under a situation where the average family size in the survey area is close to six, the amount of bed nets proposed to be purchased by respondents in either cases cannot be sufficient to protect the whole family against mosquito bites.

An attempt was also made to cross tabulate the WTP responses with household characteristics in order to investigate the factors that might influence the WTP decisions. As can be seen from the tables in appendix 1(tables 32 to 41) the percentage of women household heads that were willing to pay above Birr 51 for a bed net was greater than the percentage of men household heads who were willing to pay above the stated amount. Similarly younger household heads who are between the age of 18-30, were willing to pay higher amount for bed nets than older household heads.

Concerning educational level willingness to pay amount have not shown a clear trend. Moreover, direct relationships have been observed between size of land holding and willingness to pay responses.

This same relationship was depicted willingness to pay between and income. The higher the income the higher was the willingness to pay amount for insecticide impregnated bed nets from the cross tabulation. This positive relationship between WTP and income was further verified through comparing mean annual income of households with the mean willingness to pay of households by sample kebeles as shown by the table below.

income. The higher the family size, the more available is the agricultural labour force. Intensive and extensive farming could be possible under such a situation, which would lead to increased productivity and hence, income. Therefore, WTP and family size were positively related. This observed relationship between willingness to pay and other explanatory variables would further be examined using the regression analysis.

The cross-tabulation further depicted the absence of consistent and definite relationship between willingness to pay amount and the number of family members infected by malaria. The same was true for willingness to pay amount and household expenditure on malaria prevention, treatment and other associated costs.

4.2. Regression Results

As indicated in the introduction part, one of the objectives of this study was to identify the determinants of willingness of households to pay for insecticide impregnated bed nets. For such an exercise the multivariate analysis is usually employed for its quality in providing better information. In a contingent valuation method that attempts to capture the willingness to pay of households or individuals, the OLS method can be used if there are few responses with non positive willingness to pay. In this study since there were only 12 "no" responses to such question, out of the 300 sample households, the OLS method can therefore qualify and hence, was used for the estimation.

Before running a regression using the OLS method different tests have to be conducted to check for any violations of the OLS assumptions. To this end the outliers in the data (7% of the sample) were cleared out so as to avoid the violation of the assumption of normality.

In the OLS estimation method the disturbance term, which accounts for errors in the measurement and omitted variables need to have constant variance. Therefore whether a problem of heteroscedasticity that violates this assumption exists or not was checked. The graph of standardized residuals against frequency of their occurrences showed the normal distribution. in the SPSS econometric package test of heteroscedasticity(See Annex 2).

The other possible problem that may be encountered in the OLS estimation for cross sectional data is the degree of collinearity between the explanatory variables. Though we may not expect total absence of correlation between explanatory variables due to the interdependence of most economic variables, the degree of correlation must not be so high that could lead to the breakdown of the OLS estimation exercise. Whether this problem of multicollinearity exists or not was checked against a bivariate correlation matrix of the SPSS econometric package. As can be observed from the correlation matrix(see appendix 3), the degree of collinearity among the variables is below the level that as a rule of thumb(0.8) could be considered as a problem. Hence multicollinearity cannot be said to exist in the data.

The functional form of the model, which was regressed using OLS method after the necessary tests were carried out gave us the estimation results shown in Table 8.

Table 8 - OLS estimation results

Variable	Coefficients	Standard Error	T-ratio	Significance Level
Constant	32.302	5.410	5.970	.000
SXHH	-1.214	2.947	-.412	.681
AHH	-.222	.081	-2.751	.006
EDUHH	-7.457	2.674	-2.788	.006
FSZH	-1.506	.574	-2.624	.009
SZLOH	1.256	1.281	.980	.328
NOXOH	4.281	1.418	3.020	.003
INCH	9.716	.000	5.123	.000
SZMIMH	1.669	.530	3.148	.002
TCMH	4.404	.002	2.227	.027

Adjusted R2 = .240

Standard error of the estimate = 18.5983

F-value = 10.562

Number of observation = 274

For the estimates of the OLS regression model the adjusted R^2 is a summary measure for the goodness of fit of the model in explaining variations in willingness to pay. The adjusted R^2 value , i.e. 0.24 which is obtained from the regression result indicate that only 24 percent of the variations in the willingness to pay responses were explained by the model. Though we lack hard rule as to the value of the adjusted R^2 that better describe the model, our rule of

thumb suggests that the higher the adjusted R^2 the better is the fit. On the basis of this rule of thumb, the adjusted R^2 value obtained will not make us comfortable to conclude that the model is strong in describing the variations in willingness to pay. The implication is that there are some other explanatory variables, which could account for the variations in the willingness to pay responses however, in cross section data low R^2 are not uncommon. The F-value(10.562) on the other hand, shows the overall fitness of the model. The other important observation from the OLS estimation results table is that all the explanatory variables but sex and size of land holding are found to be statistically significant.

Contrary to the proposed hypothesis, that women household heads will have greater willingness to pay for bednets since they are assumed to suffer more in taking care of the ill household member, the coefficient of sex of the household head is negative and insignificant. The coefficient for the age of household head is negative and statistically significant confirming the theory that suggests younger household heads will have more preference for modern means of health care goods and services than older household heads. Therefore the negative coefficient shows that as the age of household head increases the maximum willingness to pay for bed nets declines.

