Socioeconomic Aspects of Malaria in Honduras: Towards an Effective Agenda

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PREFACE

Health has come to be increasingly recognized as a fundamental aspect of economic development. On one hand, improved health contributes to human capital formation. On the other hand, higher level of development leads to better health. This paper presents preliminary results of an aspect of this important subject. It was coauthored by José Cuesta (IDB) and Maria Victoria Avilés (United Nations Research Institute for Social Development, Switzerland).

There is little worldwide knowledge of the socioeconomic determinants of malaria, a tragedy that has transcended the sanitary arena to become a developmental problem. Evaluating concrete public interventions provides useful information but falls short of a proper and extensive knowledge of which socioeconomic factors (both at household and community levels) are more closely associated with differentials in the incidence of the disease; preventive and curative practices; and knowledge of efficient treatments and public interventions. This study builds a primer on that knowledge for Honduras, a country with high levels of malaria and poverty.

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1. Introduction

Malaria, together with HIV/AIDS, tuberculosis and other infectious diseases is no longer an epidemiological concern exclusively. These diseases are widely recognized as fundamental obstacles to development and their control is one of the Millennium Development Goals by 2015. The poor are more exposed to contagion and spread of these diseases and their impact on human capital accumulation is more devastating than among other socioeconomic groups (by affecting their mortality and morbidity and their access to education and school performance). Also, the fight against these diseases demands large amounts of public health spending in developing countries. In effect, UN (2004) estimates that effective public health spending should increase by an additional US$ 12 per capita (thus doubling the initial health spending per capita) in HIV high-prevalence countries by 2006. These factors have all prompted an increasing interest in their socioeconomic aspects among the scientific and academic communities, governments and practitioners. International initiatives like the *Roll Back Malaria* and, more recently, the Global Fund to fight HIV/AIDS, Malaria and Tuberculosis have been launched. Global Fund (2004a) reports that as many as US$ 315 million dollars have been earmarked to worldwide malaria projects in 2005 and 2006.

Making these projects and resources effective in the fight against malaria calls for a more comprehensive knowledge on the causes, determinants, effects and best-practice interventions related to the disease. Evaluations of interventions already in place are important instruments to provide knowledge of the disease but should be contextualized in a more encompassing knowledge on disease incidence patterns;

behavioral and socioeconomic characteristics of affected (and unaffected) households; and the community characteristics where such households are located. This study is a first attempt to provide that comprehensive information for Honduras, a heavily indebted country with the third largest incidence of poverty in Latin America seventy seven percent according to CEPAL, (2004) and the largest number of cases reported in Central America, forty percent; (Global Fund, 2004b). With that task in mind, a pilot household survey (*Encuesta Socio-Económica de la Malaria en Honduras,* ENSEMAH) is collected among twenty-nine communities all over Honduras in August 2004. This pilot survey collects information on socioeconomic characteristics of households and communities; individual knowledge of the disease and public interventions; preventive and curative habits among the households of the sample; and the presence of policies or interventions fighting the disease. The following section reports what is known of the socioeconomic aspects of the disease in the country, identifying main information gaps. The data and methodological section describes the objectives, hypotheses and design of the pilot survey. The discussion section reports and analyzes the main results of the survey, finding that the disease is subject to wide variations, which indicates that public interventions -- if well designed -- may have a substantive impact in the reduction of the disease. The need for a careful design of public interventions is strengthened by the fact that differences in incidence appear associated with some socioeconomic characteristics of the interviewed households: among them, gender and location are more relevant than income levels. Interestingly, knowledge of causes, characteristics, and treatments of the diseases are widespread in the sample, and when treatments are started, they are not abandoned. With these findings, the final section draws key policy recommendations to step up the efficiency in the fight of malaria in Honduras,

emphasizing nevertheless that more efforts are needed to validate these results for a nation-wide representative sample.

2. An Overview of the Socioeconomic Impact of Malaria in Honduras

According to official reports (by the Vector Transmitted Diseases Unit of the *Hospital Escuela* in Tegucigalpa) malaria remains notoriously high in certain areas of Honduras. The Northern and Central regions of the country report the highest incidences, with municipalities such as Tocoa where incidence exceeds 1,570 episodes of malaria by 100,000 individuals. Although incidence is lower among Southern municipalities, some sites also show worrisome statistics. For instance, in La Paz incidence reaches a high level, 710 episodes per 100,000 individuals.[1] Beyond these figures, the connection between malaria and socioeconomic conditions should be a key consideration in the design of welfare programs in high-prevalence communities. As an example, data on infant mortality reported by the Government of Honduras (2001) in its Poverty Reduction Strategy shows that despite improvements in infant mortality rates during the last decades, approximately half of those mortality cases are related with poverty conditions in the household: typically, acute respiratory infections and diarrheic diseases. The presence of malaria, as well as other vector-transmitted diseases like dengue, aggravates this situation.

A significant volume of studies and research does not match this increasing importance attributed to the socioeconomic aspects of malaria (that is, malaria as a cause and a determinant of underdevelopment), however. This is certainly not only the case in Honduras but also internationally, as the literature review by Worral et al (2003) show. Research on malaria has focused so far on its epidemiological dimensions rather than on its socioeconomic aspects. Indeed there are several recent

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[1] Incidences are, however, largest in jungle areas of the Mosquitia, in the Northeastern department of *Gracias a Dios*. Information by PNUD (2003) indicates that malaria is on top of the health priorities in that department.

epidemiological studies in Honduras, such as Mejía-Díaz et al (2000), Fernández et al (2001) and Aguilar et al (2002). Also, there are a handful of international studies that estimates the impact of malaria on economic growth. Among them, McCarthy et al (1999) and Sachs and Malaney (2002) estimate that GDP would increase by 1.3 percent annually if malaria were eradicated in a sample of forty four disease-ridden countries in subtropical regions of Sub-Saharan Africa, Latin America and the Caribbean, and East Asia[2]. McCarthy et al (1999) report shorter gains from eradicating malaria in Honduras at 0,07 percent per annum. Similarly, a study of socioeconomic impact of HIV/AIDS in Honduras (Cuesta 2002) finds that the relation between the incidence of that disease and economic growth is much shorter than the estimated impacts among high-incidence African countries.

