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ECONOMIC IMPACTS OF MALARIA IN KENYA AND NIGERIA

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ABSTRACT

This paper is an analysis of the short-run economic impact of malaria in Kenya and Nigeria, based on field data. The study concentrates on the annual malaria-related production loss at the national, sectoral, and household levels, as well as for urban and rural populations and for men and women. Included in these estimates are schooldays lost due to both teachers' absence from school and children's affliction with the disease, and the proposed corresponding household spending to combat it. Another factor explored in this study is the reduced productivity for those individuals who return to work during a malaria episode. Popular impressions shared by the population about the disease were also reviewed.

Malaria, whether perceived or confirmed, has a significant economic impact for a single disease. Due to the similar symptoms of other diseases, the study uncovered widespread discrepancies in the identification and definition of malaria in the absence of laboratory tests. In addition, three determinants emerged that are critical to making accurate estimates: 1) malaria prevalence is quite high in general for those who live in malarious zones, regardless of gender or whether the areas are urban or rural; 2) although there exist inaccuracies as to true and perceived malaria for those who do not undergo lab exams, the incidence of both types of malaria nevertheless indicates a high burden of annual illnesses for these countries; 3) estimates on the effectiveness of malaria control tend to be overestimated due to the inaccuracy of estimating true malaria incidents.

Conclusions based on this and related studies stress the importance of including caretaking costs when determining malaria's economic impacts. Significant productivity is lost when women — who comprise a large measure of the production base in both countries and are generally accepted as the caretakers of the family — do not work to care for sick children.

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LIST OF EXHIBITS

GLOSSARY

AFR/ARTS/HHR	AID Africa Bureau
AID	Agency for International Development
ARI	Acute Respiratory Infection
CDC	Centers for Disease Control
CCCD	Combatting Childhood Communicable Diseases Project
GDP	Gross Domestic Product
HEDRA	Health & Development Research Associates
HFS	Health Financing and Sustainability Project
MOH	Ministry of Health
R&D/H/CD	AID Health Office of the Research & Development Bureau
VBC	Vector Biology Control Project
WHO	World Health Organization

CURRENCY VALUES

KENYA 1992 EXCHANGE RATE

1 Kenya pound (K£) = US$.56
20 Kenya shillings (Ksh) = 1K£
36 Ksh = US$1.00

NIGERIA 1991 EXCHANGE RATE

9.91 naira = US$1.00

PREFACE

Each of the country case studies in this report is written as a stand-alone section to facilitate review by readers with a primary interest in findings from only one of the countries. The report has only one overall introduction and description of methodology which provides background that is relevant for all readers. The *Executive Summary* and final section, *Conclusions and Policy Implications*, serve for both country case studies, compare findings from the two country studies, and present information that has general applicability beyond Kenya and Nigeria.

The research team wishes to acknowledge the cooperation and collaboration of Ministry of Health officials and USAID Mission staff in Kenya and Nigeria in the arrangements for and conduct of the field research for this study. In addition, all the people who participated in focus group discussions and related interviews in Kenya and Nigeria did so on short notice, gave generously of their time, and provided much valuable information and insight.

Several HFS and VBC project staff and consultants also contributed to the conduct of field research for the study and final report. The *Introduction* section of the report details these contributions.

The author also wishes to thank Drs. Robin Barlow and Carl Stevens for providing especially useful, thoughtful, and constructive reviews that have enriched the technical analysis in the original draft report. Holly Wong and Samir Zaman also provided comprehensive and insightful reviews that have clarified and strengthened the original presentation.

EXECUTIVE SUMMARY

BACKGROUND AND PURPOSE OF THE STUDY

The Agency for International Development's (AID) Africa Bureau (AFR/ARTS/HHR) and the Health Office of the Research and Development Bureau (R&D/H/CD) asked the Health Financing and Sustainability Project (HFS) to conduct a study of the economic impact of malaria in Africa, with a particular focus on economic productivity and output. R&D/H/CD designated the Vector Biology Control (VBC) project as a collaborator for relevant epidemiologic analysis, along with the Centers for Disease Control (CDC).

Although not intended to be a major primary data collection effort, the study was intended to collect some field-based primary data to confirm assumptions or extend the analysis of other, recent studies. AID specified that the field research would take place in Kenya and Nigeria.

The purpose of the study is to provide estimates and analysis of selected aspects of the short-run economic impact of malaria in two sub-Saharan Africa countries, using a rapid assessment methodology. The study concentrates on estimating one key aspect of the economic impact of malaria that is among the least well-documented with field evidence: annual lost production due to morbidity of workers suffering from malaria episodes and due to workers taking care of infants and children suffering from malaria. The study estimates these malaria-related production losses at the national gross domestic product (GDP), sectoral, and household levels, as well as for urban and rural populations and for men and women.

In addition to these production losses due to malaria, the study estimates health costs for malaria treatment and control at the household level, though not at the national level. At AID's request, the study also includes field-based information on estimated schooldays lost due to malaria morbidity.

Given AID's objectives for the research and a given level of resources for field work, HFS designed the research to focus on a selected number of key research issues and data gaps, and developed a rapid assessment methodology for the field work, using focus groups in an innovative way.

PATTERNS AND PERCEPTIONS OF MALARIA

In Kenya, the Ministry of Health (MOH) estimates that malaria accounts for 30 percent of all illness nationwide, as measured by out-patient clinic visits. Malaria morbidity and mortality rates have increased in recent years due to the increase in chloroquine-resistant malaria, along with other factors. Malaria is endemic in most of Kenya, with either stable (continuous) or unstable (seasonal and epidemic) transmission patterns. Approximately 14 percent of the population lives in a malaria-free zone, Nairobi, and areas with an altitude greater than 1,600 meters.

In Nigeria, malaria is endemic throughout the country, though seasonality varies, particularly between the northern and southern regions. Malaria is reported to be the leading cause of death in children in Nigeria, but is not life-threatening for adults in most cases.

Although the most serious health threat from malaria in Kenya and Nigeria is mortality for infants and children, one of malaria's most immediate economic impacts derives from morbidity that causes people to miss work because they and their children are suffering from malaria. Because adults rarely die of malaria, the impact of malaria mortality, in the short or long run, on loss of trained manpower (human capital cost) is minor or negligible. The economic impact of malaria is different in this respect than in the case of other major diseases in Africa, such as HIV/AIDS, which causes premature death primarily for prime working-age adults.

The study focuses on "perceived" malaria, that is, on what people perceive to be malaria and what health workers typically, presumptively diagnose as malaria. It is concerned with what people perceive to be malaria illness episodes, not with the prevalence of malaria as measured by presence of parasites in the blood that are not manifested in illness symptoms. The study is also not intended to be an epidemiologic or clinical study of malaria.

The focus group interview methodology used, however, did attempt to ensure that people reported on malaria episodes based on symptoms as close as possible to accepted clinical symptoms. But because of the well-known discrepancy between perceived and "true" laboratory-confirmed cases of malaria, the study also includes estimates of economic impact based on existing country data for laboratory-confirmed malaria. The study adopted this approach to provide a reality check for people's perceptions and for related policy implications of the benefits to be obtained from reducing the incidence and severity of "malaria."

Exhibit E-1 shows the high and low estimates from the focus group perceptions about malaria incidence and its effect on their work. These focus group estimates form the basis of the estimates of production loss due to malaria.

MALARIA'S IMPACT ON PRODUCTION

As a rapid assessment focused on the short run, this study adopts the standard assumption that the workdays lost due to malaria mean that production is lower than it would have been had the workers not been absent. Specifically, the study makes the standard assumption that all workdays lost because of malaria represent the loss of an average day's worth of production, as measured by the average wage value of those days' labor in each of the major economic sectors. Within the parameters of a rapid assessment, the study uses a variety of methods to minimize distortions that may exist in these standard measures for the economies under analysis due to surplus labor, underemployment, and unemployment.

Workdays lost due to malaria include days lost during a malaria episode, as well as lower productivity for days that workers come to work during an episode, for both men and women full-time workers who miss days for purposes of their own malaria episodes, as well as for caretaking of children suffering from malaria. Following focus group responses in Kenya and Nigeria, the study assigned all caretaker production losses to women.

Exhibit E-1: Key Focus Group Perceptions Used For Estimates Of the Economic Impact of Malaria in Kenya & Nigeria

FOCUS GROUP PERCEPTIONS	KENYA		NIGERIA	
	HIGH ESTIMATE	**LOW ESTIMATE**	**HIGH ESTIMATE**	**LOW ESTIMATE**
Malaria episodes per adult per year	4	2	3	1
Workdays missed per adult episode	4	2	3	1
Malaria episodes per child per year	4	2	4	2
Workdays missed per child episode for caretaking	4	2	3	1
Children per woman who require caretaking for malaria	3	3	3	3

Conclusions from this study suggest three important characteristics about the economic impact of malaria.

First, accumulating evidence from this and similar studies suggests that malaria's economic impact is substantial, especially for a single disease, principally because such a large percent of the population experiences several malaria episodes per year that require adults to stay home from work to recuperate themselves or to take care of sick children.

Second, the magnitude of the economic impact is different at different levels of the economy and broad national averages are likely to mask some of the most important economic impacts. This study shows that the impact is stronger for some sectors than others, stronger at the sectoral than the national economic level, and may be most severe at the household level.

These differences in impact are also likely to vary across countries. For example, in countries where a substantial majority of the population works in agriculture, as in Kenya and most African countries, malaria may have its biggest economic impact in the agricultural sector even though the value of a day's labor in agriculture is generally the lowest of any of the major economic sectors. In other situations, such as in Nigeria, where the structure and distribution of the labor force is more complex, malaria's economic impact may be equal to or greater in other sectors than agriculture.

Third, this study's findings demonstrate that the dynamics of malaria's economic impact may be more complex than they are usually thought to be. One of the implications of the complexity is that the impact of lost production from malaria cannot be easily predicted based only on the importance of each sector to the national economy.

For example, although the agriculture sector produced only 27 percent of Kenya's GDP in 1992, malaria-related production loss in agriculture represents 57 percent of the total value of malaria's production loss to the Kenyan economy. In Nigeria, the service sector produced 26 percent of 1991 GDP, but represents 43 percent of malaria's production losses. Industry in Nigeria shows the reverse relationship, representing 38 percent of GDP but only 10 percent of the total value of malaria-related lost workdays.

This complexity is also evident in findings that malaria's economic impacts are at least as sensitive to the numbers and male-female composition of workers in each sector as they are to value of a day's labor in that activity. For example, agriculture can represent a disproportionate portion of malaria's economic loss because the much greater number of workers in agriculture outweigh the lower value of their average daily labor.

The agriculture sector in Kenya is also the most strongly affected, based on percentage of total production lost, because more than one-half (55 percent) of the agriculture workforce is female, compared with 18 percent in the service sector and 7 percent in industry. In Nigeria, the service sector bears the largest burden because it has the greatest proportion, 41 percent, of women workers. The relative percentage of women workers has this disproportionate effect because they lose workdays for their own malaria episodes, as well as for their children's.

Specific results that illustrate these points follow.

National and Sectoral Levels

- The total annual value of malaria-related production loss — due to lost workdays and low productivity days — represents 2 to 6 percent (low and high estimates) of GDP in Kenya and 1 to 5 percent in Nigeria, where malaria incidence is somewhat lower than in Kenya, according to focus group reports.

- The total effect of workdays lost due to malaria in Kenya is to deprive the national economy of the person-year equivalent of 3 to 14 percent of its employed workforce, and 1 to 8 percent in Nigeria.

- The value of production losses based on laboratory-confirmed malaria are about one-half the level of the study's main estimates based on the number of malaria episodes as perceived by focus groups.

- The total value of production losses in both Kenya and Nigeria is highest in agriculture and lowest in industry. Losses in agriculture account for 58 percent of total malaria production losses in Kenya and 50 percent in Nigeria. Industry losses represent 7 percent of the total in Kenya and 10 percent in Nigeria.

- Sectoral impacts, as measured by percent of total sectoral production lost due to malaria, range from 2 to 13 percent in Kenya and from 1 to 8 percent in Nigeria under the high estimates. In Kenya, the agriculture sector, with 13 percent loss, is the worst affected. In Nigeria, it is the service sector, with 8 percent loss, that is worst affected.

Urban and Rural Populations

- In Kenya, the annual value of lost production due to malaria morbidity in rural areas is almost 40 percent higher than lost production in urban areas. In Nigeria, the rural-urban distribution is reversed, with urban losses five percent higher than rural losses.

- In the aggregate, the rural population bears the largest share, 58 percent, of total annual production loss in Kenya. In Nigeria, the urban population bears a slightly greater portion, 51 percent, than the rural population.

Men and Women Workers

- Working women bear 71 percent of the malaria-related production loss in Kenya under the high estimate and 65 percent in Nigeria.

- Rural women bear 80 percent of the total production loss in Kenya, while urban women in Nigeria bear the largest burden, 71 percent.

- Because of their dual role as worker and caretaker, working women in Kenya stand to lose 16 to 64 (low and high estimates) workdays per year to malaria, four times as many workdays as their employed male counterparts. In Nigeria, working women lose 7 to 45 days per year to malaria, five to seven times as many workdays as employed men.

Urban and Rural Households

- The total impact at the household level of lost income and health care costs for malaria morbidity could amount, under the high estimates, to 5 to 18 percent of household income, depending on socioeconomic level, in Kenya and 5 to 19 percent in Nigeria, depending on socioeconomic level.

- Typical rural households in Kenya and lower income urban households in Nigeria are the hardest hit by malaria's economic impact. Kenyan small farm households stand to lose four to nine times (low and high estimates) a greater share of household income due to malaria-related lost workdays than agriculture laborers in the formal sector or urban middle-income households. Nigerian urban lower income households and small farm households are three to six times more disadvantaged than urban middle-income households in terms of lost income from malaria workdays missed.

- For both Kenyan and Nigerian households, malaria's health care costs — treatment for malaria in the public and private sectors, along with modest expenditures for protection from mosquitoes — can outweigh the lost income from missing work due to malaria morbidity. In Kenya, these health costs could absorb 4 to 9 percent (high estimate) of household income, depending on socioeconomic level and patterns of health care chosen. In Nigeria, health costs could absorb 4 to 13 percent (high estimates) of household income.

- The burden of malaria health costs is highest for small farm households in Kenya (9 percent of annual income) and highest for urban middle-income households in Nigeria (13 percent of annual income). Urban middle-income households in Kenya, however, can spend a greater share of income, 8 percent, than rural small farm households on malaria health costs when they choose higher priced sources of care and medications.

Schooldays Lost

- In Kenya, each primary school student misses an estimated 20 schooldays per year due to malaria; 10.8 percent of Kenya's 186-day school year. Each secondary school child misses eight days, 4.3 percent of a school year.

- Nigerian primary and secondary school students miss an estimated 3 to 12 schooldays per year, 2 to 6 percent of the school year.

- Additional losses to students, not included in these estimates, can occur due to days that teachers also miss due to malaria.

Exhibit E-2 provides summary data for these economic impacts in Kenya and Nigeria.

Exhibit E-2: Annual Economic Impact of Perceived Malaria in Kenya and Nigeria

(High Estimates, values in millions of U.S. Dollars)

	KENYA		NIGERIA	
Economic Sectors	**Value**	**% of Sector's Total Production Value**	**Value**	**% of Sector's Total Production Value**
Agriculture	231	12.7	872	6.9
Service	139	4.2	746	8.4
Industry	29	2.2	170	1.3
Total, GNP	400	6.1	1789	5.2
Urban, Rural Men, Women Workers	**Value**	**% of Total Impact**	**Value**	**% of Total Impact**
Urban	169	42.2	916	51.2
Rural	231	57.8	872	48.8
Men	117	29.3	623	34.8
Women	282	70.6	1165	65.2
Households	**% of Annual Household Income Represented by Malaria Economic Burden**		**% of Annual Household Income Represented by Malaria Economic Burden**	
Urban middle-income	9		5	
Urban self-employed	(Nigeria typology only)		19	
Rural small farm	18		13	
Agribusiness & Industry Laborers	5		(Kenya typology only)	

POLICY IMPLICATIONS

Malaria and the Overall Illness Burden

Based on popular perceived malaria episodes, the overall burden of illness that adults and children face each year is quite high. Given the effect that malaria has on individual productivity, there is a strong economic justification, as well as a health justification, for intervention.

- ▲ Future program and project initiatives should address economic impacts by focusing on specific studies that target groups who would benefit most from planned interventions.

Health Costs

It was beyond the scope of this study to estimate health care costs for malaria at the national level. But findings from the household and industry analyses indicate that total private sector costs are substantial.

- ▲ The development of less costly malaria treatment and control alternatives would benefit the majority of the population, which does not have employer-provided health benefits, aa well as employers who provide those benefits.

Health Education

Due to incorrect self-diagnoses by individuals and clinics, the strengthening of health education and service delivery is needed to improve identification and diagnosis of malaria and illnesses with related symptoms.

- ▲ Health education efforts that improve malaria diagnosis can have an economic benefit by helping families, firms, and insurance companies properly allocate expenditures and health dollars more effectively.

Household and Employer Willingness to Pay for Malaria Services

Findings from this study demonstrate that the population is willing to pay substantial amounts for the costs of treating malaria. These findings suggest that spending for malaria could absorb the majority, or entire, household budget for health, regardless of income level.

- ▲ Financing policies for malaria can build on the demonstrated high willingness to pay on the part of both households and employers, but should also provide information and create incentives to allocate spending for cost-effective treatment regimens and cost-effective combinations of treatment, prevention, and control measures.

Distribution Of The Economic Burden of Malaria

The burden of health expenditures tends to be unevenly distributed among rural and urban populations, with households at lower socioeconomic levels spending greater shares of their income than better-off households and women losing more income than men.

- ▲ Special priority should be given to women employed in the lowest income occupational categories who bear the greatest burden.

- ▲ Targeting efforts to reduce malaria and provide more effective diagnosis and treatment for infants and children would provide the single greatest relief to women in low-income groups, and also serve to lessen the economic burden of employers who provide substantial sick leave and health services benefits.

Emerging Patterns

AID recently supported two other major studies of the economic impact of malaria in sub-Saharan Africa (Shepard, et al. 1990 and 1991 and Ettling, et al. 1993). In combination, findings from this and the other studies suggest several emerging patterns about malaria's economic impact in sub-Saharan Africa:

1. Malaria has a measurable economic impact at the national level that is significant for a single disease.

2. The highest impact is consistently shown at the household level; the lowest impact is shown at the level of sub-Saharan Africa as a whole.

3. The incidence of what the population perceives as "malaria" and what is presumptively diagnosed as "malaria" in health facilities is substantially higher than estimates based on laboratory-confirmed, or clinical cases.

4. Estimates of caretaking costs must be included in assessments of the economic impacts of malaria and other diseases in sub-Saharan Africa.

FOLLOW-UP RESEARCH

The purposes of future research should be: to better understand the determinants and dynamics of the relationships; to assess the cost-effectiveness of current spending and coping patterns; and to develop alternatives that minimize the economic impact.

Topic areas for further research include:

- ▲ Caretaker behavior, lost income, and costs
- ▲ Household spending for malaria treatment and prevention
- ▲ Employer health and production costs for malaria, including organizational and technological coping methods for frequent worker absences
- ▲ Cost-effectiveness and cost-benefit analyses that go beyond usual malaria effectiveness measures to include measures of economic benefit
- ▲ Use of pilot projects and demonstrations to test alternative approaches for reducing the economic impact of malaria on households, women, and employers.

1.0 INTRODUCTION

1.1 BACKGROUND

AID's AFR/ARTS/HHR and R&D/H/CD asked the HFS Project to conduct a study of the economic impact of malaria in Africa, with a particular focus on economic productivity and output, which is an area of emphasis in the Development Fund for Africa Action Plan. R&D/H/CD designated the VBC Project as a collaborator for relevant epidemiologic analysis and, along with the CDC, as responsible for providing and collecting relevant epidemiologic data to support the economic analysis.

Following AID's request, this study became part of the HFS Project's major applied research activity. The project's mandate calls for nine major and 30 smaller applied research activities in five technical areas related to the costs and financing of health services. The HFS applied research approach reflects a practical orientation based on field research and ground-breaking subject matter. HFS applied research aims to help countries develop policy options to improve the financing and performance of their health systems, and hence the health of their populations.

The main features of the scope of work for this study provided for an analysis of economic impact of malaria in two African countries, focusing on labor productivity, especially in agricul- ture, with a modest field data collection effort (two to three weeks each for a two-person team) in the two countries. The scope of work suggested initial research questions and data needs, to be further specified after review of the literature and available data. The scope also specified that the economic impact would be assessed with a spreadsheet model, which HFS would develop and which would be available to AID and interested countries for replication. The focus was to be on short-term economic impact, with estimates for a single recent year, to facilitate comparison with other recent studies of economic impact of malaria in Africa of interest to AID.

Given AID's particular objectives for the research and working with a given level of resources for field work, HFS designed the research to focus on a selected number of key research issues and data gaps, and developed a rapid assessment methodology for the field work, using focus groups in an innovative way. The following text elaborates briefly on the purpose, scope, and intended uses of the study, followed by a description of the theory and methodology for the study.