Better education is generally assumed to create more awareness for health and hence a positive relationship was expected to exist between educational level of the household head and the willingness to pay for bed nets. But contrary to this expected relationship the coefficient of education is found to be negative and significant. No valid theoretical explanation can be suggested for such an outcome other than suspecting strategic bias. With the increase in the education level the power of linking the present with the future will also increase. Hence they might have suspected their willingness to pay responses to have an

influence on the future price of bed nets and therefore deliberately reported lower willingness to pay.

The other variable with a negative coefficient was the family size of the household. Statistically significant and negative coefficient of this variable shows the decline in the maximum willingness to pay amount as the size of the household member increases. This is theoretically valid since total house hold expenditure increases with the increased family size. Therefore with the increase in the family size, household per capita income falls as a result of which the willingness to pay amount may also decline. The positive coefficient of land holding size indicates the rise in willingness to pay amount with the increase in the size of land holding.

Oxen ownership is one of the important assets to the rural households that determine their well being. This is why the coefficient of the number of oxen owned by households is positive and highly significant. Those households with more oxen can cultivate more plots of land by renting, leasing or share cropping in addition to their own plots. Oxen ownership can also enable them to generate more income through renting oxen to other households. So the positive coefficient indicates that the higher the number of oxen owned the greater is the willingness to pay for insecticide impregnated bed nets.

Among the various explanatory variables included in the model, income of the household is found to be highly significant and to positively influence the willingness to pay decisions. Economic theory holds that income is one of the determinants of demand for goods and services. Hence the observed result is in conformity with this theory.

The estimated coefficient of the size of the number of malaria ill members of the household is not only positive but also is significant. This result is in line with the hypothesized relationship. The higher the size of malaria ill household members, the greater is the suffering to the household. Therefore such households will have greater willingness to take any malaria prevention measures than the households with less number of ill members. The positive estimated coefficient, therefore, indicate this situation.

The household expenditure on malaria prevention, treatment and other associated costs referred to as total cost of malaria to rural households is another important explanatory variable included in the model. Theoretically households with higher expenditure for the prevention and treatment of any disease are expected to have a greater willingness to pay for any intervention that could reduce or totally abandon its burden. The result of the regression confirms the above explanation. Total cost incurred by households due to malaria is found to be statistically significant and its coefficient is positive.

Generally other than the education level of the household head, all other variables have sound relationship with the maximum willingness to pay amounts. Moreover all variables except sex of the household and size of land holding are statistically significant. Hence, the estimated regression results are consumable.

CHAPTER FIVE

5. Summary and Policy Implication

5.1 Summary

Health is both capital and consumption good. As capital good it contributes to economic development since labor is one of the most important factors of production. As consumption good it provides satisfaction by reducing suffering from ill health.

Malaria is a communicable disease that threatens the health and lives of millions around the world. In Ethiopia about two third of the country's population and 75 percent of the area of the country are at risk of malaria. It is the second largest killer disease that affects about 4 to 5 million people annually. Malaria burden is more pressing to the rural households due to lack of access to health services, socio-cultural factors and poor income.

The fact that malaria is a significant national health problem and has serious impact on production, necessitates an all round coordinated action and every possible individual contribution to its prevention and control. Accordingly this study has attempted to estimate the cost of malaria to rural households in a selected wereda and their willingness to pay for insecticide impregnated bed net. The cost of illness and the contingent valuation methods were used for the study. The primary data collected from the study area was analyzed through descriptive and multivariate statistical techniques.

It was learned from the descriptive statistical results that 92.6% of the households included in the survey reported that at least one family member had malaria in the last five years. For the majority of these households (52%), three to five household members were infected, while for

28.5% of the households this number exceeded five. The impact of malaria on production might not clearly be visible unless we look at these numbers from the age point of view. Of those who were infected by malaria 61% were between ages 15 to 65, which constitute the productive age group. From among the infected household members, males constitute 54.5%, which indicate the impact of malaria on plowing which is predominantly performed by male household members. As a result of malaria infection working days lost are 28 for patients and 23 for care takers. The opportunity cost of these lost working days can only be appreciated if it coincides with the period in which some agricultural activities have to be performed. In this regard for 74% of the responses the infection period was between August to November, where important agricultural activities such as plowing, weeding and harvesting were to be executed. This again indicates the impact of malaria on productivity.

The survey has attempted to estimate total cost of malaria to rural households. In estimating the indirect cost two things have been considered. First in the survey area hiring labour in but not hiring labour out is practiced. Second due to higher size of family members (6.3/household on average) and limited land holding (2.83ha per household) disguised unemployment is prevalent. Under such a situation uninfected family members, relatives, and friends compensated 42.3% of the lost working days.

Therefore the value of forgone workdays considered only the cost incurred by households to hire labour for the remaining uncovered working days. Under such a situation the average total cost of malaria to rural households was estimated to be birr 158.78 of which prevention cost is Birr 13.21, treatment cost is 85.58 and indirect cost (lost workdays) is Birr 59.99. Similar study that was conducted in Malawi to capture cost of malaria to low income households estimated average annual expenditure on malaria treatment to be $11.07 (World Bank 2000), which is very close to our finding (Birr 85.58).