Specific to socioeconomic aspects of malaria in Honduras, Avilés (2003) is the only study found that adopts that perspective. The study develops a theoretical framework of health production functions for malaria and estimates econometrically the impact of a series of socioeconomic, individual and environmental factors on differentials in malaria incidence throughout the sanitary regions of the country. Using the same information provided by the Vector Transmitted Diseases Unit at *Hospital Escuela*, sanitary region-based information is expanded uniformly across municipalities that belong to the same sanitary region. This information is matched with household socioeconomic data by scaling up averaged household information within the same municipality. This allows connecting regional information on malaria incidence with household and community socioeconomic data coming from the Permanent Household Survey (1996) and the Yearbook of Statistics (2000) from the National Institute of Statistics (*Instituto Nacional de Estadísticas,* INE). The study

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[2] All but three of these countries are among the least developed countries according to Gallup and Sachs (2000)

finds that age is a significant factor explaining different rates of incidence (being children the most vulnerable group in the population), whereas gender is not significant once socioeconomic and individual factors are controlled for. Human capital is related negatively with the incidence of malaria: the disease is less likely to affect households with more educated and well-nourished members. Living conditions within the household also affect its exposure to malaria, although not all conditions affect that exposure in a similar way. Access to sanitation is reported as having the most influential single impact. Environmental factors matter too: specifically, levels of rainfall, frequency of fires and deforestation in the department where municipalities are located. Public health interventions appear to have significant impacts in the fight against malaria, although different interventions have different impacts. Thus lower incidence is associated with the presence of infrastructure at the community level. Widespread attention to pregnant women reduces their reporting of malaria, whereas attention to under-five children is associated with higher incidence of malaria in that community. Avilés (2003) concludes that preventive health interventions have positive impacts in the reduction of malaria, while curative interventions focus on already high-incidence communities. Public infrastructure and prevention programs are argued to be the most effective strategies reducing the incidence of malaria in Honduras.

3. Objectives and Design of a Pilot Survey

Objectives of the Survey

Given the scarcity of studies, the present research aims at providing additional and comprehensive information on malaria in Honduras. That information refers to the incidence of the disease at the household level; behavioral prevention and reactions to the disease; and the consequences of different public interventions on the

incidence of malaria. For that, the present study designs and collects a pilot survey that characterizes malaria from a socioeconomic point of view. Although the collected information facilitates a detailed analysis of the disease, it is important to emphasize the pilot nature of the instrument. The final objective of the current pilot is therefore not to provide a nation-wide baseline but rather to test preliminarily an instrument among a small number of locations that (i) is manageable in a short period of time and with limited resources available; (ii) provides preliminary but relevant information about the suitability of hypotheses on possible associations between socioeconomic aspects and malaria incidence; and (iii) constitutes a sound basis for a future nation-wide survey.

Specifically, the design of the pilot survey addresses the following questions. First, what are the preventive and curative practices reported by individuals and households with malaria (and prevention among non-infected households)? Second, does this type of behavior vary substantially by the socioeconomic characteristics of households and communities? Third, do socioeconomic differences among households affect their probability of reporting malaria? Fourth, are the characteristics of the municipalities (economic, demographic and geographic) relevant when explaining the incidence of malaria among households? Fifth, are public interventions -- either sanitary or of another type -- effective in the reduction of malaria? If this is the case, which interventions have the greatest impact? Sixth, what reasons may explain that certain interventions become more effective than others in reducing malaria: suitable targeting; more financial and/or human resources available; the implementation of early preventive rather posterior curative interventions; community participation, or other reasons?

Underpinning these questions, there are three fundamental hypotheses that articulate the design of the survey:

(i). There is not a unique set of factors (behavioral, socioeconomic, geographic or intervention-related) that explains wholly observed differentials in malaria incidence among households and/or communities;

(ii) Individual and/or household preventive habits against malaria are significant in reducing the incidence (and propagation) of the disease; meaning that cultural and educative aspects may well be paramount in reducing the incidence of malaria;

(iii) Preventive health interventions and basic health infrastructure at the community level are the most effective practices to fight malaria in Honduras.

A proper testing of these hypotheses requires econometric modeling (the estimation of production functions for malaria being the most feasible option). However, this quantitative exercise becomes meaningful for policy-making to the extent that the sample is nation-wide representative. This is not the case of the pilot ENSEMAH 2004 given restrictions of time and resources. Instead, the pilot provides an educated prior on what associations are more relevant to explain differences in malaria incidence; what interventions or practices are more effective; whether there are socioeconomic or gender differences; and, ultimately, what sets of determinants are likely to affect malaria incidence. Therefore, this prior knowledge from a small pilot sample provides only a second-best to a proper econometrically estimation of nation-wide determinants of malaria. However, as the information theory suggests this prior knowledge is fundamental to estimate true relations in an uncertain context of information gaps.[3] Although prior knowledge does not substitute for a quantitative nation-wide analytical effort, the current analysis of the pilot survey provides the foundations to build up an effective agenda to fight against malaria in Honduras.

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[3] See Robinson et al (1998) for a succinct presentation of the application of information theory to national accounts.

Design

The design of ENSEMAH 2004 draws from the abundant literature and long experience of health surveys worldwide. A classic reference is Grosh and Glewe (2000). Specifically for malaria, World Bank (2002) elaborates a best-practice module that explores the contraction and transmission of malaria, as well as coping and treatment strategies of affected individuals and their households. These references are taken into account at the time of elaborating ENSEMAH 2004 ensuring that the pilot instrument follows international good practices.

As a result, the survey is articulated in six modules.[4] The first module produces a socioeconomic characterization of the household and its members. It captures demographic and geographic information of the household; the access of its members to public services; and household members' labor, education and income status. A second module investigates conditions and habits related to members' health, separating three sub-modules: one, relative to hygienic and healthy habits; another refers to general health conditions; and a last one enquires about the knowledge, perceptions, and presence of public health interventions in the municipality. The third module of the survey assesses the knowledge on malaria by elaborating indexes on the correct understanding of causes, prevention, transmission, curative practices, treatment and available information about the disease. The next module obtains information on the incidence of malaria among members of sampled households, creating a detailed log of the disease during the last month, last year, and prior to the last year. The fifth module is divided in two blocks, one directed to those households where individuals have suffered or are currently suffering the disease; the other, directed to those households that have never experienced episodes of malaria.

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[4] The questionnaire is absolutely available upon request to the authors. It is not included in this paper due to length restrictions.

The objective is to collect comparative information on the behavior of both types of households. Finally, the sixth module collects information on the characteristics of the community where households are located, especially on its epidemiological vulnerability; presence of public health institutions; and other community organizations likely to contribute to the prevention and/or treatment of the disease.

The sample design of the survey deserves special attention, as indicated in the previous section. Being a pilot survey, the sample size is necessarily limited. Constructing a nation-wide representative sample would have required the computation of expansion factors that projected each observation from the pilot sample into population observations. This, in turn, requires a detailed knowledge of the sampling frame of a nation-wide representative instrument, in this case, the latest available 2001 population census. Based on that population-sampling frame it is possible to determine the probability that each observation in the pilot survey be selected from the population. However, the research team was not granted with access to the 2001 population census-sampling frame. Neither was possible to resort to other alternatives such as the use of expansion factors from previous Permanent Household Surveys. As these surveys do not report the identity of the sampled households, it was not possible to match them with the households interviewed for the ENSEMAH 2004. As a result, it was not technically possible to expand the pilot survey into nation-wide representative observations.