1.2 PURPOSE AND SCOPE OF THE STUDY

The purpose of the study is to provide estimates and analysis of selected aspects of the short-run economic impact of malaria in two sub-Saharan Africa countries, using a rapid assessment methodology. The study concentrates on estimating one key aspect of the economic impact of malaria that is among the least well-documented with field evidence: annual lost production due to morbidity of adults suffering from malaria attacks and due to adults taking care of infants and children suffering malaria attacks. The study estimates these malaria-related production losses at the national (GDP), sectoral, and household levels, as well as for urban and rural men and women.

In addition to these production losses due to malaria, the study estimates health costs for malaria treatment and control at the household level. At AID's request, the study also includes field-based information on estimated schooldays lost due to malaria morbidity.

The study excludes estimates of the economic impacts of mortality due to malaria, even though malaria's most serious health threat from malaria is mortality for infants and children. In part, the mortality impact is excluded because of resource and data constraints. It is also important to note, however, that malaria's most immediate, short-run economic impact derives from morbidity that causes people to miss work because they or their children are suffering from malaria.

Because adults rarely die of malaria, the impact of malaria mortality, in the short or long run, on loss of trained manpower (human capital cost) is minor or negligible. The longer run impacts of the relatively high rates of infant and child mortality due to malaria and to any other major childhood disease on lifetime earnings lost or population growth rates and development, while important, are outside the scope of this study. (For discussion and analysis of these longer-run impacts see, for example, Barlow 1968, Stevens 1977.)

The study focuses on "perceived" malaria, that is, on what people perceive to be "malaria" and what health workers typically, presumptively diagnose as "malaria." It is concerned with what people perceive to be malaria illness episodes, not with the prevalence of malaria as measured by presence of parasites in the blood that are not manifested in illness symptoms. The study is not intended to be an epidemiologic or clinical study of malaria.

The interview methodology used, however, did attempt to ensure that people reported on malaria episodes based on symptoms as close as possible to accepted clinical symptoms. But because of the well-known discrepancy between perceived and "true" laboratory-confirmed cases of malaria, the study also includes estimates of economic impact based on existing country data for laboratory-confirmed malaria. The study adopted this approach to provide a reality check for people's perceptions and related policy implications of the benefits to be obtained from reducing the incidence and severity of malaria.

The study focuses on malaria-related health costs at the household level to help fill an important gap in current information. But the scope of work for this study specifically excluded analysis of systemwide health sector costs (i.e, in-patient and out-patient services and medications in the public and private sectors) for malaria treatment and prevention. These health sector costs, especially at the national level, are often already available to MOHs and USAID missions. Estimation of these costs is relatively routine and can be more efficiently conducted through means other than this research effort.

AID intended that this study's findings be useful for policy and programming decisions related to allocation of resources to malaria and design of interventions to prevent or mitigate the economic impact of malaria. The study was not intended, however, to compare the cost-benefit or cost-effectiveness of malaria interventions with other health sector services or with investments in other sectors or to provide information on the relative cost-effectiveness of different types of services or actions to treat, prevent, or control malaria.

R&D/H and AFR/HHR identified two main intended users of the study results: 1) national level, government policymakers and program managers (e.g., primarily in the Ministries of Health, Finance, and Planning) and USAID mission program staff, in the countries to be studied; and 2) AID/Washington staff. The study methodology, as well as any generalizations of the findings that would be appropriate, were to be useful, as well, to other countries and USAID missions who might wish to replicate the study.

1.3 CONDUCT OF THE STUDY

Because of its nature as a centrally funded AID research activity, design and conduct of the research occurred with participation in various phases on the part of Washington-based staff and USAID mission, Ministry, and research staff based in the countries concerned. HFS developed the research design, with input from VBC, under the overall direction of AID/Washington offices. AID/R&D/H/CD chose the two countries for field research, based on information and interest expressed by USAID missions. Final adaptations to the research design and data collection instruments were made in the field, based on advice of local MOH and USAID mission officials and local research teams.

HFS made every effort to be responsive to individual country situations, perspectives, and interests, while retaining necessary elements of comparability between the two field research efforts. In this regard in Nigeria, an additional emphasis was placed on gathering qualitative epidemiologic data from focus groups and the initial design element of conducting research in both a continuous and seasonal malaria transmission zone was dropped. In Kenya, the additional emphasis was on refinements to the economic data and analysis, as well as on doubling the number of sites in each type of malaria zone in response to MOH interests.

Two research teams conducted the field data collection over the period March - April 1993 in Nigeria and May - June 1993 in Kenya. In both countries, the data collection instruments, including interview guides for the focus groups, were pre-tested in several sites. The research teams conducted the actual focus group interviews in a total of three weeks' time in both countries.

In Kenya, the research teams were led by Dr. John Ouma, the chief of malaria activities for the Kenyan MOH and Dr. Joseph Wang'ombe, Chairman of Health and Development Research Associates (HEDRA), a Kenyan health and economics consulting firm under subcontract with the HFS project. Dr. Charlotte Leighton, HFS Principal Investigator for the study, worked with the MOH and HEDRA teams on final planning and pre-testing for the field study in May 1993. MOH staff, led by Dr. Ouma's delegate, Mr. Njage, partici-pated along with HEDRA researchers and interviewers, Dr. O.N.

Gakuru, Dr. Casper Odegi Awuondo, Ms. Rose Ngugi, and Mr. George Odera Outa, at each of the research sites in Kenya. HEDRA conducted the focus group interviews, collected Kenyan economic data, and provided preliminary estimates and analyses of the Kenya findings.

In Nigeria, CDC staff of the Combatting Childhood Communicable Diseases project (CCCD), Mr. James Herrington and Dr. Richard Spiegel, provided in-country support and facilitated contacts with Nigerian MOH officials. Dr. Okokon Ekanem, Chief Consultant in the Malaria and Vector Control Division of the Federal MOH and Mr. Jide Banjo, Senior Technician from the same division, along with Dr. Elemile from the Malaria Division in the Oyo State MOH advised and actively participated in the various research activities during the field research phase. Dr. William Brieger, Professor in the Department of Preventive and Social Medicine at the University of Ibadan and consultant for the HFS Project, was responsible for arranging and conducting the focus group interviews with university-based interviewers and researchers. Mr. Samir Zaman, an HFS economist and Dr. Mary Ettling, a VBC consultant in epidemiology, worked with Dr. Brieger and the focus group interviewers, collected the economic data, and collected additional facility-based epidemiologic data during a three-week visit to Nigeria in April 1993.

Under its contract, HFS was responsible for preparing the final estimates and writing the final report. Dr. Leighton was the main author, with assistance from Rebecca Foster, HFS Research Associate. Ms. Foster and Mr. Zaman completed the final compilations of focus group data and data analyses for the estimates of economic impact for Kenya and Nigeria. Dr. James Sonneman, the VBC project manager and collaborator for the study, made contributions to the Nigeria and epidemiology sections of the final report. Dr. Wang'ombe made contributions to the Kenya, research, and methodology sections of the report.

1.4 ORGANIZATION OF REPORT

The following report describes the theory and methodology (Section 2.0) and presents findings and analyses of the epidemiologic and economic impacts of malaria for Kenya (Section 3.0), followed by Nigeria (Section 4.0).

For both country case studies, Sections 3.0 and 4.0 first present an overview of the epidemiology of malaria in the country and the results of the focus group findings regarding perceptions of malaria that serve as the basis for the estimates of the disease's economic impact. The presentation and discussion of economic impacts includes results for the agriculture, industry, and service sectors and the national economy (GDP); for urban and rural populations and men and women; and for households. The country sections conclude with a brief discussion of estimated schoolday loss due to malaria.

Section 5.0 presents general conclusions, identifies selected policy and program implications, and suggests follow-up research.

2.0 THEORY AND METHODOLOGY

2.1 THEORIES AND REALITIES ABOUT PRODUCTION LOSS DUE TO ILLNESS

One of the most important theoretical and practical questions in any study of the economic impact of a disease is how much production is lost when a worker misses a day because of illness. This question is particularly important for economies such as those under analysis in Africa that are often characterized by surplus labor in agriculture, underemployment in industry and services, and/or high unemployment. This question has also both short and long-run dimensions, with different implications depending on current technologies, ways of organizing work, and coping mechanisms that firms develop to accommodate expected levels of morbidity among workers. The longer-run dimensions of this issue are especially important for overall levels of economic development and well-being of the societies under analysis (see for example, Barlow 1968 and Stevens 1977).

This study does not seek to provide new information to answer all the dimensions of this question. The field research did not include studies to determine the extent of surplus labor or underemployment. As a rapid assessment, focused on the short run, this study adopted standard approaches and assumptions that provide order-of-magnitude approximations of the financial value of short-run production losses. The field research and analytic approach of this study also provide important insights for some of these theoretical questions and lay the foundation for more in-depth research to develop more refined estimates of production losses due to malaria.

The following text elaborates briefly on the theory and reality of lost production due to malaria in the countries under analysis because they are important for interpretation of the findings.

Workdays lost due to malaria potentially represent the amount by which the overall production of the economy could be raised. That is, in theory, the lost workdays mean that a lower level of production is achieved than would be possible with available production resources and existing technology if workers were not periodically absent due to malaria. This production loss represents a loss of income throughout the economy and it is often measured by the average daily wage, or marginal product of labor, for the lost workday.

A variety of circumstances could mean that, in reality, no or very little production is lost if a worker misses several days' work, compared with production that would have occurred had the worker been present. This situation can occur in surplus labor situations such as high labor-to-land ratios in agriculture or high underemployment situations in the formal sector where other workers can easily make up the sick worker's output; or where leisure time is substituted to make up for the lost sick time; or where an otherwise unemployed family member takes the place of a self-employed worker. Many of these situations represent deliberate mechanisms that employers and workers have developed to cope with a certain level of absence from work that all expect to occur. In many of these cases, the marginal product (and the opportunity cost) of the lost days could be small or zero and the same level of production could occur with or without the sick worker present on that day.

At the level of the individual firm, malaria workday losses could also mean that the firm produces less because of frequent worker absences than it could, with available technology, if the absences did not occur. On the other hand, to the extent that coping mechanisms are already in place to accommodate a certain level of worker absence for illness, the workday absences could mean a higher cost of production than if workers were never absent due to malaria.

These higher costs can take the form of the costs of extra workers that need to be hired to achieve a desired current production level in the face of frequent absences due to malaria. To the extent that more full-time employees are hired than would be necessary in the absence of malaria, these costs of adapting the production function to malaria may be higher than the costs of the missed workdays since the extra workers, or over-hiring, would be a continuous cost regardless of and in addition to workers' illness absences.[1] The high prevalence and incidence rates of malaria in Kenya and Nigeria (and sub-Saharan Africa generally) suggest that the cost of coping with malaria by adapting the organization and technology of work may be significant.

Higher costs to the firm can also include the costs of paid sick days or medical care benefits that malaria absorbs. Ordinarily, these costs are likely to be lower than the other labor and production function costs of malaria. But the high prevalence and incidence of malaria in sub-Saharan Africa could make these costs not insignificant to employers.

Similarly, at the worker and household level, lost workdays theoretically represent lost income. But in reality the loss depends on the nature of the work and the terms of employment. For example, workers with paid sick leave days do not lose a day's income when they miss work due to malaria. Self-employed workers may not actually lose a day's income during "off seasons," but may during "peak seasons." At the household level, malaria episodes can also represent a greater or lesser cost for malaria treatment or prevention and control measures depending on whether an employer provides health benefits.

For the sectoral and national economy estimates, this study focuses on workdays lost to malaria morbidity. It is beyond the scope of this study to assess the losses due to (or costs of) production function adaptations. In addition, in the absence of more detailed, readily available information for Kenya and Nigeria, the study adopts the standard assumption that each full workday lost to illness represents the loss of one full day's production, as measured by the average daily wage (see, for example, Rice 1967, Shepard, 1991). But, as the following sections on methodology explain, it adapts several approaches to minimize the distortions that may arise from problems of surplus labor and underemployment in the economies under discussion.

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[1] The author wishes to thank Carl Stevens, Professor of Economics at Reed College of Oregon, for emphasizing this point.

Further, this study was designed to provide new information to capture some of the variations that in reality affect malaria's economic impacts for households. At the household level, the field data collected for this study permits analysis of a variety of situations depending on whether workers in fact are likely or not to lose income due to workdays lost.

2.2 METHODOLOGY OVERVIEW

In general, the methodology serves as a pilot effort to examine malaria's short-run economic impacts at various economic levels and for various target population groups, and to do this with a rapid assessment methodology that could be readily replicated by interested countries.

The principal innovation in the analytic approach is to estimate malaria's economic impact at various levels of the economy and for various population groups to identify the distribution of the economic burden and the levels at which the impact is most significant. Most studies of the economic impact of various diseases in developing countries assess the impact at only the national or regional level. Some estimate the impact at a single work site. Few have assessed the impact on various population groups or at the household level. The usefulness of this study's approach is to reveal impacts that may be masked by overall averages, identify the relative distribution of the economic impact among key sectors and population groups, and identify economic impact in a way that has the clearest implications for program decisions and actions.

The principal innovation in primary data collection consists of developing a hybrid focus group methodology to collect both quantitative and qualitative information about malaria. This methodology can be implemented more readily and less expensively than household surveys. As a rapid assessment method, however, it relies on small, not purely random samples that can provide indicative though not statistically representative findings.

The following text describes the main features of the research design, estimating techniques, data bases, the field site sample, and focus group methodology. It also identifies data constraints addressed by the study methodology and provides guidance for interpretation of the findings within the parameters of the rapid assessment methodology.

2.3 LEVELS AND MEASURES OF ANALYSIS

This study estimates the economic impacts of both the production loss and health care costs due to malaria. These two components — production loss and health care treatment costs — are standard elements in assessing the economic impact of disease and are often referred to as the indirect and direct costs (Rice 1967).

The study focuses its estimates of malaria-related health costs at the household level, rather than the national health sector level. At the household level, the study estimates the costs of out-patient treatment services and medicines during malaria episodes for the adults and children, as well as costs related to prevention. The sections of this report that present household findings for Kenya and Nigeria provide more detail on methodology for the health cost estimates.

With respect to the main focus on malaria-related production loss, or indirect costs, the study estimates production loss at several levels of analysis: national (GDP) and sectoral economic levels; the household, urban, and rural populations; and men and women workers. At the sectoral level, the study uses the three standard categories — agriculture, industry, and service[2] — that make up the national economy and for which data are generally available for a wide range of countries (e.g., in the World Bank's annual World Development Report statistical annex).

This study assesses two dimensions of malaria's impact on production: 1) lost workdays during a malaria episode, and 2) lower productivity during days that workers come to work during a malaria episode. For simplicity, the estimates ignore the effects on work that may occur due to subsequent complications (e.g., anemia) following a malaria episode.

Exhibit 2-1 summarizes the key features of the research design.

Exhibit 2-1: Key Features of Research Design for Estimating the Economic Impact of Malaria in Kenya and Nigeria

<table>
<tr><th>LEVEL OF IMPACT</th><th>DIMENSIONS OF PRODUCTION LOSS</th><th>MEASURES OF PRODUCTION LOSS</th><th>DATA SOURCES</th></tr>
<tr><td>National economy (GDP)</td><td rowspan="4">1. Lost workdays
PLUS
2. Low productivity days

On the part of men and women workers a) who are suffering from malaria and

b) who take time off to take care of infants & children suffering from malaria</td><td rowspan="3">1. Average daily wage for workers in each of the 3 economic sectors
2. Person-Year equivalent of lost workdays and low productivity days</td><td rowspan="3">Focus group interviews conducted for this study

Secondary sources with statistical data on production, wages, and employment</td></tr>
<tr><td>Economic Sectors:
Formal and informal sectors in :
Agriculture
Service
Industry</td></tr>
<tr><td>Urban and Rural Men and Women</td></tr>
<tr><td>Households</td><td>1. Lost income
PLUS
2. Health care expenditures</td><td>Typology constructed for this study using focus group and secondary data</td></tr>
</table>

[2] "Agriculture" includes forestry, hunting, fishing, and animal husbandry, as well as agriculture. "Industry" covers manufacturing, mining, construction, and utilities (electricity, water, and gas). The service sector includes all other branches of economic activity, such as restaurants, transportation, banking, commerce, and government.

Estimates include these dimensions of production loss both for workers afflicted with malaria, as well as for workers who are caretakers of children suffering from malaria. The study assigned all caretaker production losses to women, since — in both theory and in reality as confirmed by the field data collected for this study — they are the primary persons who take time from work to take care of sick infants and children.

Lost workdays, as well as lower productivity days, are valued at average wage levels (converted into an average daily wage) in each of the sectors. For Kenya, which had the greater available economic data, this study derived the average sectoral wages from available government statistics for average wages in a series of formal and informal economic activities that comprise the industry and service sectors. For the agriculture sector, this study used two values of a day's labor, one for the formal sector and another for the small farm sector. For wage-based agriculture in the formal sector, the study used the official published average wage for that sector. For the much larger small farm agriculture sector, the study derived a separate value of a day's labor on small family farms based on the value of total agriculture sector production (after subtracting the value of the formal agriculture sector) and government employment and population data.

The more appropriate measure of value of a lost workday would be the marginal product of labor, which could be lower or higher than the average wage. But since marginal product data were not available, this study follows the standard approach and uses the average wage as an approximation of the marginal product.

This approach has some drawbacks in economies such as Kenya's and Nigeria's, where average wages will reflect the marginal product better in some of the individual labor markets within the various sectors than in others. These variations in accuracy across subsectors will also make overall sectoral and national averages less reliable as measures of the true economic cost of malaria-related lost workdays. Certain other adjustments could also have been made to average wage data for purposes of estimating the value of a day's labor (e.g., shadow wage rates; including the value of lost capital associated with the lost labor).

Some of these refinements and adjustments to the average wage measure of a lost workday would lower the total estimates; others would have the effect of raising the estimated value of lost workdays. On balance, using the prevailing average wages provides as reasonable an approximation in the short run of the financial value of a day's labor if not a refined measure of labor's marginal product or of the full economic cost in the economies under discussion as would estimates based on refinements that would have to rely on several additional uncertain assumptions. In addition, by using the specific average wages that prevail in a series of activities in each of the formal sectors of the economy, major differences in productivity, in the value of a day's labor, and across the agriculture, industry, and service sectors are reflected.

The study also measures lost workdays and lower productivity days in terms of the equivalent amount of time they represent in terms of full-time employed persons, or "person-years," using a standard average number of days per year, 260, for which a person employed full-time is paid. This measure helps assess malaria's impact in relation to employment levels and organization of work and provides another perspective on malaria's economic impact. The "person-year" measure, 260 days, is a standard average number of paid workdays that fits some of the occupations in Kenya and Nigeria better than others. But the average used here can be taken as illustrative of the concept and could be easily altered with more in-depth field research to reflect specific country or sector realities.

The estimates of lost production measure the lost workdays of the total employed labor force. Thus, time lost from work is counted for men and women workers (adults between age 15 and 65) who are counted in officially available data as employed full-time in the formal and informal sectors or who are actively engaged full-time in small farm family agriculture. This study's estimates for lost production do not include any value for any time of unemployed people or non-remunerated activities that any person may carry out. For example, no value is included for time lost from conducting household chores, raising children, and related household and family maintenance activities.

Appendix A contains details on key variables, measures, and estimating assumptions.

2.4 ESTIMATING TECHNIQUES

This analysis uses a simple spreadsheet methodology for estimating these economic impacts. Spreadsheet methodologies in general do not incorporate certain dynamic changes and interactions in the economy addressed by more sophisticated macro-economic modelling equations. One of the main reasons for choosing a spreadsheet methodology was to fulfill the original intent of the study to use a methodology that would be replicable in interested countries without extensive training in its use. It represents a practical approach that provides reasonably indicative estimates that can be performed relatively rapidly with secondary and generally available economic data.

For example, the spreadsheet model for this study estimates the annual production loss due to malaria at the national level, GDP, simply by adding the total of production losses in the agriculture, industry, and service sectors. For the sectoral production losses, the average daily wages for each of the sectors are calculated as weighted averages of the wages prevailing in key types of activities in each of the sectors, as listed in the available government statistical publications.

These average daily sectoral wages are multiplied by the numbers of malaria episodes per worker, times the numbers of days missed, including low productivity days per episode, times the number of people employed in each of the sectors. Lost production due to "caretaker days" are calculated in the same fashion, using number of child episodes and days missed per child episode and number of children under the care of each employed woman, and added to the value of days lost due to the workers' own malaria episodes.

The estimates in this study apply the same average wage to both men's and women's workdays lost due to malaria, assuming that the published average wages were derived from both men's and women's wages. Urban and rural estimates are derived from the sectoral estimates. Thus, lost production in rural areas is assumed to be largely composed of loss in the agriculture sector; urban losses are assumed to be the sum of industry and service sector losses.

This simple model required a series of initial calculations, such as those to derive average sectoral wages, distribution of informal sector workers, and numbers of adults working primarily on small family farms. It also required manipulation of and judgements about the focus group data base to determine the average or mode where that measure was more appropriate to the distribution of responses, value for such variables as number of days missed or worked at lower productivity per worker per episode, or proportion of day lost on low productivity days varying in each of the three main sectors.