The other objectives of the survey were to estimate the willingness to pay for insecticide impregnated bed-nets and to identify the determinants of willingness to pay for it. Thus, the survey has estimated the mean willingness to pay for insecticide impregnated bed net in cash to be Birr 44.26 as against Birr 65.05 if availed on credit basis. If we view the result from the point of the willingness to pay intervals, 81 percent of the respondents were willing to pay up to Birr 50 for a medium sized rectangular bed net. Households that were willing to pay between Birr 51 to 100 constituted 15.2 percent and those who were willing to pay more than Birr 101 accounted for 3.7 percent. Generally 96% of the respondents have shown willingness to pay for insecticide impregnated bed net. As to the amount of bed nets they are willing to buy, their responses indicate that they will buy one if sold in cash and buy two if supplied on credit.

An attempt has been made to identify the factors that might influence the willingness to pay decisions through cross tabulation and multivariate statistical technique, specifically ordinary least squares method. The characteristics of the household in general and some characteristics of the household head in particular were considered as the explanatory variables. Such variables included:-

- Sex of the household head
- Age of the household head
- Educational level of the household head
- Family size of the household
- Household land holding size
- Number of oxen owned by the household

- Income of the household
- Size of malaria infected household members and
- Total cost incurred by households to prevent and treat malaria.

The ordinary least squares estimation result showed that all the explanatory variables except sex and size of land holding are statistically significant. More over number of oxen owned, income, size of malaria infected household member and total cost incurred for the prevention and treatment of malaria have positive influence on the maximum willingness to pay amount. Age and educational level of the household head and family size of the household have negative influence on willingness to pay amount. Other than educational level of the household head all other variables are in conformity with the theoretical expectation.

5.2 Policy implications

One of the ultimate goal of any research is to present some policy implications that could assist in decision making. To this end the following policy implications can be extracted from the study results.

a) The economic cost of malaria to rural households, which is on average Birr 158.78 per household annually is quite a significant amount of money for households whose income generally is poor. It constitute 7.8 percent of their mean annual income (Birr 2033.84). It means 7.8% of their income is diverted either from saving or consumption or both due to malaria infection. The ill feel and suffering that malaria patients experience exacerbate the problem. Therefore this calls for coordinated and cost effective malaria control actions that could reduce this burden to the rural households

b) The study result showed that malaria treatment cost is by far greater than prevention cost. Despite the health policy emphasis on preventive than curative measures, in practice treatment have consumed more resources than prevention. The existing households prevention action is dominated by smoking the area, which has got a negative environmental impact and leads to unwise use of energy resources. Though complete malaria eradication is not feasible under present financial and health infrastructural constraint, well organized and coordinated control action in which the community is fully mobilized can undoubtedly reduce the burden of malaria on society in general and rural population in particular. Enhancing the awareness of the community on various preventive mechanisms and mobilizing them on such actions could possibly reduce treatment cost which is relatively higher at present.

c) The use of insecticide impregnated bed net is one of the best and easiest method of malaria control measures. Despite this fact the great majority of households surveyed did not have any information on what insecticide-impregnated bed net is and its role in preventing mosquito bites. Close to 97% of the respondents have said they had no information on bed nets.

This indicates the awareness and health education required.

d) Among the various explanatory variables income is found to be the most important determinant of the willingness to pay for insecticide impregnated bednets in both descriptive and multivariate statistical analysis. As can be seen from an average household annual income in the survey result and from various statistical sources

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for the mean annual income of the Ethiopian population as a whole, it is one of the lowest in the world. The implication is that the willingness to pay for bednets is highly constrained by this poor income. Hence, households can not afford for the current price of insecticide impregnated bed net which is between Birr 100 to 130 for medium sized rectangular bed net. The average willingness to pay for it is estimated to be Birr 44.26 The wide gap between the price of insecticide impregnated bednet and the maximum willingness to pay can be narrowed down if the current combined tax rate of 62% (World Bank et al 1992) on mosquito nets is completely lifted. Government subsidy or special tax incentive that promote domestic production of the insecticide-impregnated bed net can have similar positive impact on its usage.

The need for impregnation every six months which was mentioned to respondents during an interview imply the necessity of providing special orientation to rural households. It is also an additional factor that further constrain the purchase of bed-nets under the current price level.

Finally a nationwide research to estimate cost of malaria to households and to the government and the willingness to pay for bed nets can provide substantial information which could be taken as an input in decision making.

