THE ROLE OF CAREGIVERS IN THE TREATMENT OF CHILDHOOD MALARIA IN TURBO, COLOMBIA

By

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A THESIS PRESENTED TO THE GRADUATE SCHOOL
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This document is dedicated to my daughter, Luna.

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Malaria is a major cause of death among children in many parts of the world, especially in tropical regions, even though simple and effective treatments do exist. Colombia is a malaria endemic country; ninety percent of its territory serves an environment for malaria transmission. This research was carried out in a health center located in the municipality of Turbo, in the Department of Antioquia. Antioquia reported 50,000 cases of malaria per year in the last five years from 2003. An average of thirty-two percent of the infected were children under 14 years of age.

One purpose was to investigate the multiple ways in which children under the age of eleven, with fever and/or convulsions, two key symptoms of malaria, were being provided treatments by their caregivers. A second aim was to determine the roles that different providers of health care (i.e., physicians, whether at the health center or private practice, traditional healers, community leaders, and drug vendors) play in diagnosing and treating febrile illnesses, especially malaria, in children.

This study focus was on community perceptions of, and response to, febrile illness, using illness narratives as the primary data collection vehicle. Analysis of the 67 illness narratives collected in the course of the study indicates that caregivers, principally mothers, recognize fever and treat it promptly. Most caregivers said they consider the mosquito bite to cause malaria, but they did not know the details of the infection process. They identified fever, chills, headache, vomit, and weakness as the most frequent symptoms of malaria. Synchronic analysis (indicating frequency of use of each type of care) and diachronic analysis (indicating the sequence in which these alternatives are utilized) show that most treatments begin at home, even those that end up in the formal health system later. Common home treatments are baths with herbs and the use of antipyretic pills. These findings suggest that most children do not receive appropriate care initially. Due to inadequate explanations by health providers, caregivers may not carry out the instructions. Caregivers who said they sought treatment with traditional healers and/or drug vendors who did not require prescriptions constituted a minority of the interviewees. It was found that neither caregivers not the traditional healers conceptualize malaria as a disease that involves the spirits.

An intricate mixture of biomedicine, home treatment and traditional medicine was described by the caregivers. This pluralistic medicine helps to explain, in part, the caregiver's decision-making process. Moreover, from the point of view of western medicine, this complex mixture of knowledge leads to inadequate treatment of children with malaria.

CHAPTER 1
INTRODUCTION

Malaria (mal aria: bad air) is a debilitating disease with a high incidence on tropical areas worldwide. Children with malaria who do not receive adequate medical care may suffer serious health problems. This thesis presents research carried out in a hospital that serves children with malaria, located in Turbo, a municipality of the department of Antioquia, Colombia, South America (Colombia is divided into departments that are equivalent to states in the United States).

This chapter contains three sections. The objectives and specific aims, significance and applications of the research are set out first. The second section gives a brief general background of malaria, and a discussion about how social factors relate to the presence of the disease. Emphasis is placed on understanding how cultural adaptation has changed treatment situations; such changes relate to locations. The last section of chapter 1 describes the behavior of caregivers of children with febrile illness,[1] and/or with malaria. Caregivers of children may seek treatment outside their home; their treatment-seeking behaviors and factors affecting these behaviors are described.

Chapter 2 provides in depth information about malaria, its history, biology and prevalence in the world, with special emphasis on Colombia. Chapter 3 describes the health system in Turbo. General procedures from the biomedical perspective are outlined in order to give a better understanding of the malaria situation in Turbo. Chapter 4 talks

[1] Febrile illness is basically all the illnesses that produce fever as symptom and sign, for instance infectious diseases such as malaria and yellow fever.

about the findings regarding treatment-seeking patterns and health care-seeking behavior, which includes the caregiver's definition of malaria and its cause. Chapter 5 presents the conclusions of this thesis and recommendations for further research.

General Information About This Research

In this section the objectives and specific aims, significance and applications of the research are set out. This information gives a general idea of the thesis and the research that was carried out in Turbo, Colombia, South America.

General Objectives

This thesis has the following general objectives.

1) One purpose of this study is to provide an understanding of the multiple ways in which treatment-needing children under eleven years of age, who have fever and/or convulsions, two key symptoms of malaria, are being treated by their caretakers in Turbo, Colombia, a malaria endemic area.

2) A second purpose is to examine the role of different health providers (the physician, whether at the health center or private, the traditional healer, the drug vendor) in treating illnesses in children, especially malaria.

Specific Aims

The project was divided in two different phases, each phase having its own aim. The phases were carried out at the same time according to the availability of the caregivers and health providers.

Phase 1: Illness narrative module

In this phase the aims were to identify treatment-seeking patterns including types and sequence of treatment actions and the factors that affect treatment decisions; to learn how caregivers define the beginning of an illness, and what symptoms make them define

a child as “sick” and illness as “severe”; to ascertain knowledge of correct dosage for antimalarial drugs, actual dose given to a child, and reasons why that dose was given; to identify what prompts caregivers to seek help from various providers; to determine the amount of time between onset of danger sign and treatment by a health worker; to identify how caregivers define treatment success or failure; to identify the factors that facilitate or impede appropriate care-seeking; and to identify obstacles for acting on referrals.

Phase 2: Health providers module

In this phase three types of health provider in Turbo were identified.

Private clinic/health center doctor: to find out provider’s role in treating illnesses with fever, especially likely malaria; provider’s treatment for malaria; and provider’s treatment for convulsions.

Traditional Healer: to find out the provider’s role in treating illnesses with fever, especially likely malaria; provider’s perception of causes of fever; provider’s treatment for fever; provider’s role in treating illnesses with convulsions; provider’s perception of causes of convulsions; and provider’s treatment for convulsions.

Pharmacist/drug vendors: to find out the vendor’s role in treating malaria in children; vendor’s advice/recommendations for malaria treatment; to determine if caregivers seek advice from vendor on which drug to purchase to treat malaria in children; if caregivers seek advice from vendor on dosage to treat malaria in children; and the dose caregivers generally purchase (full vs. partial).

Study Site and Sample

Colombia is divided into departments and one of them is Antioquia, which is located in the northwestern region of the country, its capital is Medellín. The site of this

research, Turbo, is a municipality of the department of Antioquia; it is located 368 km from Medellín. Turbo has 140,000 inhabitants (estimated year 2000). Its area is 3.055 square kilometers. Founded in 1840, became a municipality in 1847. Its average temperature is 28° Celsius throughout the year. Its economic strengths are exportation of bananas and plantains, fishery, importation of merchandise from Panama, cattle, cacao, corn, rice, sesame seeds, and African palm. Turbo municipality includes six corregimientos, namely Currulao, Nueva Colonia, San José de Mulatos, Río Grande, El Tres, and Blanquicet; 230 villages; and the indigenous group of Caimán Nuevo. Most inhabitants of Turbo municipality are fishermen, farmers, marketers, or have low-income jobs. Turbo is inhabited mostly by black people, the minority are mestizos and indigenous people.

The research interviews were conducted at the San José Health Center in Turbo. During a two-week period, sixty-seven caregivers came to the health center with children who had febrile syndrome. The caregivers wanted to get a blood smear to know if the children had malaria and all of them were interviewed. Some of the children taken by the interviewed caregivers did not have malaria.

Methodology

Symptom-based approach

The research protocol takes a symptom-based rather than an illness-based approach, concentrating on treatment of fever and convulsions rather that just on the children that had malaria infection.

When an illness term such as “malaria” is used, one cannot be sure that all parties understand the term to mean the same thing. Ethnographic studies from various parts of the world show that local persons may use the term to cover a wider range of illnesses

than clinical malaria, thereby calling something malaria when it is not. Or they may interpret some signs of malaria, especially convulsions, as something else, thereby not calling something malaria when it is. By talking about a symptom, it is more likely that both researchers and respondents are talking about the same phenomenon.

Description of methods

The interviews were conducted in the urban area at the health center of Turbo, instead of a village that was the initial idea, due to the political turmoil existing in the rural area (villages). It was both unnecessary and very dangerous to be exposed to this violent environment especially when the researcher constitutes a strange subject for the belligerent armed groups in the area (mostly paramilitaries), more so if the researcher represents a foreign institution (the University of Florida in this particular case). This fact limited accessibility to some interesting research sites, and also resulted in forced changes on the interview strategies. The latter may introduce possible bias because the people interviewed were exclusively the caregivers that went to the health center seeking help to get the malaria diagnosis (blood smear) and the treatment for their children, in the event of a positive diagnosis for malaria infection. Thus, it is unfortunate that the caregivers that stayed in the village with their sick children and did not go to the health center were not interviewed, because that would have added important pieces of information for this research project. In addition there could be a bias also because the interviewer was a trained physician and may be some of the interviewees felt uncomfortable about sharing their non-biomedical knowledge and beliefs, and, hence, provided the researcher only with partial information, hiding some potentially interesting facts.

This study was principally qualitative, although some information was quantified. The full research protocol consisted of two phases, each of which was designed to answer specific research questions related to the overall care-seeking process. The two phases and their associated purposes are as follows:

- Illness narratives (67 narratives): obtain detailed descriptions of an actual recent episode of childhood febrile illness and the treatments undertaken in response to it; identify the factors associated with specific treatment decisions.
- Interviews with health providers: interviews with medical doctors (5 interviews) and with non-facility-based providers (10 interviews): understand the role of medical doctors and community providers (traditional healers, community leaders, and pharmacist) in the treatment of childhood febrile illness.

The narratives were organized as semi-structured interviews that led the caregiver through a day-by-day account of the child's symptoms and caregiver's treatment decisions, and included probing to gain an understanding of why each action was taken and how care-seeking decisions were made. Thus the narratives described the sequence and timing of treatment actions, and the factors that influenced actions taken. The narratives yielded a sample of 67 cases of fever and/or convulsions occurring 4 weeks prior to the interview in a child 11 years of age or younger.

The information from the interviews was coded and entered into a database. The narratives resulted in two data sets: a qualitative data set that captures rich descriptions of the illness situation and the rationale for treatment actions from the caregiver's perspective; and a small quantitative data set of variables from the narratives.

The purpose of quantifying key variables related to treatment was to indicate trends and facilitate analysis of community case management practices, rather than provide a precise population-based data. Because the study site was purposively selected, these findings may not be generalized beyond the 67 caretakers who gave illness narrative

interviews and the health providers who also gave interviews. Tests of statistical significance to make inferences beyond this sample were not conducted.

Significance of the Research

Colombia is a country in Latin America with a high number of malaria cases. In Colombia studies of malaria among children are still scarce, studies have focused mainly on information gathered directly at health centers. However, the caregiver's point of view has never been taken into account.

A considerable number of infant patients receive different kinds of household treatment depending on the caregiver's knowledge, beliefs and previous experience with ill children. Initial treatment steps ultimately determine the probability of healing success, whether the full extent of treatment procedure is carried out at home or at the health center. A coherent approach to tackling the problem of childhood malaria must give a great deal of attention to the role of caregivers during every stage of the treatment process with special emphasis in the initial stages. Understanding the factors that can influence caregivers of the children to seek and complete efficient treatment should serve as a basis for planning future interventions, improving case management of febrile illness in the community and advancing the competence of health providers in order to prevent severe childhood malaria and mortality associated with it. Malaria can produce severe damage to the brain if it is not treated on time. Children could have chronic sequels, which could alter their normal development for the rest of their life. If childhood malaria is treated on time, this damage could be avoided.

Application of the Research

Usually biomedicine imposes its particular health perspective, serving usually as the basis for implementing health programs that rarely take into consideration the beliefs

and local knowledge of the population for the treatment of different diseases and the use of traditional providers and their patients. Consequently, the population does not adopt the messages that biomedicine gives them as the "absolute truth" and there is a very low compliance among the communities.

The findings of this project could be used to include health providers' and caregiver's beliefs and knowledge in the design of future malaria programs planned to have a direct and positive impact on the community. With cooperation and education of the people involved, public health programs could be much more successful in terms of reducing the number of cases and the severity of malaria infection, especially among children who are the most affected part of the population and experience more severe infections.

Malaria Background

Malaria is the leading infectious cause of childhood death worldwide, claiming the lives of 1.5 to 2.7 million persons each year (World Health Organization [WHO], 1997). The highest mortality rate is that of children in African, Asian and Latin American countries where malaria is highly endemic. There is no vaccine to prevent malaria; elimination of the mosquitos that transmit the disease is not feasible for most endemic countries. For decades, malaria control programs have relied primarily on prevention and prompt, appropriate treatment to help control malaria-related morbidity and mortality (WHO, 1993).

In Latin America the situation is grim, since 1974, when only 269,000 malaria cases were recorded, the number of cases detected every year was continually rising, with 1,114,000 cases reported in 1989. The continuing increase of malaria is of particular importance since it appears simultaneously with socioeconomic deterioration occurring

during the 1980's in the Latin American countries (Panamerican Health Organization [PAHO], 1991). In 1990, the increase seems to have come to a halt with 1,057,000 cases recorded. More than half the cases were registered in Brazil (53%); 25% originated from Andean countries and 14 % were from Central America (WHO, 1992). In 1994 the three countries in Latin America with the highest number of malaria cases per 1,000 inhabitants were: Brazil, Colombia, and Peru (PAHO, 1999).

Colombia is an endemic country in ninety percent of its territory. This means that the nation permanently experiences malaria transmission and infection. In the last four years the number of reported cases doubled from 71.012 cases in 1999 to 139,542 cases in 2002. Malaria cases have increased due to multiple factors; among the possible factors are the problem of vulnerability of the population as a result of displacements, migrations, irregular climate, and environmental alterations associated with illicit crops. These problems are also related to different infectious diseases. In the following section these problems are discussed in more detail specifically associated with malaria.

Problems Linked to Infectious Diseases, Especially Malaria

Diseases caused by infectious agents have profoundly affected both human history and biology. In demographic terms, infectious diseases – including both great epidemics, such as plague and smallpox, which have devastated human populations, and unnamed viral and bacterial infections causing high infant mortality – have likely claimed more lives than all wars, non-infectious diseases, and natural disasters taken together (Brown, 1997). In the face of such attack by microscopic invaders, human populations have been forced to adapt to infectious agents on the levels of both genes and culture. Malaria has generated processes of both biological evolution and cultural evolution (Brown, 1997).

Infectious diseases have been prime moves in cultural transformation, as societies have responded to social, economic, political, and psychological disruption engendered by acute epidemics (e.g., measles, influenza) and chronic, debilitating infectious diseases (e.g., malaria, schistosomiasis). Human groups have often facilitated the spread of infectious diseases through culturally coded patterns of behavior or through changes in the crucial relationship among infectious diseases agents, their human and animal hosts, and the environments in which the host-agent interaction takes place.

It is important to note that infection with a specific agent does not necessarily result in disease. This progression depends upon a number of intervening variables, including the pathogenicity of the agent, the route of transmission of the agent to the host, and the nature and strength of the host's response. The natural and social environments in which the agent and host are juxtaposed, in turn, affect all of these factors.

In some cases the environment may promote the transmission of the agent to the host, while in other cases it may limit or even prevent such transmission. Critical characteristics of the environment may be deeply influenced by socio-political factors, thus, many infectious diseases, such as tuberculosis, are considered social diseases (Brown, 1997). Malaria may well fit the same classification scheme.

Nations (1986) has recently reviewed some of the behavioral factors that influence infectious disease transmission, including dietary customs, childcare patterns, religious practices, migration patterns, agricultural techniques, kinship relations, and traditional medical treatments.

In the particular case of malaria, many social factors have been found to affect exposure, infection, adaptation, and response. The following section discusses these social factors and the phenomenon of adaptation to malaria.

Social Factors

A variety of social, economic and cultural factors have been found to affect exposure to malaria and potential to infection. The increased rates of malaria morbidity are influenced by changes in the parasite and vector, and are also caused by human behaviors, the latter being the focal point of this research. Human behaviors are related to individual, culturally coded patterns and to larger-scale sociological phenomena, including political and economic factors. At the same time, higher levels of malaria disease and mortality are linked to lack of access to sufficient medical and appropriate antimalarial medication. Access to these resources is linked to social stratification, both within and between countries. Countries that are strongly affected by malaria present huge disparities; the people that get infected usually have a very low socio economic status. Desowitz (1991) emphasized the human dimensions of suffering from malaria and the fundamental fact that most malaria-related deaths throughout the world could be evaded if people had enough economic resources and access to adequate medical care. Today, as in the recent past, most malaria deaths are unnecessary. Similarly, malaria mortality fits into a larger infectious disease and malnutrition matrix that is predominantly characterized by conditions of poverty. Poverty is thus an underlying factor which increases vulnerability to many diseases including malaria.

Increased social stratification and poverty exacerbate the problems of malaria and its associated mortality in four ways. First, large portions of the world's poor population live in inadequate housing where they get no protection from anophelines. In fact, poor

quality housing provides perfect resting places for anthropophilic anopheline vectors (Oaks and Mitchel, 1991). Second, the undernutrition associated with poverty plays a major role in malaria mortality, especially in children. Third, inadequate sanitation and drainage control in poor areas increases anopheline densities. Finally, poverty is strongly linked to inadequate health care. Economically oppressed social groups do not have enough resources to access antimalarial drugs, or there is an inclination to use insufficient doses (Foster, 1991). Undertreatment of malaria with a small, limited course of chloroquine is caused by the lack of economic resources of malaria victims and not simply the lack of appropriate medical advice. These poverty-related medical practices play a significant role in the evolution and spread of chloroquine-resistant strains of *Plasmodium*. In addition there have been many cultural adaptations that human beings have experienced due to the presence of malaria.

Malaria and Cultural Adaptation

Malaria is a parasitic infection thought to have killed more people than any other named disease (WHO, 1997). Genetic adaptations to this disease have merited particular interest, and malariologists have recognized the important role of human behavior in malaria control.

Wood (1979) summarized many studies of cultural practices, most of them nondeliberate, that may limit transmission in areas where malaria is endemic. These include the use of alkaline laundry soaps that wipe out mosquito breeding sites, clothing styles that serve as mechanical barriers to biting insects, the use of traditional pesticides and insect repellents, and seasonal migrations away from mosquito vectors. Empirical evidence for the efficacy of such practices is generally lacking. Brown (1981) argued that the combination of nucleated settlement prototype and inverse transhumance (in Italy:

flock movement to high elevations in summer) served to decrease exposure to malaria in Sardinia. This finding explains the social epidemiological distribution of the disease.

The different behaviors that humans have adopted with respect to malaria are important. The particular focus in this research was on the care-seeking behavior of caregivers of children with malaria and in their treatment-seeking behavior. These behaviors rely on several factors, which were explored using the data collected in Turbo, Colombia. Specifically, the focus is on the role of caregivers in the treatment of childhood malaria, what they think and what they do when children get sick with febrile illness in an area where malaria is present all the time. In the study site, the chance of a child having malaria, as one of the causes of fever, is very high.

The following section discusses the importance and implications of care-seeking behavior of caregivers of children with febrile illness and/or with malaria, and the treatment-seeking behavior of caregivers and the factors that affect the decisions regarding resorts to care and treatment given. Some of these factors are cost, distance from the health center, role and quality of provider, and cultural beliefs.

Care-Seeking Behavior and Treatment-Seeking Behavior of Caregivers of Children with Febrile Illness and/or with Malaria, Factors that Affect It

Plasmodium falciparum malaria, the most severe and potentially fatal form of human malaria, an infectious disease that can progress from mild illness to severe disease and death over a short period of time (Greenwood et al., 1987). For this reason, an understanding of the factors that can influence caregivers of children to seek and complete adequate treatments is critical to developing effective malaria control interventions (Tanner & Vilassoff, 1998).