While most of these calculations are straightforward, using simple arithmetic, and based on adequate data, the estimates of adult men and women engaged full-time in the small family farm sector and the value of one day of their labor involved the most assumptions. The small farm sector had to be derived and extrapolated from other total employment, population, and sector values, since official wage and employment data do not cover this group.

The analysis includes high and low estimates of the production loss due to malaria morbidity. These are based on high and low assumptions about the incidence of malaria and its effect in causing people to miss work (e.g., number of annual malaria episodes per worker, days missed from work per episode). These high and low assumptions are derived directly from focus group responses collected for this study. The high and low estimates include variations only for these epidemiologic variables. Because the main questions prompting this study related to malaria's effect on days lost from production, the main economic variables in the estimates — wages and employment levels — are held constant.

The main analytic tool for estimating household impact was to construct a typology, using data from the focus groups and readily available statistical sources. The households are constructed to illustrate income losses due to malaria in relation to "typical" income from employment for households at different socioeconomic levels and occupational categories, "typical" malaria-related health expenditures for that type of household, and "typical" household size and composition. The household typology is also a rapid assessment effort to reflect several different situations for illustrative purposes. Data from the household typology do not reflect all common household types in Kenya and Nigeria and are not statistically representative or designed to be additive to the national level. Each country section of this report provides detail on the specific household typologies developed for that country.

2.5 DATA BASES

All epidemiologic data used for the calculations of economic impact are based on data from the focus group interviews conducted for this study in Kenya and Nigeria. In addition, data related to malaria's impact on people's work behavior are based on focus group findings.

For the Kenya analysis, economic data (e.g., average wages, employment statistics) were available or could be readily derived from the World Bank World Development Report statistical annex or published government sources (Kenya Economic Survey 1992 and 1993) for employment and wages in the informal, as well as the formal, sector and for women as well as for men, for the agriculture, service, and industry sectors. The estimated average number of children per women, three, used for the estimates related to caretaking, also come from the Kenya Economic Survey data; other estimates of percentages of the population under age 15, along with other population based data, would produce a lower average number of children per woman on a national basis.

For the Nigeria analysis, much more of the economic data had to be derived and estimated based on somewhat uncertain assumptions. For example, the only wage data available was an average manufacturing sector wage for 1990 and employment data was available only for 1986. Several very different total 1990 population estimates were identified. An exhaustive search for secondary sources in the U.S. and Nigeria in the field research sites did not locate any more current, relevant national or state level economic data.

This study estimates the annual economic impacts for malaria for a single recent year, as do most of the other studies of the economic impact of malaria (e.g., Shepard, ed. 1991, Ettling, et al. 1993). One prominent exception is the 30-year projection that Barlow made for Ceylon, now Sri Lanka (Barlow 1968). Shepard also projected his estimate of the Africa-wide economic burden of malaria for the year 1995. The base year — 1992 for Kenya and 1991 for Nigeria — is the most recent year for which the most complete economic data were available for each country. The Glossary page of this report provides the relevant exchange rates for the Kenya pound (K£) and the Nigerian naira for those years.

2.6 FIELD SITE SAMPLE AND FOCUS GROUP METHODOLOGY

Sample selection. The research design called for a small sample of focus groups to collect information from workers and managers in each of the three economic sectors covered in the study. Field research teams were also to review absenteeism, health facility, and school records where available at work sites in the sample. Although resource constraints limited the sample size, the design attempted to develop a sample that would be indicative of typical economic activity in each of the three economic sectors, as well as the principal differences in malaria transmission. The design called for two types of occupational activity each in the agriculture, industry, and service sectors to be selected in urban and rural areas in both a continuous and seasonal malaria transmission zone. Research teams were also to collect relevant general statistics, usually available at the national level.

In Nigeria, the research team conducted all focus group interviews in Ibadan and surrounding rural areas in Oyo State, a continuous malaria transmission zone. Original plans to include a seasonal transmission zone were dropped because of logistic considerations in arranging research in a seasonal zone during the timing of the study. The sample size in Oyo State was doubled to compensate for this limitation in site locations.

Nigerian agriculture focus groups were composed of farmers from various villages recruited for discussion in large market sites, as well as workers at two agribusiness sites such as a poultry farm and a sawmill. Industry sites where worker focus groups were conducted included a 7-Up bottling plant and a furniture assembly plant. Categories of service sector focus groups included teachers, artisans, drivers, traders, and workers at commercial sites, such as banks and travel agencies.

In Kenya, the initial research design was modified to include two, rather than one, geographic locations in each type of transmission zone to respond to the MOH's interests. Thus, Kenyan sites in continuous zones include sites in a coastal and a mountainous lake area (Kilifi and Kisumu); sites in the seasonal transmission zones include an irrigated area in the highlands (Mwea); and a Rift Valley site (Eldoret).

In Kenya, the small farm sites were rural communities where most residents engaged full-time in family farm agriculture. The agribusiness sites, where workers are employed on a wage basis, included a ranching plantation and a coffee processing plant. Service sites included a hotel and an insurance company, as well as one secondary and two primary schools. The industry sites were a textile factory and a brewery.

Exhibit 2-2 summarizes the numbers and compositions of the focus groups in the selected sites in Kenya and Nigeria.

In both Kenya and Nigeria, each focus group was occupationally homogeneous, with five to seven members, all of whom were workers at the same occupational level and engaged in the same or a similar activity. Focus group members included both men and women for each of the sites and types of economic activities. Men and women were interviewed in separate groups to facilitate freer discussion under local cultural practices. The agriculture focus group members were either the male or female farmers of small family farms or laborers in agribusiness sites. Industry focus group members were blue-collar workers and service sector focus groups were composed of white-collar workers in formal sector organizations, school teachers, or self-employed tradespeople.

Within each of these group criteria, focus group members were chosen as randomly as possible at the actual sites. For example, at each of the formal sector sites, the research team discussed the purpose of the survey with a manager or school principal first, and asked the manager to select focus group members as randomly as possible from among the relevant workers. For the small farm sector in Kenya, the local chief carried out this function. In Nigeria, the research team followed the same process as in Kenya for the formal sector organizations, but randomly collected many of the other focus groups (e.g., farmers, traders, artisans) in large market settings.

Managers at industry and service sector formal sector sites were interviewed separately from the workers. Depending on the site, research teams conducted interviews and a record review with the single manager or with two to three in a small group.

Exhibit 2-2: Focus Group Sample and Field Sites in Kenya and Nigeria

KENYA					
WORK SITE	# of Focus Groups	Total # Respondents		# Focus Groups in Continuous Zone	# Focus Groups in Seasonal Zone
		Male	Female		
Small Farm Agriculture	2	14	12	1	1
Agribusiness	2	12	10	1	1
Service: Schools	3	14	14	1	2
Other	2	10	10	1	1
Industry	2	11	13	1	1
Total	11	61	59	5	6

NIGERIA					
WORK SITES	# of Focus Groups	Total # respondents		# Focus Groups in Ibadan	# Focus Groups in Rural Towns
		Male	Female		
Small Farm Agriculture	4	16	15	0	4
Agribusiness	2	12	0	0	2
Service: Schools	8	28	32	4	4
Other	11	56	17+	5	6
Factory	2	13	0	2	0
Total	27	125	64+	11	16

Interview methodology. The focus group discussions were a hybrid of focus group, group interview, and household interview methodologies. One research team member acted as moderator and led the discussion, while a second member recorded responses. Discussions lasted from 1.5 to 2 hours. An English language questionnaire was developed in advance of the research, then pre-tested in Kenya and Nigeria in the local languages and adapted for relevant local variations.

Appendix B provides a copy of the agenda that served as the basis for developing and translating the exact questions for the focus groups in each country.

Discussions included questions seeking both qualitative and quantitative information about the experience of malaria for adults and for infants and children (e.g., symptoms of malaria, numbers and duration of episodes in the past year); malaria's effect on work and productivity (e.g., days of work missed each episode, days missed to take care of a child sick with malaria, whether people go to work while sick with malaria, whether someone takes the place of an absent worker); and usual sources and costs of malaria treatment and of prevention or control.

While most of the questions asked focus group members to think in terms of a typical malaria episode, the recall period for numbers of episodes was one year. Discussion about the one-year period included questions about whether there were peak periods during which most episodes occurred and questions to ensure as much accuracy as possible. The one-year recall period, though longer than usual, was chosen because there were no reliable data from which to extrapolate a shorter period to the annual period needed for this research.

The moderator began each focus group session with a discussion to reach a consensus on the definition of malaria to be used for purposes of the subsequent questions. Although discussions were spontaneous and free-flowing, as in standard focus group methodology, the moderator also asked direct questions, in varying order according to the flow of each group's discussion, to elicit the information needed, following data collection instruments developed and pre-tested in advance. The research teams subsequently compiled the quantitative information from each focus group onto standard forms that HFS developed so that the data could be reviewed systematically and estimates developed for the spreadsheet calculations.

2.7 DATA CONSTRAINTS ADDRESSED BY THE STUDY METHODOLOGY

One of the primary constraints for rapid assessment studies of the economic impact of malaria in Africa is the generally weak or unavailable secondary source information, especially relevant epidemiologic statistics, for adults. While good standard statistical sources for broad-based economic data exist for most African countries, specific data needed for assessing production losses related to illness often do not.

For example, epidemiologic data for malaria needed to make reasonably reliable estimates at the aggregate national level are limited. Data necessary for sectoral or household impact are virtually non-existent. Estimates of the lost production due to malaria morbidity require data on the number of malaria episodes and related work behavior per person (i.e., per worker), while MOH health information systems typically report on malaria episodes in the aggregate from health facility utilization data with uncertain population bases. And it is by now relatively well-documented that a large portion of malaria episodes do not get treated at health facilities (see, for example, Chitsulo, et al. 1992).

In addition, while many African countries have selected data on infant and sometimes child malaria, accurate information on morbidity and mortality for adult malaria is rare. Even when adult data exist, they are often not representative, not clear what population base they are part of, and/or not aggregated into categories of adults, e.g., by occupation or urban-rural area, age, and gender, which are important to assessing even general aspects of economic impact of malaria on labor productivity.

Very little data exists, even at formal sector work sites, on the actual absenteeism from work due to malaria or other specific diseases. Data on the degree of debility or disability from malaria are generally approximate and cited as a range (e.g., three to seven days) and based either on anecdotal evidence or expert opinion. Virtually no data exist on the effect on production of a worker suffering a malaria episode continuing to work.

An additional constraint is the difficulty of identifying malaria distinctly from other diseases in the absence of laboratory-tested blood smears. These definitions are especially important for a study of malaria because several common definitions are used: whether a person has malaria because parasites are present in the blood, but without clinical symptoms of illness *vs.* illness episodes that people and clinicians presume to be and call "malaria" *vs.* a presumed malaria episode that is confirmed by laboratory parasitology tests. Each of these definitions provides a different estimate of malaria incidence and the magnitude of the problem.

The use of focus group interviews for this study was designed to compensate for as many as possible of these data and definitional constraints. A representative sample household survey would have been the preferable method for collecting much of the individual level quantitative data needed for this study. But not enough resources were provided to conduct them, and any interview methodology addressed to the general public faces the same definitional and recall problems for malaria. On balance, this study's pilot use of a hybrid focus group discussion methodology served effectively as a rapid, less expensive alternative that is also potentially more easily replicable than a large-sample household survey.

2.8 INTERPRETATION OF FINDINGS

Interpreting the findings of this study must take account of both the advantages and disadvantages of the rapid assessment methodology used for this study. For example, because the sectoral and national estimates were extrapolated from a small sample of focus groups, statistical measures that can be applied to large, random samples of quantitative data do not apply. Thus, the findings must be viewed as indicative, rather than predictive or statistically representative at any of the levels of analysis, whether household, sectoral, or national.

This study's findings are especially useful for indicating areas in which future research and pilot demonstration efforts may be most useful. Although the usual statistical measures are not applicable, this study's estimates can be taken as order-of-magnitude estimates of production losses, that could be refined with more extensive and in-depth data gathering and analysis. They also provide a reliable measure of the relative magnitudes of malaria's economic impact — that is, solid evidence of which types of economic activity and population groups are likely to be most and least affected, along with some of the principal reasons for those distributional impacts.

Similarly, the extent to which the rapid assessment estimates using readily available secondary economic data accurately measure "true" economic cost in economies like Kenya's and Nigeria's is uncertain. But these data can be expected to provide a reasonable estimate of the short-run financial costs of lost workdays due to malaria morbidity. In addition, the focus group responses in both Kenya and Nigeria revealed clear, consistent patterns of response on all the major variables. This internal consistency adds confidence to the reliability and representativeness of the results. Further, as Section 5.0 discusses, the methodology produces estimates that are in line with findings of other studies of the economic impact of malaria in other African countries.

3.0 IMPACTS OF MALARIA IN KENYA

3.1 EPIDEMIOLOGY

3.1.1 Epidemiology of Malaria in Kenya

Malaria has long been a leading cause of morbidity and mortality in Kenya. While the patterns and rates of transmission vary considerably among regions, malaria accounts for roughly 30 percent of all out-patient visits to health facilities. In 1989, malaria was the leading cause of out-patient morbidity. Over four million cases are reported annually, with a case fatality rate among those admitted to health facilities of at least 5.1 percent. The situation, already a major public health concern, has deteriorated in recent years as both morbidity and mortality rates due to malaria have increased. Reasons for this increase include the rising presence of chloroquine-resistant malaria parasites, and the implementation of development projects, in particular irrigation schemes and water conservation dams that serve as vector breeding grounds.

The primary species of malaria in Kenya, accounting for 80 to 90 percent of all cases, is *Plasmodium falciparum*, associated with the most fatal form of the disease. The second most common species, *P. malariae*, accounts in some areas for as much as 10 percent of all cases. While the two remaining species, *P. ovale* and *P. vivax*, do exist in Kenya, their presence is limited and sporadic.

Transmission patterns, influenced by rainfall, vector species, intensity of biting, and altitude, vary dramatically by region. In the most severely impacted areas, Coast, Nyanza, and Western Provinces, transmission is high with as much as one infective bite per person per week. This pattern of transmission is stable or continuous with some fluctuation during the year. Peaks generally occur four to eight weeks after rainfall in May, June, and July. In these areas, the burden of the disease falls primarily on infants and young children who have not developed the high levels of clinical immunity maintained by older age groups. Approximately 37 percent of the population live in continuous transmission zones.

Unstable malaria transmission is characterized by much lower rates of endemicity. In seasonal endemic zones, malaria tends to have one or two peak periods of transmission. The impact of agricultural development is most serious in these areas where maintenance of mosquito breeding zones has increased the number of transmissions as well as the length of transmission periods. About one-half the population lives in a seasonal or other type of unstable malaria transmission zone.

In addition to seasonal transmission, there are two other types of unstable malaria zones. Highly unstable but endemic malaria occurs primarily in the arid and semi-arid regions of Kenya. While this pattern of transmission is unpredictable, it nevertheless accounts for 40 percent of all out-patient cases. Highland malaria occurs in the form of epidemics in areas which border endemic zones. Following three decades of relatively little transmission, there has, since 1988, been a series of highland epidemics. Given the high population density and agricultural yield in these areas, the impact of these epidemics has been particularly severe.

The final category of unstable transmission in Kenya is non-endemic malaria. These "malaria-free" zones are areas with an altitude greater than 1,600 meters and Nairobi city. About 14 percent of the population lives in these malaria-free zones.

The Kenya MOH has recognized and responded to the significant threat malaria poses to the health of its population. Its efforts to control malaria, as described in the 1992 "Kenya National Plan of Action for Malaria Control," are multi-faceted and diverse, emphasizing prevention, diagnosis, and case management. Key prevention activities include the promotion of insecticide-treated bed nets, specific vector control interventions, as well as health education targeted at individuals, families, and communities.

3.1.2 Population's Perceptions of Malaria and Its Impact on Work

In Kenya, focus group responses indicated that perceptions of the symptoms of malaria conformed to the classical expectations for the condition, i.e., high temperature, head and body aches, shivering, and weakness.

Focus group estimates of the number of malaria episodes per year and duration of episodes did not vary significantly by age, sex, sector, or geographic location. Over one-half (60 percent) of the focus group responses fell between the range of two to four malaria episodes, lasting three to seven days each episode, in the past year. The low and high ends of this range provide the basis for this study's high and low estimates. The remaining 40 percent of responses suggest that roughly equal proportions of people have no malaria episodes as those who have, or perceive that they have, a very high number of episodes. Thus roughly 20 percent of the adult responses were zero and 16 percent reported no malaria episodes for children. Another 20 percent report more than four annual episodes, with almost 8 percent of the adults citing more than ten episodes and 4 percent reporting a child with more than ten. Similarly, focus group responses for number of workdays missed tended to fall between the range of two to four days per episode.

Exhibit 3-1 summarizes the key elements of the focus groups' perceptions used in the analysis of sectoral and national economic impact of malaria. The sections of the report that present the household typology describe patterns of focus group responses regarding seeking and paying for health services and medicines to treat malaria.

It is important to note that, even though focus group sites were located in both continuous and seasonal malaria transmission zones, there was no systematic pattern of differences in the reported number of malaria episodes or number of days missed per episode between the two types of zones. Focus groups in the seasonal zones did, however, identify two peak seasons each year during which they were most likely to have an malaria attack.

Focus groups varied by sector with respect to whether or not someone replaces or compensates for the tasks of a person who misses work due to malaria. In some types of work situations, such as manufacturing and agribusiness, focus group respondents indicated that fellow workers often carry out the work of a worker absent due to malaria (or other illness), so that the same production target is reached each day regardless of absences. Because production goals are set for teams, fellow team members are expected to make up for the efforts of a worker who is absent due to malaria. They reportedly do this by working during breaks or staying overtime. This form of worker substitution and compensation is most common in industries where fixed, quantitative production targets are most common.

In other types of work situations, where production goals tend to be less easily quantifiable, focus group participants indicated that no one takes their place when they are absent. Such a pattern was most evident for the service sector, in particular schoolteachers and people working in insurance or hotels. In addition, fewer than one-half of the small farmer focus group respondents indicated that someone took their place or helped out on days they were too sick to work or, in the case of women, had to care for their children.

Exhibit 3-1: Key Focus Group Perceptions Used For Estimates For The Economic Impact Of Malaria In Kenya

FOCUS GROUP PERCEPTIONS	HIGH ESTIMATE	LOW ESTIMATE
Malaria episodes per adult per year	4	2
Workdays missed per adult episode	4	2
Episodes per child per year	4	2
Workdays missed to take care of infant/child with malaria, per child episode	4	2
Children per woman who require caretaking for malaria	3	3

Informal sector workers and small farmers tended to be the only ones who reported that they actually lose money from missed workdays. Their responses indicated that they lose 50 to 100 percent of their potential earnings for each day. Workers employed full-time in the formal sector are not as likely to lose income for days they are sick. All but two of the workers in the focus groups who were employed full-time reported no income lost from missing a day's work due to malaria or other illnesses. Managers at these sites reported sick leave policies that would provide benefits ranging from 45 to 60 sick days per year.

In addition to missing work, focus group respondents indicated that many workers go to work while sick with malaria for at least a portion of the duration of the illness. This practice is particularly common among agricultural and service sector workers — people who stand to lose income if they miss work. For example, all male and female agriculture sector workers in the focus groups for this study and all workers at two out of five (40 percent) of the service sector sites reported following this practice. Among participants who worked while sick with malaria, estimates of the number of such days tended to cluster around two days per episode.

These workers also estimated that they accomplished none to 50 percent of their usual production on those days. By contrast, none of the industry workers reported going to work while sick with malaria.

Similarly, managers at the service sector, industry, and agribusiness sites reported that workers come to work even though sick. Five out of six of these managers reported that fewer than half the workers followed this practice and three of the six reported that those workers lost less than one-half the workday due to low productivity, while the other three managers reported a loss of one-half a day or more due to low productivity.

Managers expressed a variety of opinions about the overall impact of malaria on their company. Managers' views in the hotel, plantation, brewery, and coffee processing operations included "loss of money and man-days," "costly in terms of lost work," "means an extra cost of drugs and casual labor." On the other hand, managers in an insurance firm and a wool mill thought malaria's impact was "nil" and "not very serious."

Missed work due to caretaking of children with malaria contributes significantly to lost production for urban and rural women in all sectors. Female focus groups indicated that they missed two to four days of work caring for each malaria episode of each of their children. Male focus group participants indicated that they knew very little about their children's episodes of malaria and felt that caretaking is a woman's responsibility. None of the focus groups said that anyone stayed home from work to take care of older people.

3.2 ECONOMIC IMPACTS

3.2.1 Production Loss in Agriculture, Industry, and Service Sectors

Value of Workday Loss. Estimates based on focus group discussions indicate that malaria causes the highest production losses in the agriculture sector. Under the high estimates, for example, the value of lost production in agriculture in 1992 (K£384 million) is 60 percent higher than losses in the service sector (K£240 million) and 7.5 times higher than industry's losses (K£51 million). For the economy as a whole, the aggregate value of these losses in the three sectors equals K£677 million, 6 percent of Kenya's GDP in 1992, under the high estimate and 1.5 percent under the low estimate.