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Appendix 1

Table 9 - Sex of the household heads

Sex	No	%
Male	230	76.7
Female	70	23.3
Total	**300**	**100**

Table 10 - Educational level of the household heads

Educational level	No	%
Illiterate	168	56.8
Read and write	47	15.9
Elementary	47	15.9
Junior Secondary	21	7.1
Secondary	13	4.4
Total	**296**	**100**

Table 11 - Range of family size

Range of family size	No	%
1-2	9	3
3-5	118	39.3
>5	173	57.7
Total	**300**	**100**

Table 12 - age of he household heads

Age	No	%
18-30	64	21.3
31-45	113	37.7
46-65	84	28
>65	39	13
Total	**300**	**100**

Table 13 - Average family size by sample kebeles

Name of the Kebele	Number	Average size
Weserbi Besi	45	6.27
Alengo Tulu	82	6.29
Bili	49	6.24
Mide Jigdu	52	6.81
Wereso Kelina	72	6.06
Total	**300**	**6.31**

Table 14 - Average land holding size by sample kebles

Name of the Kebele	Number	Average holding size (in hectare)
Weserbi Besi	44	3.4
Alengo Tulu	81	2.68
Bili	47	2.62
Mida Jigdu	52	3.21
Wereso Kelina	71	2.51
Total	**295**	**2.83**

Table 15 - Size of land holding (in ha)

Size	No	%
<1	16	5.5
1.01-2	70	23.7
2.01-3	130	44
>3	79	26.8
Total	**295**	**100**

Table 16 - Mean annual income of households by sample kebele (in Birr)

Name of the Kebele	Mean annual income
weserbi Besi	3272.78
Alengo Tulu	1516.97
Bili	2358.53
Mida Jigdu	2149.93
wererso Kelina	1543.36
Total	**2033.84**

Table 17 - ownership of oxen

Number of oxen	No	%
0	6	2.2
1	47	17.2
2	143	52.4
3-4	66	24.2
>4	11	4
Total	**273**	**100**

Table 18 - Range of Mean annual income

Mean annual income range	No	%
<1000	76	25.3
1001-2000	122	40.7
>2001	102	34
Total	**300**	**100**

Table 19 - Total number of malaria infected people in the area in the last five years.

Age	No	%
<5	53	7.2
5-15	190	25.7
15-65	452	61.1
>65	45	6.1
Total	**740**	**100**

Table 20 - Average length of sick days by sample kebele

Keble	**Average number of sick days**	**Average lost working days**
Weserbi Besi	31.21	26.62
Alengo Tulu	35.33	26.71
Bili	38.07	30.83
Mida jigdu	32.17	28.46
Wereso Kelina	32.11	27.54
Total	33.68	27.75

Tabl 21 - Average number of people infected by Malaria per household

Average number of sick family member	No	%
1-2	55	19.6
3-5	146	52
>5	80	28.5
Total	**281**	**100**

Table 22 - Sex of Malaria Patients

Sex	Number	%
Male	403	54.3
Female	336	45.5
Total	**739**	**100**

Table 23 - Agricultural activity during malaria transmission (Multiple response)

Type of activity	No	%
Ploughing	267	30.9
Weeding	271	31.4
harvesting	247	28.6
threshing	46	5.3
others	33	3.8
Total	**864**	**100**

Table 24 - Mechanisms through which lost working days were compensated

Compensation Mechanism	No	%
Covered by other family members	33	10.6
Covered by relatives outside the family	18	5.8
Through social institutions	18	5.8
Covered by hired labour	179	57.7
Others	62	20
Total	**310**	**100**

Table 25 - sex of deceased members due to malaria infection

Sex	No	%
Male	17	39.5
Female	26	60.5
Total	**43**	**100**

Table 26 - Symptoms through which households identify malaria infection

Symptom	No	%
Shivering	259	17.8
Coldness	221	15.2
Severe head ache	204	14
thirst	194	13.3
Pain on joints	112	7.7
poor appetite	102	7
Nausea and vomiting	80	5. 5
Sweating	72	4.9
Others	214	14.6

Table 27 - Average working days lost by care takers by kebles

Keble	average working days lost
Weserbi Besi	16.07
Alengo Tulu	26.12
Bili	22.71
Mida Jigdu	22.82
Wererso Kelina	25.27
Total	**23.49**

Table 28 - Malaria prevention action taken by household

Type of action	No	%
Used repellents	2	0.5
Screened houses	55	13.5
Sprayed insecticide	3	0.7
Dried water pools and swaps	82	20.1
Smoked the area	150	36.8
No action taken	115	28.2
Total	**408**	**100**

Table 29 - Traditional home care treatment

Type of home care	NO	%
Feed hot fluid and soup	171	42.8
Feed Garic	66	16.5
Feed fatty food	38	9.5
Provide local Araki(alcoholic drink)	20	5
N0 special treatments	105	26.3

Table 30 - Number of household members that have been infected by other diseases in the last five years

Type of the disease	No	%
Communicable diseases	40	27.8
Respiratory illnesses	22	15.3
Stomach problems	30	20.3
Mental Disorder	3	2.1
Others	49	34
Total	**144**	**100**

Table 31 - Household responses to questions asked regarding bed net

Questions asked	Yes response		No response		Total	
	No	%	No	%	No	%
• Do you have any information on bed net	10	3.3	289	96.7	299	100
• Have you used them so far	3	1.0	297	99	300	"
• Have you ever seen bed nets	9	3	290	97	299	"
• Do you have any orientation on usage	13	4.3	286	95.7	299	"
• Do you have any information on price of bed nets	3	1	294	99	297	"

Table 32 - willingness to pay by sex

Willingness to pay interval	Male		Female	
	No	%	No	%
5-50	182	81.2	52	80
51-100	35	15.7	9	13.8
>101	7	3.1	4	6.2
Total	224	100	65	100