However, the selection of communities deliberately seeks the coverage of a minimum and desirable set of characteristics that permit a wide range of heterogeneity in the sample. Thus, the sample includes communities (i) with both high and low incidence of malaria; (ii) with high and low socioeconomic status; (iii) in urban and rural locations; (iv) communities that are culturally diverse (located in the coast and in the highlands; large and small communities, with high and low ethnic

presence); and, finally, (v) communities benefiting from public health interventions against malaria and others without such interventions (see Table 1)[5]. The heterogeneity resulting from including all these features may still not avoid biases with respect to a nation-wide representative random survey, but ensures that they are minimized as key characteristics are not overlooked or omitted.

Twenty-nine communities in nine municipalities make up the pilot sample with fifteen households interviewed in each community. This implies a total of 135 households and 721 individuals with differences in all socioeconomic status; exposure to malaria; preventive and treatment strategies; and age and other individual and household characteristics.

The survey was collected between 10 and 21 April 2004 by a team of eight experienced staff of the Ministry of Health, who were specifically trained for the pilot. The selection of households in each community was randomized using available maps from the last Census in 2001. Housewives were typically the main respondents and it was virtually unnecessary to return to the household to complete unfinished questionnaires (less than one percent of the original sample). The average length of the interviews was seventy-five minutes and interviewers did not report major difficulties in the understanding of the questionnaire.

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[5] The choice of the communities was discussed with key national counterparts in Honduras, that is, with representatives of the Global Fund for HIV/AIDS, Malaria and Tuberculosis; the Ministry of Health; the Vector Transmitted Diseases Unit at *Hospital Escuela* in Tegucigalpa; and the National Program of Malaria at the Ministry of Health.

Table 1. Characteristics of the Communities Sampled in ENSEMAH 2004

Municipality	Department	Number of interviewed households	Number of individuals	Incidence of malaria (Cases per 100,000 inhabitants)[1]	Socioeconomic level of the community (Per capita GDP, PPP USD)[2]	Geographic area (regional classification)
Choluteca	Choluteca	15	91	118	1583,8	Southern
Amapala	Valle	15	76	124	1617.0	Southern
Juticalpa	Olancho	15	67	159	2094.1	Central
Tocoa	Colon	15	84	1570	2112.4	Northern
Sonaguera	Colon	15	86	450	2004.9	Northern
Tela	Atlántida	15	74	182	2409.8	Northern
Comayagua	Comayagua	15	77	311	2776.1	Central
La Paz	La Paz	15	83	710	2637.8	Southern
Villa de S.Antonio	Comayagua	15	83	65	2539.3	Central

Source: authors
Notes: ([1]) Clinical data for 2001 by *Hospital Escuela* at Tegucigalpa.
([2]) UNDP (2003)

4. Results

The incidence of malaria

Table 2 below confirms a certain degree of variation in the incidence of malaria by the socioeconomic extraction of the household. This table is constructed by dividing the number of individuals reporting incidence over the total number of individuals in the sample:

Table 2. The Incidence of Malaria in the Pilot Survey

	Incidence of malaria (% Over the sample population)	
	Last month	Last year
Household Geographic Location		
Urban	2.11	3.42
Rural	1.80	7.48
Region		
Northern	0.42	7.56
Central	4.40	3.96
Southern	1.20	4.41
Household Socioeconomic Status		
Income Quintiles		
Q1-poorest	1.63	5.69
Q2	3.02	6.79
Q3	1.63	1.63
Q4	0.0	0.0
Q5-richest	0.0	11.76
Household head level of education		
No education	0.87	4.36
Completed Primary	3.58	6.81
Completed Secondary	2.27	9.09
Technical Education	0.0	0.0
University Education	0.0	0.0
Basic Services in the Household		
Water Provision		
Public	1.29	3.09
Collective or Private	0.0	0.0
Comunitarian	2.84	6.38
Well	4.21	10.24
Location of the water connection		
Outside the property	1.82	5.45
Inside the property	1.99	5.36
Sanitation Services		
Toilet	0.99	2.31
Latrine	2.79	7.82
Does not have	1.89	5.66
Disposure		
Sewerage	1.12	0.56
Septic Tank	2.33	7.20
Electricity Provision		
ENEE (public) or others	2.12	4.23
Does not have	1.00	12.00
Perimeter Wall		
Complete	2.10	4.58
Incomplete	1.69	7.91
Individual and demographic characteristics of the household		
Number of people in the household		
3 or less	2.90	5.80
4 to 8	1.78	6.14
More than 8	2.14	2.14
Sex		
Female	2.81	6.87
Male	0.90	3.61
Position in the household		
Household head	2.17	3.62
No household head	1.91	5.73
Sex of the household head		
Male household head	1.04	2.08
Female household head	4.76	7.14

Source: ENSEMAH 2004

Table 2 confirms in effect that there are variations in the reported incidence within a year, so that the incidence in the month previous to the data collection is

smaller than the incidence in the whole previous year (except in the Central region where incidence slightly goes up in the last month). This is interpreted as an indication that the incidence of malaria is susceptible to wide variations in the short run (presumably as the result of various reasons from improved interventions to changes in whether conditions). Consequently, interventions designed and implemented effectively should be able to deliver a visible reduction of malaria incidence. Notwithstanding, pilot sample incidences are rather high; reflecting most likely that malaria continues to be a relevant problem in Honduras but also that there may be some biases. An indication of the magnitude of this biasness can be drawn from a comparison of Tables 1 and 2. Ultimately, these biases highlight the must for a careful nation-wide representative sample design. Reassuringly, however, the pilot survey confirms that the Northern part of the country is affected most, while the Central Region shows the lowest incidence of the sample considered.

Data also show that there are marked socioeconomic differences in the level of incidence among the communities of the pilot. These differences start being significant only when the household head at least has some secondary education and the household pertains to the fourth and fifth quintile of the (household per capita) income distribution. This implies that a very substantial proportion of the population in Honduras may potentially benefit from effective malaria interventions. Household conditions and, specifically, household access to essential basic public services are also important to explain differences in incidence. Interestingly, however, not all of these characteristics or services affect equally the probability of a household reporting malaria episodes. Wider differences in incidence are observed based on whether or not the household has access to water and sanitation infrastructure. There is therefore a selection and priorization of public interventions to make, if policy agenda should become effective to fight malaria.

Finally, females in the sample appear more exposed to the disease than males, and so do members of female-headed households with respect to members of male-headed households. Unexpectedly, larger households do not necessarily report a greater incidence of the disease. Rural households did not report higher incidence than urban households in the month prior to the collection of the survey either. The contrary is observed for their incidence in the last year period. Once again, this may be interpreted as an indication of malaria incidence being sensitive to effective interventions or to changes in conditions.