Exhibit 3-2 shows the distribution of these production losses under the high and low estimates by sector and for the national economy (GDP).

Agriculture also suffers the highest impact relative to the sector's total production. As Exhibit 3-2 shows, in 1992, the value of lost workdays in agriculture due to malaria represents from 3 percent (low estimate) to 12 percent (high estimate) of the value of the agriculture sector's total production. The value of lost production in the service and industry sectors is less than 5 percent under both the high and low estimates.

These findings show that the impact of lost production from malaria does not directly depend on or reflect the importance of each sector to the national economy. Thus,the agriculture sector, which produced 27 percent of Kenya's GDP value in 1992, represents 57 percent of the total value of production loss from workdays missed due to malaria in 1992 under both the high and low estimates. The service sector shows the reverse relationship: it produced 51 percent of 1991 GDP, but represents 35 percent of production loss due to malaria workdays lost in that year. Industry represents 22 percent of GDP but only 8 percent of the total value of malaria-lost workdays.

Exhibit 3-2: Annual Value of Workdays Lost Due to Perceived Malaria in Kenya

	WAGE VALUE OF LOST WORKDAYS	
Economic Sector	Wage Value in millions of Kenya £	Percent of sector's total production value
HIGH ESTIMATES		
Agriculture	384	12
Service	241	4
Industry	51	2
TOTAL, GNP	677	6
LOW ESTIMATES		
Agriculture	96	3
Service	60	1
Industry	13	.5
TOTAL, GNP	169	1.5

It is important to note some of the reasons for the higher losses in agriculture relative to the other sectors. According to focus group discussions, the incidence of malaria episodes does not appear to be higher in rural than in urban areas, or among agricultural workers, compared with workers in other sectors. But the value of lost workdays is substantially higher than the loss in the other two sectors because 85 percent of the labor force works in agriculture in Kenya. The lower value of one day's labor for a worker in small family farm agriculture, compared with average daily wages for industry and service sector workers, is more than offset by the much larger number of workers — and malaria workdays missed — in agriculture.

The main reason for the relatively larger impact *within* the agriculture sector (as measured by percent of total sectoral production lost due to malaria) is the high percentage of women in the agriculture work force, compared with women's share of employment in the service and industry sectors in Kenya. Over one-half (55 percent) of the agriculture work force is female, compared with 18 percent in the service sector and 7 percent in industry.

Women have a disproportionate effect on production losses because of their role as caretakers. Using estimates from the focus groups in this study, each employed woman loses 12 to 48 more workdays to take care of children with malaria than an employed man. Assuming an average of three children to be cared for, along with her own malaria episodes, an employed woman stands to lose 16 to 64 workdays per year to malaria, four times as many workdays as her employed male counterpart.

It is also important to note the inverse of the high impact in agriculture, that is, the wage value of malaria workday losses in the industry and service sectors are, together, almost as high (75 percent) as the value of agriculture sector losses. This effect occurs even though only 15 percent of employed workers are engaged in the industry and service sectors, because their wages substantially exceed the value of labor in agriculture. Average wages in the service sector (185 Ksh/day) and industry (167 Ksh/day) are eight to nine times higher than the estimated value of one day's labor in small farm agriculture (20 Ksh).

These dynamics demonstrate the importance of performing specific analyses and estimates for different country and economic situations to estimate the economic impact of malaria. For example, they show that the overall economic impact of malaria for a given economic sector or occupational category, such as agriculture or industrial worker, cannot be easily predicted from the sector's or occupation's relative wage levels or contribution to the national economy. Malaria's economic impacts are at least as sensitive to the numbers and male-female composition of workers in the sector as they are to the value of that activity to the economy. Because these factors combine in different ways in each national economy, general predictions must be made carefully.

Exhibit 3-3: Annual Person Year Equivalent of Lost Workdays Due to Perceived Malaria in Kenya

Economic Sector	Number of person-years represented by days missed (in 000s)	Percent of sector's total employed workers
HIGH ESTIMATES		
Agriculture	1,428	14
Service	144	10
Industry	34	8
TOTAL, GNP	1,606	13.5
LOW ESTIMATES		
Agriculture	357	3.5
Service	36	3
Industry	9	2
TOTAL, GNP	401	3

Person-Year Loss. Exhibit 3-3 shows the impact of malaria in relation to each sector's overall employment level in terms of the person-year equivalent represented by the annual total number of workdays lost due to malaria. Using this measure, the loss in workdays due to malaria in agriculture translates into a loss of 1.4 million person-years (high estimate) in 1992, representing the equivalent of 14 percent of the 10 million persons employed in the agriculture sector that year. The service sector suffered a loss of 144 thousand person-years (high estimate) in 1992, an equivalent of 10 percent of the 1.4 million total persons employed in the service sector in that year. Assuming the majority of industry and service sector workers are employed in urban areas, the combined loss of person-years in industry and service represent the equivalent of 10 percent of urban-employed persons in 1992.

The total impact of workdays lost due to malaria across all three sectors is to deprive the national economy of the equivalent of 3 percent (low estimate)to 14 percent (high estimate) of its employed workers. From this perspective, eradication of malaria — if it were possible — would free up the three to 14 percent of current person-years absorbed by malaria sick days to be applied to other economic activities or higher production levels of existing activities.

On the other hand, as focus group interviews conducted for this study suggest, some types of work are currently organized to compensate for sick days. If, in the hypothetical absence of malaria, employers chose to reduce costs by firing the "extra" workers who are needed to meet existing production goals by compensating for frequent absences due to illness, unemployment might be increased by these person-year equivalents. This alternative would double (under the high estimate) current unemployment in Kenya, which has been approximately 15 percent in recent years.

From any of these perspectives, the absolute numbers of person-years of work each year for which malaria requires employers or independent farmers to compensate in some way indicate the magnitude of adjustment required. They reflect the continuous annual effort needed to replace the lost labor hours, increase labor productivity, or make other adjustments to labor's role, in the leading growth sectors, industry, and service, as well as in agriculture.

Low Productivity Workdays. In addition to staying home and missing two to four whole workdays during the four to six day malaria episode, focus group discussions indicated that many workers go to work during some of the days while sick with malaria. Using focus group findings, this study assumed a modest amount of lost production due to low productivity days due to malaria morbidity: one-half the agriculture sector workers and 25 percent of the industry and service sector workers try to work for two of the days they are sick with malaria and lose an estimated portion of production for those two days of each malaria episode. (Appendix A provides precise details.)

Estimates based on these assumptions suggest that these low productivity days represent an additional K£11.3 million (low estimate) to K£37 million (high estimate) loss to the national economy. As in the case of lost workdays, the agriculture sector suffers the highest impact and represents the largest proportion of total costs to the national economy under both the high and low estimates.

Exhibit 3-4 shows the distribution of the estimated costs of these low productivity days by sector.

Low productivity days also represent a modest additional loss in terms of person-year equivalents. In agriculture, for example, the person-year equivalent of low productivity days under the high estimates amounts to 1 percent of the workdays of all persons employed in agriculture. The impact from low productivity days is smaller — less than 1 percent — for the service and industry sectors under the high estimates and negligible under the low estimates. For the economy as a whole, low productivity due to working during malaria episodes represents the annual equivalent of the workdays of one percent of all Kenyan workers.

Exhibit 3-4: Annual Value of Lost Production Due To Low Productivity While Working During Malaria Episodes in Kenya

Economic Sector	Wage Value of low productivity in millions of Kenya £	Person-Year Equivalent of Low Productiv. (in 000s)
HIGH ESTIMATES		
Agriculture	28	0.9
Service	8	0.1
Industry	1	0.1
TOTAL, GNP	37	0.3
LOW ESTIMATES		
Agriculture	9	0.3
Service	2	0.0
Industry	0.1	0.0
TOTAL, GNP	11	0.1

Combined Impact of Lost Workdays and Low Productivity. Combining the impacts of both lost workdays and low productivity days, malaria's total annual impact on production amounts to K£713 million or 6 percent of GDP under the high estimates and K£180 million, 1.6 percent of GDP under the low estimates. In terms of person-year equivalents, this combined impact represents from 436 thousand person-years (low estimate) to 1.7 million person years (high estimate), 4 to 14 percent of the workdays of all full-time employed Kenyans in 1992.

Exhibit 3-5 shows the wage value of these total impacts for each sector, as well as for the economy as a whole. Exhibit 3-5 also shows the estimated total economic impact of the lost workdays plus low productivity days due to malaria using the lower incidence as represented by laboratory-confirmed malaria, compared with the larger incidence of malaria as perceived by the population. At 40 percent of the perceived rate of malaria, laboratory-confirmed estimates of malaria's economic impact are just under one-half those based on people's perceptions.

Perceived and Laboratory-Confirmed Malaria. This report has focused so far on the study's findings based on the population's perceptions of malaria, that is, of the numbers of illness episodes that people themselves attribute to malaria. But both people's perceptions, as well as presumptive clinical diagnoses, are not always parasitologically accurate, as measured by laboratory tests. National MOH data for Kenya show, for 1990, that only about 40 percent of cases diagnosed clinically as malaria were confirmed as positive by laboratory-tested blood smears.

Exhibit 3-5: Annual Economic Impact of Perceived and Confirmed Malaria in Kenya Due to Value of Lost Workdays and Low Productivity

	PERCEIVED MALARIA		LAB-CONFIRMED MALARIA	
Economic Sector	Value in wages (millions of Kenya £)	Percent of sector's total production value	Value in wages (millions of Kenya £)	Percent of sector's total production value
HIGH ESTIMATES				
Agriculture	413	13	165	5
Service	249	4	99	2
Industry	52	2	21	1
TOTAL, GNP	714	6	285	2
LOW ESTIMATES				
Agriculture	105	3	42	1.3
Service	62	1	25	0.4
Industry	13	0.5	5	0.2
TOTAL, GNP	180	2	72	0.6

It is important to keep in mind this distinction between perceived and true laboratory-confirmed malaria for several reasons. To the extent that reports of perceived and clinically diagnosed malaria overestimate malaria incidence, they may cover up the existence of other health problems with similar symptoms, and these other problems may receive less attention than they deserve. Similarly, reduction or eradication of true malaria would not produce a total reduction in the morbidity — and its consequent economic impacts — commonly associated with malaria. To avoid misleading results, estimates of the cost-effectiveness and costs and benefits of prevention and control of malaria need to keep these distinctions between perceived and laboratory-confirmed malaria in mind as well.

3.2.2 Economic Impacts For Urban and Rural Men and Women Workers

Men and Women Workers*. Exhibit 3-6 shows the malaria-related production loss attributable to men and women, along with the share attributable to women.*

Women in total, and in two of the three sectors, account for a higher production loss than their male counterparts even though women have a lower labor force participation rate than men, especially in the formal sectors in urban areas. For example, the value of women's lost production in agriculture, K£332 million, is four times higher than their male agriculture worker counterparts'. Women working in the service sector account for 62 percent of the value of malaria-related lost production in that sector. The value of men's lost production exceeds that of women only in industry, where men constitute 93 percent of the employed labor force. In total, the value of women's lost production due to malaria accounts for 71 percent of the value of all lost production for the Kenyan economy and is 2.5 times greater than men's lost production.

Exhibit 3-6: Annual Lost Production For Men and Women Due to Perceived Malaria In Kenya: Lost Workdays and Low Productivity Days

HIGH ESTIMATES (in millions of K£)

Economic Sector	Men	Women	Women's Share as Percent of Total
WAGE VALUE			
Agriculture	81	332	80
Service	96	153	62
Industry	33	19	37
TOTAL, GNP	210	504	71
PERSON-YEAR EQUIVALENT			
Agriculture	283	1,245	82
Service	54	95	64
Industry	19	17	47
TOTAL, GNP	355	1,356	79

With respect to the total employed labor force, the impact of malaria on women workers amounts to an equivalent of 1.4 million person years, compared with 355 thousand person-years for men. Women's share of lost person-years in each of the sectors is similar to their share of wage value of lost production, amounting to substantially more than one-half in the agriculture and service sectors and almost one-half in industry despite their low participation in that sector.

The high share of production loss for women as a group occurs principally because of women's dual role as worker and caretaker. Caretaker days account for 60 percent of all days that all workers lose due to malaria. They account for three-fourths of all days that working women lose to malaria.

It is important to note that differences in men's and women's production losses are not due to differences in male-female patterns in the epidemiology, health impact, or work habit impact of malaria. Focus group responses suggested no systematic difference between men and women in incidence or duration of malaria attacks or in numbers of days missed from work per malaria episode.

Roughly as many women as men reported impacts on the low, medium, and high end of the scale. Thus, the high and low estimates for this study assigned the same number of malaria episodes, lost workdays, and low productivity days to men and women.

This study also used the same average wage levels for men and for women, since that was the only data available. This assumption would overstate women's production losses to the extent that women's average wages are in reality lower than men's, especially in the formal service and industry sectors; or to the extent that women are responsible for lower-valued produce in agriculture. On the other hand, it is important to recall that this study's estimates of lost production included only the average wage value of workdays lost by employed and self-employed women in both the formal and informal sectors. Consideration of time that employed and unemployed women lose from non-remunerated household and related activities would increase the value of lost production attributable to women.

Exhibit 3-7: Annual Lost Production For Urban and Rural Men and Women Due To Perceived Malaria In Kenya: Lost Workdays and Low Productivity Days

HIGH ESTIMATES (in millions of K£)

URBAN AND RURAL WORKERS	Men	Women	Women's Share as Percent of Total
WAGE VALUE			
RURAL (Agriculture)	81	332	80
URBAN (Service & Industry)	129	172	57
TOTAL	210	504	71
PERSON-YEAR EQUIVALENT			
RURAL (Agriculture)	283	1,245	82
URBAN (Service & Industry)	72	112	61
TOTAL	355	1,357	79

Urban and Rural Workers. For illustrative purposes, rural workers can be assumed to be engaged primarily in agriculture and urban workers engaged primarily in the service and industry sectors. Using this approximate allocation of workers, Exhibit 3-7 shows the annual impact of total production losses attributable to urban and rural men and women.

These estimates show that rural men and women account for 1.4 times higher production losses (K£413 million) than urban men and women working in the service and industry sectors (K£300 million) under the high estimates. In the aggregate, the rural population accounts, under both the low and high estimates, for over half (e.g., 60 percent under the high estimates) of the total lost production due to malaria, primarily because the much greater numbers of people who suffer malaria attacks in rural than in urban areas offsets their lower earnings relative to the urban population.

Assessing malaria's production losses this way also demonstrates the large proportion — in both relative and absolute terms — of production that rural women lose due to their own and their children's malaria episodes. Production loss for rural women, K£332 million, is four times higher than lost production for rural men (K£81 million) and 2.6 times higher than urban men's (K£129 million). Losses for rural women are almost twice as high as for urban women (K£172 million), primarily because of the much larger number of rural (5.6 million) than urban (.5 million) women actively engaged in the labor force.

These relationships are similar with respect to total employment levels, with the lost time for rural women accounting for a substantial majority of the total person-year equivalents lost to malaria.

3.2.3 Urban and Rural Household Impacts

This study constructed a simple typology of urban and rural households to illustrate the possible effects of malaria on annual family income at three different socioeconomic levels: an urban middle-class household; an urban lower income, self-employed household; and a rural agricultural household with a family farm. The measures of economic impact at the household level focus on 1) annual lost income from workdays missed due to malaria episodes and 2) health care expenditures for malaria out-patient treatment and for prevention and control of mosquitos. Consistent with the other analyses in this study, the household typology does not include estimates of the economic impact of family deaths from malaria.

The typology was developed from patterns evident in focus group responses and is intended to represent certain typical employment characteristics and health service seeking behavior patterns. The three household types do not represent all household types in Kenya and the typology is not a statistically representative model for all households in Kenya. It is also not designed to be additive to the national level.

Design of the typology. For comparability, the typology assumes that each household has the same composition of members, but they have different total incomes based on different employment patterns. Each household is assumed to have three working adults, at least one of whom does informal sector work, and three children under the age of 15.

At the upper end of the income scale in this typology is the urban middle- income household with two adult workers employed full-time in the formal sector and one adult worker engaged full-time in informal sector activity. The industry or agribusiness household represents a "middle-income" urban or rural household with two adult workers engaged full-time in blue-collar positions in the formal sector and one adult working in the informal sector. The typical rural household in this typology has two adults engaged in family farming and one engaged primarily in informal sector activities.

The typology assumes that, for all household types, the informal sector adult is the caretaker for the three children's malaria episodes. Household income estimates are based on the average sectoral wage levels used for this study's other economic estimates and on the 1993 economic survey data for Kenya.

The number of malaria episodes and workdays lost for household members are based on focus group responses from this study and, for comparability, are the same for members of all three types of households.

Expenditures for malaria treatment and sources of health services are also based on average patterns evident in the focus group findings. The focus group discussions included questions about spending and sources of care for treating malaria on an out-patient basis and for in-patient hospital stays. The typology includes out-patient spending only, since in-patient information was less reliable and hospital stays for malaria are much less frequent than out-patient episodes.

Because malaria prevention activities were otherwise outside the scope of work for this study, the focus group interviews did not include questions to assess people's malaria prevention practices. But the household typology does include estimated expenditures, using local prices and assumed quantities, for a moderate level of effort to carry out currently recommended actions to protect people from mosquitos with insecticide spray, coils, and bed nets sprayed with a long-lasting insecticide. These prevention expenditures are included to illustrate their impact on household income and their relation to treatment expenditures. Including assumptions about these prevention expenditures also helps assess the financial feasibility for households to undertake different levels of prevention effort.

The main factors in this typology that affect the economic impact of malaria on households are 1) the extent to which a worker may actually lose income for the workdays missed due to malaria, 2) sources and prices of health services and medications, and 3) the household's income from employment. The following section describes focus group findings that form the typology's assumptions about these factors.

Appendix A provides details on the estimating assumptions and calculations for the typology.

Focus Group Findings About Household Impact. The assumptions about the loss of income for workdays missed because of malaria morbidity derive directly from patterns of focus group responses. The high estimates assume that for informal sector workers and small farmers all workdays missed represent the loss of one full day's income; the low estimates assume loss of 50 percent of a day's average earnings for these groups.

Since workers employed full-time in the formal sector are likely to be paid for their sick leave days, the estimates assume no income loss for these workers' malaria absences. Both the urban middle-income household and the industry and agribusiness households in this typology fall into this group. For these households, each with two workers in the formal sector, the only income loss occurs when the informal sector adult misses work due to malaria or caretaking for the three children's malaria episodes.

With respect to household expenditures for malaria prevention and control, the high estimates assume that households undertake modest prevention efforts to protect themselves from mosquitos (two bed nets and one year's supply of mosquito coils and cans of spray). The low estimates assume that households spend nothing on these preventive measures.

With respect to expenditures for malaria treatment, focus group findings suggest that the predominant pattern for rural households is to seek consultation at a public health clinic, where there is no charge for the visit (at the time of the survey), and to purchase medication at a pharmacy or market stall. Traditional healers were not cited as a source of care or medication. Focus groups reported an average price of 50 Ksh for drugs, per malaria episode, at these sources. In addition, rural focus groups reported expenditures of 40 Ksh for transportation per malaria episode to obtain these health services and drugs — or one to two hours walking time. The typology uses these average expenditures for the high estimates for rural farming households.

The low health cost estimates for rural farming households assume that the family seeks treatment for only 75 percent of the malaria episodes and does not take any prevention measures. Reducing use of health services and medications is likely to be the main alternative available to rural farming households that want or need to limit their health expenditures, since almost all men and women small farmers in the focus groups already named the lowest price combination of public and private sources of health services and medications.

According to focus group responses, urban households may follow several patterns in obtaining treatment for malaria. The highest cost pattern, adopted in this typology for the urban household high estimate, is to visit a public sector clinic, where there is no charge for the visit, purchase malaria medication at a private pharmacy for an average cost of 300 Ksh per episode, and spend 150 Ksh on transportation to seek these services and drugs. The lower cost pattern that the focus groups identified involves a visit to a private clinic or doctor's office, where a single fee (on average, 100 Ksh) covers malaria medication and the visit, along with transportation costs of 30 Ksh. Even though employed urban middle-class households are likely to have health insurance, the typology assumes that out-patient treatment and medications for malaria are not covered.

A substantially different pattern of health care for malaria is evident for households with workers employed by companies that provide health services and medications on site. According to focus group and manager interviews conducted for this study, a majority of industry and agribusiness concerns provide these on-site health services, and especially malaria medication. In most of these instances, workers are treated free of charge, but their children frequently are not. The high estimates for households in this group assume expenditures for malaria services for children only; the low estimates assume all adults and dependents also receive free health services.

Household Economic Impact. Exhibit 3-8 summarizes estimates of these economic impacts of malaria on households.

Households at the three illustrative socioeconomic levels have total earnings losses and health care expenses that range, under the high estimates, from 5 to 9 percent of their annual income to 1 to 9 percent under the low estimates.