Table 33 - Willingness to pay by age

Willingness to pay Interval	18-30		31-45		46-65		>65	
	No	%	No	%	No	%	No	%
5-50	44	71	95	87.2	63	79	32	84.1
51-100	10	16.1	13	11.9	16	20.2	5	13.2
>101	8	12.9	1	0.9	1	1.3	1	2.6
Total	62	100	119	100	80	100	38	100

Table 34 - Willingness to pay by educational level

Willingness to Pay interval	Illiterate		Read and write		Elementary		Junior secondary		Secondary	
	No	%	No	%	No	%	No	%	No	%
5-50	133	80	37	78.7	33	70.22	17	81	10	77
51-100	21	12.6	8	17.02	12	25.54	1	4.8	2	15.4
>101	6	3.6	1	2.2	1	2.2	2	9.5	1	7.7
No response	6	3.6	1	2.2	1	2.2	1	4.8		
Total	**168**	**100**	**47**	**100**	**47**	**100**	**21**	**100**	**13**	**100**

Table 35 - Willingness to pay by land holding

Willingness to pay interval	<1		1. 01-2		2.01-3		>3	
	No	%	No	%	No	%	No	%
5-50	16	100	56	80	103	79.2	25	31.7
51-100	0	0	7	10	15	11.5	32	40.5
>101	0	0	7	10	12	9.2	22	27.9
Total	**16**	**100**	**70**	**100**	**130**	**100**	**79**	**100**

Table 36 - Willingness to pay by oxen ownership

Willingness to pay interval	0		1		2		3-4		>4	
	No	%	No	%	No	%	No	%	No	%
5-50	5	83.3	38	80.9	120	83.9	44	66.6	6	54.6
51-100	1	16.7	7	14.9	19	13.3	17	25.7	2	18.2
>101	0	0	2	4.2	4	2.8	5	7.5	3	27.3
Total	**6**	**100**	**47**	**100**	**143**	**100**	**66**	**100**	**11**	**100**

Table 37 - Willingness to pay by income (average total income)

Willingness to pay Willingness to pay Interval	<1000		1001-2000		>2001	
	No	%	No	%	No	%
5-50	65	91.6	106	89.1	64	64
51-100	5	7	13	10.9	26	26
>101	1	1.4	0	0	10	10
Total	**71**	**100**	**119**	**100**	**100**	**100**

Table 38 - Willingness to pay by family size

Willingness to pay interval	1-2		3-5		>5	
	No	%	No	%	No	%
5-50	7	87. 5	91	81.3	137	80.6
51-100	1	12.5	17	15.2	26	15.3
>101	0	0	4	3.5	7	4.1
Total	8	100	112	100	170	100

Table 39 - Willingness to pay by the number of malaria infected family members.

Willingness to pay interval	1		2-3		>3	
	No	%	No	%	No	%
5-50	42	80.8	120	83.9	59	75.6
51-100	9	17.3	19	13.3	15	19.2
>101	1	1.9	4	2.8	4	5.1
Total	**52**	**100**	**143**	**100**	**78**	**100**

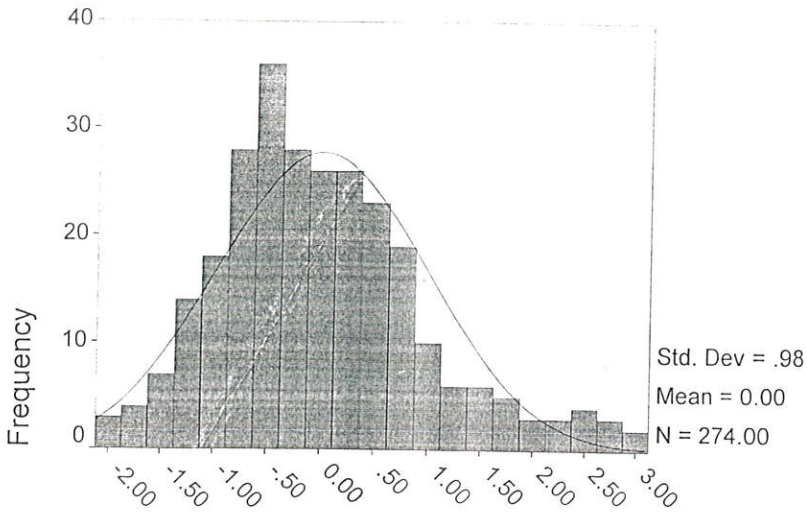
Table 40 -Willingness to pay by average total cost incurred as a result of malaria infection

Willingness to pay interval	< 25 (birr)		26-50		>51	
	No	%	No	%	No	%
5-50	65	83.3	50	84.8	103	78
51-100	12	15.4	8	13.6	22	16.7
>101	1	1.3	1	1.7	7	5.3
Total	**78**	**100**	**59**	**100**	**132**	**100**