In addition, many studies in Africa have established that local populations frequently associate malaria and fever with mosquitos. However, these biomedical concepts have not been accepted universally, there are other ideas of disease classification and causation in nearly every culture where local illness taxonomies have been studied. Lubanga et al., (1997) found that maternal diagnosis of malaria does not always correspond to biomedical diagnosis. In spite of this low level of understanding of malaria transmission and prevention, local populations often have an essential capacity to recognize symptoms of malaria and to associate them with the necessity to seek treatment (Munguti, 1998).

A number of observers have noted that caregivers may classify conditions with malaria symptoms as different illnesses, describing them in terms that are entirely distinct from those they use for fever or simple uncomplicated malaria. Fevers with convulsions, have often been described as separate illnesses requiring a different form of treatment (Makemba et al., 1996). Conversely, other authors find that severe malaria noticeable by convulsions is more likely to be documented as malaria than simple malaria without convulsions (Lubanga et al., 1997).

In most front-line health facilities where laboratory diagnosis is not available, fever is the most practical clinical definition for malaria and patients are treated with antimalarial drugs based on this evidence alone. When caregivers do recognize fever the majority of patients receive some form of antimalarial treatment, there is good evidence from many studies throughout Africa to support this assertion (McCombie, 1996). In most studies caregivers employ multiple treatments for the same illness; this practice may be particularly probable when the illness is severe or of long duration (Snow et al., 1992).

Because multiple, and even simultaneous treatments are commonly identified in studies of care-seeking behavior for febrile illness, the hierarchy or sequence of resorts may be important for understanding potential delay in getting appropriate treatment (Ryan, 1998 and Baume et al., 2000). While it has been estimated that at least half of all fever cases may in the end make contact with the formal health sector (McCombie, 1996), it is also clear that the majority of cases are first treated in the home or through informal health care providers (Foster, 1995). Home and community-based treatments are generally initiated more promptly than treatments in the formal health sector.

Djimde et al., (1998) pointed out that a significant proportion of antimalarial drug use may occur in the home or community. However, these drugs are frequently used in inadequate ways, the most common being underdosage treatments, or for illnesses other than malaria. Both procedures contribute to enhance the parasite's resistance to antimalarial drugs.

A variety of social and economic factors have been found to affect treatment-seeking behavior. Distance from and transportation to the health facility affects whether help from a formal provider will be sought (Ruebush, 1995). Direct cost of transportation, fees, and medication are compounded by opportunity costs; time lost to farming, marketing, and household activities can be significant (Jayawardene, 1993; Asenko and Dzator, 1997). Furthermore, there are cultural aspects that also influence the treatment-seeking behavior. For instance, some people simply do not believe in the biomedical system and they proceed accordingly seeking treatment from different health providers, such as traditional healers.

Finally, understanding health beliefs and knowledge that caregivers have, in the particular case of this thesis, is crucial if caregivers are going to take a better approach of the health situation of the people they care for. In the case of malaria, most of the time sick people are treated initially at home. Therefore, knowledge and belief of caregivers must be taken in to consideration in order to improve the health of children, prevent children infected with malaria from deteriorating to a severe stage and even die. Severe illness and death may be due to the fact that the care-seeking behavior and the treatment-seeking behavior of caregivers were inappropriate for different reasons.

Summary of the Chapter

The main purpose of this investigation is to understand the role of caregivers in the treatment of childhood malaria in Turbo, Colombia, one of the areas in the country with the highest incidence and prevalence of malaria. It is essential not only to explore but also to honor the knowledge and beliefs that caregivers have in order to improve the way in which communication between policy makers, health providers and the community is organized and directed. Therefore the findings of this research could serve to prevent children affected with malaria from progressing to severe stages of the disease, in which recovery is very difficult and, most likely, impossible.

Malaria is an infectious disease that affects many people in the world and is related to multiple social factors such as poverty, and inequality. Life conditions of the population, nutrition, and type of housing, type of job, education, and environmental factors predispose the people to get malaria infections. This is especially true for communities that are exposed to harsh life conditions both in the “natural” and socioeconomic domains. However, there have been processes of cultural adaptation that have helped people to survive in environments where malaria is a constant threat. In

addition, different and simultaneous treatments have been identified in studies of care-seeking behavior for febrile illness. Thus, the hierarchy or sequence of resorts may be particularly important for understanding potential delay in reaching appropriate treatment. Even though it has been estimated that part of all fever cases may ultimately make contact with the formal health sector, it is also clear that majority of cases are first treated in the home or through informal health care providers. Moreover, home and community-based treatments are generally initiated more promptly than treatments in the formal health sector, which means that community-based treatments must be explored in more detail. Its is important to take in to account a variety of social and economic factors that have been found to affect treatment-seeking behavior such as cost of treatment and attention, distance from the health center, and household activities.

CHAPTER 2
MALARIA BACKGROUND

Introduction

In the previous chapter the purpose, methodology, significance, and study site of the thesis were described, and a brief background of malaria was provided. In this chapter the biology of the malaria parasite is explained. The evolution of ideas throughout the history of malaria is traced from the first existing reports until today. The different hypotheses of how and when malaria came to the New World are examined, and the main discoveries about malaria in the last four centuries are pointed out. The last portion of this chapter describes the malaria situation in the world, especially in Colombia. The aim is to give a general idea of the dimension of the malaria problem.

Malaria, described by Hippocrates in the fourth century BC, is almost certainly one of the most ancient diseases of humans. Indeed, it is reasonable to suppose that it is older than us, that the parasite that causes the fever, and the mosquito that transfers it from one person to another, have accompanied us throughout our history. It is less than a hundred years, however, since the causes were discovered, and only since the beginning of this century that people began systematically to attack not only malaria but also the propagator insect.

The eventual spread of western civilization at the turn of the 19th century hinged, chiefly, on the "scientific control of nature." But as people moved into the tropical part of the globe, they encountered tremendously inhospitable conditions both in tropical Asia

and tropical Latin America. Everywhere in the tropics white men languished and died, wasted by the heat and ravaged by disease, above all by malaria (Harrison, 1978).

Malaria has been evolving throughout history but still today is a big danger especially in most of the tropical regions of the world. The most affected places are tropical Asia, Africa, and Latin America. In Latin America the countries that have been more affected and that have had most malaria infections are Brazil, Colombia, and Peru. This thesis explores the case of Colombia, specifically in Turbo, a municipality in the department of Antioquia. This region is of great significance because it has had the highest incidence of malaria in Antioquia in the last five years and one of the highest numbers of malaria cases in the country. Factors that affect the malaria situation in Colombia are discussed in this chapter.

In the next section the biology of malaria is discussed. This will help us to understand the dimension of malaria as a disease and how is transmitted. Important discoveries have occurred during the last decade in this fascinating field. Emerging ideas are continually changing the way malaria is perceived and approached today. Many research projects are in progress taking into consideration the biology of malaria, and are largely directing efforts towards the development of new vaccines, alternative antimalarial drugs, and to understand the evolution of parasite strains resistant to antimalarial drugs.

The Biology of Malaria

Cause, Transmission and Epidemiology of Malaria

Malaria is caused by a parasite called *Plasmodium*, which is a genus that belongs to the phylum Protozoa. Out of 120 known *Plasmodium* species, Nevill (1990) identified four types of malaria parasites that infect human beings: *Plasmodium falciparum,*

Plasmodium vivax, Plasmodium ovale, and *Plasmodium malariae. P. falciparum* seems to produce the most severe infection. In areas of tropical Africa it accounts for more than 90% of the infections (Beausoleil, 1986).

The vector that carries and transmits the *Plasmodium* parasite is the female mosquito of a group of 50 to 60 species belonging to the genus *Anopheles*. One female mosquito is capable of transmitting the *Plasmodium* parasite to human hosts (Meuris, 1986). The probability and rate of transmission are mediated by multiple biological and ecological variables associated with the parasites, the vectors, the hosts, and the environment itself. Individual human host exhibit other particular complexities in addition to the merely biological ones. Thus, for instance, the transmission of the parasites to humans may be influenced by a myriad of factors including biological, as well as demographic, behavioral, cultural, and social variables.

One of the key determinants in the epidemiology of malaria is the emergence of parasites species resistant to chloroquine and mosquitos resistant to insecticides. In Colombia, the first case of a patient infected by *P. falciparum* resistant to chloroquine was reported in 1961 (Young and Moore, 1961). Today strains of *P. falciparum* resistant to chloroquine have been reported in many countries in the Indian subcontinent and Southeast Asia, Africa, and South America (Center for Disease Control, 1990).

Four species of *Plasmodium* are found in Colombia: *P. vivax* is the leading cause of malaria in the nation, with a prevalence between 54% and 69 %; *P. falciparum* is the most aggressive specie, with a prevalence between 30% and 45%; *P. malariae* with a prevalence less than 1%, and *P. ovale* just one reported case of a patient who was infected in the Chocó department in 1993 (Meneses and Blair, 1995).

Three clearly defined epidemiological situations are found in Colombia: endemic,[2] epidemic,[3] and no malaria transmission.[4] This distribution is related to rain fall and altitude patterns. Malaria is more common in places with high mean annual precipitation. In addition, malaria cases tend to increase right after the rainy season. Altitude is a very important factor controlling vector distribution because *Anopheles* cannot exist above approximately 1,600 meters above sea level. However, this varies according to the specie of *Anopheles*.

The Life Cycle of the Malaria Parasite

The *Plasmodium* parasite has three phases of development in the mosquito and two in the human host. It is transmitted to humans in the sporozoite forms that are in the saliva of infected female mosquitos called *Anopheles*. The sporozoite invades liver cells and stays there for a period of 5 to15 days (this time varies between species of *Plasmodium*), until the sporozoite matures into squizonts. Development into squizonts takes about 7 days for *P. falciparum*, 6 to 9 days for *P. vivax* or *P. ovale*, and 14 to 16 days for *P. malariae* (Jetten and Takken, 1994). Each of the squizonts contains 10,000 to 30,000 merozoites. The merozoites are released into the blood stream where they invade the red blood cells. The pre-erythrocitic development in the human host is known as the intrinsic incubation period.

In the red blood cell each merozoite matures into a squizont with 8 to 32 new merozoites. The red blood cell eventually ruptures to release the merozoites to the blood

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[2] Endemic means that the disease is present all the time.

[3] Epidemic means that the disease is present just for some periods of time.

[4] This term means that is an area of the country that never has malaria.

stream; they will invade new red blood cells. Some merozoites in the red blood cell differentiate into sexual forms, the gametocytes, which may be ingested by the mosquitos. Once in the mosquitos, the gametocytes leave the red blood cell to initiate the process of fertilization. Male and female gamets fuse to form a zygote. Within 12 to 48 hours, the zygotes elongate to form ookinetes (the fertilized form of the malaria parasite in the mosquito's body). The ookinete penetrates the wall of the mosquito's stomach and becomes an oocyst. Within a week or more, depending on the *Plasmodium* specie and ambient temperature, the oocyst forms more than 10,000 sporozoites.

The development stage of the malaria parasite outside the human hosts is known as the extrinsic period. When the oocyst ruptures, the sporozoites migrate to the mosquito's salivary glands, ready to be injected into a human host, and the lifecycle is concluded (Nyamongo, 1998)(figure 2.1). The rupture of the squizont is related with the presence of fever (Oaks et al., 1991). Disease symptoms are caused by asexual parasite stages present in the human host.

Malaria parasites can remain in the human host for a long time. These can cause malaria after a lapse of several months and, sometimes, years. In patients with *P. vivax* and *P. ovale,* this phenomenon, which is caused by dormant liver-stages forms of malaria parasites, is known as relapse. They can remain dormant up to 4 years before resuming development and releasing merozoites into the blood stream. In patients with *P. falciparum* and *P. malariae,* recurrence of malaria is due to recrudescence. This phenomenon is produced by surviving blood-stage parasites from earlier infections (Oaks et al., 1991).

History of Malaria

Origin of Malaria

The evolutionary history of mammalian plasmodia started with the adaptation of Coccidia of the intestinal epithelium to some tissues of the intestinal organs and then to the invasion of free cells in the blood. The great antiquity of malaria infection is confirmed by the fact that well over 100 parasite species similar to those in humans are also found in a wide range of vertebrates from reptiles to birds to higher apes. None of the parasites, except for those found in some monkeys, can be transmitted to humans. This high host specificity indicates a long association between the human species and the four particular species of *Plasmodia* that infect humans (*P. vivax*, *P. malariae*, *P. ovale*, and *P. falciparum*) (Guilles and Warrell, 1993).

Malaria in the Ancient World

Malaria in Europe and Asia

Malaria is a very old disease; references to it abound in the myths, legends, and historical accounts of the ancient world. Nancy Tayles (1996, in Poser and Bruyn 1999) has claimed that malaria existed as long as 4000 years ago in central Thailand. She based this on the indirect evidence of severe, probably genetic, anemia derived from the examination of human bones from that period, which she assumed to have been an effect of chronic malaria. Malaria was known in China long before the beginning of the Christian era. The Chinese medical classic Nei Ching (the Canon of Medicine), edited in 2700 BC by the legendary Emperor Huang Ti, measured the enlargement of the spleen connected with different types of fevers. This document illustrates three malaria demons, one with a hammer, one with a pail of cold water, and the third with a stove. They were responsible respectively for the characteristic headache, chills, and the fever. The fact

that Chinese physicians used various plant remedies with antimalarial properties, including ch'ang shan (*Dichroa febrifuga*) in combination with exorcism, acupuncture, and moxibustion, may suggest that malaria probably existed in ancient China (Poser and Bruyn 1999)

There was voluminous medical literature on malaria in India, the best known works being the Charaka Samhita and the Susruta Samhita. One of the four Hindu Vedas compiled before 500 BC is the Arthavana, of which the Ayurveda is a part: The Ayurveda constitutes a chief source of Vedic medical teaching. In it, malaria is referred to as a most dreaded affliction, the king of diseases. This malady was usually attributed to the anger of the god Shiva. Five category of mosquitos were illustrated, all of them blamed today for the transmission of the disease (Poser and Bruyn 1999).

The historian Jaime Jaramillo-Arango (in Poser and Bruyn 1999), explained that due to an abundance of water, Greece boasts of some rich and productive farmlands. But the standing water that made farming successful put forth bad air. Every one was attacked by fever. Those who could pull up stakes, largely the rich and the intellectuals, found healthier places to live. The poor, the weak, and the small farmers stayed where they were and they could not escape the disease, so many of them died.

The legend of the philosopher Empedocles of Agrigentum (about 550 BC) (in Poser and Bruyn 1999), who delivered Selinus in Sicily from a plague by draining its marshes or by turning two rivers into them, proves how early the Greeks rationally associated malaria with swamps. In the first Hippocratic book on epidemics, different classes of fever were mentioned, presumably including malaria. The Hippocratic authors of the fourth century BC described the different stages of an attack, as well as symptoms

such as splenomegaly (enlarged spleen), bilious complexion, generalized edema, and cachexia. They noticed the seasonal character of the disease and the detrimental consequences of wet springs and dry summers.

The Hippocratic writings acknowledged a relationship between marshes and fevers; they wrote that residents of low, moist, and hot districts who drank the stagnant marsh water suffered of necessity from enlarged spleen. Although they may have misunderstood this influence, the idea that the fevers were caused by drinking marsh waters was still shared by Manson and Ross in the late nineteenth century (Poser and Bruyn, 1999). The fevers that can be identified most easily in the Hippocratic writings are the tertians and quartans, and can be attributed to *P. vivax* and *P. malariae* (Bruce-Chwatt and de Zuleta, 1980).

The disease is said to have been introduced into Greece by a soldier of Alexander the Great, who, himself, is said, perhaps incorrectly, to have died of a fever that was probably malaria, on returning from the East. Jean Cardamatis presumed that the disease that attacked the Greek army besieging Troy was malaria because of the marshy character of the region. The malariologist Sir Ronald Ross suggested that the decadence of the Greek civilization might have been due to the introduction of malaria about the time of Hippocrates (Poser and Bruyn, 1999). There is evidence in the Hippocratic collection for the existence in Greece towards the end of the fifth century BC of *P. vivax* and *P. malariae* (Bruce-Chwatt and de Zuleta, 1980).

It seems that intermittent fevers were introduced in Italy by 200 BC Pollio Vitruvius, the great architect and military engineer of the Emperor Augustus, who

observed in the first century BC that certain mosquitos cannot bread in salt water. He said that a city built among marshes but near the sea, need fear little from the fevers.

The evidence that Rome was highly malarious at the beginning of the Christian era is overwhelming. It has been suggested that malaria played a significant role in the decline of the Roman Empire, but for centuries it was actually the protector of Rome. Foreign invaders were prostrated by malaria, while the local population was able to survive because of the partial immunity acquired as a result of repeated infections. The "bad air" that rose from the marshes of the Roman Campaign was a notorious cause of fever. Byzantium (Constantinople) and the Eastern Roman Empire shared the same fate, and there are indications that several Byzantine Emperors died of malaria probably caused by *P. falciparum*. In the year 1602, malaria killed 40,000 people in Italy (Poser and Bruyn, 1999).

Historians and medical writers suggest that malaria became a serious problem in Europe after the second century AD. By that time it seems feasible that *P. falciparum* must have been brought to Europe by traders, slaves, and returning soldiers coming from South-West Asia and North Africa (Bruce-Chwatt and de Zuleta, 1980).

A convergence of geological, ecological, and historical data tend to support the hypothesis that the changes leading to an increase in the severity of malaria, noticeable between the early and late classical times, took place during Hellenistic and early Roman days. But despite this information, a great gap exists in our comprehension of malaria between the classical period and modern times (Bruce-Chwatt and de Zuleta, 1980).

Malaria in Africa

The consensus is that in prehistoric times malaria was common in the upper valley of the Nile, accessible from the vast hinterland of tropical Africa, but relatively rare in

lower Egypt. Enlarged spleens, possibly due to malaria, have been found in mummies dating from about 3,000 years ago, and splenomegaly with fever is mentioned in the Ebers papyrus of 1570 BC Judging from its geographical situation, Mesopotamia must have been one of the important malarious areas of the ancient world. Mention of deadly fevers and of intermittent fevers disturbing many people at the same time are common in the 800 clay tablets referring to medicine and surgery which form a part of the library dating back to 2000 BC assembled by Assurbanipal (Poser and Bruyn, 1999).

In the Nigerian regions and westward to the Gambia and Senegal, agricultural tools made of stone were discovered. These were replaced by tools with cutting edges of iron around 1000 BC A theory emerged, based on the idea of tools, that West Africans used those iron tools to clear great amounts of forest. This contributed to the emergence of malaria in that area. A different theory states that West Africans cleared the forest mostly by setting them on fire instead of using iron tools. This labor with its energy saving technique, neither disturbs the ground cover and soil, nor does anything to provide special breeding sites for *Anopheles gambiae*. This bit of empirical research suggests that the old hypothesis about Africa having been afflicted by malaria time out of mind should be reconsidered (Watts, 1997).

Equatorial Africa, the principal arena of the nineteenth century empire, had notoriously resisted white settlement. The west coast in particular was so disease-ridden that a military posting to such colonies as Sierra Leone, Lagos or the Gambia throughout the eighteenth and nineteenth century was considered equivalent to a sentence of death. Except for the highlands of east and southern Africa, no portion of the continent was healthy (Harrison, 1978).