Preventive practices

Two separated indices on hygienic and preventive habits are constructed from the original information reported by ENSEMAH 20004. The hygienic index includes the frequency of household cleaning; time dedicated to these activities; and disposal practices. The most hygienic household would score three points in this index, while the least hygienic household would score no points, instead. The average hygienic score is estimated at 1.43.

In addition, the index of preventive practices gives a value of one to households whose members follow certain preventive practices. These practices are: fumigation; cleaning of precipitated water around the house; protection of doors and windows with nets; protection of all beds with mosquito nets; and spraying insecticide into the mosquito nets within the house. The value of this preventive index and the hygienic index are reported in Table 3.

Table 3. Prevention Practices

	Do household members purify the water before drinking?		Household members have been vaccinated and follow regular medical check-ups:		Household hygiene index		Preventive practices		
	No	Yes	Households affected by malaria	Households unaffected by malaria	Below average	Above average	None	One practice	Two or more (0-5 index)
Household Geographic Location									
Urban	63.78	36.22	18.18	31.43	2.38	97.62	13.23	29.37	57.40
Rural	51.76	45.70	19.30	17.65	11.64	88.36	10.70	42.20	47.10
Region									
North	59.84	40.16	9.67	18.33	2.93	97.07	7.38	25.00	67.62
Center	53.30	46.69	28.97	35.29	3.13	96.88	18.30	35.27	46.43
South	60.80	39.20	19.05	25.81	13.60	86.40	10.97	45.99	43.04
Household Socioeconomic Status									
Income Quintiles									
Q1	55.69	44.31	22.12	40.43	10.16	89.84	6.87	39.91	53.22
Q2	50.75	49.25	10.66	17.14	3.88	96.12	16.17	31.20	52.63
Q3	74.42	25.58	25.27	37.50	10.08	89.92	13.49	26.98	59.33
Q4	89.13	10.87	40.00	27.78	0.0	100.00	10.87	52.17	36.96
Q5	29.41	70.59	0.0		0.0	100.00	11.76	44.12	55.88
Household head level of education									
No education	57.56	42.44	17.02	25.56	8.72	91.28	11.78	50.15	38.07
Completed Primary	60.00	40.00	17.75	0.0	6.50	93.50	10.99	21.63	67.38
Completed Secondary	68.18	31.82	28.57	100.0	0.0	100.00	4.55	27.27	68.18
Technical Education	30.00	70.00	45.45	50.0	0.0	100.0	22.50	25.00	52.50
University Education	100	0.0	0.0	0.0	0.0	100.0	100.0	0.0	0.0
Basic Services and Household Conditions									
Water Provision									
Public	58.25	41.75	12.96	24.51	4.16	95.84	13.23	33.07	63.70
Collective or Private	100.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0	0.0
Comunitarian	69.39	30.61	44.21	27.78	4.08	95.92	12.93	34.01	53.06
Well	47.90	52.10	0.0	31.91	12.35	87.65	4.97	39.13	55.90
Location of the connection									
Outside the property	83.61	16.39	0.0	0.0	5.73	94.27	6.56	34.43	59.01
Inside the property	56.27	43.73	20.52	27.61	8.20	91.80	11.76	35.74	52.50
Sanitation Services									
Toilet	61.06	38.94	11.19	25.81	0.33	99.67	15.33	25.33	59.34
Latrine	60.82	39.18	27.85	28.38	9.32	90.68	7.95	42.05	50.0
Does not have	22.64	77.36	9.09	0.0	27.08	72.92	20.75	47.17	32.08
Disposure									
Sewerage	58.99	41.01	22.73	31.67	0.0	100.0	20.0	21.14	58.86
Septic Tank	62.00	38.00	20.0	20.59	7.31	92.69	8.37	40.13	51.50
Electricity Provision									
ENEE (public) or others	48.60	51.40	21.93	19.18	7.04	92.96	12.56	34.71	52.73
Does not have	59.77	40.23	5.97	62.96	4.90	95.10	9.00	39.00	52.00
Perimeter Wall									
Complete	56.19	43.81	23.42	16.42	5.22	94.78	11.11	33.52	55.37
Incomplete	60.66	39.34	10.89	58.97	11.48	88.52	15.88	40.0	44.12
Individual and demographic characteristics of the household									
Number of people in the household									
3 or less	66.67	33.33	0.0	57.14	12.12	87.88	16.67	28.79	54.54
4 to 8	58.98	41.02	20.32	29.93	5.33	94.67	12.63	31.86	55.51
More than 8	50.71	49.29	18.75	0.0	9.29	90.71	7.86	50.71	41.43
Sex									
Female	61.05	38.95	16.32	26.51	6.68	93.32	14.29	34.23	51.48
Male	54.60	45.40	21.53	25.56	6.87	93.13	9.70	36.97	53.33
Position in the household									
Head of the household	57.55	42.45	18.97	31.25	7.30	92.70	12.50	33.09	54.41
No household head	58.25	41.75	18.71	24.82	6.60	93.40	11.95	35.85	52.20
Sex of the household head									
Male household head	50.52	49.48	19.57	25.00	6.25	93.75	7.37	35.79	56.84
Female household head	73.81	26.19	16.67	41.67	9.76	90.24	24.39	39.02	36.59

Source: ENSEMAH 2004

Data show that there is plenty of room to promote more widespread preventive practices. Indeed this is the case both among urban and rural households. Even though almost ninety percent of the sample reports to follow one or more preventive practices, the proportion of individuals in households that do not purify their drinking water; strictly follow medical check-ups; and vaccinate their children is still rather high. Indeed this proportion exceeds fifty percent of the sample. The room for improvement is especially wide in the Central Region.

Interestingly, preventive practices do not seem to differ substantially by socioeconomic conditions. Preventive practices do not increase necessarily as the education of the household head or the income level of the household rises (the only exception being that households with higher socioeconomic status more likely have garbage collection services which improve their preventive index systematically). Households in the intermediate (third and fourth) quintiles of the income distribution and households with university-educated heads show a worse record of preventive habits than the rest of the distribution. Although there is actually a lower incidence of the disease in those households (as indicated in Table 2 above) and therefore a less compelling need for preventive behavior, it is more likely that this somewhat surprising result highlights that income does not capture accurately socioeconomic differences in the sample. Whatever the cause, the underlying need to improve prevention practices among Honduran households holds for a substantive proportion, not least among the poorest quintiles.