As the exhibit shows, the biggest impact for all households comes from health care spending under both the high and low estimates. Spending for treatment of malaria episodes and mosquito control could absorb 4 to 9 percent of household income under the high estimates. Under the low estimates, malaria treatment expenditures could range from 0 to 4 percent of household income. For households at all three socioeconomic levels, these health expenditures exceed estimated income lost from missed workdays during malaria episodes.

Exhibit 3-8: Impact of Malaria on Annual Income In Urban & Rural Households in Kenya

HIGH ESTIMATES, in Kenya Shillings

HOUSEHOLDS with 3 Adult Workers & 3 children under 15	URBAN MIDDLE-INCOME WORKERS	RURAL SMALL FARMERS	AGRI-BUSINESS/ INDUSTRY LABORERS
ANNUAL HOUSEHOLD INCOME	100,000	20,000	35,000
EARNINGS LOSS			
Value of work days lost	1,200	1,920	660
Percent of income	1.2	9.6	1.9
(Low Estimate)	(0.6)	(4.8)	(0.9)
HEALTH CARE COSTS			
Malaria Treatment	7,650	1,170	675
Prevention & control of mosquitoes	590	590	590
Total Cost	8,240	1,760	1,265
Percent of income	8.2	8.8	3.6
(Low Estimate)	(2.2)	(4.4)	(0.0)
TOTAL IMPACT			
Total lost income & health cost	9,260	3,520	1,805
Percent of income	9.3	17.6	5.2
(Low Estimate)	(2.7)	(8.8)	(0.8)

In general, rural small farm households suffer the greatest impact from lost income and health expenditures due to malaria, with costs that could range from 9 to 18 percent of household income. Households facing the lowest burden are those in which at least two of the adult earners are employed in agribusiness, industry, or other firms that provide on site health services, including for malaria, at no cost, and who have paid sick leave adequate to cover the number of workdays that may be missed due to malaria.

Urban middle-income households who purchase malaria medication at private pharmacies could be almost as seriously affected as small farm households, with malaria health costs representing 8 percent of household income (high estimate), compared with 9 percent for small farm households. But middle-class urban households who have received their health services and medications from a single private sector source at a single fee (low estimates for this group) have a substantially lower burden, 2 percent of household income.

The typology also illustrates that, at the modest level assumed for household expenditures to control mosquitos, expenditures for treatment of malaria episodes consume the larger share of health spending. Treatment expenditures constitute a substantial share, 53 to 93 percent, of household health spending under the high estimates, except when households receive most of their malaria-related health services from their employers, as in the example of households working for agribusiness or industry.

Discussion. Estimates for this typology illustrate that in general the health care costs associated with malaria may represent a bigger economic burden at the household level than the possibility of lost income. But for households that depend on informal sector employment and small farm agriculture, both of which can be sensitive to "peak seasons" and to uncertain alternatives for substitute workers, days lost from work can represent a high opportunity cost and lost income can almost equal health care costs. In these household situations, malaria carries a double burden of lost income and health care costs.

Households adopt a variety of means to cope with income constraints and health care costs that absorb relatively high proportions of that income. In the case of malaria, these methods can include foregoing treatment during some adult malaria episodes, purchasing less than full doses of medication, purchasing the least expensive medication that they perceive to be effective, purchasing medications or travelling to seek consultation only for infants and children, or undertaking no prevention measures to save cash for treatment when needed. To use one example from this typology, however, if rural small farm households chose (under the low estimate) to treat only 75 percent of malaria episodes and spend nothing on control of mosquitos, health treatment costs for malaria alone, and excluding any hospitalization for malaria would still amount to 4 percent of household income.

Findings from focus groups suggest a high willingness to pay for malaria treatment. At the levels cited by focus groups, spending for malaria could absorb the majority, or entire, household budget for health. It is also possible that focus groups overestimated their average malaria treatment expenditures and that, when applied to the full possible numbers of malaria episodes in a household, as in these estimates, the total is more than typical households would be willing — or, more importantly, able — to spend for malaria alone, such that they would in reality adopt various coping mechanisms to reduce those costs. Even if estimates derived from focus group reports are double what households typically spend, they still suggest that spending for malaria treatment is likely to represent the largest share of their annual health spending.

Data are not available from the focus groups for this study to indicate how effective these health expenditures are or how often people might be treating malaria with the more expensive drugs to counteract chloroquine-resistant strains. Given the relatively high perceived levels of spending on treatment, it is likely that in many cases households would not have much additional disposable income to spend for prevention or control of mosquitos. On the other hand, room may exist for a reallocation of household health spending for malaria that would produce a more effective combination of treatment and prevention for the same or a lower spending level.

3.2.4 Schooldays Lost

In addition to answering questions regarding their own malaria experiences, teacher focus groups responded to questions about school absenteeism due to malaria. The two primary school and two secondary school groups (one of each in the seasonal and continuous zones) estimated both the number of malaria episodes per student for which a student misses school, as well as the number of schooldays missed per episode. In one case, information from school records was gathered as well.

The teachers estimated that each primary student has four episodes per year and misses five schooldays per episode. They estimated that secondary students have two episodes per year and miss four schooldays per episode. Each primary school child, then, misses an estimated 20 days of school each year due to malaria; 11 percent of Kenya's 186-day school year. Each secondary school child misses an estimated eight days, 4.3 percent of a school year.

Days that teachers also miss due to malaria can cause losses for the students, especially if substitute teachers or other learning activities are not provided. While one primary school group interviewed for this study said that absent teachers are replaced 100 percent of the time, all other primary and secondary teacher groups said that they are never replaced.

4.0 IMPACTS OF MALARIA IN NIGERIA

4.1 EPIDEMIOLOGY

4.1.2 Epidemiology of Malaria in Nigeria

Malaria is endemic throughout Nigeria and constitutes the leading cause of death in children. Although it affects all ages, cases in children under the age of five are more likely to be serious, reflecting their relative lack of immunity to the disease compared with adults. More than 80 percent of cases are caused by *Plasmodium falciparum*. The rest are due to *P. malariae*, *P. ovale*, or a combination. Although chloroquine resistance has been reported to be increasing, recent scientific studies document relatively low levels. Chloroquine is still the drug of choice for uncomplicated malaria in Nigeria.

The seasonality of malaria transmission varies from a pronounced seasonal peak during and after the rains in the north to a less obvious but measurable rainy season peak in the south. Malaria can, however, occur at any time of the year, anywhere in the country.

The actual numbers and rates of malaria cases in Nigeria are unknown. Although more than a million cases are typically reported every year, malaria is not reported by most treatment facilities and the amount of self-treatment can only be guessed at. Reporting is incomplete, subject to disturbances in availability of public health services, and based on varying criteria. As elsewhere, there are problems in defining malaria. Not all febrile cases presumed to be malaria are confirmed to be so when blood smears are examined. The private sector, where the majority of cases treated by modern medicine are seen, does not report most cases. What estimates are available are based on special studies and records from scattered medical facilities. While it is unknown how representative such records are, they indicate an order of magnitude of the malaria problem in Nigeria.

For example, a 1987-89 study of febrile cases seen in Ibadan found the rate of confirmed cases to vary by age.[3]

Age	Number Examined	Percent Positive
< 1 year	352	56%
1 - 4 years	1923	62%
5 - 9 years	1607	65%
10 - 18 years	1654	54%
> 18 years	2177	41%

[3] Study and data cited in Ettling 1993.

Seasonal variation by month for all ages in this group varied from a dry season low of 40 percent in March to a wet season high of 69 percent in June. A well-equipped modern clinic in Igbo-Ora Town found 86 percent of slides positive in March 1993. This percentage can be expected to vary with the skill of the laboratory and index of suspicion of the clinician. In any event, significant levels of malaria are demonstrated when blood from febrile individuals is examined microscopically.[4]

Many apparently healthy individuals can also be demonstrated to have malaria parasites in their blood. A 1990 study of asymptomatic rural school children near Ibadan found just over 3 percent parasitemic in the dry season and 74 percent in the wet season.

Most malaria cases are relatively mild and easily treated. Nevertheless, a small but significant proportion of cases progress to become life-threatening. Malaria mortality is highest among the youngest age groups. In Igbo-ora, where deaths are carefully registered, 25 percent of deaths of under age five are ascribed to malaria, convulsions, anemia, or fever associated with malaria. (Nigerian medical experts consider the diagnoses of death from convulsion, anemia, or fever to be due principally to malaria except in times of epidemic.) For 5 to 14-year-olds, the comparable figure is 24 percent, and for those over 14, 13 percent. While data such as these on percentages of registered deaths due to malaria exist in various locations, the general mortality rate and age-specific mortality rates for malaria (i.e., percentage of the population or of an age group that dies from malaria each year) are extremely difficult to estimate because of widely divergent population estimates.

4.1.3 Population's Perceptions of Malaria and Its Impact on Work

The malaria symptoms most commonly described by focus groups interviewed for this study included classical symptoms such as high temperature, head and body aches, shivering, and weakness. Descriptions also included symptoms that do not conform to clinical disease definitions such as yellow eyes, cough, sore throat, sneezing, catarrh, yellow urine, and vomiting. While all groups (male, female, urban, rural) mentioned ordinary and yellow malaria when listing types of malaria, most groups listed other diseases such as typhoid fever and jaundice fever as additional types of malaria.

Despite this broad understanding of the definition of malaria, most people, when asked about their most recent malaria episode, followed the definitional consensus established by the focus group moderator and described symptoms that conform to the more classical expectations for the condition. There were essentially no differences between the types of malaria for adults and children, though symptoms described for children tended to be more behavioral, such as "sleep and cry a lot."

In addition, most focus groups (particularly rural females but also males when referring to child malaria) made a distinction

[4] For more detail on epidemiologic and health service findings from the field work for this study, see Ettling, 1993.

between "inherited" malaria, which is stronger, lasts longer, and does not respond well to western medicine, and "non-inherited" malaria. According to indigenous beliefs, the latter is thought to be caused by external factors such as sun, dust, and heat. Focus group respondents who had adopted western views said that mosquitos caused non-inherited malaria. In either case, non-inherited malaria is said to respond more easily to western medicine.

Rural male and all female focus groups said that malaria is most common in the dry season when there is much sun and dust. One urban female group, as well as most urban male groups, said that malaria occurs mostly in the rainy season when mosquitoes are most prevalent. Some rural male groups also mentioned the rainy season as well, but this was attributed to the hot sun that follows the rain.

All rural focus groups indicated that people who were most often exposed to sun and dust (e.g., farmers and taxi drivers) were most likely to get malaria. Urban respondents, in particular male, cited more technical reasons. It was common for respondents to mention that people in the AA blood group were more susceptible to malaria, as were people with sickle cell disease and people with fairer skin. In addition, urban men noted that people who lived in mosquito- prone areas such as near streams or swampy areas were more likely to get malaria. Even in urban male groups, however, there were some allusions to more indigenous beliefs, such as "traders who stay in the sun or live in hot areas are more likely to suffer from malaria." All teacher groups mentioned the connection between malaria and mosquitoes.

Focus group estimates of the number of malaria episodes per year and duration of episodes did not vary significantly by sex or geographic location, but they did reflect variation between adults and children. All male and urban female responses tended to cluster around two to three episodes per year, while rural female responses clustered around three to four. Children, according to female focus groups, have two to four episodes per year with slightly more episodes for rural school-age children and all urban children (three to four episodes) than for rural children under five (two to three episodes). Estimated duration of a malaria episode according to most focus group respondents clustered around two to three days. Urban female estimates had an additional cluster around five to seven days and urban children estimates were slightly longer than the average at three to five days.

In general, over one-half, 60 percent, of all focus group responses for number of malaria episodes fell between the range of one to three episodes per year per adult and two to four episodes per year per child. The low and high ends of these ranges provide the basis for this study's high and low estimates. Only three respondents, 1.7 percent of all focus group members, said they had had no malaria in the previous year. The remaining responses tended to be slightly higher (in the four to seven range) or substantially higher (in the 12-25 range). The responses in these higher outlying ranges reflect the broader definitions of malaria common in the Nigeria sample and include diseases other than classical malaria.

Exhibit 4-1 summarizes the key elements of the focus groups' perceptions used in the economic analysis. The sections of this report that present the household typology describe patterns of focus group responses regarding seeking and paying for health services and medicines to treat malaria.

Exhibit 4-1: Key Focus Group Perceptions Used For Estimates Of The Economic Impact of Malaria In Nigeria

FOCUS GROUP PERCEPTIONS	HIGH ESTIMATE	LOW ESTIMATE
Malaria episodes per adult per year	3	1
Workdays missed per adult episode	3	1
Episodes per child per year	4	2
Workdays missed, per child episode, for caretaking	3	1
Children per woman who require caretaking for malaria	3	3

Most male focus groups indicated that they missed one-half to one full day of work during each episode of malaria, though rural groups also reported missing work for three to four days up to one to two weeks. The most common response among female focus groups was one to three days per episode with a maximum of seven days. Reasons for staying at home for all groups included weakness, pain, and to allow for faster recovery. A number of participants said that it was better to miss work than to die of the disease, implying that they felt malaria was serious.

Focus groups were divided on whether or not someone fills in for a person who misses work due to malaria. Male artisans and factory workers in urban areas said that no one took their place, as did secondary school teachers in both urban and rural areas. Primary school teachers and commercial drivers, on the other hand, said that someone always fills in for them when they are sick. Male farmers said that wives and children could help out if necessary. With the exception of primary school teachers, however, all female focus groups indicated that no one helps with their work when they are sick.

Managers interviewed at most sites for this study indicated that workers who are present absorb the work of those who are absent due to malaria (or other illness), so that "no production is lost due to malaria." This form of worker substitution and compensation is most common in manufacturing and service sector sites, such as hotels, petrol stations, travel agencies, and supermarkets. But several managers indicated that malaria's main impact was to make it difficult to rearrange people's shifts to accommodate the absences. At the 7-Up bottling plant, the manager indicated that they "always hire more workers than needed, as a buffer" for both worker absences due to illness and due to "aches and pains" related to the heavy work. A sawmill manager thought that malaria "sets back business;" other managers thought malaria "affects productivity" or "creates a nuisance for the company."

The self-employed, in both urban and rural groups, tend to be the only ones who report that they actually lose money from missed workdays. Traders who are not at the market will miss sales, artisans who are not at their shops will lose customers, and farmers lose produce when it spoils. Only casual, not regular, factory workers lose pay if they miss work.

All focus groups agreed that, in general, no one misses work to care for an adult sick with malaria. As one farmer said, "Nobody will leave his work and care for you. They will only stop by and greet you." Missed work due to caretaking of children, however, contributes significantly to lost production for women. While a few men noted taking their children in the early morning or late afternoon to the clinic, or caring for them if their wife is away, the consensus among men was that caretaking is the responsibility of the wife. Urban female focus groups indicated that they miss one to two days of work per episode per child while rural groups tend to miss three days.[5]

4.2 ECONOMIC IMPACTS

4.2.1 Production Loss in Agriculture, Industry, and Service Sectors

Value of Workday Loss. Estimates based on focus group discussions for this study indicate that malaria causes the highest production losses in the agriculture sector. Under the high estimates, for example, the value of lost production in agriculture in 1991 (7.7 billion naira) is 8 percent higher than losses in the service sector (7.1 billion naira) and 4.8 times higher than industry's losses (1.6 billion naira). For the economy as a whole in 1991, the aggregate value of these losses under the high estimate in the three sectors equals 16.3 billion naira, 5 percent of Nigeria's GDP under the high estimate and almost 1 percent under the low estimate.

Exhibit 4-2 shows the distribution of these production losses under the high and low estimates by sector and for GDP.

The service sector suffers the highest impact relative to the sector's total production. As Exhibit 4-2 shows, in 1991, the value of lost workdays in services due to malaria represents from 1 percent (low estimate) to 8 percent (high estimate) of the value of the service sector's total production. The value of lost production in agriculture ranges from less than one percent (low estimate) to 6 percent (high estimate) of that sector's total, while the impact in industry is one percent or less under both the high and low estimates.

These findings show that the impact of lost production from malaria does not directly depend on or reflect the importance of each sector to the national economy. Thus, the agriculture sector, which produced 37 percent of GDP value in 1991, represents 47 percent of the total value of production loss from workdays missed due to malaria in 1991 under both the high and low estimates. The service sector shows a similar inverse relationship: it produced 26 percent of 1991 GDP, but represents 43 percent of production loss due to malaria workdays lost in that year. Industry

[5] For a detailed description of focus group responses in Nigeria, see Brieger, 1993.

represents 38 percent of GDP but only 10 percent of the total value of malaria-related lost workdays.

It is important to note some of the reasons for the variation in impact of malaria across the sectors. According to focus group discussions, the incidence of malaria episodes does not appear to be higher in rural than in urban areas, or among one sector's workers, compared with workers in other sectors. But the value of losses in agriculture shows the highest total losses from malaria since the largest proportion, 48 percent, of the employed labor force works in agriculture. Total losses in the service sector are almost equal to agriculture losses, since an almost equal percentage, 45 percent — a much higher proportion than in many other sub-Saharan African countries where the vast majority of the population works in agriculture — is employed in services and at an average daily wage that is only somewhat lower. Industry, where only 7 percent of Nigerian workers are employed, shows a much lower absolute impact than the other two sectors even though the value of a day's labor lost to malaria is much higher.

Exhibit 4-2: Annual Value of Workdays Lost Due to Perceived Malaria in Nigeria

	WAGE VALUE OF LOST WORKDAYS	
Economic Sector	Wage Value in millions of Naira	Percent of sector's total production value
HIGH ESTIMATES		
Agriculture	7,691	6
Service	7,061	8
Industry	1,568	1
TOTAL, GNP	16,318	5
LOW ESTIMATES		
Agriculture	1,070	1
Service	1,029	1
Industry	210	0.2
TOTAL, GNP	2,309	1

The estimated value of one day's labor in small farm agriculture (30.8 naira) and estimated average wages in the service sector (23.1 naira/day) are about one-half the level of average wages in industry (53.1 naira/day). The lower value of one day's labor for an agricultural or service sector worker, compared with average daily wages for industry, is more than offset by the much larger numbers of people engaged in the agriculture and service sectors.

In spite of the higher absolute value of the impact in agriculture, the service sector is hardest hit in terms of percentage of its total production that malaria losses represent. The main reason for this higher impact is the high percentage of women engaged in services compared with women's share of employment in the agriculture and industry sectors in Nigeria. A greater proportion, 41 percent, of the service sector workers are women, compared with 25 percent of the agriculture workforce and 18 percent of the labor force employed in industry.

Women have a disproportionate effect on production losses because of their role as caretakers. Using estimates from the focus groups in this study, each employed woman loses 6 to 36 more workdays to take care of children with malaria than an employed man. Assuming an average of three children to be cared for, along with her own malaria episodes, an employed woman stands to lose 7 to 45 workdays per year to malaria, five to seven times as many workdays as her employed male counterpart.

These dynamics demonstrate the importance of performing specific analyses and estimates for different country and economic situations to estimate the economic impact of malaria. For example, they show that the overall economic impact of malaria for a given economic sector or occupational category, such as agricultural or industrial workers, cannot be easily predicted from the sector's or occupation's relative wage levels or contribution to the national economy. Malaria's economic impacts are at least as sensitive to the numbers and male-female composition of workers in the sector as they are to the value of that activity to the economy. Because these factors combine in different ways in each national economy, general predictions must be made carefully.

Person-Year Loss. Exhibit 4-3 shows the impact of malaria in relation to each sector's overall employment level in terms of the person-year equivalent represented by the annual total number of workdays lost due to malaria. Using this measure, the loss in workdays due to malaria in agriculture translates into a loss of 961 thousand person-years (high estimate) in 1991, representing 7 percent of the 13.8 million persons employed full-time in agriculture that year. The service sector suffered a loss of 1.2 million person-years (high estimate) in 1991, representing 9 percent of the 12.8 million total persons working in the service sector in that year. Assuming the majority of industry and service sector workers are employed in urban areas, the combined loss of person-years in industry and service represent 9 percent of urban employed persons in 1991.

Exhibit 4-3: Annual Person-Year Equivalent of Lost Workdays Due to Perceived Malaria in Nigeria

Economic Sector	Number of person-years that represent days missed (in 000s)	Percent of sector's total employed workers
HIGH ESTIMATES		
Agriculture	961	7
Service	1,177	9
Industry	114	6
TOTAL, GNP	2,252	8
LOW ESTIMATES		
Agriculture	134	1
Service	172	1
Industry	15	1
TOTAL, GNP	320	1

The total impact of workdays lost due to malaria across all three sectors deprives the national economy of the equivalent of 1 percent (low estimate) to 8 percent (high estimate) of its employed workers. From this perspective, eradication of malaria — if it were possible — would free up the 1 to 8 percent of current person-years absorbed by malaria sick days to be applied to other economic activities or higher production levels of existing activities.

On the other hand, as focus group interviews conducted for this study suggest, some types of work are currently organized to compensate for sick days. If, in the hypothetical absence of malaria, employers chose to reduce costs by firing the "extra" workers who are needed to meet existing production goals by compensating for frequent absences due to illness, unemployment might be increased by these person-year equivalents.