Various researchers suggested that people in West Africa, whose ancestors had lived in heavily infected malaria regions since time immemorial, inherited genetic responses to the disease. These responses prevented permanent liver damage or death. Biochemists have shown that in West and West Central Africa local variants of malaria are related to different locally centered types of human biological features. These are known as sickle cell traits. It would seem that these traits are genetically transferred from one generation to the next. However it is important to bear in mind that this process is not unique to Africans. It also occurs among Italians who live in south of Rome, which was the malaria zone in the nineteenth century (Watts, 1997).

Malaria in Pre-Columbian America

The question of the existence of malaria in pre-Columbian Latin America is greatly disputed. Speculation about the pre-Columbian existence of malaria is based on three types of evidence: linguistic, botanical, and historical. Pictures of mosquitos have been found in prehistoric pottery from New Mexico, and Bernal Diaz del Castillo in 1632 often referred to the plague of mosquitos that made life difficult in several places on the Mexican coast. However, the presence of mosquitos does not necessarily signify the existence of malaria. Many vocabularies of Peruvian languages contain native words of a disease characterized by symptoms of chills and fever. For instance chills in quichua is chug-chu, in jibaro is curamat, in colorado is kupara, and in cayapa is penguina.

Leonard Bruce-Chwatt (in Poser and Bruyn, 1999) devoted an erudite paper to the problem in 1965, titled “Paleogenesis and Paleoepidemiology of Primate Malaria” in which he stated that is probable, but not proved, that malaria existed in the Americas before the Spanish Conquest and there is some likelihood that seagoing people brought it to the New World long before Columbus’ voyages. Other medical historians disagreed

and stated that malaria in the Americas was brought by Spanish conquistadors and later by the colonists; the infection carried by local *Anopheles* spread from the island of Hispaniola to other islands, and from there to the mainland. Percy Ashburn gathered valuable evidence in the defense of this judgment and addressed the importance of the African slave trade in the introduction of malaria from the Old World into the New (in Poser and Bruyn, 1999).

Indirect evidence has been presented by Antonius Bollus (in Poser and Bruyn, 1999), who lived in Peru for many years in the seventeenth century, by Joseph de Jussieu and Charles de la Condamine, who visited Ecuador in 1735-1739, and by William Arrot, a Scottish surgeon who went to Peru at about the same time. All of these affirmed that chinchona bark was well known to the Indians and that they used it for treatment. Such mention would not preclude the fact that the bark was used as a non-specific febrifuge. Yet a number of naturalists and explorers have emphasized that there is no reference to the chinchona plant in the available written records of Incas, Mayas, and Aztecs. This might signify that malaria was unknown in America before the Spanish Conquest (Hoff, 1999).

The historical evidence for and against the pre-Columbian existence of malaria in the New World is poorly documented. Those who deny it stress the absence of clear reference to epidemics of fevers, but others believed that the Inca healers were acquainted with the disease, while the Ecuadorian historian Gualberto Arcos stated that it affected the armies of Pachacutec in 1378.

In contrast, Percy Ashburn wrote that malaria must have been introduced into the New World in the early days of the Spanish Conquest by African slaves who were

infected, so they carried the parasite in their blood, they were ready to be bitten by the vector, mosquito *Anopheles*. Saul Jarcho stated that an endemic focus of malaria in San Sebastian de Urabá, reported by Gonzalo Fernandez de Oviedo y Valdés, could have been established in Panama by the Spaniards who visited this area previously and were accompanied by black slaves. Although the first Africans may have been brought to the islands of Cuba and Santo Domingo as early as 1503, their numbers were relatively small. It is doubtful whether any large-scale epidemics of malaria could have started so soon from these probable carriers of plasmodia. By 1510 African blacks were in great demand by their Spanish masters to replace the Indians, and after 1514, when Bartolomé de las Casas, the Bishop of Mexico, began to denounce the cruelties inflicted on the Indians and proposed that African slaves should replace them, Africans were shipped across the Atlantic in growing numbers (Poser and Bruyn, 1999).

Paul Russell (in Poser and Bruyn, 1999) pointed out that if malaria existed in the Americas before Columbus, it must have had a patchy distribution. This is likely, considering that the main American indigenous civilizations were on the mountain plateaus and high valleys, where the climate is salubrious, so that only the coastal areas may have been malarious. Jarcho concluded that the presence of malaria in pre-Columbian America is improbable but not impossible.

Most of the references to malaria in pre-Columbian America understandably failed to distinguish between the different species of parasites. It is possible that *P. vivax* and *P. malariae* existed in several areas of central South America before the discovery of the New World and that *P. falciparum* was brought by the Spaniards and their black slaves. If malaria did exist in pre-Columbian America, one possible route of invasion would have

been at the time of the great migration from Asia across the Bering Strait. However, the survival of malaria parasites in man or vectors during the thousands of years of the postglacial period is unlikely. If the original inhabitants of the American continent were free of malaria, the infection must have been new, though long before the landing of Columbus (Poser and Bruyn, 1999).

There is evidence of prehistoric voyages of people of the Bronze Age, who lived on the western shores of the Mediterranean and sailed over the Atlantic, perhaps as far as the coast of Central America (Poser and Bruyn, 1999). According to some historians, Arab navigators and slave traders made repeated contact with the Caribbean coast of America in about 900 AD. Researchers have supported this statement by botanical, anthropological, and historical data. However, pre-Columbian contacts between the Americas and the Old World seem even more probable across the Pacific Ocean (Poser and Bruyn, 1999).

It is known that mosquito types, able of serving as intermediate hosts for one or another malaria form, existed in large concentrations to have hosted the disease before Columbus arrived. Seemingly absent, however, were malaria plasmodia. This means that malaria, like yellow fever, was unknown in the Americas before the coming of the Europeans (Watts, 1997).

Frederick Dunn has based his view that malaria did not exist in pre-Columbian America on an ingenious but rather convoluted genetic analysis. He pointed out that it is generally accepted that heterozygosity for the sickle cell gene provides some measure of protection against *P. falciparum* infection. The genes for hemoglobin C, hemoglobin E, and glucose-6-phosphate dehydrogenase deficiency (G6PDD) have also been tentatively

linked to protection against malaria. These genes seem to have been absent in pre-Columbian man; survivors of the New World aboriginal populations apparently do not carry these genes, with the possible exception of that for G6PDD (Poser and Bruyn, 1999). Any explanation to this disparity in distribution must rest on the answer to a fundamental question: were there or were there not malaria parasites infected from primates in the Americas before the European contact? The only reasonable assumption is that neither man nor monkey could have harbored the malaria parasite in the Western hemisphere in pre-Columbian times (Poser and Bruyn, 1999).

Another idea is that it is possible that *P. vivax* and *P. malariae* were brought from Southeast Asia by early trans-Pacific voyages, while *P. falciparum* is of post-Columbian origin, through the African slaves brought by the Spanish colonizers (Guilles and Warrell, 1993). In the timing of its first New World appearances malaria seemed to work along the moving frontier on a delayed time fuse. Ten or twenty years after settlers had cleared a forest and built their barns and houses, epidemic malaria struck (Watts, 1997). Goh and Phua have asserted that the lost cities of Sri Lanka, Angkor Wat in Cambodia, and even the Mayan civilization in Central America were deserted because of devastation by malaria.

Finally, the weight of evidence of the previous information from different sources suggest that it is very probable that the disease was brought to the Western Hemisphere by the Spanish conquerors and their African slaves, and that malaria has been devastating for many people, or at least has affected their life in a significant way (Poser and Bruyn, 1999).

Malaria Milestones in the Last Four Centuries

Intermittent fevers known in England as algues received in the eighteenth century the Italian name malaria, because it was widely believed that their cause was related to the foul air common near marshy areas. The French term “paludismo” indicating a close connection with swamps was introduced much later. In 1642, a Spanish doctor, Pedro Barba, became the first European to try the extract of a tree bark brought from Peru, as a treatment on a patient, the countess of Chinchon (Hoff, 1999). That is why in 1735 the tree producing the Peruvian bark was given, by Linnaeus, its scientific name of Chinchona. But quinine, the active agent in the bark, was not isolated until 1820 by Pelletier and Caventou in France (Guilles and Warrell, 1993).

Advances on the biology of the malaria parasite

The most important events in the history of malaria took place towards the end of the nineteenth century, when the sciences of bacteriology and pathology were discovering the causes of infectious diseases, observing the morbid changes in the organs and tissues and also perceiving the role of insects in the transmission of some infections. It was in 1880 that Laveran, a French army surgeon in Algeria, first saw and described malaria parasites in the red blood cells of human beings. However, the way in which the disease was transmitted person to person was still a mystery although a few early and inspired guesses pointed to the possible association between swamps, mosquitos, and fevers (Guilles and Warrell, 1993).

The actual mode of transmission was not forthcoming until 1897 when Ronald Ross working in Secunderabad (India) found a developing form of the malaria parasite in the body of a mosquito that had previously fed on a patient with the plasmodia in his blood. The whole complex picture of the cycle of development of malaria parasites in

humans and in the female *Anopheles* mosquito became clear as a result of further studies by the Italians Amico Bignami, Guiseppe Bastianelli and especially Battista Grassi in 1898-99. A striking confirmation of the fact that malaria is transmitted by *Anopheles* mosquitos was based on the combined field experiment carried out by Patrick Manson and his colleagues near Rome and in London in 1900.

Advances on treatment for malaria

The ravages of malaria experienced during the First World War, and the difficulties of securing cheap supplies of quinine, stimulated a line of research in Germany aimed at the discovery of synthetic antimalarial drugs. This was brilliantly accomplished in 1924 by Schulemann's discovery of primaquine. A much more valuable drug - atabrin (mepacrine) - was prepared in 1930 by Kikuth, Mietzsch and Mauss. There can be no doubt that the availability of this compound played an immense role during the Second World War. Other valuable synthetic drugs developed by the British followed in 1934 (chloroquine), 1944 (proguanil), 1946 (amodiaquine), 1950 (primaquine), and 1952 (pyrimethamine) (Guilles and Warrell, 1993).

In the meantime, another major discovery was to revolutionize the technique of malaria control by spraying insecticides to combat adult mosquitos. At the beginning of Second World War in Switzerland, Paul Muller discovered the high insecticide action of a synthetic compound, dichlorodiphenyl-trichloroethane, which was given the abbreviated name of DDT when samples of it were sent in 1942 to UK (Guilles and Warrell, 1993). But, unfortunately, today many studies have shown that DDT has a dangerous effect in animals and human health, because it is a hormone disruptor that bioaccumulates and biomagnifies. Besides, DDT is a Persistent Organic Pollutant (persisting for several years) that travels through air, and water. DDT has been banned in

the Unites States and other developed countries due to its toxic effects, but regrettably it is still used in developing countries such as India, Colombia, and Mexico for agriculture and malaria control, producing terrible damage to the population and the environment.

In the next section the malaria situation in the world is discussed, especially in Colombia. Some of the factors that contribute to maintaining the disheartening situation of malaria in Colombia are also explored. These factors are poverty, environmental changes, political violence and conflict, drug resistance, and cultural beliefs about malaria. The deficiency of the Colombian health system is also a crucial factor that is explored in the next chapter.

World Malaria Situation

Most malaria endemic areas of the world are restricted to the tropics, including vast regions of Central Africa, Central and South America, Caribbean, and Southeast Asia. Today, more than 90 countries worldwide are affected by malaria. Of the total number of cases reported annually to the World Health Organization (excluding the African region), 90% are from only 19 countries. Some 75% are concentrated in 9 countries (in decreasing order): India, Brazil, Afghanistan, Sri Lanka, Thailand, Indonesia, Viet Nam, Cambodia and China. Coverage of reporting is particularly poor in “frontier areas” of economic development, such as intensified exploitation of natural resources in jungle areas, or in areas over burdened with civil war or other conflicts, illegal trade, and mass movements of refugees. Figures are therefore underestimates. For example, a total of 1,428 deaths were reported from the Americas in 1986; annual malaria mortality for the Brazilian Amazon region alone has been estimated to be between 6,000 and 10,000. However, the vast majority of malaria deaths occur in Africa; estimates vary greatly. A figure of 800,000 deaths per year in African children has been quoted in 1991 (WHO, 1992).

Among the main barriers to prevention and control of the disease in areas with high transmission are: inadequate sanitation and precarious living conditions; a frequent lack of financial resources; lack of knowledge about the biology, ecology and control of the vectors; expansion of agriculture, mining and forest industries into new areas, leading to migration; and inefficient or non-existent health infrastructure (WHO, 1992).

Malaria in the Americas

The continuing increase of malaria is of particular importance since it appears simultaneously with the socioeconomic deterioration occurring during the 1980's in the countries of the region (PAHO, 1991). In 1990, the increase seems to have come to a halt with 1,057,000 cases recorded. More than half the cases were registered in Brazil (53%); 25% originated from Andean countries and 14 % were from Central America (WHO, 1992). In 1994 the three countries in Latin America with the highest amount of malaria cases were: Brazil, Colombia, and Peru (PAHO, 1999).

Transmission of the disease has been intensified by new settlements. The resulting deforestation has created new breeding areas for *Anopheles darlingi*, the main vector of malaria in the Americas. Migration into areas of high risk and environmental degradation continued to be mayor contributing factors in sustained malaria transmission (Bernard, 1999).

Colonization of former forested areas, settlement establishment and subsequent deforestation can be better understood as a consequence of the expansion of the market economy in the West during the period after World War II. Enhanced deforestation in the Amazon Basin falls in this lapse. Construction of roads augmented the colonization dynamics in the region attracting more and more peasants from other regions that further increased the deforestation process.

Migrating colonists and wealthy investors became active generators of deforestation in different parts of the Amazon region. At the same time there was little concern for environmental consequences, and land value was calculated in terms of its production in the market (Schmink, 1995). Ranchers, colonists, indigenous, miners, and others were fighting among themselves, even becoming violent, in order to have control of the resources opened by the roads (Schmink and Wood, 1987).

The migratory movements, the interaction between groups, and the evolution of the economical and political context were the dynamic elements that produced specific results in each local situation. The forces of the national and the international markets are a necessary and important condition for the expansion into forest areas relatively inaccessible, such as the Amazon region. The population pressure in areas of settlement produces internal migrations further increasing deforestation. The governmental policies, especially those that favor road construction and the use of industrial resources, intervene in the population distribution and land use through migration dynamics and land tenancy patterns (Schmink, 1995).

Malaria in Colombia

Colombia is an endemic country in ninety percent of its territory and there are some departments where the prevalence and incidence are considerably high, e.g., Chocó and Antioquia (table 2.1). Antioquia, department in which the study site for this investigation is situated, is the department with the highest percentage of malaria cases. Some of the municipalities that have reported the highest number of cases in the last ten years are: El Bagre, Tarazá, Turbo, Carepa, Necoclí, and San Pedro de Urabá (figure 2.2 and 2.3). The incidence of malaria in Antioquia has been marked by significant shifts during the last eight years, but in the years 2000, 2001, and 2002 it appears that the incidence is

increasing again (figure2.4). During the last 5 years there have been around 50,000 cases of malaria per year in Colombia with an average of 13 % in children under 4 years of age and 32 % in children under 14 years of age. Furthermore, in Antioquia, more than 1,6 million people live in endemic areas, so that a substantial portion of the population is being permanently exposed to malaria infection. In the whole country, and during the last four years, the number of reported cases doubled: from 71,012 cases in 1999 to 139,542 cases in the year 2002.

Malaria cases have increased due to an augmentation of vulnerability of the population caused by displacements, migrations, irregular climate, and environmental alterations resulting from illicit crops fumigations, among others (Sandoval, 2003). In fact, a total of 140,000 infected individuals were reported last year in the whole country. The population at risk today has been estimated to be 5,027,427 people concentrated in 10 departments. The highest number of cases being reported in the departments of Antioquia, Meta, Guaviare, Chocó, Cordoba, Nariño, Valle, Caquetá, Cauca, and Putumayo (Sandoval, 2003).

According to the "Informe de la Situación de los Programas de Malaria en las Américas" (Report on the Situation of the Programs in the Americas), a report presented by the Panamerican Health Organization in September 2002, between the year 2000 and the 2001 whereas Brazil (the country that historically has presented the highest number of cases per 1,000 inhabitants) reduced the incidence of malaria, Colombia increased the incidence (Sandoval, 2003). Along with the diagnosis performed by the program on vector-transmitted diseases, in the majority of departments in Colombia, malaria is not a priority for the public health officials and local health authorities. The resources allocated

to run antimalarial programs are insufficient and the systems for epidemiological surveillance are also deficient (Sandoval, 2003).

Some factors that influence the malaria situation in Colombia are: environmental changes, the socio-economic situation, drug resistance of the parasite, and cultural beliefs.

Environmental seasonal variations

Climate and its variability contribute to the incidence of malaria in low land tropical endemic areas of Colombia. During "normal years", endemic malaria in those regions exhibit a clear-cut "normal" annual cycle, tightly associated with prevalent climatic conditions, mainly mean temperature, precipitation, humidity and river discharges. In general, during dry seasons malaria incidence increases, following periods of reduced rainfall, and river flows, and augmented average and minimum air temperature.

Overall, Colombia experiences drought - reduced rainfall, soil moisture, river discharges, and evaporation - along with increases in air temperature during El Niño events. During El Niño years (interannual time scale) there is intensification in the incidence of malaria at the local, regional, and national level in Colombia (Poveda et al., 1996).

Socio economic aspects

This factor was mentioned earlier in Chapter one, but here a specific case study in Colombia is described. The study carried out by Bonilla et al., (1991), in the region of Cunday (Tolima, Colombia), showed that the presence of malaria is related to the levels of exposure associated with the environment in which individuals live and work. The

activities developed to confront and minimize the risk levels depend upon the socio-economic conditions of the family groups.

Malaria causes negative effects in all the households where one or some of its members suffer the disease. Not only the time for work but also the monetary resources of the individual and the household are negatively affected when the disease occurs (Bonilla, 1991). Due to poverty many children in Colombia are malnourished. A study of children infected with malaria conducted in the department of Antioquia, municipality of El Bagre, showed that 69 % of the sample presented some risk of malnutrition, and 63 % had some risk of chronic malnutrition (Blair et al., 2002). There is a clear relationship between malnourished children and the presence of malaria infection. Malnourished children have a weaker immune system so that when they contract malaria, the infection can be more severe than a similar infection in well-nourished children with a strong immune system (Blair et al., 2003).

Drug resistance

In Colombia, parasite strains of *P. falciparum* and *P. vivax* that are resistant to antimalarial drugs have been found. A study carried out in the municipality of Zaragoza, Antioquia, showed that the in vivo prevalence of resistance to chloroquine was 67%, to amodiaquine was 3%, and to sulfadoxine/pyrimetamine was 9% (Blair et al., 2002). Another study carried out in Turbo, Antioquia showed that the resistance in vivo to chloroquine was 97%, to amodiaquine was 7%, and to sulfadoxine/pyrimetamine was 13% (Blair et al., 2001). Some of the factors that have contributed to this resistance are: patient's lack of socio-economic resources, the failure of patients to properly use the prescribed antimalarial drug, metabolic differences of the individuals, changes in the intestinal absorption produced by the diet or other medications, the presence of strains of

P. falciparum that have genes for resistance, and the self-prescribed drug phenomena of sub therapeutic doses, which is very common in Colombia (Blair et al., 2001). When people need some medication to stop the fever, they often use a sub dose of antimalarial pills such as chloroquine, a procedure that contributes to the generation of resistant strains of the malaria parasite.