The need to improve malaria prevention practices is also observed among households with different degrees of access to basic services. There are some cases where the presence of some basic services in the household improves clearly the probability of observing desirable preventive practices. For example, access to water within the house more than doubles the probability of the household purifying water

before drinking it; on the contrary, failing to have any sanitary infrastructure almost doubles the probability of that household following no single preventive measure. Having a complete perimeter wall and sanitary infrastructure increases the hygienic index of the household. As a result, there seems to exist a choice to make regarding the expansion of public basic services: any public intervention to increase basic infrastructure in the household will not have the same impact neither on prevention nor hygiene.

Small-size households report to purify their drinking water more consistently than larger households. Interestingly, the former typically score lower in the hygienic index (that is, they more likely belong to the lower half of the distribution of the hygienic index reported in Table 3). However, households with eight or more members report less frequent water purifying practices; in turn, they seem to take more preventive measures. This suggests that in larger households hygiene and preventive behavior (as defined in this study) act as substitutes rather than complementary practices. Finally, it is confirmed again that members of female-headed households follow, on average, less preventive practices than males. The likely absence of female household heads in the supervision of the hygienic practices of their members and lower incomes of these households may be reasons for that difference. Both types of households, however, still have a wide potential for improving their prevention habits.

Risk Factors

The pilot survey inquires about risk factors for the contraction and transmission of malaria such as the presence of animals free within the household; having family members current or previously sick or under treatment; and failing to have a large degree of knowledge on the disease. There are several forms to assess households' knowledge on malaria. A simple way consists of asking the head of the household

whether he or she has ever heard of malaria. A more complex one verifies whether the interviewee answers correctly several questions related to malaria and, then, constructs a score for each respondent. Here, we use both approaches and report them in Table 4. For the construction of an index of knowledge on malaria, six questions are asked on whether malaria is a contagious disease; what are its symptoms; its most effective ways of prevention; its transmission mechanisms; its treatments; and their knowledge on official treatments recommended by the Ministry of Health.

The presence of animals unleashed in the household is not a discriminatory factor for differences in malaria incidence within the sample. Virtually every household that reports to have animals has them unleashed in the property rather than kept in a stable. A very low percent of rural households have them confined in a separated area. Also, the vast majority of households have at least one member who suffered or is suffering one or another type of disease during the last year. As a result, this aspect is not useful in discriminating households. This does not mean, however, that the presence of sick members does not affect the incidence, propagation or coping of malaria. Instead, it seems that the distribution of illnesses in the sampled households is rather uniform, and therefore unable to explain any type of association with differences in malaria incidence. By asking whether household members have been sick without further concretion of truly relevant illnesses for the contraction and propagation of malaria, information on *any* medical condition is proved not very useful.

Table 4. Risk factors for the Contraction and Propagation of Malaria

	Animals in the property		Diseases and treatments		Know what is malaria		Degree of knowledge about malaria						
	Leashed	Unleashed	No	Yes	No	Yes	0	1	2	3	4	5	6
Household Geographic Location													
Urban	3.29	96.70	6.82	93.17	5.24	93.43	2.17	4.03	3.41	22.04	29.81	32.60	5.90
Rural	0.0	100.0	1.40	95.60	9.70	90.29	3.23	0.0	0.0	7.76	27.50	47.57	13.91
Region													
North	0.0	100.0	7.87	92.12	10.24	89.75	4.85	6.31	0.0	12.13	32.03	31.07	13.60
Center	0.0	100.0	0.0	100.0	0.44	97.36	0.0	0.0	1.44	17.79	27.40	42.79	10.57
South	4.18	95.82	5.07	94.93	10.80	89.20	3.22	0.0	3.68	15.20	26.72	45.62	5.52
Household Socioeconomic Status													
Income Quintiles													
Q1	0.0	100.0	0.0	100.0	7.72	92.27	4.52	1.80	0.45	11.31	22.62	39.36	19.90
Q2	0.0	100.0	11.49	88.51	8.64	91.35	2.88	0.0	4.11	14.81	32.09	41.56	4.52
Q3	0.0	100.0	0.0	100.0	8.52	91.47	0.0	0.0	0.0	28.31	33.01	32.07	6.60
Q4	0.0	100.0	0.0	100.0	0.0	89.13	0.0	24.32	0.0	0.0	35.13	40.51	0.0
Q5	36.00	64.00	0.0	100.0	0.0	100.0	0.0	0.0	0.0	16.66	20.83	62.5	0.0
Household Head Level of Education													
No education	3.25	96.75	4.36	95.64	8.72	91.27	3.14	4.08	3.45	17.61	29.55	31.44	10.69
Completed Primary	0.0	100.0	6.06	93.94	7.71	92.28	3.00	0.0	0.0	11.15	28.32	47.63	9.87
Completed Secondary	0.0	100.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0	20.0	17.14	51.42	11.42
Technical Education	0.0	100.0	0.0	100.0	2.5	85.00	0.0	0.0	0.0	15.0	27.5	57.5	0.0
University Education	0.0	100.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0	0.0	80.0	0.0	20.0
Basic Services and Household Conditions													
Water Provision													
Public	3.60	96.40	5.83	94.17	6.95	91.75	3.98	3.70	3.13	22.22	29.62	29.91	7.40
Collective or Private	0.0	100.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0
Comunitarian	0.0	100.0	5.21	94.79	0.68	99.31	0.0	0.0	0.0	3.33	250.0	55.83	15.83
Well	0.0	100.0	0.0	100.0	11.37	88.62	2.12	0.0	0.0	4.96	33.33	47.51	12.05
Location of Connection													
Outside the property	0.0	100.0	0.0	100.0	1.63	98.36	0.0	0.0	0.0	7.31	58.53	34.14	0.0
Inside the property	1.77	98.23	4.66	95.34	7.03	92.20	2.91	2.22	1.88	14.72	26.88	40.75	10.61
Sanitation Services													
Toilet	0.0	100.0	3.75	96.24	2.97	95.37	3.77	4.90	4.15	21.50	29.43	30.94	5.28
Latrine	2.95	97.05	5.85	94.14	71.69	29.31	2.23	0.0	0.0	10.22	31.30	46.32	9.90
Does not have	0.0	100.0	0.0	100.0	11.32	88.67	0.0	0.0	0.0	11.32	9.43	47.16	32.07
Disposure													
Sewerage	0.0	100.0	3.57	96.42	0.0	97.19	4.09	5.26	6.43	25.73	27.48	22.80	8.18
Septic Tank	2.27	97.73	5.49	94.51	9.81	90.18	2.52	1.01	0.0	11.36	31.06	46.21	7.82
Electricity Provision													
ENEE (public) or others	1.95	98.05	5.09	94.91	6.51	93.48	2.62	2.43	2.05	16.66	29.40	38.20	8.61
Does not have	0.0	100.0	0.0	100.0	12.14	83.17	3.09	0.0	0.0	6.18	24.74	49.48	16.49
Perimeter Wall													
Complete	2.28	97.72	4.37	95.63	6.28	92.76	0.0	2.88	2.43	19.29	25.72	41.01	8.64
Incomplete	0.0	100.0	4.16	95.84	10.92	89.07	5.98	0.0	0.0	4.79	38.92	36.52	13.72
Individual and demographic characteristics of the household													
Number of people in the household													
3 or less	0.0	100.0	6.81	93.19	5.79	94.20	5.00	0.0	6.66	33.33	31.66	16.66	6.66
4 to 8	0.0	100.0	4.97	95.03	7.61	91.40	2.96	0.84	1.48	15.88	27.75	43.43	7.62
More than 8	7.37	92.62	0.0	100.0	7.14	92.85	0.0	9.09	0.0	0.0	31.31	37.37	22.22
Sex													
Female	1.36	98.63	2.90	97.09	6.57	92.89	1.51	1.81	2.11	16.91	27.49	40.78	9.36
Male	1.49	98.51	5.93	94.06	8.30	90.80	4.05	2.36	1.35	13.17	30.40	38.17	10.47
Position in the household													
Head of the household	0.99	99.01	4.44	95.56	7.91	91.36	2.43	1.62	2.43	17.88	29.26	38.21	8.13
No head of the household	1.72	98.28	4.28	97.72	7.21	92.09	2.75	2.16	1.57	14.37	28.54	40.35	10.23
Sex of household head													
Male household head	1.37	98.63	4.76	95.24	8.24	91.75	2.38	0.0	1.19	16.66	30.95	41.66	7.14
Female household head	0.0	100.0	3.70	96.30	7.14	90.47	2.56	5.12	5.12	20.52	25.64	30.76	10.25