From any of these perspectives, the absolute numbers of person-years of work each year for which malaria requires employers or farmers to compensate in some way indicate the magnitude of adjustment required. They reflect the continuous annual effort needed to replace the lost labor hours, increase labor productivity, or make other adjustments to labor's role, in the leading growth sectors, industry, and service, as well as in agriculture.

Low Productivity Workdays. The initial research design and focus group questionnaires included an attempt to collect information about the effect on productivity when a worker goes to work even though suffering with malaria. Although findings from the Nigeria focus group make it clear that people do often try to work during a malaria episode, information from Nigeria on the extent to which production is lower is, for a variety of reasons, inadequate to make specific assumptions. In the absence of specific information from Nigeria on lower productivity, this study combined the assumptions that the Kenya focus group findings produced on this point with the Nigeria findings on numbers of workers who go to work while sick and numbers of days each episode that this practice is likely to occur.

Based on these combined data, this study assumed a modest amount of lost production due to low productivity days due to malaria morbidity in Nigeria: one-half the agriculture sector workers and 25 percent of the industry and service sector workers try to work for three of the days they are sick with malaria and lose an estimated portion of production for those three days of each malaria episode (Appendix A provides precise details).

Exhibit 4-4 shows the distribution of the estimated costs (high and low) of these low productivity days by sector.

Estimates based on these assumptions suggest that these low productivity days represent an additional 241 million naira (low estimates) to 1.4 billion naira (high estimate) loss to the national economy. As in the case of lost workdays, the agriculture sector represents the largest proportion of total costs to the national economy under both the high and low estimates.

Low productivity days also represent a modest additional loss in terms of person-year equivalents. In agriculture, for example, the person-year equivalent of low productivity days amounts to 1 percent of total agriculture employment under the high estimates. The impact from low productivity days is smaller — less than one percent — for the service and industry sectors under the high estimates and negligible under the low estimates. For the economy as a whole, low productivity due to working during malaria episodes represents the annual equivalent of the workdays of 0.6 percent of all Nigerian workers.

Exhibit 4-4: Annual Value of Lost Production Due To Low Productivity While Working During Malaria Episodes

Economic Sector	Wage Value of low productivity in millions of Naira	Person-Year Equivalent of Low Productiv. (in 000s)
HIGH ESTIMATES		
Agriculture	954	5
Service	333	1
Industry	115	0.1
TOTAL, GNP	1,402	0.4
LOW ESTIMATES		
Agriculture	162	1.0
Service	59	0.1
Industry	21	0.0
TOTAL, GNP	241	0.1

Combined Impact of Lost Workdays and Low Productivity. Combining the impacts of both lost workdays and low productivity days, malaria's total annual impact on production amounts to 17.7 billion Naira or 5 percent of GDP under the high estimates and 2.6 billion Naira, 0.8 percent of GDP, under the low estimates. In terms of person-year equivalents, this combined impact represents from 352 thousand person-years (low estimate) to 2.4 million person-years (high estimate), 1.2 to 8.5 percent of the workdays of all employed Nigerians.

Exhibit 4-5 shows the wage value of these total impacts for each sector, as well as for the economy as a whole. Exhibit 4-5 also shows the estimated total economic impact of the lost workdays plus low productivity days due to malaria using the lower incidence as represented by laboratory-confirmed malaria, compared with the larger incidence of malaria as perceived by the population. At 50 percent of the perceived rate of malaria, laboratory-confirmed estimates of malaria's economic impact are one-half those based on people's perceptions.

Perceived and Laboratory-Confirmed Malaria. This report has focused so far on the study's findings based on the population's perceptions of malaria, that is, the numbers of illness episodes that people themselves attribute to malaria. But both people's perceptions, as well as presumptive clinical diagnoses, are not always parasitologically accurate, as measured by laboratory tests. For example, one large sample study conducted for 1987-1989 in Ibadan shows that, when malaria averaged across age groups, about 50 percent of cases diagnosed clinically as *were confirmed as positive by laboratory-tested blood smears.*

Exhibit 4-5: Annual Economic Impact of Perceived and "True" Malaria in Nigeria Due to Value of Lost Workdays and Low Productivity

	PERCEIVED MALARIA		LAB-CONFIRMED MALARIA	
Economic Sector	Value in wages (millions of Naira)	Percent of sector's total production value	Value in wages (millions of Naira)	Percent of sector's total production value
HIGH ESTIMATES				
Agriculture	8,645	7	4,322	3.5
Service	7,394	8	3,697	4.2
Industry	1,683	1	842	0.6
TOTAL, GNP	17,722	5	8,861	2.6
LOW ESTIMATES				
Agriculture	1,322	1.0	661	0.5
Service	1,088	1.3	544	0.6
Industry	231	0.2	115	0.1
TOTAL, GNP	2,641	0.8	1,320	0.3

It is important to keep in mind this distinction between perceived and "true" laboratory-confirmed malaria for several reasons. To the extent that reports of perceived and clinically diagnosed malaria overestimate malaria incidence, they may cover up the existence of other health problems with similar symptoms and these other problems may receive less attention than they deserve. Similarly, reduction or eradication of "true" malaria would not produce a total reduction in the morbidity — and its consequent economic impacts — commonly associated with malaria. To avoid misleading results, estimates of the cost-effectiveness and costs and benefits of prevention and control of malaria need to keep these distinctions between perceived and laboratory-confirmed malaria in mind as well.

4.2.2 Economic Impacts For Urban And Rural Men and Women Workers

Men and Women Workers. Exhibit 4-6 shows the production loss attributable to men and women workers, along with the share attributable to women.

Women in total, and in two of the three sectors, account for a higher production loss than their male counterparts, even though women have a lower labor force participation rate than men. For example, under the high estimates the value of women's lost production in agriculture, 5.1 billion naira, is 1.4 times higher than their male agriculture worker counter-parts'.Women working in the service sector account for 76 percent of the value of malaria-related lost production in that sector. The value of men's lost production lightly exceeds that of women only in industry, where men constitute 82 percent of the employed labor force. In total under the high estimates, the value of women's lost production due to malaria accounts for 65 percent of the value of all lost production for the Nigerian economy and is almost twice as high as men's lost production in 1991.

Exhibit 4-6: Annual Lost Production For Men and Women Due to Perceived Malaria in Nigeria: Lost Workdays and Low Productivity Days

HIGH ESTIMATES (in millions of Naira)

ECONOMIC SECTOR	Men	Women	Women's Share as Percent of Total
WAGE VALUE			
Agriculture	3,557	5,087	59
Service	1,762	5,632	76
Industry	855	829	49
TOTAL, GNP	6,174	11,548	65
PERSON-YEAR EQUIVALENT			
Agriculture	445	636	59
Service	294	939	76
Industry	62	60	49
TOTAL, GNP	800	1,635	67

With regard to the total employed labor force, the impact of malaria on women workers amounts to an equivalent of 1.6 million person-years, compared with 800 thousand person-years for men. Women's share of lost person-years in each of the sectors is similar to their share of wage value of lost production, amounting to substantially more than 50 percent in the service sector, where women's participation rate is highest (41 percent of the employed service sector labor force), and representing slightly more or less than one-half in agriculture and industry, where women equal 25 and 18 percent, respectively, of those employed labor forces.

The high share of production loss for women occurs principally because of women's dual role as worker and caretaker. Caretaker days account for 67 to 75 (low and high estimates) percent of all days that workers lose due to malaria. They account for 80 to 86 percent (low and high estimates) of all days that working women lose.

It is important to note that differences in men's and women's production losses are not due to differences in male-female patterns in the epidemiology, health impact, or work habit impact of malaria. Focus group responses suggested no systematic difference between men and women in incidence or duration of malaria attacks or in numbers of days missed from work per malaria episode. Roughly as many women as men reported impacts on the low, medium, and high end of the scale. Thus, the high and low estimates for this study assigned the same number of malaria episodes, lost workdays, and low productivity days to men and women.

This study also used the same average wage levels for men and women, since that was the only data available. This assumption would overstate women's production losses to the extent that women's average wages are in reality lower than men's, especially in the formal service and industry sectors; or to the extent that women are responsible for lower-valued produce in agriculture.

On the other hand, it is important to recall that this study's estimates of lost production included only the average wage value of workdays lost by employed and self-employed women in both the formal and informal sectors. Consideration of time that both employed and unemployed women lose from non-remunerated household and related activities would increase the value of lost production attributable to women.

Exhibit 4-7: Annual Lost Production For Urban and Rural Men and Women Due To Perceived Malaria in Nigeria: Lost Workdays and Low Productivity Days

HIGH ESTIMATES (in millions of Naira)

URBAN AND RURAL WORKERS	MEN	WOMEN	Women's Share as Percent of Total
WAGE VALUE			
RURAL (Agriculture)	3,557	5,087	59
URBAN (Service & Industry)	2,616	6,461	71
TOTAL	6,174	11,548	65
PERSON-YEAR EQUIVALENT			
RURAL (Agriculture)	445	636	59
URBAN (Service & Industry)	356	999	74
TOTAL	800	1,635	67

Urban and Rural Workers. For illustrative purposes, rural workers can be assumed to be engaged primarily in agriculture and urban workers engaged primarily in the service and industry sectors. Using this approximate allocation of workers, Exhibit 4-7 shows the annual impact of total (i.e., lost workdays and low productivity days) production losses attributable to urban and rural men and women.

These estimates show that urban men and women working in the service and industry sectors account for 6 percent higher production losses (9.1 billion naira) than do rural men and women (8.6 billion naira) under the high estimates. In the aggregate, the urban population accounts, under both the low and high estimates, for just over half (e.g., 51 percent under the high estimates) of the total lost production due to malaria. The higher loss in urban areas is primarily due to the fact that slightly more than one-half (52 percent) of the employed labor force works in the service and industry sectors and the higher paid industrial workers are in urban areas.

Assessing malaria's production losses this way also demonstrates the large proportion –in both relative and absolute terms – of production that urban women lose due to their own and their children's malaria episodes. Production loss for urban women, 6.5 billion naira, is 2.5 times higher than lost production for urban men (2.6 billion naira) and 1.7 times higher than rural men (3.6 billion naira). Losses for urban women (6.5 billion Naira) are greater than for rural women (5.1 billion naira), primarily because of the larger number of urban (5.6 million) than rural (3.5 million) women in the employed labor force.

The relationships are similar in comparison with total employment levels, with lost time for urban women accounting for a substantial majority of the total person-year equivalents lost to malaria.

4.2.3 Urban and Rural Household Impacts

This study constructed a simple typology of urban and rural households to illustrate the possible effects of malaria on annual family income at three different socioeconomic levels: an urban middle-class household; an urban lower income, self-employed household; and a rural agricultural household with a family farm. The measures of economic impact at the household level focus on 1) annual lost income from workdays missed due to malaria episodes and 2) health care expenditures for malaria out-patient treatment and for prevention and control of mosquitoes. Consistent with the other analyses in this study, the household typology does not include estimates of the economic impact of family deaths from malaria.

The typology was developed from patterns evident in focus group responses and is intended to represent certain typical employment characteristics and health service seeking behavior patterns. These three types of households do not represent all household types in Nigeria and the typology is not a statistically representative model for all households in Nigeria. It is also not designed to be additive to the national level.

Design of the typology. For comparability, the typology assumes that each household has the same composition of members. But they have different total incomes based on different employment patterns. Each household is assumed to have three working adults, at least one of whom does informal sector work, and three children under the age of 15.

At the upper end of the income scale in this typology is the urban middle- income household with two adult workers employed full-time in the formal sector and one adult worker engaged full-time in informal sector activity. The urban self-employed household represents a lower-income urban household with all three adult workers engaged full-time in relatively small scale informal sector activities. The rural example is a household with two adults engaged in family farming and one engaged primarily in informal sector activities.

The typology assumes that, for all household types, the informal sector adult is the caretaker for the three children's malaria episodes. Household income estimates are based on information from interviews with employers in Nigeria and on the average sectoral wage levels used for this study's other economic estimates. The number of malaria episodes and workdays lost for household members are based on focus group responses from this study and, for comparability, are the same for members of all three types of households.

Expenditures for malaria treatment and sources of health services are also based on average patterns evident in the focus group findings. The focus group discussions included questions about spending and sources of care for treating malaria on an out-patient basis and for in-patient hospital stays. The typology includes out-patient spending only, since in-patient information was less reliable and hospital stays for malaria are much less frequent than out-patient episodes.

Because malaria prevention activities were otherwise outside the scope of work for this study, the focus group interviews did not include questions to assess people's malaria prevention practices. But the household typology does include estimated expenditures, using local prices and assumed quantities, for a moderate level of effort to carry out currently recommended actions to protect people from mosquitoes with insecticide spray, coils, and bed nets sprayed with a long-lasting insecticide. These prevention expenditures are included to illustrate their impact on household income and their relation to treatment expenditures. Including assumptions about these prevention expenditures also helps assess the financial feasibility for households to undertake different levels of prevention effort.

The main factors in this typology that affect the economic impact of malaria on households are 1) the extent to which a worker may lose income for the workdays missed due to malaria, 2) sources and prices of health services and medications, and 3) the household's income from employment. The following section describes focus group findings that form the typology's assumptions about these factors.

Appendix A provides details on the estimating assumptions and calculations for the typology.

Focus Group Findings About Household Impact. The assumptions about the loss of income for workdays missed because of malaria morbidity derive directly from patterns of focus group responses. The high estimates assume that for self-employed and informal sector workers and small farmers all workdays missed represent the loss of one full day's income; the low estimates assume loss of 50 percent of a day's average earnings for these groups.

Employees in the formal sector — urban middle-income workers in this typology — are assumed to incur no loss of income because of paid sick leave days that employers typically provide. Since two of the adults in the urban middle-income household are assumed to work in the formal sector, this household loses income only for days the informal sector adult misses work due to malaria or caretaking for the three children's malaria episodes.

With respect to household expenditures for malaria prevention and control, the high estimates assume that households undertake modest prevention efforts to protect themselves from mosquitoes (two bed nets and a year's supply of coils and/or cans of insect spray). The low estimates assume that households spend nothing on these preventive measures.

With respect to household spending for malaria out-patient treatment, focus group findings suggest that the predominant pattern for urban and rural households is to seek consultation at a public health clinic, where there is a modest charge for the visit and to purchase medication at a pharmacy or market stall. According to focus group estimates, typical costs for transportation and drugs varied between urban and rural areas, but consultation fees at public clinics did not show much variation.

For example, rural agriculture and urban focus groups cited similar prices for clinic fees, usually ten naira per visit. But rural respondents cited somewhat higher transportation costs per malaria episode (typically ten naira per episode vs. three to seven naira for urban respondents) and somewhat lower prices for malaria medication per episode (e.g., 20 naira for either women or children vs. 20 naira for urban women and 45 naira for urban children) than did urban respondents. Both urban and rural focus groups cited prices that systematically varied for men, women, and children, with children having the highest treatment costs per malaria episode and men the lowest.

It was not possible to identify systematic clusters of high and low health spending in the rural small farmer focus groups. Similarly, both urban self-employed and employed focus group members cited the same types of sources and had similar ranges of spending to treat malaria, in spite of differences in income between the two groups. Thus, the typology's estimates of malaria treatment spending for each of the three types of Nigerian households does not include high and low estimates; only the median expenditure for each of the focus groups in those categories is used. The only difference, then, in high and low health estimates in the typology of Nigerian households is prevention, with low estimates reflecting no household prevention activities.

Household Economic Impact. Exhibit 4-8 summarizes estimates of these economic impacts of malaria on households. Households at the three illustrative socio-economic levels have total earnings losses and health care expenses that range, under the high estimates, from 5 to 19 percent of their annual income and from 3 to 11 percent under the low estimates.

As the exhibit shows, the biggest impact for all households comes from health care spending under both the high and low estimates. Spending for treatment of malaria episodes and mosquito control could absorb 4 to 13 percent of household income under the high estimates. Under the low estimates with no spending for prevention, malaria treatment expenditures could range from 3 to 8 percent of household income. For households at all three socioeconomic levels, these health expenditures exceed estimated income lost from missed workdays during malaria episodes.

In general, urban self-employed households suffer the greatest impact from lost income and health expenditures due to malaria, with costs that could range from 11 percent (low estimate) to 19 percent (high estimate) of household income. Rural small farm households, who have lower costs for treatment of malaria and higher average household incomes than urban informal sector families, face a lower burden than their urban self-employed, informal sector counterparts. But the total annual impact for rural small farm households could still represent 5 to 8 percent of annual household income. Urban middle-income households who use the same sources of health care as urban self-employed households face the lowest burden, with a total impact from malaria representing 3 percent of their household income.

Exhibit 4-8: Impact of Malaria on Annual Income in Urban & Rural Households In Nigeria

HIGH ESTIMATES, in Naira

HOUSEHOLDS with 3 Adult Workers & 3 children under 15	URBAN Middle-Income WorKers	URBAN Self-Employed	RURAL Small Farmers
ANNUAL HOUSEHOLD INCOME	36,000	12,000	16,000
EARNINGS LOSS			
Value of workdays lost	280	855	960
Percent of income	0.8	7.1	6.0
(Low Estimate)	(0.4)	(3.6)	(3.0)
HEALTH CARE COSTS			
Malaria Treatment	978	978	731
Prevention & control of mosquitos	540	540	540
Total Cost	1,518	1,518	1,271
Percent of income	4.2	12.7	7.9
(Low Estimate)	(2.7)	(8.2)	(4.6)
TOTAL IMPACT			
Total lost income & health cost	1,758	2,238	2,111
Percent of income	4.9	18.7	13.2
(Low Estimate)	(3.1)	(11.2)	(7.2)

The typology also illustrates that, at the modest level assumed for household expenditures to control mosquitoes, expenditures for treatment of malaria episodes consume the larger share of health spending. Treatment expenditures constitute a substantial share, 58 to 64 percent, of rural and urban household health spending for malaria under the high estimates.

Discussion. Estimates for this typology illustrate that in general the health care costs associated with malaria may represent a bigger economic burden at the household level than the possibility of lost income. But for households that depend on informal sector employment and small farm agriculture, both of which can be sensitive to "peak seasons" and to uncertain alternatives for substitute workers, days lost from work can represent a high opportunity cost and lost income can almost equal health care costs. In these household situations, malaria carries a double burden of lost income and health care costs.

Households adopt a variety of means to cope with income constraints and health care costs that absorb relatively high proportions of that income. In the case of malaria, these methods can include foregoing treatment during some adult malaria episodes, purchasing less than full doses of medication, purchasing the least expensive medication that they perceive to be effective, purchasing medications or travelling to seek consultation only for infants and children, or undertaking no prevention measures to save cash for treatment when needed. To use one example from this typology, however, if households spent nothing on control of mosquitoes, health treatment costs for malaria alone, excluding any hospitalization for malaria, would still amount to 3 to 8 percent of household income.

Findings from focus groups suggest a high willingness to pay for malaria treatment. At the levels cited by focus groups, spending for malaria could absorb the majority, or entire, household budget for health. It is also possible that focus groups overestimated their average malaria treatment expenditures and that when applied to the full possible numbers of malaria episodes in a household, as in these estimates, the total is more than typical households would be willing — or, more importantly, able — to spend for malaria alone, such that they would, in reality, adopt various coping mechanisms to reduce those costs. Even if estimates derived from focus group reports are double what households typically spend, they still suggest that spending for malaria treatment is likely to represent the largest share of their annual health spending.

Data are not available from the focus groups for this study to indicate how effective these health expenditures are or how often people might be treating malaria with the more expensive drugs to counteract chloroquine-resistant strains. Given the relatively high perceived levels of spending on treatment, it is likely that in many cases households would not have much additional disposable income to spend for prevention or control of mosquitoes. On the other hand, room may exist for a reallocation of household health spending for malaria that would produce a more effective combination of treatment and prevention for the same or a lower spending level.

4.2.4 Schooldays Lost

The field research team reviewed daily records of attendance, numbers of students, and absences per term in four schools in Oyo State: one rural primary school, one rural high school, one urban primary school, and one urban high school. They interviewed teachers from those schools to estimate the proportion of absences due to malaria. In addition, teachers reported that children often come to school during their recovery period from malaria, even though they are unproductive and tired.

In the rural primary school, teachers estimated that 20 percent of all absences were due to malaria, or one missed schoolday due to malaria per student per year. In the three other schools, teachers estimated that 40 percent of all absences were due to malaria. This translates into one half day per year for urban primary students and two days per year for rural and urban secondary students.

Estimates based on women's focus group responses about the number and duration of child episodes are twice as high, under the low estimates, and several times higher under the high estimates, than these estimates based on school attendance records and teacher recall. Using numbers of episodes and workdays missed from focus group estimates, schooldays missed due to malaria could thus range from 3 to 12 days per year per student. For a school year of 186 days, these missed days could represent 2 to 6 percent of the school year.

Days that teachers themselves miss due to malaria can also cause losses for the students, especially if no substitute teachers or other learning activities are provided. Teachers' estimates of their own malaria episodes are similar to other focus group responses for adult malaria. According to teacher focus groups, teachers have three episodes per year and miss two days per episode. While primary school teachers said that there are enough teachers for each class to cover for a teacher who is absent, secondary school teachers said that there would be no one who could teach their subject.