Political violence and internal conflict

Colombia is a country that has been facing very serious problems of political violence in the last 100 years. The narcotrafic, social injustice, and the desire for power of certain paramilitary groups that represent the interest of the wealthiest sector of the population have placed the country in a state of social and political instability that materializes in generalized terror and insecurity. The socio-economic inequality among the population creates an ideal setting for these problems to be perpetuated.

Moreover, the well being of the people, and the health services, are directly affected by this situation. Some places, for instance, cannot be accessed by the health providers and the food providers, especially when armed confrontation (between the military, the guerrilla and the paramilitary groups) is taking place. In addition to this the government exerts control on and imposes severe restrictions to the distribution of medicines and foodstuffs to some 'guerrilla infested' areas of the country, thus jeopardizing all chances for civilians to have access to such vital items. Again, this puts the community at risk for many diseases.

Malaria is a severe problem in the communities affected by armed conflict. Some times the antimalarial drugs can not be delivered to the rural places where they are needed, ill people can not seek help in neighbor villages, and the ambulances can not go where some people are sick with malaria because either the paramilitary groups or

guerrilla groups impede the normal displacement. As a result of the political violence in rural places, people are being displaced to the main towns or cities, carrying with them unemployment, hunger, and loss of their land and their animals. The internal migration increases the spreading of the disease and deterioration of life conditions in the already overpopulated urban areas. All these circumstances create a complex environment and lead to the persistence or even worsening of the malaria situation in Colombia.

Cultural beliefs

Cultural beliefs can affect the way malaria is approached especially in rural areas. Colombia has many examples.

A study by Lipowsky et al., (1992), carried out in the town of Buenaventura, Valle department, Colombia, a city mostly inhabited by black people, showed interesting aspects of how people perceive malaria. For instance, most individuals in this geographic area believe that malaria starts with an inflammation of the spleen and can be caused either by "strenuous activities" or by excessive ingestion of "hot food." The inflamed spleen subsequently attracts body fluids, blood or water, which in turn forces the affected person to drink even more liquid. This process leads to a swelling of the spleen, which is for them, the main symptom of the disease. It must be noted that most of the people do not consider mosquitos as an etiological agent of "spleen."

It is important to clarify that these previous findings vary in different regions of the country. In other regions people relate mosquitos with the cause of malaria. In Buenaventura, some portion of the population has its own specialist to cure "spleen", called spleen-prayers (rezadores de bazos). The impact of these traditional beliefs seems to decrease with the increasing contact of the population with modern medicine. In villages where modern health services are provided, the malaria control program

influences people's ideas and behaviors towards malaria. The population has adopted the term "malaria" as an everyday word.

In the popular perception about malaria in Buenaventura, two important aspects of the disease are nearly completely missing: the fact that there is the possibility to have an infection without disease, and that the transmission of the disease from infected persons to uninfected persons occurs through the inoculation of the parasites by mosquitos.

In rural areas of Buenaventura, self-diagnosis is a dominant pattern and people feel confident in doing so. Indications of the disease are, first, its symptoms and second its positive response to chloroquine treatment. The population recognizes some malaria symptoms such as fever, chills and headaches. In the urban realm, on the other hand, the population relies more on the conventional blood test (blood smear) as a definite diagnostic measure. Treatment only starts in the case of positive result, which is readily available (Lipowsky et al., 1992).

For the rural population, home treatment, malaria health posts, traditional healers and doctors are the main sources of treatment for malaria. Urban population places malaria posts first and physicians second (before home treatment and traditional healers) as the appropriate health agents in case of illness. Where the population still holds traditional concepts, they rely on traditional healers, i.e., spleen prayers, for treatment. Their methods consist of conjurations, healing ceremonies and herbal remedies. In the rural areas they treat malaria with: chloroquine 69%, herbal infusions 25.2%, and mixtures containing vitamins, iron and quinine 5.8% (Lipowsky et al., 1992).

Some informal interviews carried out during the study in Buenaventura revealed that a high percentage of the population buys the chloroquine tablets without

prescriptions from any health service. They use the pills at will and based on their own judgment rather than following professional instructions. Villagers reported that their dosage for an acute attack was 2-4 tablets (when the recommended dosage is 10 tablets for adults). The majority of the population ignores the correct dosage and duration of treatment with chloroquine.

Household surveys suggest that the urban population know less about medicinal plants, which can be used in the treatment of malaria than to those people who live in rural areas. The plants that were most commonly used by the population were the herbs matarratón (*Glicidia sebium*) and sauco (*Sambucus nigra*). It was found that 52.7 % of the people interviewed in the rural areas acknowledge having used the plants as opposed to only 33% in the urban zone. Rural traditional healers classified the plants into "cold plants" and "hot" or "bitter plants." They identified two principles in the use of these plants: reduction of the body temperature by administration of cold plants and reduction of inflammation of the liver and spleen by utilization of the hot or bitter plants.

All this information that comes from the people is important but there are few studies in Colombia that explore this aspect. When this knowledge is understood and respected, is easier to make changes in the health system that can benefit the population and that are accepted by the local people who are directly affected by malaria. The factors mentioned above are crucial and contribute, in different extent, to shape the malaria situation that the Colombian population is facing today.

Summary of the Chapter

Malaria is caused by a parasite called *Plasmodium*, which is a genus that belongs to the phylum Protozoa. Out of 120 known species of *Plasmodium* there are four types of malaria parasites that infect humans: *P. falciparum, P. vivax, P. ovale,* and *P. malariae.* It

seems that *P. falciparum* produces the most severe infection. The vector that carries the *Plasmodium* parasite is the female mosquito that belongs to the genus *Anopheles* and is capable of transmitting the *Plasmodium* parasite to humans that are the hosts. It is assumed that the evolutionary history of mammalian plasmodia started with the adaptation of Coccidia of the intestinal epithelium to some tissues of the intestinal organs and then to the invasion of free cells in the blood. None of the parasites, except for those found in some monkeys, can be transmitted to humans.

Malaria is a very old disease; references to it abound in the myths, legends, and historical accounts of the ancient world. For instance, some authors have claimed that malaria existed as long as 4,000 years ago in central Thailand. Historians and medical writers suggest that malaria became a serious problem in Europe after the first and second century AD By that time it seems possible that traders, slaves, and returning soldiers coming from South-West Asia and North Africa must have frequently brought *P. falciparum* to Europe. The consensus about the history of malaria in Africa is that in prehistoric times malaria was very common in the upper valley of the Nile, accessible from the vast hinterland of tropical Africa, but relatively rare in Lower Egypt. Enlarged spleens, possibly due to malaria, have been found in mummies dating from about 3,000 years ago, and splenomegaly with fever is mentioned in the Ebers papyrus of 1570 BC Judging from its geographical situation, Mesopotamia must have been one of the important malarious areas of the ancient world. With respect to the history of malaria in the new world, it is very probable that the disease was brought to the Western Hemisphere by the Spanish conquerors and their African slaves.

Most malaria endemic areas of the world are restricted to the tropics, including vast regions of Central Africa, Central and South America, Caribbean, and Southeast Asia. Today more than 90 countries worldwide are affected by malaria. In the case of Latin America, the most affected countries are Brazil, Colombia and Peru. Colombia is an endemic country in ninety percent of its territory and there are departments where the prevalence and incidence are very high, e.g., Chocó and Antioquia. Antioquia is the department with the highest number of malaria cases. Municipalities with the highest number of cases in the last ten years are: El Bagre, Tarazá, Turbo, Carepa, Necoclí, and San Pedro de Urabá.

Some of the factors that influence the malaria situation in Colombia are: environmental changes, socio-economic situation, drug resistance, and cultural beliefs. Among the main barriers to prevention and control of the disease in areas with high transmission are: inadequate sanitation and precarious living conditions; a frequent lack of financial resources; lack of knowledge about the biology, ecology and control of the vectors; expansion of agriculture, mining and forest industries into new areas, leading to migration; and inefficient or non-existent health infrastructure.

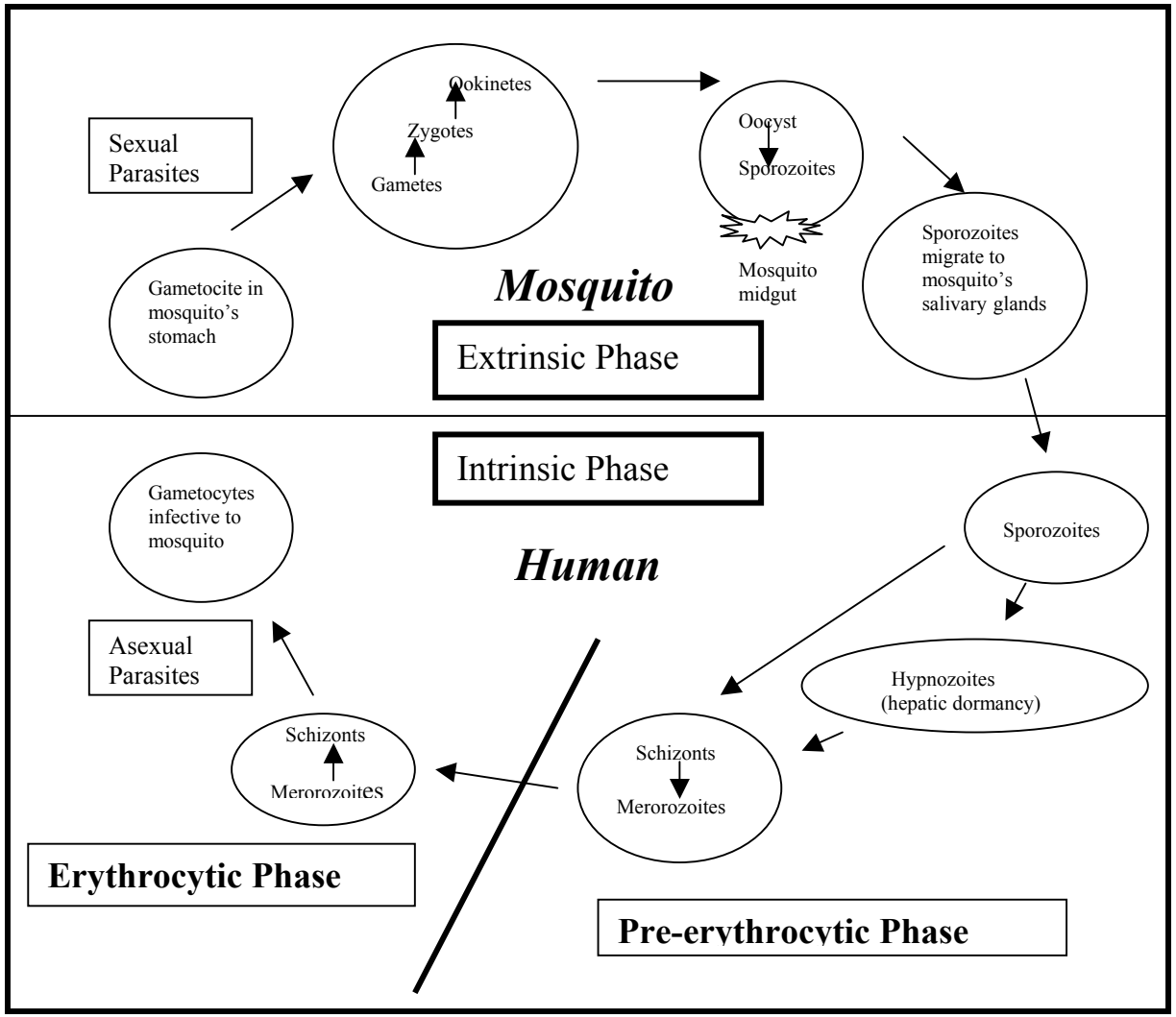

Figure 2.1. Life cycle of the malaria parasite.

Table 2.1: Malaria in Colombia by department year 2000.

DEPARTMENT	***TOTAL MALARIA CASES***
AMAZONAS	1,381
ANTIOQUIA	**24,545**
ARAUCA	537
ATLANTICO	2
BARRANQUILLA	1
BOGOTA	2
BOLIVAR	443
BOYACA	70
CALDAS	5
CAQUETA	10,868
CARTAGENA	6
CASANARE	120
CAUCA	1,485
CESAR	97
CHOCO	**8,981**
CORDOBA	**29,423**
CUNDINAMARCA	126
GUAINIA	216
GUAVIARE	**23,240**
HUILA	97
LA GUAJIRA	4,478
MAGDALENA	10
META	7,234
NARIÑO	**17,366**
NORTE DE STDER	2,167
PUTUMAYO	3,879
QUINDIO	67
RISARALDA	334
SAN ANDRES	0
SANTA MARTA	27
SANTANDER	140
SUCRE	28
TOLIMA	31
VALLE	1,782
VAUPES	213
VICHADA	1,646
TOTAL CASES	**141,047**

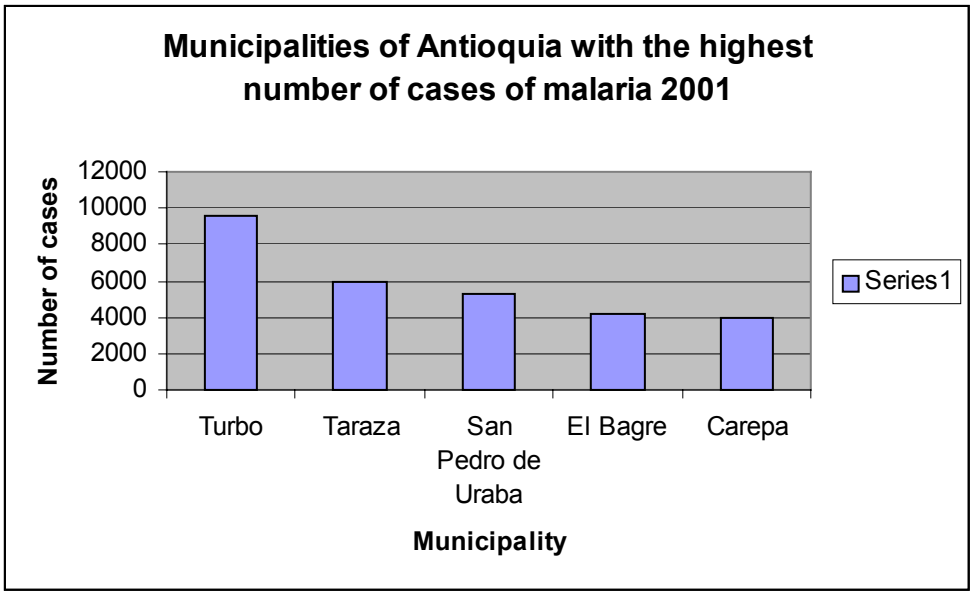

Figure 2.2. Malaria incidence in Antioquia, top five municipalities 2001.

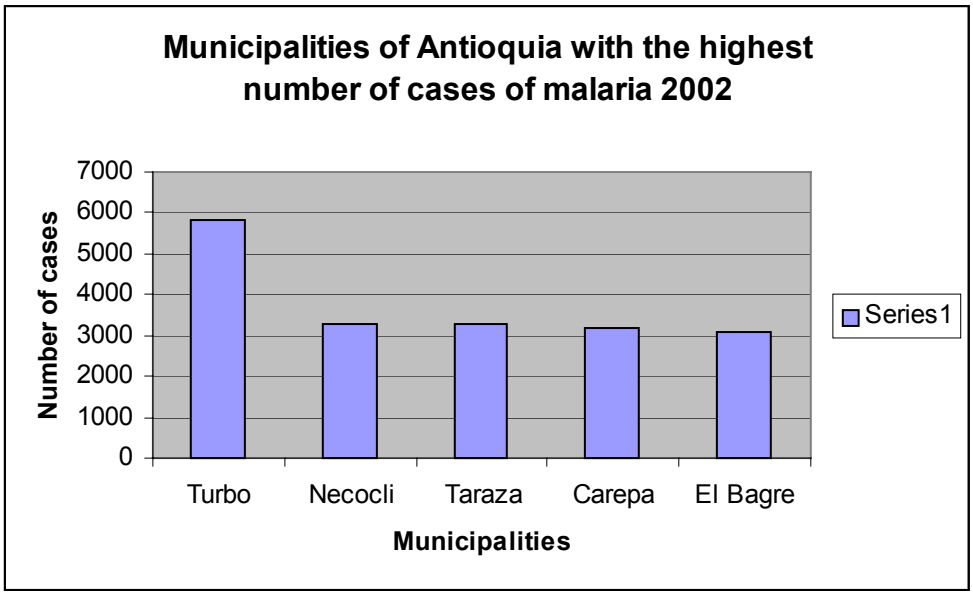

Figure 2.3. Malaria incidence in Antioquia, top five municipalities 2002.

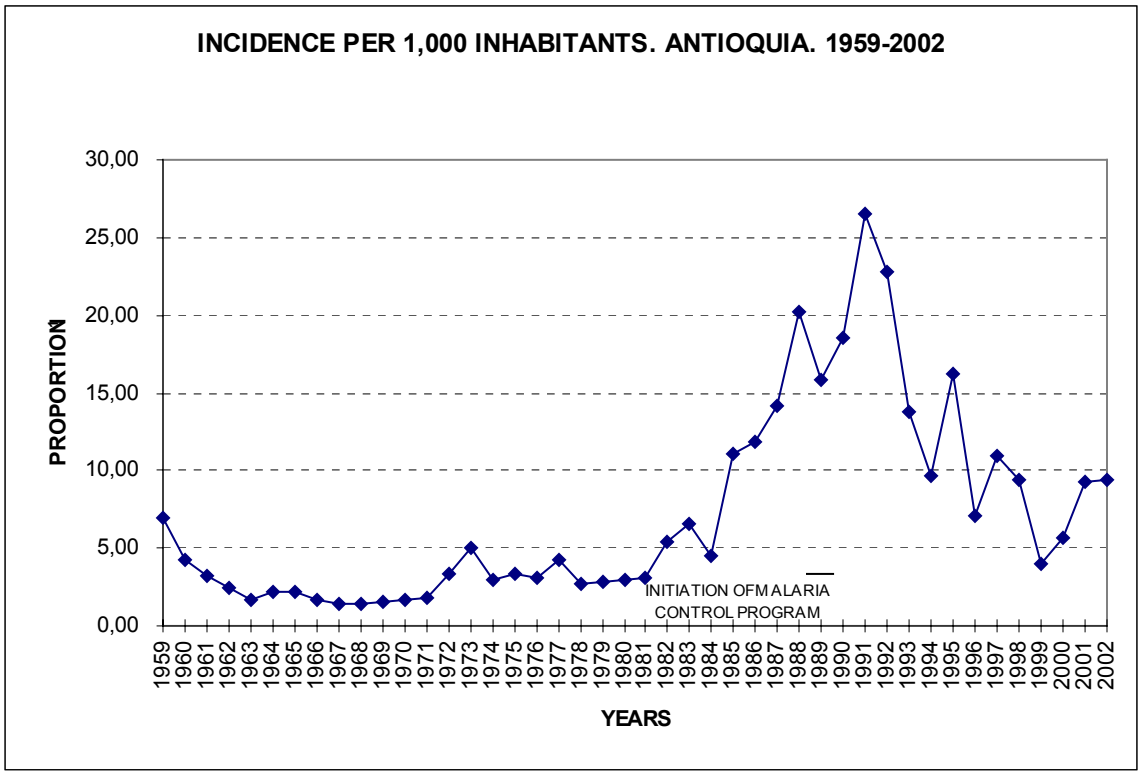

Figure 2.4. Incidence of malaria in Antioquia years 1959-2002.