Appendix 2

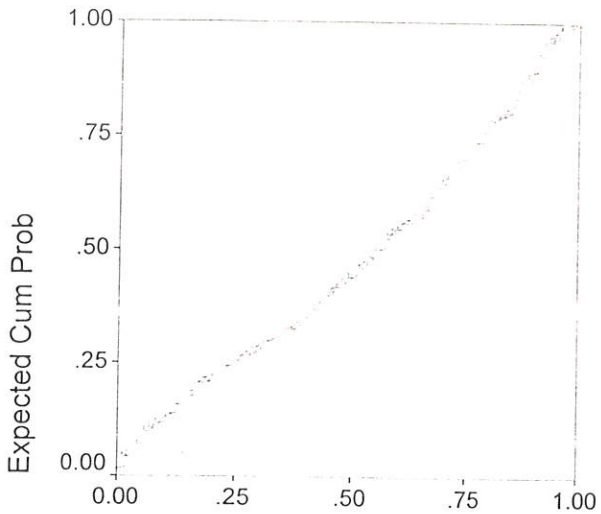
Histogram

Dependent Variable: MWTP



Normal P-P Plot of Regression Sta

Dependent Variable: MWTP



Histogram

Appendix 3

		MWTP	SXHH	AHH	range of education level	FSZH	SZLOH	NOXOH	INCH	SZMIMH	TCMH
MWTP	Pearson Correlation	1.000	-.039	-.032	.020	.119	.280**	.287**	.389**	.202**	.217**
	Sig. (2-tailed)	.	.521	.598	.738	.050	.000	.000	.000	.001	.000
	N	271	271	271	271	271	271	271	271	271	271
SXHH	Pearson Correlation	-.039	1.000	-.140*	-.294**	-.146*	-.130*	-.168**	-.150*	-.058	-.113
	Sig. (2-tailed)	.521	.	.021	.000	.016	.033	.006	.013	.340	.063
	N	271	271	271	271	271	271	271	271	271	271
AHH	Pearson Correlation	-.032	-.140*	1.000	-.234**	.034	.125*	.147*	.070	.041	.096
	Sig. (2-tailed)	.598	.021	.	.000	.572	.040	.016	.254	.498	.115
	N	271	271	271	271	271	271	271	271	271	271
range of education level	Pearson Correlation	.020	-.294**	-.234**	1.000	.093	.052	.173**	.215**	.110	.265**
	Sig. (2-tailed)	.738	.000	.000	.	.126	.392	.004	.000	.071	.000
	N	271	271	271	271	271	271	271	271	271	271
FSZH	Pearson Correlation	.119	-.146*	.034	.093	1.000	.440**	.396**	.345**	.247**	.202**
	Sig. (2-tailed)	.050	.016	.572	.126	.	.000	.000	.000	.000	.001
	N	271	271	271	271	271	271	271	271	271	271
SZLOH	Pearson Correlation	.280**	-.130*	.125*	.052	.440**	1.000	.376**	.547**	.155*	.159**
	Sig. (2-tailed)	.000	.033	.040	.392	.000	.	.000	.000	.011	.009
	N	271	271	271	271	271	271	271	271	271	271
NOXOH	Pearson Correlation	.287**	-.168**	.147*	.173**	.396**	.376**	1.000	.442**	.007	.202**
	Sig. (2-tailed)	.000	.006	.016	.004	.000	.000	.	.000	.905	.001
	N	271	271	271	271	271	271	271	271	271	271
INCH	Pearson Correlation	.389**	-.150*	.070	.215**	.345**	.547**	.442**	1.000	.023	.138*
	Sig. (2-tailed)	.000	.013	.254	.000	.000	.000	.000	.	.709	.023
	N	271	271	271	271	271	271	271	271	271	271
SZMIMH	Pearson Correlation	.202**	-.058	.041	.110	.247**	.155*	.007	.023	1.000	.407**
	Sig. (2-tailed)	.001	.340	.498	.071	.000	.011	.905	.709	.	.000
	N	271	271	271	271	271	271	271	271	271	271
TCMH	Pearson Correlation	.217**	-.113	.096	.265**	.202**	.159**	.202**	.138*	.407**	1.000
	Sig. (2-tailed)	.000	.063	.115	.000	.001	.009	.001	.023	.000	.
	N	271	271	271	271	271	271	271	271	271	271

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Questionnaire

Date of the interview _____

Interviewer's name _____

Interview started _____

Interview ended _____

Kebele (P.A) _____

Household code _____

Part I – Household Characteristcs

1. Name of the Respondent _____

2. Sex ☐

   1. Male
   2. Female

3. Are you head of the household? ☐

   1. Yes
   2. No

4. If no, who is the head of the household?

   _____.

5. What is your relation to the head of the household? ☐

Relationship code

1. Wife	5. Brother	9. Uncle
2. Son	6. Father	10. Grandfather
3. Daugther	7. Mohter	11. Grandmother
4. Sister	8. Aunt	12. Others(Specify)

6. Age _____.

7. Educational level ☐

1. Illiterate
2. Read and Write
3. Elementary (1-6)
4. Junior Secondary (7-8)
5. Secondary (9-12)
6. Teritiary level

8. How many people live in this household including yourself?

_____

9. Would you please tell m.e the age, sex, educational level,occupation profile and type of relation ship of the household memebers.

a) Sex code

1- Male
2- Female

b) Age code

1= <5
2= 5-15
3= 15-65
4=>65

c) Educational level code

1. Iliterate
2. Literate
3. Traditional education
4. Primary
5. Junior secondary
6. Secondary
7. Teritiary

d) Occupation code

1. Agiculture
2. Stock
3. Off farm activity
4. Student
5. Child

e) Relationship code

1.Wife
2. Son
3. Daughter
4. Sister
5. Brother
6. father
7. Mother
8. Aunt
9. Uncle
10. Grand father
11. Grand mother
12. Household head
13. Grand son /daugher
14. Hired labourer