Source: ENSEMAH 2004

Interestingly, as much as ninety percent of people in interviewed households know what is malaria. There are no substantive differences on the knowledge of malaria and, more importantly, between male- and female-headed households. Yet, some unexpected values are observed for households whose head have technical education or pertain to the fourth quintile of the household per capita income distribution. Similarly, the estimated index of knowledge on malaria indicates that the share of people reporting correct answers to malaria-related questions is indeed notable. At least seventy percent of the sample obtains a score of four or above in a six-point index. Rural households; households in the Central region; households with access to water from wells; and large households (more than eight members) are particularly aware of the existence and characteristics of the disease, their causes and treatments. This knowledge, however, seems more the result of a higher exposure to malaria rather than the opposite relation of more knowledge preventing its contraction. Interestingly, there are neither substantive differences of knowledge between females and males nor among members of households headed by males or females.

Curative practices in affected households

Table 5 presents curative practices (if at all) in those households that reported to have at least one of its members ever affected by malaria. Curative practices of interest in this study refers to the initial response to malaria; whether diagnosis accrues from or is confirmed by a blood test (*'gota gruesa'*); what kind of treatment was or is being followed, if any; and whether an individual who starts a treatment is able to complete it.[6]

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[6] This question is not asked to individuals who were in the midst of their malaria treatment at the time of the interviews; only to those individuals who were in a position to have had all the possible doses prior to the interview.

Table 5. Curative Practices (among Affected Households)

	What did you do when you had malaria			Blood test			Treatment			Official treatment completed	
	Treated at home	Went to a Co vol, doctor, healer	Went to Health Center	No	Yes	Does not know	Combined	Individual	Others	No	Yes
Household Geographic Location											
Urban	5.10	45.95	48.93	12.75	86.00	1.23	85.53	1.23	15.22	21.81	78.18
Rural	5.55	62.60	32.14	3.57	96.42	0.0	95.63	0.0	4.36	6.69	93.31
Region											
North	9.87	58.64	31.48	0.0	100.0	0.0	100.0	0.0	0.0	0.0	100.0
Center	0.0	47.74	52.26	14.11	85.89	0.0	81.59	0.0	18.41	23.41	76.58
South	5.88	56.47	37.65	10.0	88.23	1.77	86.39	2.04	11.57	21.08	78.92
Household Socioeconomic Status											
Income Quintiles											
Q1	3.84	56.04	40.10	3.84	96.15	0.0	90.34	0.0	9.66	16.48	83.52
Q2	9.82	56.06	34.10	5.52	92.81	1.65	96.61	1.69	1.70	6.78	93.22
Q3	2.04	38.77	59.18	23.46	76.53	0.0	72.94	0.0	27.05	28.75	71.25
Q4	0.0	68.42	31.57	0.0	100.0	0.0	78.94	0.0	21.05	21.05	78.95
Q5	0.0	100.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0	100.0
Household head level of education											
No education	5.53	60.42	34.04	2.98	97.02	0.0	88.42	0.0	11.58	17.13	82.87
Completed Primary	4.73	45.02	50.23	12.78	87.21	0.0	91.62	0.0	8.37	11.16	88.84
Completed Secondary	0.0	52.38	47.61	0.0	100.0	0.0	80.95	0.0	19.05	19.04	80.96
Technical Education	0.0	100.0	0.0	31.25	68.75	0.0	100.0	0.0	0.0	0.0	100.0
University Education	75.00	25.00	0.0	0.0	25.00	75.00	25.00	75.00	0.0	75.00	25.00
Basic Services and Household Conditions											
Water Provision											
Public	5.00	47.08	47.91	7.25	91.53	1.21	88.70	1.20	10.08	14.40	85.60
Collective or Private	54.54	0.0	45.45	0.0	100.0	0.0	100.0	0.0	0.0	0.0	100.0
Comunitarian	6.20	55.04	38.76	9.30	90.70	0.0	82.11	0.0	17.89	17.88	82.12
Well	0.0	77.14	22.85	9.52	90.48	0.0	100.0	0.0	0.0	12.50	87.50
Location of the Connection											
Outside the property	0.0	68.08	31.91	8.52	91.48	0.0	100.0	0.0	0.0	0.0	100.0
Inside the property	5.90	52.95	41.15	8.03	91.29	0.68	88.51	0.69	10.80	15.81	84.19
Sanitation Services											
Toilet	6.05	43.95	50.0	6.04	92.31	1.65	84.61	1.64	13.75	19.77	80.23
Latrine	5.74	56.70	37.54	10.78	89.22	0.0	95.13	0.0	4.87	9.35	90.65
Does not have	0.0	84.09	15.91	0.0	100.0	0.0	77.27	0.0	22.73	22.72	77.28
Disposure											
Sewerage	2.88	46.15	50.96	10.57	86.53	2.88	73.08	2.88	24.04	35.35	65.65
Septic Tank	6.90	54.06	39.04	8.50	91.50	0.0	96.22	0.0	3.78	7.23	92.77
Electricity Provision											
ENEE (public) or others	4.39	50.97	44.63	9.56	89.72	0.72	90.02	0.75	9.23	14.65	85.35
Does not have	10.38	72.72	16.88	0.0	100.0	0.0	85.91	0.0	14.09	14.08	85.92
Perimeter Wall											
Complete	3.48	52.46	44.06	10.19	88.95	0.86	90.49	0.86	8.65	14.91	85.09
Incomplete	10.85	65.11	24.04	3.10	95.90	0.0	91.07	0.0	8.93	8.92	91.08
Individual and demographic characteristics of the household											
Number of people in the household											
3 or less	13.51	43.24	43.24	0.0	91.89	8.11	83.78	8.11	8.11	0.0	100.0
4 to 8	6.03	50.86	43.13	7.86	92.14	0.0	93.64	0.0	6.36	5.12	94.88
More than 8	0.0	70.58	29.41	11.76	88.24	0.0	75.28	0.0	24.72	0.0	100.0
Sex											
Female	7.25	55.34	37.40	9.36	89.51	1.12	86.71	1.17	12.12	16.60	83.40
Male	3.16	53.84	42.98	6.69	93.30	0.0	95.45	0.0	7.55	12.38	87.62
Position in the household											
Head of the household	5.49	54.94	39.56	6.52	92.39	1.08	91.01	1.12	7.87	12.50	87.50
No household head	5.30	54.29	40.40	8.43	91.07	0.49	89.03	0.52	10.45	15.03	84.96
Sex of household head											
Male household head	4.41	58.82	36.76	5.79	94.20	0.0	93.93	0.0	6.07	10.77	89.23
Female household head	8.69	43.47	47.82	8.69	86.95	4.34	82.61	4.35	13.04	17.39	82.61