CHAPTER 3
HEALTH SYSTEM IN TURBO AND REGULAR PROCEDURES FOR MALARIA

Introduction

In the preceding chapter the biology of malaria, the history of malaria and the malaria situation in the world and in Colombia were discussed. This chapter contains a brief description of the Colombian health system and the regular health procedures for malaria from the biomedical standpoint. A health system is influenced by economic and political factors, such as public health ordinances, health care policies, investment priorities, administrative structure of health care system, and budget. These factors affect the adoption (and development) of disease control technologies, the epidemiology of the disease, and quite frequently, the ability of citizens to pay for health care services received. The quality and efficiency of malaria control programs are affected by the factors mentioned above. These factors pertinent to Turbo are related to the existing health system.

Health procedures related to malaria explain, from the biomedical perspective, what, in theory, should be done to correctly diagnose and treat patients with probable or confirmed malaria.

Health System and Administrative Structure

Characteristics of the Colombian Health System

Poor quality in the offered services, low coverage of the population needing services, and inequality in the attention to patients were common in the previous health system created by the government in the 1987 national constitution. These deficiencies

generated the need to change the health system in the 1991 national constitution to a decentralized system in which real coverage and services would be provided. Thus the laws of the distribution of competence and resources (Law 60/93) and of the social Security System (Law 100/93) were created. The slow implementation of these two laws generated new problems. In order to develop a better health system different strategies have been adopted:

Assuring coverage for the population

The current model was developed to provide universal coverage by means of two alternatives based on a fundamental criterion which is the economic capacity of the clients for paying the benefits: the subsidized regime directed to the people without payment capacity, and the contributive regime directed to people who do have payment capacity.

As the name suggests, the contributive regime is based on the monetary contribution of the laborers and employees that today corresponds to the 12 %,[5] of their salary. The increase in coverage that this system tries to provide is based on the increasing affiliation of independent workers, and the family coverage, which was not possible in the previous health system. The family members now have the right to be covered provided at least one family member is working. The family members other than the head of household that pays are called beneficiaries. Through the creation of a privatized health system, the government transferred the obligation to provide efficient and accessible health services for all citizens to private and for profit "health companies." This new policy is central to the Law 100 and has been activated through the constitution

[5] Of this 12 5, 11% is used to the own financial support, and 1% is used to financially support the people that belong to the subsidized regime.

of "Empresas Promotoras de Salud" EPS (Health Promotion Companies), which are the entities responsible for the affiliation of the population of the contributive regime and guaranty the health services (Minsalud, 2003).

Administrators with a clear monetary inclination manage these business-oriented companies. Decisions within these companies are based, largely, on financial matters alone leaving more crucial aspects of the health phenomena aside, and making it impossible to resolve public health problems. The Health Promotion Companies put limits on their coverage, and the people affiliated with them have to pay the extra coverage depending on the type of service given, i.e., surgery, laboratory test.

The creation of the subsidized regime is a major change in the health system structure. The resources are not given directly to the institutions that offer the health services known as Instituciones Prestadoras de Salud IPS (Health Offering Institutions), i.e., hospitals and health centers. The resources are paid to the institutions after the health service is provided according to the number of people attended. The subsidized regime is oriented towards the attention of the most vulnerable population in situation of acute poverty: pregnant women, children, disabled, informal workers, and indigenous people, among others. The entities in charge of the affiliation in this regime are called Administradoras del Régimen Subsidiado, ARS (Subsidized Regime Administrators), which can be: Empresas Solidarias de Salud, ESS (Health Shared Companies), Cajas de Compensación Familiar, CCF (Family Compensation Company), and the Empresas Promotoras de Salud that are authorized to manage this regime if they complete the necessary requirements (Minsalud, 2003). In this regime the government assigned a card with a specified level depending on the economic capacity of each family or individual.

When the family makes use of any health services, the family group has to make a co-payment according to the card level; the government will pay the rest of the money. People with card level one (1) pay 5 % of total cost, card level two (2) pay 10 % of total cost and card level three (3) pay 30 % of total cost of attention. The government's coverage of children under one year of age is obligatory. The difference between this subsidized regime and the contributive regime is that people that belong to the subsidized regime do not have to pay any money for affiliation every month to the Subsidized Regime Administrators; they just have to pay the co-payment when they are attended.

Benefits of plan standardization

The new system offers a Plan Obligatorio de Salud, POS (Obligatory Health Plan), which includes education, prevention, promotion, treatment, diagnosis, and rehabilitation actions that should be equal for each person that belongs to the system. The subsidized POS initially covered first level attention, which means very simple attention, and maternal and infant attention at all levels, which range from very basic attention to very sophisticated attention encompassing specialized health providers and use of advanced technology for diagnosis and treatment. The diseases with associated high treatment costs were included at a later stage, for instance, AIDS. The POS covers many public health services besides vector-transmitted diseases such as malaria and leishmaniasis. The system also offers the Plan de Atención Básica (Plan for Basic [medical] Attention) PAB,[6] which puts more emphasis on health promotion and prevention. For instance, it

[6] "This plan consists of interventions that are directed to collectivities or the ones that are directed to individuals but have public information, public health education, control in the consumption of tobacco, alcohol, and psychoactive substances, nutritional supplementation, family planning, school disparasitation of intestinal worms, vector control, national prevention campaigns, detection and control of transmitted disease such as AIDS, tuberculosis, and leprosy, and tropical diseases as malaria" Article 165 law 100 of 1993.

covers education programs for prevention of tobacco and alcohol consumption, family planning, and vector control (Minsalud, 2003).

Decentralized health attention

Initially, the Law 10 of 1990, and later the law 60 introduced the scheme of decentralized health attention, which was designed to give the population the necessary attention in a more direct form. With this scheme, the municipalities are authorized to manage autonomously their situado fiscal,[7] (Minsalud, 2003). Each municipality can organize its own money that comes from the government, dividing it freely among the institutions and programs that the municipality offers. There is no need for government authorization. The municipalities can use the money autonomously for several purposes, such as improving health facilities, building roads, fumigating households against mosquitos, or buying equipments.

Information About the Plan de Atención Básica, PAB

The PAB was created with the objective of improvement of health promotion and prevention programs that can guarantee the conditions necessary to prevent people from getting sick or dying due to biologic, environmental, and social causes. With this plan the state assumes the responsibility for public health. The PAB is free for patients and obligatory for health care institutions. Its funding comes from national and municipal resources.

The PAB has the following characteristics according to resolution 4288:

a) Gratuity: free and financed with public resources.

[7] Situado fiscal is the money from the national budget destined to health and education. This money depends on the number of inhabitants of the municipality and the resources that the municipality has. The legislative act #12 of 2001 changed the permanent percentage of the situado fiscal and ended up modifiable by the congress according to the national budget.

b) Federal: directed and administered by the national government.

c) Obligatory: the state guaranties the PAB to all the population as a right, independently of the affiliation to the general system of social security.

d) Territoriality: the area of action is determined by the political-administrative division of the country, it is managed locally, the main agency is the municipality or district.

e) Complement: enlarges the outreach of public health plans that do the environmental, working, productive, and educational sectors, among others.

Among the promotion actions that the municipality must perform are the following: Integral health for children, adolescents, disabled, elderly and the people that belong to the informal economic sector; sexual and reproductive health such as family planning and prevention of sexual transmitted diseases; prevention of domestic violence; tobacco and alcohol consumption; sanitary environmental conditions; public information about the adequate use of health services; promotion of social participation, and more that are determined by local priorities (Montoya et al., 2003).

The municipalities have to develop public health surveillance, and control of risk factors such as: quality of potable water, vectors that transmit diseases, recollection and analysis of the information of diseases that must have control, prevention of the following diseases: immuno-preventable, tuberculosis, bacteria meningitis, rheumatic fever, leprosy, sexual transmitted diseases, HIV/AIDS, cholera, rabbis, Hepatitis B, C, and D, the active search of cases with the diseases mentioned previously, and referral of the cases to diagnosis and treatment services, and investigation and control of the epidemics. Is the responsibility of the nation to obtain and distribute the medicines for tuberculosis, leprosy, leishmaniasis, and malaria; and the materials to make the diagnoses of immuno-preventable, tuberculosis, bacterial meningitis, rheumatic fever, leprosy, sexual transmitted diseases, HIV/AIDS, cholera, rabbis, Hepatitis B, C, and D, Chagas disease,

typhoid fever, syphilis, cisticerquiasis, dengue, yellow fever and others that can be defined by the ministry of health (Montoya et al., 2003).

Actual Functioning System

Many deviations occur from the theoretically mandated procedures explained above. For instance, a number of municipalities contract IPSs and EPSs, to supply the PAB services. Thus the importance of community participation and other creative and relevant portions of the plan are severely weakened. Some studies carried out by the Colombian Ministry of Health have shown that there is a lack of commitment and even apathy to support and enhance health programs on the part of the mayors of the municipalities. Also, researchers noted technical incapacity to make the system fully operational as well as a profound lack of clarity in the destination of the assigned resources (Montoya et al., 2003).

This new health system seems sound in its theoretical foundations but in reality there are severe problems at all scales that involve even the simplest tasks, such is the case of health card assignations. Card distribution is commonly managed through obscure procedures supported by negligent, dishonest political leaders who promote assignation of cards to their "best friends', to influential persons belonging to local elites, to individuals that support patterns of corruption in the local administration, and to individuals with the same political affiliation (co-partisans).

Another acute problem is bankruptcy of hospitals and health centers alike. This is due to the fact that the government does not pay on a opportune manner or completely fails to disburse to the health facilities the amount of money that corresponds with the service granted to a patient that belongs to the health system. The majority of hospitals in Colombia are insolvent; they do not have money to pay salaries to doctors and nurses and

even lack the basic resources required to offer good quality medical attention to the population. This is just one example of the irregularities and disorganization in the implementation of the health system established more than 12 years ago by constitutional mandate in Colombia.

Despite all the changes in the health system, and isolated efforts to correct some of its major flaws, many official reports indicate that public health in Colombia is deteriorating. Infectious disease control is worsening, and the morbid-mortality due to chronic disease has increased. The cases of violence, unwanted pregnancies, drug-addiction, and sexual transmitted diseases, principally HIV, are increasing.

Health System in Turbo

This research was conducted in Turbo, a municipality that belongs to the department of Antioquia. Today the health system in Turbo follows the national system explained previously. Because of the decentralization mentioned above, each municipality has its own health organization and autonomy. Each hospital is autonomous economically and administratively. The Ministry of Health is located in Bogotá, the Colombian capital, but it has branches in each department. The municipal government organizes the malaria program in Turbo, but the national government provides antimalarial drugs.

The health facilities consist of some EPS, one hospital in the urban area of Turbo called Francisco Valderrama, and a health center called San José, which belongs to the hospital. San José offers free services such as vaccination, prenatal control, and diagnosis and treatment for malaria. It is important to emphasize that, theoretically, the treatment and diagnosis for malaria is free in the hospital and in the health center. But the

price of the medical appointment (consulta médica) at the hospital depends on the type of health card that the patient has.

Situation of Malaria Program in Turbo

The problem of malaria in Antioquia department is related to the decentralization of health. Since the responsibility for health has been delegated to the municipalities, the program has not been well managed. Two main sections carry out the malaria control program:

- Preventive: this is the section that does vector control, mainly with fumigations, and provides community education. Six officials paid by the municipality do this work. Unfortunately, due to the disorganization of the municipality, this section has problems because the officials sometimes do not have insecticides to fumigate, and they do not have good instruments or enough time for community education. Insecticides are difficult to get for fumigations because of the underreporting of malaria cases to the Ministry of Health in the Colombian capital, Bogotá. When malaria cases are underreported to the national government, the government does not sent enough insecticide to the municipality. Households that may need the fumigations cannot be completely fumigated. In addition, violence blocks the fumigations in some villages.

- Curative: the work assigned to this section has been delegated to the hospital and the health center. These institutions offer diagnostic service (blood smear) and treatment (antimalarial drugs). The municipality in theory should pay these institutions for the service given to the patients in the subsidized regime, and should send the antimalarial drugs used for treatment to the institutions. Thus the institutions can give the antimalarial drugs to the patients. But the reality is that the municipality sometimes does not pay the institutions for the services and does not give them the antimalarial drugs, so the service is inefficient. Usually antimalarial drugs are sent by the Ministry of Health in Bogotá according to the number of cases in each municipality. But antimalarial drugs have been scarce as a consequence of different factors such as underreporting of malaria cases to the Ministry of Health and general disorganization in the generation and flux of information in Turbo and within the Ministry itself.

Health promotion and prevention in theory should be well organized; these should be very active in order to improve the health situation of the population. But in practice deficiencies are found in many areas. There are few human resources and the equipment is obsolete and inefficient.

In theory the money for the malaria programs should come from the government. The government gives that money to the municipalities and the respective official should distribute the money for the diagnosis, treatment (drugs), fumigations (vector control), and community education. But unfortunately, according to the information gathered in the interviews with some officials, the municipalities do not assign the money that should correspond to the malaria control program, apparently due to failures of an administrative personnel that is strongly affected by a generalized state of dishonesty, disorganization, bureaucracy, and corruption rampant throughout the country.

The Colombian Ministry of Health does not have a coherent policy for the use of chloroquine in the treatment of febrile syndrome, and does not promote the use of fansidar instead of chloroquine, as a measure to overcome chloroquine resistance, as is done in some African countries such as Zambia and Kenya. Fansidar is instead used as a regular treatment only in cases of malaria due to *P. falciparum*.

Health Procedures in Turbo

Regular Procedure for the Malaria Diagnosis

The diagnosis for malaria is traditionally made with a blood test called blood smear. The test is carried out by taking a drop of blood from the patient's fingertip with a lancet. The drop of blood is put on a small piece of glass, colored and dried. After a few minutes, the sample can be read in the microscope to observe the blood cells and the malaria parasite *Plasmodium* (for a better understanding see malaria cycle).

Diagnosis of malaria and subsequent treatment is also offered by the hospital but people seem to prefer going to the health center. The service at the health center is free, including the antimalarial drugs used for treatment such as chloroquine, primaquine, mefloquine, amodiaquine, and quinine, among others. Personnel who take the blood

smears at the hospital and the health center are bacteriologists or nurses especially trained for this task. But in the countryside there may be nurses, health promoters or community leaders who have learned how to do it in a very informal and empirical way. Health promoters are people from the community that have some training in very basic health procedures, such as taking blood pressure, giving shots, reporting the number of malaria cases to the municipality, etc. They perform a very important role within the community because they are part of it, so they are respected and people trust them. Health promoters usually receive very little monetary compensation from the government. Several years ago health promoters used to perform the blood smear test in the countryside, but, unfortunately, since about 1997, in a unilateral maneuver, the government decided to no longer use health promoters with the weak argument of "trying to reduce the cost of health programs." Today, the community leaders that take the blood sample to conduct blood smear tests are now volunteers; they do not receive any salary from the government. At times they charge a little money to the patients (1,000 Colombian pesos, equivalent to 30 cents in US currency). This money is used to pay the bus ticket to go to town, in this case Turbo, and take the samples to the health center to be processed and read.

Procedure of Seeking Help and Treatment

The ideal procedure for seeking help and treatment for malaria from the biomedical perspective would be that as soon as the person has fever or another symptom associated with malaria, he/she should go to the health provider or to the place where personnel will take the blood smear in order to know if the patient has malaria or something else. If the blood smear yields a negative result the first day, the patient should go back to get the blood smear again two more times, during two consecutive days.

If the blood smear is positive, the patient should receive appropriate drug treatment immediately, in the correct dose. Also, the patient should receive enough instructions so that he/she can follow the directions for drug usage as given by the health provider. Once the correct treatment is completed, the patient should go back to the health center to get another blood smear test on the days number 7, 14 and 21 after the first day of treatment. This is done to discard resistance to the antimalarial drugs, or other complications that can occur such as reinfection or recrudescence (when the patient takes the correct treatment and the level of the parasite in the blood decreases, but in a few days the level increases again). Retesting at days 7, 14, and 21 is rarely undertaken because of various reasons. Usually, health providers do not tell the patient he/she must return to be retested. In other cases, patients live so far away from the health center that they cannot afford the bus ticket or cannot abandon their duties. In addition, patients simply forget to return for retesting, and/or decide not to follow the instructions given to them by the health provider.

Procedure of Health Providers

Health providers, especially medical doctors, who work in endemic areas, should, in theory, prescribe the blood smear in the first visit to every patient that has symptoms leading to suspect a possible malaria infection such as fever, headache, chills, etc. Besides that, studies show that patients with such symptoms should avoid taking analgesics (pain killers) or antipyretics (fever killers) other than acetaminophen. When these drugs are taken before the blood smear, the *Plasmodium* can be hidden in the blood smear test, that is to say, the blood smear appears to be negative, but the person may in fact have malaria. The problem with this situation is that if the diagnosis in not made, the

person's health is eventually going to deteriorate and a moderate illness can easily advance to a severe stage of the disease, which requires very delicate treatment.

The pharmacies in Turbo town must sell most medications such as antimalarial drugs, antidepressants, meperidine, and psychoactive drugs (benzodiacepines) with prescriptions. Pharmacists know that the government passed a law prohibiting the sell of medications without prescription. Some drugs can be sold without prescription such as acetaminophen, ibuprofen, vitamins, and antihistaminic.

Irregularities of the Procedures Mentioned Above

Many irregularities alter the procedures affecting the quality of the service given to the patients. The irregularities mentioned in this section are as follows: The antimalarial drugs are given by the state, which sometimes is a problem because occasionally the government does not send some of the antimalarial drugs used for treatment and they have to be given to the patients incomplete. The only thing that patients need to bring to the health center to be attended is a copy of the birth certificate. This represents a difficulty many times for patients because they do not have it with them, and sometimes they have never even gotten it.

If blood smear gives a negative result in the first attempt, the patient should ideally go back to be tested again two more times, two days in a row. Unfortunately this protocol is rarely carried out. Although health providers know that this procedure is correct, they just say that they do not perform as they should due to "time restrictions." Moreover, a number of health providers do not follow the treatment or malaria recommended by the Ministry of Health, and sometimes the doses are incorrect. For instance, the treatment in children should be calculated by the weight (kilograms), but in reality it is done by age, maybe because of lack of rigor of the health provider or because of "time restrictions" as

some health providers assert. Another reason of bad treatment is that many times the health center or the hospital does not have the complete treatment to give to the patient. Besides that, health providers, in particular medical doctors that work in endemic areas, should supposedly prescribe the blood smear to every patient that has symptoms of probable malaria. Medical doctors rarely adopt this conduct, and the reason was not explored in this research.

Patients sometimes take analgesics or antipyretics other than acetaminophen without prescriptions or health providers prescribe some of the drugs mentioned above, which should not happen. The pharmacists often sell many medications without prescription even when they know that is against the law. Moreover, pharmacists sell even the medications that are more restricted, such as antibiotics, antidepressants, and antimalarial drugs.

All the procedures mentioned above show what really happens. The fact that all these irregularities occur is very delicate. The whole process of correct diagnosis and treatment offered to the patients is deteriorating. These irregularities contribute to the present malaria situation in Turbo, and should be addressed in order to improve the health of the population.