I.D Code	Name	Sex (code a)	Age (code b)	Educational level (code c)	Occupation (code d)	Relationship to the houshold head (code e)

10. What is the total farm size holding of the household?

Code for local unit

1. Timad
2. Kert
3. Geme
4. Massa
5. Hectare
6. Others (Specifty)

	Local Unit	Amount	Hectare
Plot 1			
Plot 2			
Plot 3			
Plot 4			
Plot 5			
Plot 6			
Plot 7			
Plot 8			

11. How many livestock do you own, in the last 5 years.

Code for livestock

1. Oxen
2. cows
3. Calves
4. Donkeys
5. Horses
6. Sheep
7. goat
8. Bulls
9. Heifer
10. Hens
11. Mules
12. Others

Code	1993	1992	1991	1990	1989
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					

12. What is the type of house you own? ☐

1- Tin roofed (Galvanised iron)

2- Grass roofed (Thatch)

3- Other material (specify) _____

13. Household production from agricultural activity (produce) during the last five years.

Crop code

1. Teff
2. Mixed Teff
3. Black Teff
4. Barley
5. Maize
6. Cheak peas
7. Lentil
8. Linsed (telba)
9. Vetch(Guaya
10. Nueg
11. Sorghum
12. Beans/Peas
13. Wheat
14. Fenugreek (Abish)
15. Others(Specify)

Year	Type of the product	Amount produced (in kgs)	Price pre kg.	Income

14. What was the income of the houshold from other sources?

Income Source Code

1. Remittance
2. Off farm activity
3. Food for work
4. Sale of livestok
5. Assistance
6. Honey Sales
7. Sale of hen and eggs
8. Sales of vegetables
9. Others

Year	Income source (code)	Amount (in birr)

Part II- Malaria infection and associated cost

15. When did malaria appear in your area? _____

16. Were any member of your family infected by malaria in the last five years? ☐

1- Yes

2- No

17. If yes, have your taken the patient to modern health instituion or traditional healers?

1- Yes

2- No

18. If any formal health instituion or traditional healers are not visited, what is the reason? ☐

Reason for not vistiing formal health instituions code

1. Hoping that he/she can get better without medical intervention.
2. Went for a holy water
3. Vowed to churches
4. Visited sorcrer
5. Prayed
6. Nutritional care
7. Others (specifty)

19. Would you please tell me the names, occupation, age, sex total days of morbility as a result of malaria infection, severity of illness of the malaria patients of the household members in the last 5 years and agricultural activities to be performed during this period?

a) Occupation codes

1. Agriculture
2. Stock raising
3. off farm activity
4. Student

b) Severity of illness code

1. Very severe
2. Severe
3. Not severe

c) Agricultural activity code

1. Ploughing
2. Weeding
3. Harvesting
4. Threshing
5. Others

d) Action taken to treat code

1. Visted primary health worker
2. Visited the nearest clinic
3. Visited the nerest hospital
4. Visited traditional healer
5. Visitied pharmacy or drug vendor
6. Bought drugs from shop
7. Tsebel
8. Visted Sorcerer
9. Home care
10. No action is taken

year (1993 - 1989)	ID code of Household members	Occupation (code a)	Age 1 = < 5 2 = 5-15 3= 15-65 4= > 65	Sex 1. male 2. female	Length of sick days	Working days lost	Illness month	Severity of illness (code b)	Agricultural activity during this period (code c)	Action taken to treat (code d)	Cost incurred			
											Prevention cost	Modern Treatement cost		Total cost
												Modern Treatment (1-6)	others (7-9)	

20. What actions have you taken to prevent the disease in the last five years? ☐

Preventive actions code

1. Use of repellents
2. Screning of houses
3. Used insecticide impregnated bednets
4. Used insecticide spraying
5. Dried water ponds and swaps
6. Smoked the area
7. Others Specify
8. No action

21. How far are the following from your house? (in kms)

- Primary health worker _____
- Clinic _____
- Hospital _____
- Traditional healer _____
- Drug vendor/Pharmacy _____
- Shop _____

22. How did you compensate the lost working days due to the disease? ☐

1- Covered by other family members

2- Covered by relatives and friends outside the family members

3- Through social institutions such as Idir, Debo etc.

4- Hired labour

5- None

23. If lost working days is compensated through hiring labour and social instituions (idir, debo etc...). Please state the number of days worked and cost incurred.