Source: ENSEMAH 2004

Note: Treatment categories: "Combined" includes primaquine and cloroquine; "unique" includes any treatments with amodiaquina, pirimetamina sulfa, quinine, or injectable cloroquine; 'Others' reported treatments (open-end answer) include Aralen, Paludol, injections, or injectable serum.

No one who suffered or was suffering from malaria at the time of the interview reported doing nothing about the disease. The most frequent answer was to visit volunteers, doctors or healers. In contrast, attending health centers (that is, some sort of 'institutional' response) varies strongly by category but typically does not exceed the share of those seeking 'personal' treatment. The only exception is that institutional treatment is more frequent that accruing to volunteers, doctors and healers in the Central Region. Treatment at home lags much behind of the other two options, never exceeding the ten percent of cases. These differences remain relatively uniform across many categories considered, narrowing down only among urban households; households with heads having completed primary or secondary education; and small-sized households (eight or less members). Interestingly, the ratio of 'institutional' *versus* 'personal' care is similar for males and females, although it seems to differ substantially by region.

As for diagnosis, most malaria-affected individuals conducted a blood test (*'gota gruesa'*). Once again there are some irregularities associated with high-income quintiles and higher education. While there are not substantive differences by gender, there are by region. As for treatments, the 'combined' treatment is the most followed type. Between eighty-five and ninety percent of all those that have suffered or were suffering malaria at the time of the interviews, chose the combined treatment (everyone interviewed in the Northern Region). Interestingly, the second most used treatment is not the 'unique' use of amodiaquina, quinine or cloroquine, but 'other' treatments including serum or injections, that are by no means specific to the treatment of malaria. In fact, the use of "unique" treatments is quite marginal in the sample.

Importantly, there are no great differences in the selection of treatments by household characteristics or socioeconomic categories. Treatment differences are

observed, however, between rural and urban areas, and by gender. In rural areas, ninety five percent of affected individuals deal or dealt with malaria using combined treatments. In urban areas, that proportion decreases to eighty five percent of affected individuals. By gender, men treat malaria by using a combined treatment in ninety percent of the cases, while women follow such a treatment in eighty six percent of cases. Also, household size seems to be a discriminating factor when selecting treatments: the larger the household is, the more unlikely is that its members follow a combined treatment. Only seventy percent of such affected individuals use combined treatments.

Table 5 also shows that in most cases treatments are not abandoned, once they are started. The inverse of the completion ratio, the abandonment ratio, reaches between ten and fifteen percent (with no abandonment at all in the communities of the Northern Region) in the relevant sample of affected individuals ever starting a treatment. This result suggests that the main challenge in the fight against malaria in the sample considered may be no longer increasing treatment coverage but making treatments more effective.

Public Interventions to Fight Malaria

ENSEMAH 2004 also permits to analyze relations between certain health interventions and observed differences in malaria incidence. This analysis is conducted at the municipal level. This broader level is considered more appropriate than the household level for analyzing this public-good type of effects that campaigns or regional health centers have in the incidence of the disease. The socioeconomic characteristics of the municipality are also included, in particular, its GDP; human development index; and the undernutrition index (all reported by the UNDP country office in Honduras in its Human Development Reports; UNDP, 2003). It is also interesting to characterize municipalities by the Index of Sanitary Achievement,

calculated on the basis of improvements in the undernutrition index. Table 6 reports the estimated results:

As it was the case with the short-term incidence of malaria, the longer run (beyond the year previous to the pilot survey) incidence has been reduced. As a general average, the incidence of malaria during the last year is fifty percent lower than the incidence of malaria in previous years. Also, there are important regional differences, with Northern and Central municipalities bearing larger incidence.

The irregularities (or non-linearities) found at the household level between malaria incidence and socioeconomic category is also observed at the municipal level. In fact, municipalities around the national average of GDP report the highest incidence of malaria across the sample, exceeding the incidence of those municipalities below and above the national income average. Likewise the household level, income does not seem to be the most adequate variable to capture socioeconomic conditions at the municipal level.

Instead, the relation of human development and undernutrition with respect to malaria incidence appears more evident. In the case of undernutrition, differentials in its index are associated with differentials in the municipal incidence of malaria (although this relation is ambiguous when episodes of malaria took place more than a year ago). In any case, the index of undernutrition may be a good predictor of malaria incidence in the municipality.