Summary of the Chapter

The malaria situation in Colombia is affected by the national health system that operates since the inception of new health regulations that came into effect with the 1991 national constitution. Although the new health system increases the coverage, it decreases its quality. In addition, it is putting the health sector at risk of serious deterioration due to financial problems. At least in part, the treatment-seeking patterns of the population are determined by the actual health system, which prevents some people from receiving

appropriate and opportune medical attention. When people are sick with probable malaria they may delay treatment or they do not follow the prescribed course of therapy. The patients may also receive inadequate treatment, partially due to the myriad of irregularities in the health procedures performed by health providers who, in theory, should be prepared to supply the population with correct attention, diagnosis, and treatment.

CHAPTER 4
FINDINGS REGARDING TREATMENT-SEEKING PATTERNS AND HEALTH CARE-SEEKING BEHAVIOR

Introduction

The previous chapter described the Colombian health system and the regular procedures for malaria diagnosis and treatment in Turbo. In this chapter the findings regarding treatment-seeking patterns and health care-seeking behavior of caregivers are discussed. It is essential to note that the vast majority of ill children with febrile syndrome are often treated at home by the caregivers, before any biomedically-accepted malaria diagnosis is carried out, and before they seek help someplace else. The first part of this chapter gives illustration of the meaning and the use of the words "malaria" and "paludismo" by the local people in Turbo. The purpose is to ensure a good understanding of what these words signify for the caregivers.

The second part presents the findings regarding treatment-seeking patterns that contain recognition of signs. In order to treat an illness in a timely manner, a caregiver must recognize when a child becomes ill, what are the symptoms of the illness, and the types of treatment for fever that caregivers may be able to provide. The third part of this chapter discusses the factors that affect the health care-seeking behavior of the caregivers, which are: availability of diagnosis and drugs, role and quality of provider, distance from the health center, paper work, and cost. The last part shows the different resorts to care and sequences of treatment that caregivers used for the ill child. Resorts to care are categorized, and both synchronic analyses (indicating frequency of use of each

resort to care) and diachronic analyses (indicating the sequence in which these resorts are sought) are presented.

Caregiver's Definition of Malaria and Its Cause

It is important to make a terminological clarification regarding the meaning and the use of the words "malaria" and "paludismo" among the local people in this specific study site. Malaria, for the majority of the population studied, means the group of people that work in the malaria program, specially the people involved in fumigation to control mosquitos in the households. What is defined as malaria by biomedical standards is called in this region paludismo, so the interviews took into account this definition of terms.

First it is necessary to understand what caregivers think malaria is and what they perceive as its causal factors. About four out of five caregivers in the sample knew that mosquitos' bites cause malaria, but they do not understand how the mosquito is involved in the development of the infection. The rest of the caregivers mentioned very interesting causes such as: taking a bath with cold water when the person is sweating, the bite of a bird (they do not attributed the disease to a special type of bird), drinking non-potable water, the fact of living in close contact with sanitary fields, breathing contaminated (polluted) air. A few of them simply claimed that they did not know.

There seems to be certain general recognition about the importance of the use of mosquito nets in preventing malaria infection. One caregiver said: "I know the importance of the mosquito nets because I can protect myself from the mosquito bite, but I have got some very old mosquito nets and I do not have the money to get new ones."

When the question of what is malaria was asked to the caregivers, the answers were quite diverse. Proportionally, the questions can be grouped as follows: malaria is when

one has symptoms such as fever and headaches, 29%; it is a virus, 17%; don't know, 16%; it is an illness, 10%; malaria is a dangerous disease, 10%; it is an infection produced by mosquito, 9%; malaria is due to a parasite in the human blood, 4%; it is an illness acquired by drinking non-potable water, 3%; it is an illness related to climate change, 1%; and malaria is a poison injected by mosquitos in the blood, 1%. These definitions suggest limited understanding of the infection process; at least from a biomedical stand point. Further, after the caregivers "define" malaria, they fail to accurately explain the details of malaria infectious processes.

Among the children included in the interviews, the most common symptoms they had when they went to the health center, besides fevers, were chills, headache, and vomit. They also mentioned, although less frequently, abdominal pain, and diarrhea.

The perceived illness of the child by the caregivers was malaria in 97% of the cases, which reflects that most of the people relate malaria with the symptoms mentioned above. It is important to note that 67% of the caregivers were the mothers (table 4.1). This is a sensitive point to be considered in the design and implementation of future health policies and community oriented education programs.

Findings Regarding Treatment-Seeking Patterns

Treatment-seeking patterns have two components: recognition of signs and treatment for fever. Recognition of signs is crucial as it determines how promptly caregivers interpret the signs of the ill child (e.g., fever, chills, and vomit) as an indication of malaria infection. Acting on accord with this recognition, caregivers can make decisions. The treatment can be accomplished using both traditional and modern remedies, and the type of treatment that caregivers carry out for fever is of paramount

importance because it determines the well being of the child and ultimately the severity of the illness.

Recognition of Signs

In order to treat an illness in a timely manner, a caregiver must recognize when a child becomes ill, and what are the symptoms of the illness. The illness narrative delved into what specific symptoms are considered to indicate the onset of the illness. In the narratives, fever appears to be an unambiguous indicator of infection. Mothers seemed to be aware of the initiation of a febrile process. They also managed to accurately track fever over a given period of time. Many narratives included descriptions of the intensity of fever at various intervals throughout a day. Fever is considered as a serious heath condition when it is high (above 39° C) or persistent, or when it is accompanied by other illness signs such as vomiting, weakness, headache, and/or chills. Other symptoms that caregivers attributed to malaria and that were less frequently mentioned were: diarrhea, delirium, dizziness, and thirst.

Treatment for Fever

Fever is something that warrants attention, but at the same time, fever is so common that is not immediately considered a serious health threat. Typically, the initial response to fever is to treat at home and monitor the child's general health condition. Ninety two percent of the 67 caregivers reported some form of home treatment as their first response to febrile illness (table 4.2).

Home treatments embrace both traditional and modern remedies (figure 4.1). Common home treatments include the following procedures:

Sponging/bathing: Sponging/bathing is practiced both with cold and/or warm water and sometimes with herbal infusions that are thought assist in lowering the fever.

The herbs most commonly used are: rosa amarilla and matarratón (*Glicidia sepium*). Less commonly used are: balsamina (*Impatiens balsamina*), lemon leaves (*Citrus limon burman*), orange leaves (*Citrus sinensis* and *Citrus aurentium*), guandul (*Cajanus indicus*), anamú (*Petiveria alliacea*), malba (*Lavatea arborea, Malachra rudis,* and *Malvastrum peruvilanum*), bonche, gallinaza (*Phorophyllum ruderale*), venturosa (*Lantana sp.*), and avocado leaves (*Persea gratissima*) (figure 4.2). Over 28% of the caregivers in the sample reported the use of warm or cold water and over 34% the use of bath with herbs. Caregivers assert that this is one of their initial responses to treat child's febrile episodes. Just one caregiver said that the herb matarratón is useful for fevers that are not due to paludismo; the rest of the caregivers that used this herb seem to attribute some antimalarial power to it.

Commercial antipyretics: Commercial antipyretics were used at home in 85% of the sample cases as initial treatment. Some of these were acetaminophen, aspirin, buscapina, and ibuprofen.

Herbal beverages: Herbal beverages were given as initial treatment in 7% of cases. The herbs used include: anamú (*Petiveria alliacea*), cilantro, onion, yanten, ajenjo, paico, matarratón (*Glicidia sepium*), garlic, and/or lemon. Aguardiente, a common alcoholic drink, is sometimes used as part of the treatment in conjunction with the herbs. All of these substances were mentioned with the same frequency (10% each), although under certain circumstances, not clearly defined by the interviewees, a mixture rather than a single component is employed.

Chloroquine and primaquine: Conventional antimalarial drugs were given at home as a first response in just one case of the sample. These medicines are used without

prescription and in underdose. This finding suggests that the use of antimalarial drugs in the sample is not a common practice. An alternative interpretation is that, because of the fact that the interviewer was a trained medical doctor, the interviewees may have misleadingly avoided to admit that they, in fact, do use antimalarial drugs. In addition, the interviews with pharmacists clearly suggest that people commonly buy antimalarial drugs without prescription and in an underdose. Some antibiotics, antihemetics (to stop the vomit) and vitamins are also used, in conjunction with antimalarial drugs by a small number of caregivers. These medications are also purchased over the counter.

Some caregivers are aware of the danger of giving pills to the child without diagnosis and without prescription. Ten (10) out of 67 caregivers expressed: "If I give some pill (other than acetaminophen) to the child, the diagnosed will be hidden and the blood smear can yield a negative result, when it should be a positive one because the child has paludismo." One indigenous caregiver (Embera Katío group) said: "I cannot even give breakfast to the child before the blood smear because the diagnosis can be obscured." All of these statements seem to be partially based on biomedical information transmitted to the community, but with some degree of unintentional tergiversation.

Biomedical standards suggest that if some antipyretic other than acetaminophen is given to a child infected with malaria, the blood smear test can produce a "false negative" result, which means that the diagnosis could be negative even though the child has malaria. This has been explained as a consequence of the effect of the antipyretics over the parasite in the blood.

There is also evidence that people educated within the biomedical system are promoting community education on malaria, chiefly through radio programs that address

the use of antimalarial pills. One of the interviewed caregivers expressed: "I learned from the radio that one should not give any antimalarial pill like chloroquine and primaquine to sick people, including children, that have some symptom related with paludismo, before one seeks help in the hospital or health center. Since then, I do not do it, but I used to do it before."

It was also found that when children that do not receive full treatment with antimalarial pills, due to different factors such as vomit or loss of the pills, caregivers are not cautious enough about getting the pills again. In fact, some caregivers do not seem to care at all, instead they wait until the child gets fever again or some different symptom related to paludismo, to seek help at the health center. Evidently, from the biomedical perspective, if the child does not receive full treatment he/she will not be cured, but it seems that probably caregivers are not aware of this risk or they are not concerned about it. Stated abstractly, symptomatic relief tricks the caregivers, thinking the illness has gone away.

Thirty six percent of the children were taken to the health center within 36 hours of the caregiver noticing fever. The average of days that the child had been sick before going to the health center was 6 days. All this indicates that the response is not as quick as it should. Strictly speaking, caregivers should ideally take the child to the health center within the first 24-48 hours of symptoms.

Factors That Affect Health Care-Seeking Behavior

There are many factors that influence the health care-seeking behavior of the caregivers. The findings of this study show that the most important factors were: availability of diagnosis and drugs, role and quality of provider, distance from the health center, paper work to be completed, and cost associated to medical services.

Availability of Diagnosis and Drugs

It was clear that there were two major reasons why caregivers went to the health center: the possibility of getting a correct diagnosis by means of the blood smear test, and to obtain the drugs for treatment.

Role and Quality of Provider

In this particular study the term "health provider" refers to five categories: medical doctors, pharmacists, traditional healers, community leaders, and bacteriologists. All of them play a specific role in the healing process of a child with febrile illness.

Caregivers generally have a high level of confidence in the formal biomedical health system for treating childhood febrile illness. They believe that providers have medical expertise as to provide appropriate treatment for their children. They also believe that bacteriologists that perform the blood smear are very well trained and that the diagnosis given by them is unmistakable.

Some caregivers consider that malaria is a very serious health problem and that is very important to quickly seek medical attention in the health center: "…I have to go fast to the health center to get the blood smear because I need to know if the child has paludismo." However, some times even the medical doctors did not prescribe the blood smear to the child, which should be a essential step in the diagnosis protocol as explained in chapter three in the section of health procedures. Often caregivers visited medical doctors (17 times out of 67) before they went to get the blood smear at the health center and some of the medical doctors (9 out of 17) did not prescribe the blood smear for the febrile child. On many occasions the caregivers went to get the blood smear for the child pushed by their own initiative, even after they visited the medical doctor who did not prescribe a blood smear test. Some caregivers stated that before they took the child to the

medical doctor they went to the health center to get the blood smear to make sure that the child did not have paludismo. If the blood smear was negative, the caregiver went to the see the medical doctor; otherwise the caregiver would start malaria treatment without delay and without the doctor's consent.

Nevertheless, despite the confidence that caregivers manifested to have on medical doctors, there are also few caregivers who believe that health providers other than medical doctors are as capable in treating paludismo. One caregiver expressed his doubts regarding the role of a doctor as a reliable healer: "…if the child is sick with paludismo, medical doctors cannot cure the child." Unfortunately caregivers did not give more information about this idea. This shows that there is an important belief nonetheless: paludismo cannot be well treated by standard biomedical procedures. However, this belief is not widespread, because the idea that doctors can handle malaria infection successfully still prevails among the majority of the population interviewed.

Two out of five medical doctors interviewed did not know how to treat patients with malaria. They did not remember the different antimalaric drugs used, the combinations and/or the dose. They seem to concur on several issues such as the most common symptoms related to malaria infection, the blood smear as the most reliable procedure for diagnosis, and the correct treatment for convulsions and fever. Doctors are aware of the fact that they live and work in a malaria endemic zone and they asseverate that they always send the blood smear to the children that have fever. However, this conflicts with the findings in the interviews with the caregivers, because in many cases, as asserted by the caregivers, medical doctors did not send the blood smear to the sick

child. Therefore, there is probably a gap between what medical doctors "say they do" and what "they really do."

The other category of health providers that was explored in this investigation was that of the traditional healers. Based on interviews with both caregivers and traditional healers, three types of traditional healers were identified:

1. Rezandero (prayer). This is usually somebody within the community, without any formal study, that is believed to have spiritual power for healing. He/she is sought when the illness is believed to have a spiritual cause. The way in which healing takes place is by praying, and by performing some rituals with the ill person. The rezandero may or may not use herbs beverages.

2. Traditional healer with some degree of formal study, diploma and with homeopathic orientation. This healer uses also traditional herb beverages.

3. Traditional healer without any formal study, more empiric in his approach. His procedures are based on experience, trail and error, and learning from someone else. This healer also uses traditional herb beverages but does not pray.

At least among the caregivers that were interviewed, help from the traditional healers was not commonly sought. Just three caregivers sought help from traditional healers. One caregiver gave home treatment to the child and after that, visited the traditional healer (the caregiver referred to him as "rezandero"), who gave the child a beverage with herbs (matarratón and paico) and did some prayings. This treatment was undertaken because the traditional healer suspected that the child had intestinal worms. Another caregiver gave home treatment and after that, went to the traditional healer (the caregiver also referred to him as "rezandero"). This traditional healer just said prayers for the child but no beverage. A third caregiver also proceeded with home treatment for the child and after that, went to the traditional healer, (the caregiver also referred to him as "rezandero") who gave the child a beverage made with lemon, sugar, garlic and said some prays. This treatment was also carried out based on the traditional healer's

assumption that the child had intestinal worms. It is important to clarify that the traditional healers that were interviewed were not the ones mentioned by the caregivers because they could not be found. None of the traditional healers mentioned by the caregivers appear to have thought about malaria as a cause of the child's illness. In contrast, the traditional healers that were interviewed mentioned that they often do handle children with paludismo, and they described the type of treatment they use.

The traditional healers that were interviewed do not use prayers, just beverages; a procedure that appears to be different from the treatment enunciated by the caregivers that sought help from traditional healers. Furthermore, it was found that malaria is not a disease that fits a spiritual explanation. People interviewed (caregivers and traditional healers) do not consider paludismo as an illness produced by spiritual disorders (for more information see the appendix that shows the interviews with traditional healers).

The third category of health providers is pharmacist, which plays an important role in the health care-seeking process. According to the narratives, it appears that caregivers do not go very often to the pharmacist to buy pills without prescription. Just two caregivers went to buy medicine to the pharmacy without prescriptions before they went to the health center to get the blood smear. One pharmacist gave the child acetaminophen and the other gave the child 10 pills of chloroquine, with instructions to take one every day for ten days, an incorrect dose according to biomedical standards; and five injections of the antibiotic dispacilina also prescribed in the wrong dosage.

With the same rational used to describe the role of the medical doctor and the traditional healer, the pharmacist can be considered in this research as another type of folk healer. The pharmacists that were interviewed at the beginning of the field work did

not want to admit that they were selling antimalarial drugs without prescription, but when the method of interviewing was changed and the strategy adopted was that of going to different pharmacies asking for antimalarial pills, the pharmacists were offering any amount of pills saying: "yes I have antimalarial drugs, how many do you want?" Evidently they were selling them without any restriction, and usually in the wrong dose. One pharmacist mentioned that most of the people that buy chloroquine without prescription to stop fever are indigenous people, which can show that this could be considered a predominant behavior among a specific ethnic group. It is important to state clearly that the term "pharmacist" refers mostly to a drug vendor without any training or formal study.

Distance from the Health Center

Caregivers who came from rural areas expressed that for them it is very difficult to go to the health center because it is so far away and they may have to walk, ride a horse, or pay a bus ticket. All these things considered together encompass a lot of effort, consume time and cost money. Going to the health center means a lost labor day; a risk they cannot take because of the widespread precarious economic situation in the region. The community leader who was interviewed lives in a village called Las Mercedes, which is approximately 4 hours away from the health center. She mentioned that many people in her village live at a greater distance. They get very sick and cannot go to the health center, so she has to do domiciliary visits (for more information see Appendix B that includes the interview with the community leader).

Paper Work

In order to be serviced at the health center, people have to do some intricate, time-consuming paperwork. Parents have to bring a copy of the birth certificate of the child;

most of the caregivers do not have it. Therefore paper work requirements sometimes are responsible for delays in the response to malaria treatment. One caregiver noted: "Too much paper work to be taken care of."

Cost

In order to be served in the hospital the patients need to make a co-payment according to the level of the health-card, but some people do not have the money to pay it. Even worst, when they do not have the card because of whatever reason, even if they need care, people cannot go to the hospital because they cannot pay $20,000 Colombian pesos (US $5 dollars), which is the full price to cover a visit to the general doctor. This economic factor is a very crucial issue because it is one of the reasons why sometimes people prefer to go to the health center to get the malaria diagnosis for free rather than go directly to see the medical doctor at the hospital. Thus, as noted before, if the blood smear is negative, which means that they do not have malaria, they go to see the medical doctor at the hospital for further diagnosis. Some caregivers state: "I prefer to have malaria than other illness because for malaria I have the diagnosis and treatment for free, whereas if I have another illness I have to go to the hospital to see the medical doctor and I can not afford it."

The reality in terms of health coverage is that approximately 50% of the population in Turbo does not have any health card to access medical service, which greatly affects the decision-making process of caregivers, and the type of treatment they give to the child. It is important to note that these decisions of the caregivers are also influenced by culture.

In the hospital some irregularities occur, for instance, hospital representatives charge for the blood smear on Sundays, not only a detestable but an illegal practice

because blood smear tests were established as a free service. Since people do not have the money to pay for "Sunday's blood smear testing" they simply go and buy an incorrect dose of antimalarial drug in the pharmacy without prescription or use herbs at home.

Resorts to Care and Sequence of Treatment

Each of the illness narratives provided a chronological account of where care was sought for a case of fever occurring prior to the interview. Thus they provided the information for a synchronic analysis that documents frequency of use of a particular resorts to care, and the diachronic analysis that shows the sequence of resorts to care. Caregivers in the sample had the following options for sources of care: Home treatment, health center, traditional healer, pharmacy, and public or private medical doctor.