Year	Type of agricultural activity	Number of days worked	Cost per day	Total cost

24. Did any member of the household lost working 7 ng care of the patient? ☐

1- Yes

2- No

25. If yes, how many days were lost for each patient in the last five years?

a) Care takers relationship to the diseased code

1. Wife
2. Son
3. Daughter
4. Sister
5. Brother
6. Father
7. Mother
8. Aunt
9. Uncle
10. Grand father
11. Grand mother
12. Others (specify)

b) Agricultural activity to be performed code

1. Ploughing
2. Weeding
3. Pruning
4. Threshing
5. Herding
6. School
7. Others

Year	ID code	Patient's name	Names of household members who took care of the patients	Working days lost	Agricultural activity to be performed by the care taker (code b)	Daily wage rate	Total cost

26. Did any member of the household die as a result of malaria infection? ☐

1- Yes

2- No

27. If yes, specify age, sex, and the type of relationship to the respondent in the last five years.

a) Age code

1= <5
2= 5-15
3 =15-65
4=>65

b) Sex code

1. Male
2. Female

c) Type of relationship code

1. Wife
2. Son
3. Daughter
4. Sister
5. Brother
6. Father
7. Mother
8. Aunt
9. Uncle
10. Grand father
11. Grand mother
12. Others(specify)

d) Occupation code

1. Agriculture
2. Stock raising
3. Off farm activity
4. Student
5. None

Year	Name of the deceased	Age (code a)	Sex (code b)	Type of relationship (code c)	Occupation (code d)

28. Is there any action taken by the government to prevent malaria transmission? ☐

1- Yes

2- No

29. If yes, what were this actions?

Year	Action taken

30. How do you identify malaria infection from other diseases, other than laboratory test?

_____

_____.

Symptoms code

1. Fever
2. Shivering
3. Sweating
4. Poor apetite
5. Pain on joints
6. Coldness
7. Severe headache
8. Respiratory distress
9. Losing weight
10. Nausea and vomiting
11. Thirst
12. Don't know

31. What type of care and treatment are provided at home for a patient who is not taken to formal health centers or traditional healers? [ ]

Care code

1. Feed garlic
2. Give them local araki(caticala)
3. Give them hot fluid and soup
4. Feed fatty food items
5. Nothing especial

32. Did any member of the household suffered from other diseases in the last five years? If so how many members and what were the actions taken.

a) **Type of disease code**

1. Tuberclosis
2. Pneumonia
3. Diahrrea
4. Typhoid
5. STD
6. Menta
7. Goiter
8. Gasterites
9. Kidney
10. Other

b) **Severity code**

1. Very severe
2. Severe
3. Not severe

c) **Aciton taken code**

1. Vistied formal health instituions
2. Vistied traditional healers
3. visted sorcerer
4. Went for a holy water (well)
5. Only prayer to God
6. Home care only
7. Vowed to churches
8. No action is taken

Year	Type of a disease (code a)	Number of the deceased	Severity (code b)	Sick kays (amount)	Action taken (code c)	Treatment cost incurred

Part III. Questions on Willingness to Pay for Bed nets

"Malaria is a public health problem in Ethiopia. It is estimated that two-thirds of the population and 75 percent of the total area of the country are at risk of the disease. Limited government resource and efforts of health institutions alone could not guarantee the prevention and control of the disease. Hence, community involvement in these activities has become very crucial in the face of the ever increasing damage inflicted by the disease.

One possible and cost effective means of preventing malaria infection is found to be the use of insecticide impregnated bed nets. These bed nets have proved in reducing malaria morbidity and mortality in many parts of the world. In Ethiopia too it is one of the best malaria control measure that can be handled by households with out difficulty. A bed net can serve for so many years by re-threating it with insecticides every six months for which training will be provided.

Since two thirds of the total population is at the risk of malaria it is not feasible for the government and donor organizations to distribute it free of charge. Therefore, every household in malaria endemic area is expected to buy them so that they can protect themselves against mosquito bites and the consequent morbidity, mortality and other assciated costs." (The net will be visually demonstrated).

Based on the above understanding I will ask you some questions for which I require your kind cooperation.

33. Do you have any information on the insecticide impregnated bed nets? ☐

1- Yes
2- No

34. If yes, where did you get this information?

1- From community health worker
2- From health institutions
3- From extension agents
4- From friends and relatives
5- From media (Radio)
6- From other sources (specify)

35. Have you ever used this bed net so far? ☐

1- Yes
2- No

36. How important do you consider the net in preventing malaria? ☐

1- Very important
2- Important
3- Not important
4- Have no idea

37. Have you ever seen insecticide-impregnated bed nets? ☐

1- Yes

2- No

38. Do you have any orientation on how to use the bed nets? ☐

1- Yes

2- No

39. Do you have any information on the price of bed nets? ☐

1- Yes

2- No

40. If bed nets are provided by the market are you willing to buy them? ☐

1- Yes

2- No

41. If yes, what is the maximum amount that you are willing to pay for it in cash?

_____ Birr

42. If no, what is the reason for that? (if more than one reason, rank the reasons).

a) **Reason code**

1. I have no confidence in it.
2. Can not buy for all family members
3. I can not afford
4. I don't bother much for the disease
5. Others(specify)

43. If certain agency is willing to sale on credit basis, what is the maximum amount that you may be willing to pay for these bed nets? _____ Birrr

44. How many bednets are you willing to buy for the household members?

1- In cash _____

2- On credit _____

DECLARATION

I declare that this thesis is my original work and has not been presented for a degree in any university and all the sources of materials used for the thesis are duly acknowledged.

Name: BELAINEH TAYE

Signature : _____

Date: July 15, 2001

Place: Addis Ababa University, Addis Ababa

This thesis has been submitted with my approval as a thesis supervisor.

Name of supervisor : ABDULHAMID BEDRI

Signature : _____