5.0. CONCLUSIONS AND POLICY IMPLICATIONS

The following narrative presents conclusions from this study with a view to highlighting findings that are most relevant to policy and programming decisions and have general applicability beyond Kenya and Nigeria. It identifies specific policy and programming implications and recommendations that flow from these conclusions, as well as areas in which follow-up research might be most useful to confirm and elaborate this study's findings.

5.1 MALARIA AND THE OVERALL ILLNESS BURDEN

One of the first questions a study of the economic impact of malaria must answer is "how much malaria is there?". In spite of the recognized importance of malaria in sub-Saharan Africa, a wide range exists in estimates of total or per person numbers of malaria cases each year.

One of the main reasons for the range of estimates is differences in identifying and defining "malaria" distinctly from other diseases in the absence of laboratory-tested blood smears. Several common definitions are used: a person has malaria because parasites are present in the blood, but without clinical symptoms of illness *vs.* illness episodes that people and clinicians presume to be, and call, "malaria" *vs.* a presumed malaria episode that is confirmed by laboratory parasitology tests. Each of these definitions provides a different estimate of malaria incidence and the magnitude of the problem.

For example, estimates of clinical cases in Africa range from an average of one case per year in African children under five (Greenwood, et al. 1991) to an average of 0.2 cases per person per year (WHO in Shepard, et. al. 1991). Estimates based on people's own perception of malaria episodes are often much higher, such as an average of 7.5 cases per year for children under five and 6.1 for adults in Malawi (Chitsulo et al. 1992). There is a well-recognized discrepancy between perceived and true malaria, however. In general, 40 to 50 percent of the cases in Africa that health personnel diagnose presumptively at clinics as malaria are confirmed by laboratory tests of blood smears (Brinkmann, 1991).

On the other hand, estimates based on health facility utilization data tend to understate the existence even of presumed malaria, because so many people treat malaria themselves without going to a facility. The highest estimates of malaria prevalence are those that measure infection only and are based on the presence of malaria parasites in the blood regardless of illness symptoms. But it is studies based on parasite infection only, without regard to malaria illness episodes, or on prevalence of infection in non-peak seasons, that tend to show that malaria has no impact on production (see, for example, Audibert 1986 for Cameroun, and Brohult, et al. 1981 for Liberia.)

This study is not an epidemiologic or clinical study and does not seek to resolve questions of malaria prevalence and incidence — beyond collecting data on people's perceptions of the number of annual episodes for adults and children. But evidence from this study, along with other evidence, suggests three patterns that are key to any estimates of malaria's economic impact in sub-Saharan Africa.

First, findings from this study, as well as other studies of perceived malaria, suggest that malaria incidence and prevalence are quite high for the whole population living in malarious zones, whether seasonal or continuous transmission zones. High and low estimates based on focus group interviews for this study suggest that the adults and children in Kenya who live in malarious zones (86 percent of the population) usually experience two to four malaria episodes per year, each lasting from three to seven days. In Nigeria, focus group findings yield high and low estimates of one to three episodes per year for adults and two to four for children, lasting two to three days each episode, according to most focus group respondents.

Findings from this study also demonstrate that, according to the population's perception of experiencing malaria attacks, malaria incidence does not vary systematically by urban or rural areas or continuous and seasonal transmission malaria zones, or by gender. All these groups tend to say they have, on average, the same number and duration of malaria episodes. People living in seasonal zones do, however, identify the peak seasons for coming down with malaria. Although Nigerian focus group responses suggest a slightly higher incidence for children under five than for others, Kenya focus group data shows no systematic variation by age.

Second, estimates of malaria based on popularly perceived malaria can usefully serve as a bellwether for the overall burden of the most frequent morbidities that adults and children in Africa experience. The fact that perceived malaria rates — even with attempts to carefully define the clinical symptoms — are likely to be somewhat higher than true laboratory-confirmed malaria means that people are including other diseases with similar symptoms that they also experience frequently. These perceptions alone produce a relatively high rate of morbidity of sufficient seriousness as to keep people from work. But even though perceived malaria may include some other illnesses with similar symptoms, it still does not include all illness. Thus rates of malaria alone indicate that, in combination with the remaining common illness episodes, the overall burden of illness that adults and children face each year is quite high.

Third, to the extent that estimates based on perceived malaria will overstate the incidence of true malaria, they will also overstate the benefits to be derived from better management and control of malaria. Similarly, when comparing the magnitude of "the malaria problem" with problems of other diseases, these distinctions between perceived and laboratory-confirmed illness must be kept consistent across the diseases to be compared.

For purposes of priorities in health education and service delivery, these patterns mean that it is especially important to strengthen both health education and service delivery to improve the identification and diagnosis of malaria — and illnesses with related symptoms. Improvements in these areas is especially important because so many individuals treat what they perceive to be malaria themselves. These efforts are important so that appropriate treatment, management, and control are provided to address more effectively and efficiently the common set of diseases that people face. As a bellwether for the common diseases that most people face, malaria can also be used as an entree to strengthen primary health care and child survival services more generally.

5.2 MALARIA'S IMPACT ON PRODUCTION

In addition to epidemiologic questions related to the incidence of malaria, one of the most important issues for assessing malaria's economic impact is: How much production is lost, especially in economies such as those in sub-Saharan Africa that are often characterized by surplus labor in agriculture, high underemployment in the formal sectors, and/or high unemployment generally. This is a long-standing question with theoretical and practical implications and short-run, as well as long-run, dimensions.

As a rapid assessment focused on the short run, this study adopts the standard assumption that the lost workdays represent lower production than would have occurred had the workers not been absent. Specifically, the study assumes that all workdays lost because of malaria represent the loss of an average day's worth of production as measured by the average wage value of those days' labor in each of the major sectors. The study uses a variety of methods to minimize some of the distortions due to surplus labor, underemployment, and unemployment that may exist in these standard measures for the economies under analysis.

In addition, the field research and analytic approach of this study provide important insights for some of these theoretical questions and lay the foundation for more in-depth research to develop more refined estimates of production losses due to malaria. At the household level in particular, the study developed a typology based on field data that specifically takes account of situations affecting whether or not workers actually lose income from missed workdays due to malaria.

With this framework in mind, conclusions from this study suggest three important characteristics about the impact of malaria on production.

First, accumulating evidence from this and similar studies suggests that malaria's economic impact is substantial, especially for a single disease. The main reason that malaria has a substantial impact, especially in comparison to other diseases, is that such a large percent of the population, including both adults and children, experience several malaria episodes per year that require adults to stay home from work to recuperate themselves or to take care of sick children.

For example, this study found that the total impact of workdays lost due to malaria in Kenya is to deprive the national economy of the person-year equivalent of 3 to 14 percent of its employed workers, and 1 to 8 percent in Nigeria. The value of malaria-related production loss ranges from 2 to 6 percent of GDP in Kenya and 1 to 5 percent of GDP in Nigeria, which has a somewhat lower average incidence of malaria attacks according to focus group findings in this study. The estimated value of production loss based on laboratory-confirmed malaria are about one-half the level of these estimates based on perceived malaria.

Second, the magnitude of the economic impact is different at different levels of the economy and broad national averages are likely to mask some of the most important economic impacts, especially at the sectoral and household level, as well as for urban and rural populations and for women compared with men.

Thus, the impact is stronger for some sectors than others, stronger at the sectoral than the national economic level, and may be most severe at the household level. Findings from this study show that sectoral impacts, as measured by percent of total sectoral production lost due to malaria, range from 2 to 13 percent in Kenya and from 1 to 8 percent in Nigeria under the high estimates.

In countries where a substantial proportion of the population works in agriculture, as in Kenya and most African countries, malaria may have its biggest economic impact in the agricultural sector even though the value of a day's labor in agriculture is generally the lowest of any of the major economic sectors. In other situations, such as in Nigeria, where the structure and distribution of the labor force is more complex, malaria's economic impact may be equal to or greater in other sectors than agriculture.

This study's findings show that malaria's impact is stronger for households at some socioeconomic levels than it is for some of the major sectors of the economy. At the household level, study findings show that, in Kenya, the economic impact of malaria could represent from 5 to 18 percent of household income under the high estimates, and from 5 to 19 percent in Nigeria.

Third, findings from this study demonstrate that the dynamics of malaria's economic impact may be more complex than they are usually thought to be. One of the implications of the complexity is that the impact of lost production from malaria cannot be easily predicted based only on the importance of each sector to the national economy. For example, this study shows that although the agriculture sector produced only 27 percent of Kenya's GDP in 1992, the value of malaria-related production losses represents 57 percent of the total value of production loss. In Nigeria, the service sector produced 26 percent of 1991 GDP, but represents 43 percent of malaria's production losses. Industry in Nigeria shows the reverse relationship, representing 38 percent of GDP but only 10 percent of the total value of malaria-related lost workdays.

Study findings also show that malaria's economic impacts are at least as sensitive to the numbers and male-female composition of workers in each sector as they are to value of a day's labor in that activity. For example, agriculture represents a disproportionate share of malaria's economic loss because the much greater number of workers in agriculture outweigh the lower value of their average daily labor.

The agriculture sector in Kenya is also the most strongly affected, based on percentage of total production lost, because more than one-half (55 percent) of the agriculture work force is female, compared with 18 percent in the service sector and 7 percent in industry. In Nigeria, the service sector bears the largest burden because it has the greatest proportion, 41 percent, of women workers. The relative percentage of women workers has this disproportionate effect because women lose workdays for their own malaria episodes, as well as for their children's.

Taken together, these characteristics of malaria's economic impact mean that efforts to control and better manage malaria have a strong economic, as well as health, justification. These arguments can be made strongly even on grounds of the morbidity that malaria causes, in addition to its mortality. Whether or not the economic benefits of malaria interventions would be greater or less than other disease interventions, or than investments in other sectors, was beyond the scope of this study. Follow-up to this study could, however, readily adapt some of this study's measures and analytic approach for purposes of identifying measures to assess the relative economic benefits of malaria interventions compared with other activities, or of alternative malaria interventions.

Evidence of malaria's strong economic impacts also means that future program and project initiatives in malaria should include components to mitigate those impacts. The variations and complexity of malaria's economic impact mean that policies to mitigate the economic, as well as the health, impacts of malaria need to include the results of special studies that would identify specifically where the burden may fall most heavily, and thereby, target groups who would benefit most from planned interventions.

These complexities also mean that, because the relevant economic factors combine in different ways in each national economy, no single criterion is likely to be adequate within a single country or across countries for selecting priority population groups for prevention efforts for purposes of minimizing malaria's economic impact. As a subsequent discussion in this section of the report suggests, findings from this study provide specific indications about target groups in Kenya and Nigeria.

5.3 HEALTH COSTS

Conclusions from the household typology in this study suggest that health costs related to treating and controlling malaria are not only substantial, they may also represent a larger burden in the short run than the value of lost production due to malaria morbidity. Usually, health costs are much lower than the value of lost production when measures of lost production include cumulative lifetime earnings lost from death due to malaria or other illnesses. The analysis here helps to show the relative importance of health care costs when measuring the production losses from morbidity only.

The study excludes estimates of the economic impacts of mortality due to malaria, even though malaria's most serious health threat from malaria is mortality for infants and children. In part, the mortality impact is excluded because of resource and data constraints. It is also important to note, however, that one of malaria's most immediate, short-run economic impacts derives from morbidity that causes people to miss work because they or their children are suffering from malaria.

Because adults rarely die of malaria, the impact of malaria mortality, in the short or long run, on loss of trained manpower (human capital cost) is minor or negligible. The economic impact of malaria is different in this respect than other major diseases in Africa, such as HIV/AIDS which causes premature death primarily for prime working-age adults. The longer run impacts of the relatively high rates of infant and child mortality due to malaria – as well as to any other major childhood disease – on lifetime earnings lost or population growth rates and development, while important, are outside the scope of this study. (For discussion and analysis of these longer-run impacts see, for example, Barlow 1968, Stevens 1977, Mwabu 1991).

Findings from this study's analysis of costs for treatment and control of malaria at the household level suggest that the health care costs for malaria can outweigh the potential loss of income for households at various socioeconomic levels. At the household level, annual health costs to treat and control malaria can represent 50 to 89 percent of the total economic burden of the disease in Kenya under the high estimates and 58 to 64 percent in Nigeria. These annual health costs represent 4 to 9 percent of annual household income in Kenya under the high estimates and 4 to 13 percent in Nigeria.

Study findings also suggest that the cost to employers of either providing health services and/or providing paid sick leave days may be substantial and represent a higher proportion of the additional costs of production that malaria imposes than may have been thought. For example, evidence from interviews with managers, along with focus group discussions, in Kenya suggests that firms can provide sick leave policies ranging from 45 to 60 days and can cover all the malaria medication costs of their employees, and sometimes their dependents. Under the high estimates of this study, a typical adult worker would use 16 of the sick leave days annually for malaria alone; a woman worker with caretaking responsibilities for three children would use 48 sick leave days.

These high health care costs for malaria make it especially important that households and firms allocate that spending effectively. Data are not available from the focus groups for this study to indicate how effective household malaria health expenditures are or how often people might be treating malaria with the more expensive drugs to counteract chloroquine-resistant strains. Given the relatively high perceived levels of spending on treatment, it is likely that, in many cases, households would not have much additional disposable income to spend for prevention or control of mosquitoes. On the other hand, room may exist for a reallocation of household health spending for malaria that would produce a more effective combination of treatment and prevention for the same or a lower spending level.

This means that health education efforts that improve malaria diagnosis and appropriate medication and control activities can have an added economic benefit by helping families save unneeded expenditures or spend health dollars more effectively. Such efforts could also be directed to industries, firms, and insurance companies providing malaria health benefits.

Current health spending levels for malaria also highlight the importance of developing less costly malaria treatment and control alternatives, not only for the majority of the population without employer-provided health benefits, but also to help employers minimize the costs of providing these benefits.

It was beyond the scope of this study to estimate health care costs for malaria at the national level. But findings from the household and industry analyses indicate that total private sector costs are substantial. In addition, typical utilization data suggests that an estimated average of 30 to 40 percent of all out-patient visits in the public sector are for malaria.

These data suggest that the resource demands that malaria places on the health system as a whole detract from its ability to meet the needs for other curative and preventive health services that also contribute to increased productivity and human capital development (e.g., child survival services related to immunizable diseases or to ARI, family planning, services to reduce maternal mortality). Cost pressures of the magnitude of that malaria produces in the health sector make it especially important that malaria funds are allocated most effectively across target groups and across diagnosis, treatment, management, prevention, and control efforts.

5.4 HOUSEHOLD AND EMPLOYER SPENDING FOR MALARIA

In addition to providing information about malaria-related health costs, findings from this study on household expenditures for malaria demonstrate that the population is willing to pay substantial amounts for the costs of treating malaria. These findings suggest that spending for malaria could absorb the majority, or entire, household budget for health. Even if estimates derived from focus group reports overestimate — as is often the case — what households typically spend, they still suggest that people are willing to spend a substantial portion of their annual health spending for malaria.

But these malaria expenditures also represent a significant burden for most households, regardless of income level. Meeting the costs of more expensive anti-malarial medication to compensate for chloroquine-resistant strains may be beyond the reach of many Kenyan and Nigerian households. Households who only have the option of purchasing malaria medication from private pharmacies and/or who have no health benefits from an employer are the hardest hit. And cost estimates here did not take into account spending for in-patient hospital services for malaria episodes or other health needs.

Households will adopt a variety of means to cope with income constraints and health care costs that absorb relatively high proportions of that income. Some of these will make treatment of malaria less effective and contribute further to chloroquine-resistant strains of malaria. In addition, although it was not the purpose of this study to assess specific health spending and treatment patterns, the information collected does suggest that households may be spending a great deal for treatments that are marginally effective, if at all.

These findings mean that financing policies for malaria can build on the demonstrated high willingness to pay — on the part of both households and employers. But these financing policies should also provide information and create incentives to allocate spending for cost-effective treatment regimens and a cost-effective combination of treatment, prevention, and control measures. To advise a population on cost-effective spending for malaria, an MOH will have to conduct special studies or pilot demonstrations, which could develop alternative models and estimate several of the main variables, such as savings in treatment costs that various control methods (e.g., use of bed nets) might produce; or savings in treatment costs from better and earlier diagnosis, different medications, and different sources for purchasing medication.

5.5 DISTRIBUTION OF THE ECONOMIC BURDEN OF MALARIA

Findings from this study demonstrate that the economic impact of malaria can vary substantially for workers and households at different socioeconomic levels, with different employment patterns and benefits, and different health care-seeking behavior in the public and private sectors. It can also vary depending on responsibility for taking care of sick children in the family.

For example, this study shows that the biggest malaria-related economic burden may fall on women in both Kenya and Nigeria, due to their dual role as workers and caretakers. Working women bear 71 percent of the malaria-related production loss in Kenya under the high estimate, and 65 percent in Nigeria. The rural population in Kenya bears 58 percent of the production loss in Kenya, while the urban population in Nigeria bears the greater proportion, 51 percent.

The household burden from lost income and health care costs can vary substantially depending on type of employment and the extent of sick leave policies and health benefits. Given the way these factors tend to combine, the lowest income groups are the most likely to have the biggest burden. For example, this study's findings show that rural small farming households in Kenya are the hardest hit, while urban lower-income informal sector households suffer the highest burden in Nigeria. Depending on their source of health care, urban middle-income households in Kenya could, however, be almost as seriously affected as their rural small farming counterparts in terms of percentage of income spent on malaria health costs.

This study's household typology also illustrates that the health care costs associated with malaria may represent a bigger economic burden at the household level than the possibility of lost income. For households that depend on informal sector employment and small farm agriculture, both of which can be sensitive to "peak seasons" and uncertain alternatives for substitute workers, days lost from work can represent a high opportunity cost and lost income can almost equal health care costs. In these household situations, malaria carries a double burden of lost income and health care costs. These hardest-hit households in Kenya lose a 2-to-3.5 times greater share of income to malaria than the better-off households in the typology, and a 2.5-to-4 times greater share in Nigeria.

These findings have specific implications for policies to identify target groups who might realize the greatest economic benefit from more effective measures to reduce the incidence, duration, and severity of malaria. They suggest that the lowest income groups — small farmers and self-employed workers, especially in the urban informal sector — now tend to bear the highest burdens from combined income loss and health care costs due to malaria morbidity. Women in general, and especially women employed in these lowest income occupational categories, bear the greatest burden.

Targeting efforts to reduce malaria in infants and children would provide the single greatest relief to women in these groups. In this study, caretaker days account for three-fourths of all workdays that women in Kenya lose to malaria and 80 to 86 percent of all days that working women in Nigeria lose to malaria. For the economy as a whole, 60 percent of all malaria-related workdays lost in Kenya and 67 to 75 percent in Nigeria are for caretaking of infants and children under age 15 who are suffering from malaria. Thus, this study's findings show that, just as the greatest health threat from malaria is infant and child mortality, the single greatest economic burden from malaria is due to the need to take care of children suffering from malaria episodes.

5.6 EMERGING PATTERNS

AID recently supported two other major studies of the economic impact of malaria in sub-Saharan Africa (Shepard, et al. 1990 and 1991 and Ettling, et al 1993). Together with this study, they provide estimates for seven African countries, as well as for sub-Saharan Africa as a whole. In spite of differences as well as similarities in methodology, this study's findings are in line with these other studies in some aspects, fully confirm them in others, and extend the analyses in still others. In combination, findings from this and other studies suggest several emerging patterns about malaria's economic impact in sub-Saharan Africa.

Shepard, et al. (1990 and 1991) used data from four case studies along with general statistical information to develop an estimate for the sub-Saharan Africa as a whole. Shepard estimated that the health costs and lost production due to malaria amounted to $0.8 billion, 0.6 percent of the total output (GDP) of sub-Saharan Africa in 1987, and would rise to $1.7 billion, 1.0 percent of GDP, in 1995 due to increases in prevalence and drug-resistant strains of malaria. These costs are based on averages derived from case studies of malaria in Brazzaville, Solenzo medical district in Burkina Faso, Mayo-Kebbi district in Chad, and a national estimate for Rwanda. The costs for three of these four cases ranged from 1 to 1.3 percent of total output in their respective geographic areas. In the fourth case, Brazzaville, malaria costs represented 0.1 percent of output.

This study and Shepard's estimates of the economic impact of malaria are in the same range, even though this study shows a larger impact than the Shepard study, once two important distinctions are made — one relating to definition of "malaria" and assumptions about prevalence and incidence; the other relating to differences across African countries in the value of a lost workday.

With respect to the incidence of malaria, Shepard's estimates are based on a World Health Organization (WHO) estimate for Africa of "clinical cases" at a rate of 202.6 per 1,000 population at risk. This rate, which converts to 0.2 malaria episodes per person per year, is substantially lower than the rates of two to four episodes per year in Kenya and one to three in Nigeria, used for this study's main estimates based on focus group perceptions. But this study's estimates of malaria's impact on GDP that are based on laboratory-confirmed malaria (comparable to the clinical case definition) are in the same range as Shepard's country cases and continent-wide estimates: for Kenya 0.6 percent of GDP under the low estimate and 2.4 percent under the high; and 0.3 to 2.6 percent of GDP in Nigeria.