1. Home treatment: this category includes any treatment given at home, whether traditional or modern. Here the locus of decision-making is the caregiver. If, for example the caregiver decided to buy antimalarial drugs or an antipyretic and give it at home, this was included in the home treatment category. Also included in this category are traditional treatments such as herbal remedies, and sponging.
2. Health center: caregiver took the child to the health center.
3. Traditional healer: caregiver took the child to a traditional healer.
4. Pharmacy: caregiver went to the pharmacy to get medications without prescription.
5. Private or public medical doctor: caregiver went to the hospital to see the medical doctor (public), or went to see a private doctor in his/her private office.

Table 4.2 is a synchronic analysis showing the percentage of sample cases involving, at any point in the illness, a particular resort to care. The table shows percentages of all cases. These percentages add more that 100%, since caregivers often seek care from multiple resources.

The diachronic analysis showed in table 4.3 looks at the sequence in which treatment was sought from each of these sources. Each narrative was characterized by only one sequence; therefore, percentages add up to 100%.

Some caveats should be noted in interpreting sequential analyses. Sometimes treatments are virtually simultaneous, as is the case when a mother gives a pill to the child and sets off for the health center. In other cases, even though initiation of treatment is sequential, some treatments may be given simultaneously if one is started while another is continuing.

Amount of Children with Paludismo in the Sample

Two bacteriologists and the medical doctor that work at the health center attending patients that exclusively go to get the blood smear, said that they see an average of 20 children per day with probable malaria and 30% of them have positive blood smears, that is, they have malaria. Approximately, each medical doctor at the hospital sees an average of 10 children per day and 30% have positive blood smears.

Among the people included in the narrative sample (N = 67), there were a total of 18 children that had malaria, which represents 27 %: 14 children with malaria by *P. vivax*, 3 children with malaria by *P. falciparum*, and 1 child with mixed malaria (*P. Falciparum* and *P. vivax*).

The information presented in this chapter is crucial for a good understanding of the role of caregivers in the treatment of childhood malaria in Turbo. The research indicated that the care-seeking patterns and treatment-seeking processes are driven by multiple and complex factors that need to be taken in to account in future interventions. What caregivers “think” and “do” is described, and based on that, the recommendations is that good health education programs can be implemented with the aim of improving the

treatment that caregivers provide to children, and health standards of the community in general.

Summary of the Chapter

The meaning and the use of the words "malaria" and "paludismo" for the local people in Turbo are different. The term malaria usually refers to the group of people that work in the malaria program doing things such as fumigation of the household or diagnosis (blood smear), whereas paludismo refers to the disease itself. The recognition of signs by the caregivers is very important and mothers seem to be aware of fever's onset as well as its course over a given period of time; many narratives included descriptions of the intensity of fever at various intervals throughout a day. Fever is considered serious condition when it is high or persistent, or when accompanied by other illness signs such as vomit, weakness, headache, and/or chills. Typically, the initial response to fever is to treat at home and monitor the child's general health condition. The majority of the caregivers reported some form of home treatment as their first response to febrile illness. Home treatments include both traditional and modern remedies such as sponging/bathing with cold or warm water and sometimes with herb infusions to lower the fever, use of commercial antipyretics such as acetaminophen and aspirin, herbal drinks, and less commonly the use of chloroquine and primaquine. The factors that influenced the health care-seeking behavior of the caregivers were: availability of diagnosis and drugs, role and quality of provider, distance from the health center, paper work, and cost.

Different resorts to care and sequences of treatment were found. The majority of caregivers gave home treatment at some point during the child's illness. Further, the most common sequence of treatment was home treatment first and later caregivers went to the

health center to get the blood smear and receive the antimalarial drugs for treatment if the child had malaria infection.

Table 4.1: Characteristics of narrative sample (N=67)

Mother is caregiver (interviewee)	**67%**
Caregiver's media age	35 years
Child's median age	7 years
Gender of child	
Female	46%
Male	54%
Place of origin	
Rural	63%
Urban	37%

Table 4.2: Resorts to care

Resorts	**N**	**%**
Gave home treatment	62	92
Consulted pharmacist (without prescription)	3	4
Consulted public or private doctor	18	27
Consulted traditional healers	4	6
Total N	67	

Table 4.3:Sequence of care-seeking. Number and % of cases following a given sequence of care-seeking.

Sequence	**N**	**%**
Home→ Health Center	40	60
Health Center	5	7
Traditional healer→ Home→ Health Center	1	1
Home→ Traditional Healer→ Health Center	3	4
Home→ Hospital→ Health Center	9	13
Home→ Private Doctor→ Health Center	5	7
Home→ Pharmacist→ Hospital→ Health Center	2	3
Private Doctor→ Home→ Hospital→ Pharmacist→ Health Center	1	1
Home→ Hospital→ Private Doctor→ Health Center	1	1
Total N	67	

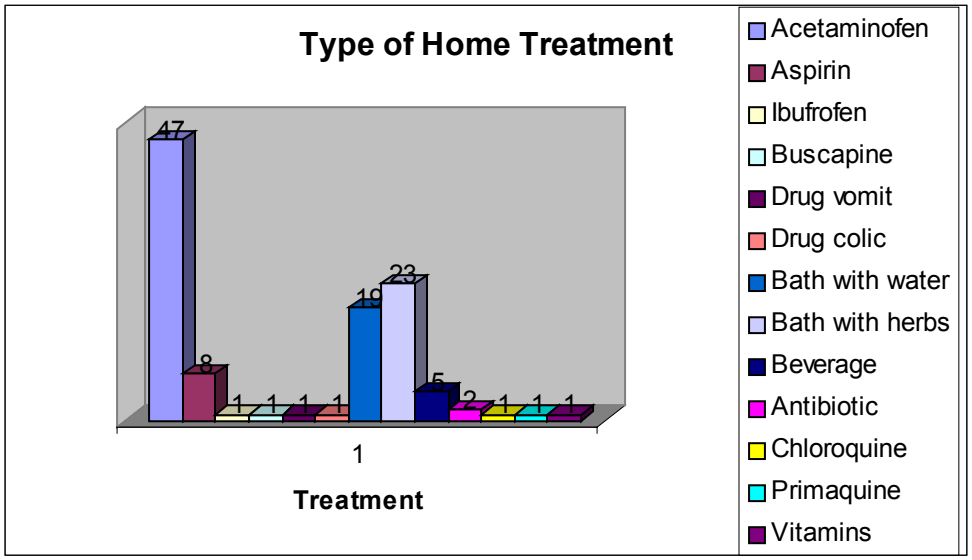

Figure 4.1: Types of home treatment.

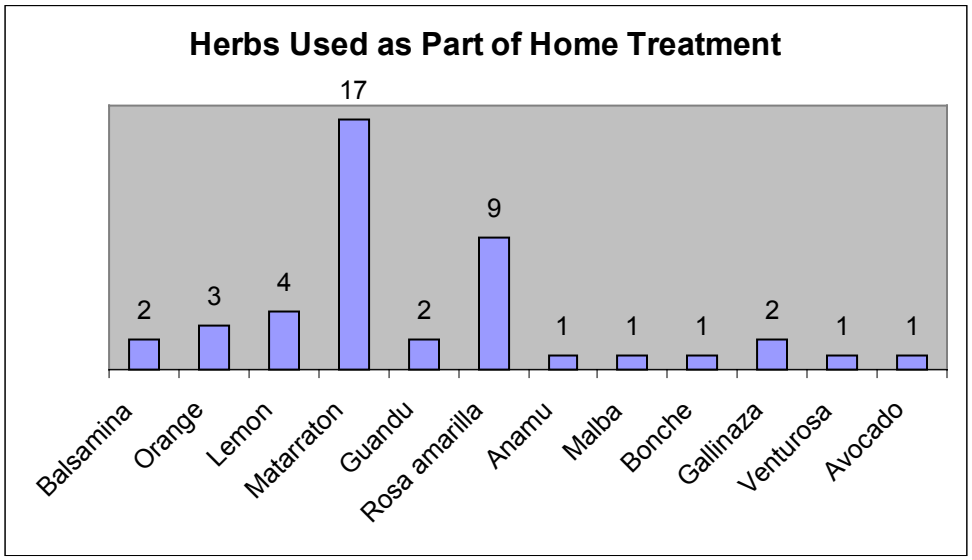

Figure 4.2: Herbs used to bath the children.

Table 4.4: Vulgar name and the scientific name of the plants that were most commonly used for home treatment.

Vulgar name	**Scientific name**
Balsamina	*Impatiens balsamina*
Guandul	*Cajanus indicus*
Anamú	*Petiveria alliacea*
Lemon	*Citrus limon burman*
Orange	*Citrus sinensis. Citrus aurentium*
Matarratón	*Glicidia sepium*
Malva	*Lavatea arborea, Malachra rudis,* *Malvastrum peruvilanum*
Gallinaza	*Phorophyllum ruderale*
Venturosa	*Lantana sp*
Avocado	*Persea gratissima*

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Malaria is a disease affecting the health of a substantial portion of the population in tropical regions of the earth. It is the leading infectious cause of childhood death, claiming the lives of 1.5 to 2.7 million persons of all ages each year. The mortality rate is particularly high in developing nations of African, Asian and Latin American, where malaria is highly endemic. Despite the efforts of experts and the implementation of different strategies to eradicate this disease, malaria remains a serious threat to world health. Some of the problems faced by investigators are related to the inherent complexity of issues involved in the growth of this malady.

Researchers have identified social, economic and cultural factors that affect exposure to malaria and infection. The increasing rates of malaria morbidity over the past few years are influenced by changes in the parasite and vector. Certain human behaviors also contribute to the higher rates; these behaviors are related to both individual and culturally coded patterns and to larger-scale sociological phenomena including political and economic factors. Higher levels of malaria disease and mortality have been linked to lack of access to adequate medical care and appropriate antimalarial medication. The access to these resources is associated to social stratification, both within and between countries.

This research undertaken in Turbo, Colombia is presented as a case study. Colombia is a malaria endemic country in 90% of its territory, which means that it

permanently has malaria transmission and infection. The number of reported total cases in the country doubled: from 71,012 cases in 1999 to 139,542 cases in 2002. The increase is due to multiple factors affecting a vulnerable population. Displacements, migrations, irregular climate, and environmental alterations associated with the production of illegal crops puts the bulk of the population at risk, making them more susceptible to malaria now than in the past.

Caretakers of children face challenges in providing them with adequate care. The health narratives of this research showed that caregivers have incorporated a wide variety of definitions for malaria. The most common are: when one has symptoms as fever and headaches, virus, don't know, illness, dangerous disease, and infection produced by mosquitos. These definitions indicate the limited understanding of the caregivers. Generally, after they enunciate what they envision as malaria, most could not provide further explanation. Caregivers expressed their lack of understanding of the nature of the disease. In addition, they could not present detailed information about the underlying causes for malaria infection, identify feasible and effective treatment procedures, suggest prevention schemes, or objectively judge the significant danger posed by the disease.

What some caretakers stated showed the obvious mismatch between what they believe are the ultimate causes of malaria and the biomedically-established cause. The majority of caregivers knew that mosquitos' bites are the cause, but they did not understand how the mosquito is involved in the development of the infection. Other caregivers mentioned interesting and inventive causes such as taking a bath with cold water when the person is sweating, the bite of a bird (they did not attribute it to a specific bird), drinking water that is not potable, living in close contact with sanitary fields, and

breathing contaminated (polluted) air. A few caregivers simply said they did not know what causes malaria.

The majority of the caregivers interviewed in this research were mothers (67%). This is a point of paramount importance, because planners of community education programs could design them to meet the needs of the majority of the caregivers. Mothers indicated that they were aware when fever started, as well as its course over a given period of time. Fever is considered a serious health problem when is high or persistent, or when is accompanied by other illness signs such as vomiting, weakness, headache, and/or chills.

Fever is something that warrants attention. At the same time, fever is extremely common, and is not immediately considered as a serious symptom. Typically, the initial response to fever is to treat at home and monitor the child's health condition. It is very important to emphasize that home treatment is widely implemented by most of the caregivers as their first response to febrile illness. Synchronic analysis (indicating frequency of use of each resort to care) shows that a great deal of treatment takes place in the home, and the diachronic analysis (indicating the sequence in which these resorts are sought) shows that the most common pattern is to give treatment at home first (either modern remedies such as antipyretics and antimalarials or/and traditional remedies such as baths with herbs, and beverages are used), and then take the child to the health center. The majority of home treatment was carried out using commercial antipyretics such as acetaminophen, aspirin, buscapina, or ibuprofen, or practicing baths with water and/or baths with herbs. Among the herbs the most commonly used are matarratón and rosa amarilla. Herbal drinks were given as initial treatment in the minority of cases.

Antimalarial drugs (chloroquine and/or primaquine) were given at home as a first response in just one case of the sample, in an incorrect dose, and without prescription.

The research findings in the interviews with pharmacists show that the practice of selling/buying antimalarial drugs without prescription and in incorrect dose is prevalent in Turbo. Few people used antibiotics, antihemetics or vitamins. However there is certain awareness among some of the caregivers about the danger of giving pills to a child that has not been diagnosed. This idea may have resulted from biomedical information that reaches the community through radio programs or other on site activities, yet the information is somehow distorted and mixed-up as people do not really know the fundamental aspects of malaria infection or treatment. The vast majority ignores what malaria really means in terms of its implications for human life. For instance, the generation of parasite resistance to antimalarial drugs, resulting from incomplete treatments, does not seem to be clear for anyone in Turbo.

Often, malaria treatment with chloroquine and primaquine is interrupted because symptomatic relief tricks the caregivers, who may think that the illness has gone away. There is not knowledge about the implications that this erroneous treatment pattern has in the child's health, which constitute a sensitive point.

The caregivers usually delay the treatment- seeking process and the response is not as rapid as it should be. In average, it takes 6 days for a caregiver to seek medical advise at a hospital or other health facility. Caregivers should ideally take the child to the health center within the first 24-48 hours after symptoms first appear in order to prevent complications of the child's health.

Many factors affect the health care-seeking behavior of the caregivers: availability of diagnosis and drugs, role and quality of provider, distance from the health center, paper work, and cost. The research findings show two major reasons why caregivers go to health center: the possibility of having a correct diagnosis using the blood smear, and to obtain the drugs for treatment. Furthermore, caregivers generally have a high level of confidence in the formal biomedical health system for treating childhood febrile illness. They believe that providers have medical expertise and, hence, will provide appropriate treatment for their children. Despite the confidence in medical doctors, some caregivers believe that health providers other than medical doctors should be the ones who treat children with paludismo. The research also shows that the procedures that medical doctors follow with patients who have probable or proved malaria infection are, in many cases, wrong. Inexplicably, some medical doctors, albeit the fact they are working in such an endemic malaria zone, do not know how to treat patients with malaria infection, a major problem that deserves further investigation and all the attention form the health authorities in Colombia. The official health care system is established in Turbo (with all its imperfections) and patients generally assume that they can trust doctors, who should be responsible for providing correct diagnosis and treatment. However, medical doctors often violate the simplest protocols such as verifying that children with malaria like symptoms do not have malaria. Thus, medical doctors often fail to prescribe blood smear test to children with febrile illness.

Based on the interviews with caregivers and with the traditional healers, three types of traditional healers were identified: rezandero (prayer); traditional healer with some degree of formal study, diploma and with homeopathic orientation; and traditional healer

without any formal study. The caregivers who were interviewed did not commonly seek help from the traditional healers. None of the traditional healers mentioned by the caregivers appear to have thought about malaria as a cause of the child's illness. In contrast, the traditional healers that were interviewed mentioned that they do handle children with paludismo, and they described the type of treatment they use. The interviews suggest that malaria is not envisioned as a disease that fits in with an explanation from the spiritual world, that is to say, caregivers and traditional healers do not consider paludismo as an illness produced by spiritual disorders.

Other factors that influence the treatment-seeking process are related to the personal situation of the caregivers. Distance from the health center is a serious constrain for many. Economic factors related to the cost of transportation and payment for medical attention is an overriding issue. People sometimes prefer going to the health center where they can obtain malaria diagnosis for free than going directly to see the medical doctor at the hospital. Ability to pay for treatment is also related to the discrepancies in the existing Colombian health system. This study discusses the many disparities and problems in the system that affect medical attention in terms of quality and access.

A major finding of this research, is that a dual system of health care exists in turbo, with caregivers utilizing both, an observation that is in agreement with Professor Alan Burns' description of what he terms *Pluralistic Medicine:* a mixture of biomedicine and traditional medicine, accepted and used by the people.

Recommendations

First, good educational programs should be implemented as soon as possible. Such programs should be directed to caregivers, especially mothers, who most often provide care for sick children. Program planners need to take in to account caregiver's knowledge

and beliefs. Assisting medical doctors and staff in understanding and respecting people's beliefs will strengthen the communication between caregivers and educators. Medical doctors could then provide instruction in terms people could understand and accept, thus empowering caregivers who could incorporate in their homes what was thought to be medically beneficial. Caregivers would have a clearer idea of the implications that malaria has for the people's health especially children. The space for these education programs should be in and outside health institutions so that people could have easy access to these programs. One example is the use of radio as an efficient media of communication for education. The research findings showed that some of the information caregivers learned has been from radio programs. People are more comfortable in family settings, so program developers should take advantage of existing community organizations and structures, using them as communication channels for disseminating information about appropriate assessment of febrile illness, specifically malaria, and effective methods for malaria treatment. The position of health promoters in the villages should be created and supported again, considering that they play an important role in the community and can attend and educate people around them more effectively than in a centralized scheme.

The government and the municipalities must address issues related to the control on drug supply, enhancing the monitoring of antimalarial drug supply to the pharmacies, and educating people, pharmacists and drug vendors about the importance of correct use of antimalarial drugs. Research indicates that the majority of pharmacist and drug vendors are not trained. The education to pharmacists and drug vendors would be especially beneficial as better-trained professionals will be have the necessary competence to give

correct instructions to their customers. The implementation of strong education programs for medical doctors that work in endemic areas is another important element in the design of programs to combat the increase of malaria. Medical personnel with a thorough understanding of community culture could give better attention to their patients and could prescribe the required treatment, and give advise correctly and opportunely.

Community leaders will benefit from the creation of educational programs but they must also be encouraged to actively participate in the design and execution of such strategies. Although the people interviewed in this research do not commonly use traditional healers, the latter could serve as good communication channels. They could also learn more about malaria by being exposed to the biomedical approach to the disease and use this information to complement what they know, thus enhancing their competence to help the people.

Researchers and health providers should pay attention to the knowledge that local people have about the traditional treatment of malaria. This knowledge should be a key component in the design of research strategies to study the medicinal plants mentioned in this investigation in order to verify if they have some active ingredient that could be the basis for creating new antimalarial medicines. Promoting the use of these plants may be appealing within the context of the local culture. A necessary step is making sure that such plants do not have other active ingredients that can be dangerous for human health.

Future research projects should also focus on the history of the use of different antimalarial plants in Colombia, specifically in the area of Turbo, to elucidate, from the biomedical point of view, why people use such the plants, what are the outcomes of such usage, and what are the sources of knowledge.

New governmental policies should be implemented in order to improve people's life, which would ultimately result in a reduction of malaria cases. These changes would be reflected in the malaria situation because as it was showed before in chapter four, the way the overall health program operates directly affects the malaria condition.

Although it sounds ideal, the last recommendation would translate into a change in the Colombian health system allowing a better coverage in terms of both the number of people that can access medical services and the quality of services offered. In such scenario, patients could seek treatment easier without all the barriers that the actual health system now has in place. The malaria program directed by each municipality must be improved and should be more effective and more organized in terms of report of malaria cases with the aim of obtaining more antimalarial drugs and perhaps more insecticides for fumigation. Although insecticides are dangerous for health in general, they are almost unavoidable under certain circumstances.