Table 6. The Municipal Dimension of Malaria and the Influence of Public Interventions

	Malaria in the last year		Malaria more than one year ago	
	No	Yes	No	Yes
Region				
Northern	92.02	7.98	81.51	18.49
Central	91.64	8.36	80.18	19.82
Southern	94.39	5.61	87.95	12.05
Municipal socioeconomic level				
Below national average	95.18	4.82	87.95	12.05
Around national average	90.72	9.28	82.73	17.27
Above national average	96.25	3.75	80.0	20.0
Human Development Index[2]				
Below national average	91.21	8.79	78.24	21.76
Above national average	93.89	6.11	85.89	14.11
Desnutrition Index				
Low (according sample average)	88.67	11.33	84.67	15.33
Medium	91.20	8.80	83.20	16.80
High	96.49	3.51	82.75	17.25
Health Profit Index[3]				
Low (according sample average)	96.49	3.51	82.75	17.25
Intermediate	91.24	8.76	83.27	16.73
High	88.67	11.33	84.67	15.33
Health Infrastructure				
Municipality with public hospital and/or private clinic				
No	91.04	8.96	82.09	17.91
Yes	96.73	3.27	85.71	14.29
Municipality with CESAMO and/or CESAR				
No	90.91	9.09	76.30	23.70
Yes	94.72	5.28	88.69	11.31
Municipality with volunteers, private doctors or healers				
No	99.32	0.68	87.16	12.84
Yes	91.40	8.60	82.08	17.92
Municipality with no health personnel or health centers				
No	92.32	7.68	83.87	16.13
Sí	100.0	0.0	77.78	22.22
Social infrastructure				
Communitarian organizations				
0	97.40	2.60	81.82	18.18
1 to 3	90.91	9.09	84.62	15.38
4 to 6	97.09	2.91	82.52	17.48
More than 6	100.0	0.0	50.0	50.0
Health Policies				
Subjective satisfaction index for health authorities				
No satisfied	100.0	0.0	33.33	66.67
Slightly satisfied	n.a.	n.a.	n.a.	n.a.
Satisfied or very satisfied	91.17	8.83	89.40	10.60
Health Campaigns knowledge				
Have heard about prevention and treatment programs from the Health Secretariat and know all programs	94.44	5.56	91.66	8.34
Have heard about the programs but only know some of them	93.73	6.27	84.47	15.22
Have heard about the programs but do not know any	81.73	18.26	71.30	28.70
Vaccination Programs				
Families in the municipality have not been benefited by Vaccination Programs	90.64	9.35	84.17	15.83
Families have benefited by Vaccination Programs	96.00	4.00	90.66	9.34
Index of participation in Social Programs				
0	96.61	3.39	91.52	8.47
1	92.43	7.57	95.13	4.86
2	95.40	4.60	75.86	24.13
3	100.0	0.0	90.91	9.09

Source: ENSEMAH 2004 and UNDP (2003)

Note: (1) The socioeconomic level of the municipalities refers to above, around and below national average when the average income of the municipality is over 110 percent of the national average (US$ 2,320.8 per capita per year), between ninety one and 110 percent, and below ninety percent respectively. Data from UNDP (2003)

(2) The national average of HDI in 2003 is 0.657 (UNDP, 2003)

(3) Municipalities performance in the health achievement index is considered low, intermediate or high when their values are below 0.730, between 0.731-0.790 and over 0.791, respectively. Data come from UNDP (2003).

There is also some relation between the presence of health infrastructure and lower incidence of malaria at the municipal level. In fact, the absence of a public hospital or a private clinic in the municipality almost triples the incidence of malaria in that municipality with respect to municipalities with those facilities. The absence of CESAMO (a health center with a doctor) and CESAR (a rural health center with a nurse) in the municipality almost doubles the incidence of malaria. This suggests that hospitals and clinics may be more effective in the fight against malaria than are CESAMO and CESAR; which may be more effective themselves than the absence of any health facility in the municipality. These effects appear stronger within the last year that in a longer term. However, the presence of sanitary personnel, volunteers or healers acts in the opposite direction, that is, their presence is associated with a greater incidence of malaria. This result may suggest some sort of "calling effect": where the incidence of malaria is higher, more volunteers, healers and doctors are expected (more so, if there are no institutional capacity present).

The social capital of a community does not seem to have a significant effect on the incidence of malaria. There is no increase or decrease in the incidence of malaria that can be related to the presence of social organizations. This can be explained, on the one hand, by the fact that these organizations are not necessarily related to health issues; on the other hand, it is possible that the "calling effect" referred above is active only within a certain range of malaria incidence. Whatever the case, municipalities in the sample with a stronger presence of community organizations are less likely to have a high incidence of the illness. This might be connected to better knowledge dissemination and more and better infrastructure that these organizations may promote in the municipality.

Finally, the influence that public health interventions have on explaining differences in malaria incidence is also evident in the sample considered. Failing to

know about Ministry of Health programs is associated with a greater incidence of malaria in the sample, both during the last year as well as further back in time. This suggests the importance of public campaigns in the fight against malaria. In fact, malaria incidence in the last year among households widely exposed to information is four times lower than in municipalities with serious knowledge gaps. That difference is halved when one or some members of the household report to benefit from public programs such as vaccinations. Although municipal incidence may in effect be sensitive to the presence of social programs, this relation is non-linear. Most likely, these programs are more effective when linked to other public interventions and not when implemented on their own.

5. Conclusions

This initial analysis of the pilot survey (721 individuals, 135 households, twenty nine communities in nine municipalities) offers important information on the current state of malaria in a sample of municipalities in Honduras; the dimensions and variables that are associated with the level of incidence; and some indication of short and long term trends. The tabulations indicate in the first place that the phenomenon of malaria in these municipalities is worrisome in the light of its high incidence. However, this incidence, both in the short and longer term, is susceptible to wide changes, which means that effective policies may in fact deliver sizeable reductions.

An agenda of effective public interventions for the country requires the extension of the pilot survey into a nation-wide representative survey and a more detailed quantitative analysis of that information. Such efforts, nonetheless, do not substitute for specific evaluation studies of current interventions and/or ex-ante analyses of the consequences of future programs. In that agenda, the present analysis constitutes a primer providing informed guidelines for a more efficient fight against

malaria. First, there is not a linear and monotone relation between socioeconomic level and the incidence of malaria. How resources and skills are put in use into preventive and curative strategies is more important than the own level of income that a household may (distortedly) report. Second, the incidence of malaria in the sample shows important variations in time and may be responsive to public health interventions and awareness campaigns. Third, municipal undernutrition and access to basic public services within the household (mainly, water and sanitation services) have the strongest association with variations in the incidence of malaria, and therefore, are good candidates for prioritization purposes. Fourth, it is necessary to explore in more depth how hygienic habits and other preventive actions interact, as the evidence from the sample suggests that they are substitutes rather than complements. Fifth, there are likely important geographic differentials in the incidence of malaria, which is captured even by this small pilot sample. Similarly, gender differences require further attention at the national level even though the pilot fails to report systematic differentials. Interestingly, the level of knowledge on treatments reported in the pilot is high and abandoning a treatment is rare. If this were the case nation-wide, a policy against malaria should focus more on efficiency rather than coverage. Sixth, it is necessary not to overlook the institutionalization of the fight against malaria as more sanitary (professional and not professional) personnel alone in high-incidence seems to respond more to a 'calling effect' than to an effective strategy. The challenge remains now to have these guidelines tested with a nation-wide representative survey using econometric techniques such as production functions for malaria. That would allow -- in addition to a proper test of the pilot results -- the identification of determinants of nation-wide incidence differentials and the ranking of the effects by such determinants in the incidence of malaria.

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