Once roughly comparable definitions of malaria are used, this study's estimates of impact on GDP should, however, be lower than, not close to, Shepard's because this study did not include national health system costs or estimates of lifetime earnings lost due to infant and child mortality. The main reason this study's estimates are in the same range as Shepard's is that the sectoral wage rates in Kenya and Nigeria are substantially higher than the national average wage rates in the countries that constituted the basis of Shepard's estimates.

At the household level, this study fully confirms findings from the other AID study that included a household analysis. Ettling, et al.(1993) conducted a large household survey of attitudes and practices regarding malaria in Malawi, along with information to estimate the economic impact of malaria at the household level. The Ettling team based their estimates on "perceived malaria" and focused their economic impact analysis on rural small farm households.

Findings from the Malawi household survey produced estimates of the number of malaria episodes per person similar to focus group findings in this study. According to the Malawi household survey, adults experience an average of six episodes per year and children under ten experience 7.5 episodes per year. For purposes of the economic estimates of lost time from work, Ettling used three episodes per year per adult based on local expert advice about a "more realistic" level.

Estimated spending for malaria treatment costs and lost income at the household level in Malawi is also in the same range as for Kenya and Nigeria. In Malawi, this total estimated impact represents 13 percent (low estimate) to 20 percent (high estimate) of small farm household income, compared with this study's small farm household estimates, ranging from nine to 18 percent of total annual household income in Kenya and 7 to 13 percent in Nigeria.

Also, as in this study's estimates, health care costs for treatment and prevention constitute a larger share of household impacts in Malawi than the estimated lost income. Health costs represent 80 percent of the total rural household economic impact, with treatment costs constituting 93 percent of total health costs. These estimated expenditures that households in Kenya, Nigeria, and Malawi make to control and especially to treat malaria suggest that malaria is among the most visible and highest-priority diseases. Even allowing for overestimates from focus group and household survey responses, these amounts represent a substantial willingness to pay, regardless of income level, for what the population perceives as malaria.

Taken together, Shepard, Ettling, and this study add further confirmation to existing evidence that the incidence of what the population perceives as malaria and what is presumptively diagnosed as malaria in health facilities, is substantially higher than estimates based on laboratory-confirmed or clinical cases. What this study adds to those findings is that such a divergence is true even when effort is spent, as in the focus groups in this study, to specify the definition of malaria to exclude as much as possible other illness episodes. These studies also add further evidence that some significant portion of malaria is treated outside of health facilities, so estimates based on facility level data can be expected to understate the incidence of malaria.

Together, these studies also demonstrate a clear pattern that malaria, whether perceived or laboratory-confirmed, has a measurable economic impact at the national level that is significant for a single disease. But they also show that it may be at least as important to evaluate the economic impact at subnational levels. The combined findings from these studies demonstrate that malaria's economic impact can be higher at the sectoral or subnational regional than at the national level and substantially higher at the household than at the national economic level. The highest impact was consistently shown at the household level; the lowest impact was the estimate for the whole of sub-Saharan Africa.

Finally, these studies confirm the importance of including estimates of caretaking costs in assessments of the economic impacts of malaria and other diseases in sub-Saharan Africa. Both Shepard's Africa-wide estimates and Ettling's Malawi estimates took these costs into account. This study sharpens those findings with greater detail and demonstrates the substantial effect that caretaking needs can have on production lost due to malaria morbidity.

5.7 FOLLOW-UP RESEARCH

This study serves as a pilot effort to examine various aspects of malaria's short-run economic impacts with a rapid assessment methodology. Follow-up research can be designed to replicate this study for other African countries; confirm some of this study's findings with more refined methodologies; and extend the analysis here, building on fairly clear patterns that are already relatively well-established. In addition to standard research projects, demonstration, operational, or pilot projects could also be implemented to test alternative approaches suggested by this study's findings to mitigating the economic impacts of malaria, especially for target population groups.

Because this study addresses a range of questions at several levels of analysis with the same rapid assessment methodology, the reliability of its findings is stronger for some questions and levels of analysis than for others. On the other hand, the rapid assessment was effective in this case precisely for its ability to use generally available statistics in combination with a single survey methodology and effort (focus groups of workers) to obtain both household and employer-based quantitative and qualitative information to identify several major types and levels of malaria's economic impact.

The alternative to this rapid assessment would be to conduct several separate, more elaborate surveys and/or extended observational analyses of households, employers, and industrial, service sector, and agricultural operations. An additional separate study would also be needed if assessment of national costs for malaria health services and control were included. Follow-up to confirm the findings of this study specifically in Kenya and Nigeria could also include a series of separate, more in-depth research efforts and methodologies for each of the levels of analysis.

For example, in Kenya and Nigeria, follow-up could be designed to confirm this study's household findings with a statistically representative household survey sample. Findings from a household survey could also test the variance between those findings and this study's focus group findings, especially for quantitative information. Follow-up studies to confirm or develop more refined estimates of lost production at the sectoral and national levels could use alternative estimating techniques and/or additional empirical information to refine the estimates of the value of lost production and the possible impact of surplus labor and underemployment.

For some issues in Kenya and Nigeria, small scale data collection and focussed analyses or case studies might be the most appropriate and effective follow-up to extend the analysis here. For example, to provide advice on more cost effective household spending for malaria, an MOH could develop alternative models to estimate how much certain control methods, such as use of bed nets, might save in treatment costs, based on an estimated number of episodes (and related treatment costs) avoided; or how much would be saved by better and earlier diagnosis and by purchasing medication at different sources. Similarly, with respect to employer spending for malaria, they could conduct a survey of employer sick leave and health benefit practices and related legal and regulatory requirements, collect data to estimate the costs of these policies and practices in representative situations, and develop cost-effective alternatives and recommended options.

In other countries, similar rapid assessments could be conducted before embarking on extensive household or other surveys. The agenda for the rapid assessment could be adapted to fill gaps in information in each country and complement data already existing. For example, where household surveys have already assessed health spending behavior, focus groups for a malaria economic study could concentrate on levels and effectiveness of malaria health spending only, along with malaria's impact on work. Where reliable information already exists on relevant epidemiologic and malaria treatment and control patterns, focus group sessions could concentrate more on malaria's impact on missing work, losing income, and spending for malaria and other health services.

In all cases, given accumulated evidence, most future research can go beyond general questions of whether malaria has an economic impact to explore more detailed questions of relative impact and dynamics of the impact. For example, it is not necessary to conduct studies with a primary purpose of estimating the national economic impact to see if it is significant, or people's willingness to pay for malaria services to see if that willingness exists, or of health system costs for malaria to see if they are significant.

It is thus important that future research, while documenting these baseline "facts" and impacts, also include information to assess the distribution and kinds of malaria's economic impacts among population, occupation, and employer groups, and between the public and private sectors. In all these cases, the purposes of future research should be to understand better the determinants and dynamics of the relationships, assess the cost-effectiveness of current spending and coping patterns, and develop alternatives that minimize the economic impact.

The most important specific areas for follow-up to confirm and extend this study's analysis and findings for Kenya, Nigeria, and elsewhere in sub-Saharan Africa include the following:

1. Caretaker behavior in relation to work, lost income, and costs, with a focus on the main factors comparative circumstances affecting these variables and developing alternatives to reduce caretaker costs, including assessment of alternative malaria diagnosis and treatment patterns to minimize lost work time.

2. Household spending for malaria treatment and prevention, with a focus on determinants and patterns of demand for malaria services and medications, e.g., sources and prices of malaria medication; reasons for choosing alternative public and private sources; factors affecting household spending levels; differences in treatment patterns for adults and children and women and men; effectiveness of current spending in terms of quality and appropriateness of treatment regimen; and cost-effectiveness of alternative spending patterns for treatment and control.

3. Employer costs for malaria, including sick leave policies, health benefits, and coping methods for frequent worker absences (technological and organizational adaptations), with a focus on understanding better the dynamics and consequences of these relationships in the short and longer run, as well as on developing more cost-effective ways for employers and employees to address malaria's impact on production. Such studies should include identifying differences in impact across industry types, key factors affecting differences in impact, the main costs of present practice, and the costs and benefits of alternatives that would be mutually advantageous to workers and employers.

4. Cost effectiveness and cost benefit analyses for malaria interventions that go beyond the usual effectiveness measures (e.g., service delivery and health status measures) to include the economic benefits for the hardest-hit population and occupational groups.

5. Use of pilot projects and demonstrations – either as stand-alone efforts or as components of relevant ongoing malaria initiatives – would also be particularly appropriate for testing alternatives for reducing the economic impact of malaria on households, women, and employers.

APPENDIX A

KENYA
ASSUMPTIONS AND KEY VARIABLES FOR ESTIMATING THE ECONOMIC IMPACT OF MALARIA
(All data for 1992 unless otherwise indicated)

Employment	# of Workers Employed (in 000's)	Derivation/Explanation	Source #
Formal Agriculture (wage-based)	272.4	Available data included numbers of employed people by 20+ occupational sectors in 1992 for wage/salaried workers and estimated #s of people working in the informal sector. Numbers of people engaged in small farm agriculture were not available but were derived from population estimates adjusted for employment and labor force participation by age minus total formal and informal employment.	1
Small Farms	9848.9		1
Industry	289.7		1
Service	900.5		1
Informal	619.8		1

Average Wage	KSh Per Day	Derivation/Explanation	Source #
Formal agriculture	63.40	Weighted average of public and private formal sector average agriculture wage.	1
Small farm	20.00	Derived from estimated small farm employment (above) and value of agriculture sector.	1,2
Industry	167.00	Weighted average of public and private industry average wages.	1
Service	184.43	Weighted average of public and private service sector average wages.	1
Informal	40.00	2/3 weighted average of informal sector industry and service wage plus 1/3 average agricultural wage, based on % distribution of informal sector activities in source #3.	1,3
Men/Women: Same average wage in each of the above sectors applies to both men and women, based on assumption that the official average wages were calculated from both men's and women's wages.			

Lost Production	High	Low	Derivation/Explanation	Source #
# of episodes per/year	4	2	High and low estimates represent the patterns evident in focus group responses, after excluding unrealistic replies. Calculations based on these estimates are discounted for percent of people who live in malaria-free zones.	3
# of workdays missed per episode	4	2		3
# episodes per child per year	4	2		3
# workdays missed per child episode	4	2		3
# children requiring caretaking per women	3	3	Based on officially published average family size.	1
% workdays missed that represent actual lost production	100%	100%		3
% of days worked with malaria that represent lost production per episode: agriculture	75% of 2 days	50% of 2 days	Based on focus group estimates of number of days spent at work with malaria and percent of production lost per day. Total lost production due to days worked while sick is then discounted to account for people who never go to work sick: roughly 50% of all agriculture workers and 25% of industry and service workers.	3
industry	25% of 2 days	0% of 2 days		3
service	50% of 2 days	25% of 2 days		3

Household Health Care Expenditures for Malaria		Kenya Shillings			Derivation/Explanation (Typical expenditures derived from focus group patterns for health care sources and average costs for malaria treatment.)	Source #
		clinic	drugs	trans		
Urban middle income:	high	0	700	150	free clinic, drugs at urban market/ pharmacy, high average transport	3
	low	100		30	single fee visit to private clinic, low average transport	3
Rural small farmers:	high	0	40	5	free clinic, drugs at rural market/ pharmacy, value of average walking time	3
	low	0	40	5	75% of episodes treated	3
Laborers (agriculture or industry)	high	0	0/40	5	treatment for 1 adult and all children at rural patterns & prices (all others use company facilities/ health plan)	3
	low	0	0	0	company facilities/ health plan	3
Prevention:	high	590 Ksh			2 bed nets, and one year's worth of mosquito coils and cans	3
	low	none				3

Household Income		Assumptions		Derivation/Explanation	Source #
		High	Low		
Earnings loss:	all households	100% for informal sector workers and small farms	50% for informal sector workers and small farmers	Based on high and low estimates from focus groups of self-employed, informal sector workers and small farmers. Formal sector workers assumed to incur no earnings loss because of availability of sick leave.	3
Annual income:	urban middle-income	100,000 Ksh		Households assumed to have 3 working adults. Urban middle-income households, as well as agribusiness or industry households, are assumed to have 2 adults working in the formal sector and 1 in the informal sector. Small farm households have 2 adults earning the estimated small farm wage and 1 adult earning the estimated informal wage.	1, This Study
	rural small farmers	20,000 Ksh			1, This Study
	laborers (agriculture or industry)	35,000 Ksh			1, This Study

Sources

1: Kenya Economic Survey, 1993.
2: World Development Report, 1992.
3: Focus groups interviewed for this study.

Kenya: Household Typology

HIGH

	Urban Middle-Income	Rural Small Farmers	Agbus or Industry Laborers
INCOME (annual KSh)	100000	20000	35000
EARNINGS LOSS			
Value of Workday Loss	1020	1760	540
% Income Lost	1.0	8.8	1.5
HEALTH CARE COSTS			
Malaria treatment	7650	1170	675
Prevention	590	590	590
Total	8240	1760	1265
% of Income	8.2	8.8	3.6
TOTAL COST	9260	3520	1805
% OF INCOME	9.3	17.6	5.2

Kenya: Household Typology

LOW

	Urban Middle-Income	Rural Small Farmers	Agbus or Industry Laborers
INCOME (annual KSh)	100000	20000	35000
EARNINGS LOSS			
Value of Workday Loss	510	880	270
% Income Lost	0.51	4.4	0.8
HEALTH CARE COSTS			
Malaria treatment	2210	878	0
Prevention	0	0	0
Total	2210	878	0
% of Income	2.2	4.4	0.0
TOTAL COST	2720	1758	270
% OF INCOME	2.72	8.8	0.8

NIGERIA
ASSUMPTIONS AND KEY VARIABLES FOR ESTIMATING THE ECONOMIC IMPACT OF MALARIA
(All data for 1991 unless otherwise indicated)

Employment	# of Workers Employed (in 000's)	Derivation/Explanation	Source #
Formal Sector and Small Farm Agriculture	13,776.1	Available data included numbers of employed people by 10 occupational sectors in 1986 based on a population of 98.9 million, an overestimate for that year (slightly less than the current population in Nigeria estimated at 90.0 million).	1
Industry	1,928.2		1
Service	12,830.7		1

Average Wage	Naira Per Day	Derivation/Explanation	Source #
Agriculture	30.8	Derived from estimated adult population working full-time in agriculture and calculated so that their total earnings equal 90% of total sector production.	1,2,3
Industry	53.10	Average manufacturing wage, 1990, updated to 1991.	3
Service	23.10	Derived from employment estimates (above) and calculated so that total wages for employed equal 60% of total sector production.	1,2
Men/Women: Same average wage in each of the above sectors applies to both men and women, assuming that average wages as listed above were derived from both men's and women's wages.			

Lost Production	High	Low	Derivation/Explanation	Source #
# of episodes per/year	3	1	Derived from pattern of focus group responses, after excluding obviously unrealistic responses (e.g., 27 episodes/year or 45 days/episode).	4
# of workdays missed per episode	3	1		4
# episodes per child per year	4	2		4
# workdays missed per child episode	3	1		4
% workdays missed that represent actual lost production	100 %	100 %		4
% of days worked with malaria that represent lost production per episode for all sectors	50% of 3 days	25% of 3 days	Based on focus group estimates of number of days spent at work with malaria and percent of production lost per day. Total lost production due to days worked while sick is then discounted to account for people who never go to work sick with malaria: 50% of all agriculture workers and 25% of all industry and service workers.	4

Household Health Care Expenditures for Malaria	Naira				Derivation/Explanation	Source #
	clinic	drugs	trans	other		
Urban: male	10	7	3	10	Typical expenditures derived from focus group patterns for health care sources and average costs for malaria treatment.	4
female	10	20	5	5		4
children	10	45	7	10		4
Rural: male	10	3	10	5		4
female	10	20	10	5		4
children	10	20	10	5		4
Prevention: high	540				2 bed nets and one year's supply of coils and spray cans.	4
low	0					4

Household Income	Assumptions		Derivation/Explanation	Source #
	High	Low		
Earnings loss: all households	100% informal sector workers and small farmers only	50% informal sector workers and small farmers only	Based on estimates from focus groups of self-employed, informal sector, and small farm workers. Formal sector workers are assumed to incur no earnings loss.	4, This Study
Annual income: urban middle-income	36,000 N		Household assumed to have 3 working adults. In urban middle-income households, two of these adults work in the formal sector and one in the informal sector. Formal sector earnings are based on interviews with managers of numerous businesses. Informal sector wages and small farm earnings are based on average earnings derived above.	This Study
urban self-employed	12,000 N			This Study
rural small farmers	16,000 N			This Study

Sources

1: ILO Year book of Labour Statistics, 1986.
2: World Development Report, 1993.
3: Industry & Development Global Report, 1992.
4: Focus groups interviewed for this study.

Nigeria: Household Typology

HIGH

	Urban Middle-Income	Urban Self-Employed	Rural Small Farmers
INCOME (annual KSh)	36000	12000	16000
EARNINGS LOSS			
Value of Workday Loss	240	720	840
% Income Lost	0.7	6.0	5.3
HEALTH CARE COSTS			
Malaria treatment	978	978	731
Prevention	540	540	540
Total	1518	1518	1271
% of Income	4.2	12.7	7.9
TOTAL COST	1758	2238	2111
% OF INCOME	4.9	18.7	13.2

Nigeria: Household Typology

LOW

	Urban Middle-Income	Urban Self-Employed	Rural Small Farmers
INCOME (annual KSh)	36000	12000	16000
EARNINGS LOSS			
Value of Workday Loss	120	360	420
% Income Lost	0.3	3.0	2.6
HEALTH CARE COSTS			
Malaria treatment	978	978	731
Prevention	0	0	0
Total	978	978	731
% of Income	2.7	8.2	4.6
TOTAL COST	1098	1338	1151
% OF INCOME	3.1	11.2	7.2

APPENDIX B

AGENDA FOR FOCUS GROUP DISCUSSIONS
WORKPLACE: WORKERS, TEACHERS, FARMERS

I. INTRODUCTION

II. DEFINITION OF MALARIA

Symptoms: how to recognize malaria
Other diseases with same symptoms
Get agreement on what malaria is for purposes of this discussion

III. EPIDEMIOLOGIC DATA

FOLLOWING QUESTIONS TO BE ANSWERED FOR WORKERS, THEIR CHILDREN (5-15), & YOUNG CHILDREN (0-5)

1. Number of malaria episodes per year
   If seasonal, in peak season

2. Usual length of episode

3. Number of malaria episodes per year, per person, that require hospitalization
   If seasonal, in peak season

4. Usual number of days in hospital

IV. PRODUCTIVITY DATA

5. Total number of work days missed per worker per year due to *all* illnesses, including malaria

6. During a typical malaria episode, number of days a worker goes to work AND number he or she stays home

7. For wage/salary earners only, if worker stays at home, how many days not worked are without pay

8. Amount/percent of production lost from worker who is sick with malaria and continues to work (for example, none, half-day, all day)

9. Number of child malaria episodes for which a worker misses work to take care of the sick child per year
   If seasonal, per month in peak season

10. Number of work days missed each time worker must take care of child sick with malaria

11. Frequency with which someone takes the place of a worker who is absent due to malaria (whether because sick or taking care of child) – for example, never, half the time, always

12. If someone (for example, sister, friend, co-worker) takes the worker's place, what is the other person's usual occupation?

13. Is there any other illness that causes the worker to miss work more often than malaria?
    If yes, name that illness.

V. SOURCES AND COST OF MALARIA SERVICES

FOLLOWING QUESTIONS TO BE ANSWERED FOR WORKERS, THEIR CHILDREN (5-15), & YOUNG CHILDREN (0-5)

14. Usual sources, and amounts paid, for malaria *medication* per malaria episode, for example:

- private pharmacy
- market
- PVO/NGO/church facility
- private clinic/doctor's office
- public health facility
- traditional healer

15. Usual malaria medication dose purchase: full or partial dose

16. Usual source(s) and amounts paid, for *out-patient health services* (excluding medication) to treat malaria, for example:

- private pharmacy
- market
- PVO/NGO/church facility
- private clinic/doctor's office
- public health facility
- traditional healer

17. Usual source and amounts paid for *in-patient hospital services*, per day, for malaria episode

FOLLOWING QUESTIONS TO BE ANSWERED IN GENERAL, WITHOUT REGARD TO WHETHER IT IS THE WORKERS OR THEIR CHILDREN

18. Average cost of round-trip *transport for visit* to health facility for malaria treatment (if walk, give time taken)

19. Average cost of round-trip *transport* to purchase *medicine* for malaria treatment (if walk, give time taken)

20. Do any workers take *medication to prevent* malaria?

21. For workers who take medication to prevent malaria, usual source(s) and amounts paid per worker, per month for the medication, for example, at:

- private pharmacy
- market
- PVO/NGO/church facility
- private clinic/doctor's office
- public health facility
- traditional healer

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