Future investigation should be carried out in the area of medical anthropology related to the malaria field in rural and urban areas in Turbo, and in different regions of Colombia that are affected by malaria disease. The findings from these studies may be beneficial for improving the communication between biomedical doctors and local people in order to reduce malaria cases in Colombia. The implementation of new sound policies and education programs for the community should be based on the findings of these research studies. This is a necessary step if we are supporting the construction of a health system that improves the health and quality of life for people, especially those who have problems related to malaria.

Finally, programs that lead to early treatment of the disease will decrease the human and economic cost associated with malaria, thus lowering the overall cost of this disease to the community and the nation.

APPENDIX A
INTERVIEWS WITH TRADITIONAL HEALERS

Interview with Traditional Healer #1

1) Types of patients this provider treats

I treat adults, children, and elderly people

2) Volume of children this provider sees with fever and /or convulsions

I see five every week

3) Providers idea of:

Symptoms associated with malaria
Children with paludismo have fever, "confusion" (weakness), and cold. Adults have fever, and chills. I recognize that they have paludismo by checking the urine. I usually send them to the hospital to get the blood smear for the diagnosis and they bring me the result. If they do not have paludismo, I give them some remedies for the fever like bath with matarratón and syrup, and dipirona drops or injections. When the fever in the child is very high, I give him/her "cataplasmas" (smashed herb and put on the forehead) with matarratón and that helps him/her to stop the "fogaje" (burning sensation) of the fever, and for older children I give them dipirona injection and if I suspect that they have an infection, I give them other types of medicines.

Cause of malaria
In children, the cause is the provision of water without boiling that has many parasites, and the mosquito bite can infect them as well.

Treatment of malaria
He does not like to intervene when a child has paludismo and he sends them to the hospital where they receive the treatment. When the child is so weak I give him/her some pills of calcium or vitamins to increase the strength and appetite.

Types of convulsions, cause and treatment
There are convulsions due to fevers, parasites, and also when children are born with a "mal de nacimiento" (something wrong since birth), that is when mothers are very angry during pregnancy the child is born with a "mal de nacimiento" and that never heals so the children can probably dye. When this "mal" is diagnosed they can have convulsions and asthma. Some of the children that are born with this "mal" do not experience any symptom until they are around four years old and they start with "ataques" convulsions and they will have to take a medicine for the rest of their life in order to stop convulsions

because that is epilepsy. This is a commonly used folk explanation for epilepsy. For the epilepsy I treat them with chives and red onion cooked in one liter of water with a bit of peppermint and sugar, the child will drink one teaspoon of this beverage before each meal.
Some of the convulsions can be present during paludismo but this is so because of the fever and they will stop once the infection stops. These convulsions are not present for the rest of their lives.
I have seen children here convulsing when I suspect they have paludismo and I always send them to the hospital and I do not give them anything until they bring me the result of the blood smear.

Types of fever and cause
There are many causes of fever:
- When people "se moja acalorada" (get wet when they are sweating).
- When people have injuries
- When they have different infections.

Treatment of fever
I always discard paludismo. If the fever is not due to paludismo I give them a beverage that I prepare with three plants: diente de león, balsamina and cola de caballo. The person drinks that beverage instead of regular water once or twice a day. Besides this beverage, I give them sometimes dipirona, ibuprofeno, acetaminofen.

4) Referral to other providers: whether she/he advises patients to consult another provider, whether she/he ever advises patients to consult formal health system.

When children have some infection and they have for instance so much diarrhea, vomit, headaches, I send them to the hospital to get test of the feces.

5) Cost of treatment and attention:

The cost of the attention is 10,000 pesos (US $ 3 approximately) plus the cost of the beverage that I prepare that varies according to its contents.

Interview with Traditional Healer #2

1) Types of patients this provider treats

There is no special age, everybody, urban and rural.

2) Volume of children this provider sees with fever and /or convulsions

Three per day. He has never seen a child with convulsions.

3) Providers idea of:

Symptoms associated with malaria
Fever, headache, vomit, and chills. The typical fever of paludismo is the one that is not constant, it disappears and reappears every 24 hours or every two days.
I usually send the blood smear to the patient to try to confirm the diagnosis.
What is meant here?

Cause of malaria
The mosquito. People here have a lot of puddles around their houses and that is the place where the mosquito breeds. This is one of the causes that increase the paludismo. The blood of a person is infected with the parasite and the mosquito bites this person and does another part of the cycle and bites again another person. This parasite goes to the blood of this new person and infects the red blood cell and goes to the liver.

Treatment of malaria
There exist the chloroquine and primaquine but I use homeopathic treatment such as water with cidrón's bark and quina (this quina is already prepared and I just put it in a smaller container to sell it). I rarely use chloroquine and primaquine to treat paludismo. Usually, people that come to see me had already taken chloroquine and primaquine and they have some problems of hypersensitivity in their stomach to these medicines. These people come here looking for another alternative treatment.
I recommend to the patient that they should take the treatment that the hospital gives them because I think it is useful to treat paludismo. Some people come here saying that they have already taken the pills that the hospital gave them (chloroquine and primaquine) but they feel that still have symptoms and they have not improved so I think they can have a chronic paludismo that it is hidden in the liver or in the red blood cell. In this case I give them beverage with diente de león - esquicento - salsaparrilla.
I have had patients that have been living for more than six months in places that do not have paludismo such as Medellín, Bogotá, Yarumal (places in Colombia where there is not paludismo) and they come to see me with symptoms of paludismo.

Types of convulsions, cause and treatment
The most common cause of convulsion here is epilepsy. Another cause is preeclampsy that occurs in pregnant women. Sometimes I have patients with convulsions due to intestinal parasites and in this case I suggest them to seek medicines from the pharmacy to kill these parasites.
I have never seen a child with convulsions due to paludismo. I know that high fever can produce convulsions. If I see a child convulsing I would not think that the cause is paludismo. I treat epilepsy with "ugurumo" or "cope", "oenante creocata", "artemisia." If the convulsion is due to fever I try to decrease the fever.
Some times people have a deficit in the brain irrigation and that can produce them convulsions and I send them a tomography (radiographic test).

Types of fever and cause
I have seen many children with brucelosis that is due to drink milk without boiling. Sometimes I see people with fever due to kidney problems. I see many children with fever due to intestinal parasites.

Treatment of fever
I treat fever with cidrón, eupatorium, china.
When I see a child with fever I always send him/her the blood smear to see if he/she has paludismo. If it is negative, I send them another blood test that is called seroaglutination parafevriles.

4) Referral to other providers: whether she/he advises patients to consult another provider, whether she/he ever advises patients to consult formal health system.

When I see children with joint problems, or strong diarrhea or when they have any fever I want to know if they have paludismo. I have here children with delicate symptoms I refer them to the hospital.

5) Cost of treatment and attention:

Attention is 10.000 Colombian pesos (around US $ 3). But I do not charge to some children when they have already come or children under two years of age or patients that I see regularly. I think that the medicines produced by the pharmaceutical industry are useful and I want to complement these medicines or give another alternative.

APPENDIX B
INTERVIEW WITH COMMUNITY LEADER OF "EL DOS" VILLAGE

Dora is a community leader in "El Dos" village that is located thirty minutes by car from Turbo. She has not been trained as a health provider. She just takes the drop of blood from the patient, puts it in a peace of glass and brings it to the health center to be colored and red by the bacteriologists that work there. She has been doing this work during four years.

1) Volume of patients handled with probable malaria.

Six (6) people every day and 30% are positive.

2) How do people treat children with probable malaria in your village?

People use a lot of treatments with herbs and take many times chloroquine (underdose) for every fever because they think they have paludismo. They buy it without prescription in any pharmacy or small stores. People sometimes do not have enough money to go to the doctor; they use the money to but the medicines directly in the pharmacy. Villagers are using the medicines of the modern system while bypassing some required diagnostic procedures of this system. They are in effect doing self diagnosis. I suspect they are also consulting with local healers, but the healers will not admit any involvement in recommendations regarding malaria.

3) Is there a traditional healer in your village?

No, there are people that know a bit about certain herbs that are useful for certain things because they have used them.
What term did you use for traditional healer and what are the different categories of healers?
I knew somebody that had malaria and she did not want to take the antimalaric drug because she said that the drug was very strong for her stomach. She went to a different town (Carepa) and received attention from a homeopath.
Is the term homeopath the local traditional term for folk healer? If so then even the term for folk healer has been borrowed from modern medicine.
She got better after taking the medicine that the homeopath sent her. Some of the traditional healers that people use are here in this town (Turbo). Another think that people use in the village is to drink water with balsamina when they have symptoms related to malaria.

4) Do people seek your help to get the blood smear on time or they delay it?

People delay to seek treatment. They sometimes go fast when children have diarrhea but when the child has fever they use acetaminophen and wait so long until they have the money to go to Turbo.
People think that maybe is paludismo when the fever is every other day. Usually they maximum wait one week with symptoms before they go to get the blood smear or to see the doctor.

5) Do you think that people are so used to get paludismo and they do not seek help one time?

People are so use to get malaria and they do not seek help fast. I have to scare them "meterles un susto" telling them that the "hemorragic dengue" is very abundant, and with this idea they go to seek help faster.
When they just have fever they do not care about it. People do not go back to get a set of blood smear when it is negative the first time (ideally should be three blood smears to be sure that is not paludismo).

6) Have you seen very complicated children with malaria in your village?
No, that is not very common. Lately there were two children that were hospitalized several days because they had malaria by *P. falciparum*. They sought help when they had been sick one week and they were very delicate.

APPENDIX C
MODULE 1. RECORDING SHEET ILLNESS NARRATIVE

Interview #:_____
ID #_____
Community:_____
Date:_____
Interviewer:_____
Child' s age: _____years _____ months Sex: F M
Caregiver relation to the child: mother other:_____
age:_____ education:_____
What is malaria?
What are the symptoms of malaria?
What produces malaria?
Symptoms of the child besides fever: vomiting diarrhea chills/sweating cough twitching/convulsion
other:_____
Perceived illness: malaria
other:_____
Perceived cause:_____
Perceived severity: not very serious somewhat serious very serious

TREATMENT (put sequence number in left hand bold column: for each care source used Then for each source of care used, tick in the vertical column the treatment given and fill in further information as indicated)

___ Gave home care
___Tepid sponging or bathing
___Home remedies/herbs
___Antimalarial given : CQ SP
other:_____
correct-dose under-dose over-dose
___Other drugs: Antipyretic Antibiotic
other:_____
___Took child to pharmacist #days after onset of fever:_____
___Antimalarial given : CQ SP
other:_____
correct dose under dose over dose
Injection: # &
type:_____
correct dose under dose over dose

___Other drugs: Antipyretic Antibiotic
other:_____

___Consulted normal provider 1 (type): _____ # days after onset of fever_____
___Antimalarial given : CQ SP
other:_____
correct dose under dose over dose
Injection: # &
type:_____
correct dose under dose over dose
___Other drugs: Antipyretic Antibiotic
other:_____
___Referred to other provider/facility
(specific):_____
Referral followed? No Yes
___Admitted
___Consulted formal provider 2 (type): _____ # days after onset fever_____
___Antimalarial given : CQ SP
other:_____
correct dose under dose over dose
Injection: # &
type:_____
correct dose under dose over dose
___Other drugs: Antipyretic Antibiotic
other:_____
___Referred to other provider/facility
(specific):_____
Referral followed? No Yes
___Admitted
___Consulted traditional healer # days after onset of fever:_____
___treatment given to the child:_____

STATUS OF CHILD: ___RECOVERED ___STILL ILL ____DECEASED
Additional information:

LIST OF REFERENCES

Asenko, O, and Dzator, W.K, 1997, Household costs of seeking malaria care: a retrospective study of two districts in Ghana. Social Science and Medicine 45: 659.

Baume, C, Helitzer, D, and Kachur, P, 2000, Patterns of care for childhood malaria in Zambia. Social Science and Medicine. 51: 1491-1503.

Beausolei, E.G, 1986, Malaria and drug resistance. World Health. 39:7-9.

Bernard, C, 1999, Le paludisme dans les Ameriques. Medecine Tropicale: Revue Du corp de Sante Colonial. 59(3): 298-302.

Blair, S, Alvarez, G, Villa, A, Carmona, J, and Rios, L, 2003, Nutritional status and immunoglobin and cytokine concentrations in children with malaria. Annals Pediatrics. 58(5): 418-424.

Blair, S, Carmona, J, and Correa, A, 2002, Malaria in children: links between nutrition and immunity. Panamerican Journal of Public Health. 11(1): 5-14.

Blair, S, Lacharme, L, Carmona, J, and Tobón, A, 2001, Resistance of *Plasmodium falciparum* to three antimalarial drugs in Turbo (Antioquia, Colombia), 1998. Panamerican Journal of Public Health. 9(1): 23-28.

Blair, S, Lacharme, L, and Carmona, J, 2002, Resistance of *Plasmodium falciparum* to antimalarial drugs in Zaragoza (Antioquia, Colombia), 1998. Memories Institute Oswaldo Cruz. 97(3): 401-406.

Bonilla, E, 1991, Salud y desarrollo: aspectos socioeconómicos de la malaria en Colombia. Edited by Plaza y Janés. Bogotá. 262 pages

Brown, P.J, 1981, Cultural adaptations to endemic malaria in Sardinia. Med. Anthropology. 5: 313-39

Brown, P.J and Inhorn, M.C, 1997, Anthropology of infectious diseases, international health perspectives. Gordon and Breach Publishers. Pp: 32-67 and 120-139.

Bruce-Chwatt. Leonard and de Zuleta. Julian, 1980, The rise and fall of malaria in Europe. Oxford University Press. Pp: 240.

Center for Disease Control, 1990, Recommendations for the prevention of malaria among travelers. Mortality and Morbility Weekly Reports. 39(RR3): 1-10.

Desowitz, R.S, 1991, The malaria capers. New York: W.W. Norton and company.

Djimde, A, Plowe, C.V, Diop, S, Kicko, A, Wellems, T, and Doumbo, O, 1998, Use of antimalarial drugs in Mali: policy versus reality. American Journal of Tropical Medicine and Hygiene. 59(3): 376-379.

Foster, S, 1991, Treatment of malaria outside the formal health services. Journal of Tropical Medicine and Hygiene. 98: 29-34.

Foster, S, 1995, The distribution and use of antimalarial drugs: not a pretty picture. In malaria: waiting for the vaccine. G.A.T.Targett, ed. Pp 123-140. Chichester and New York: John Wiley and Sons.

Greenwood, B.M, Breadley. A.K, Greenwood, A.M, Byass, P, Jammeh, K, Marsh, K, 1987, Mortality and morbidity from malaria among children in a rural area of the Gambia, West Africa. Transactions of the Royal Society of Tropical Medicine and Hygiene. 81: 478-486.

Guilles, H. M and Warrell, D.A, 1993, Essential malariology. Pp: 1-3.

Harrison, Gordon, 1978, Mosquitos, malaria and man. E.P.Dutton New York . Pp: 314.

Hoff, Brent, 1999, Mapping epidemias: a historical atlas of disease. Pp: 65.

Jayawardene, R , 1993, Illness perception: social cost and coping strategies of malaria cases. Social Science and Medicine. 37: 1169.

Jetten, T, H, and Takken, W, 1994, Anophelism without malaria in Europe: a review of the ecology and distribution of the genus *Anopheles* in Europe. Wageningen Agricultural University Papers. 94-5. Agricultural University Wageningen: The Netherlands.

Lipowsky, R, Kroeger, A, Vázquez, M.L, 1992, Sociomedical aspects of malaria control in Colombia. Social Science and Medicine 34: 625- 637.

Lubanga, R. G. N. Norman, S., Ewbak, D., & Karamangi, C, 1997, Maternal diagnosis and treatment of children's fever in an endemic malaria zone in Uganda: implementations for the malaria control program. Acta Tropica. 68: 53.

Makemba, A. M., Winch, P.H, Makame, V. M., Mehl, G. L, Premji, Z., Minjas, J.N., & Shiff, C, 1996, Treatment practices for dege-dege, a locally recognized febrile illness and implications for strategies to decrease mortality from severe malaria in Bagamoyo District, Tanzania. Tropical Medicine and International Health. 1(3): 305-313.

McCombie, S.C , 1996, Treatment seeking for malaria: a review of recent research. Social Science and Medicine. 43(6): 933-945.

Meneses, B, and Blair, S, 1995, Malaria por *Plasmodium ovale*: presentacion del primer caso Colombiano. Acta medica Colombiana. 20(6): 288-291.

Meuris, S, 1986, Mavoungou, D, and Polloitti, B, 1986, Malaria: la fin d'un regne multimillenaire? (Malaria: the end of a multimillenia reign?). Pathologie et Biologie (Paris). 34(7): 886-892.

Ministerio de salud de Colombia (Minsalud), 2003. Evaluación del plan de atención básica en los municipios descentralizados de Colombia. 2001-2002. Retrieved March 8th/2003 from Colombian ministry of health website http://www.minsalud.gov.co,

Montoya, P, 2003. Evaluación del plan de atención básica en los municipios descentralizados de Colombia. Master thesis on Public Health in process and not published.

Munguti, K.J, 1998, Community perceptions and treatment seeking for malaria in Baringo district, Kenya: implications for disease control. The east African Medical Journal: the organ of the Medical Association of east Africa. 75: 687.

Nations, M.K, 1986, Anthropology and epidemiology : interdisciplinary approaches to the study of health and disease. Pp: 97-123.

Nevill, C, G, 1990, Malaria in Sub-Saharan Africa. Social Science and Medicine. 31(6): 667-669.

Nyamongo, I, 1998. Lay people's responses to illness: an ethnographic study of anti-malaria behavior among the Abagusii of Southwestern Kenya. Ph.D. Thesis University of Florida. Pp: 14-17.

Oaks, S.C and V.S..Mitchel, 1991, Malaria: obstacles and opportunities. Washington, D.C.: National Academy press.

Panamerican Health Organization (PAHO),1991, Epidemiological stratification of malaria in the region of the Americas. Epidemiological Bulletin Pan American Health Organization. 12(4): 1-7.

Panamerican Health Organization (PAHO), 1999, Current status and trends of malaria in the Americas. Retrieved November 10th 2002 from PAHO website: http://www.paho.org/english/hcp/hctmal03.htm.

Poser, Charles and Bruyn, George, 1999, An illustrated history of malaria. Parthenon publishing. Pp: 5-9.

Poveda G, and Rojas. W, 1996, Impact of El Nino phenomenon on malaria outbreaks in Colombia. Proceedings XII Colombian Hydrological Meeting. Colombian society of engineers, Bogotá. Pp: 647-654.

Ruebush, T.K, Kern, M.K, Campbell, C.C, Oloo, A.J,1995, Self-treatment of malaria in a rural area of western Kenya. Bulletin of the World Health Organization. 73(2): 229-236.

Ryan, G.W, 1998, What do sequential behavioral patterns suggest about the medical decision-making process?: modelling home case management of acute illnesses in a rural Cameroonian village. Social Science and Medicine. 46(2): 209-225.

Sandoval, C, 2003, Se disparó la malaria en Colombia. Retrieved March 10th /2003 from El Tiempo web site: http://el tiempo.terra.com.co/salu/notisalud/articulo-web-nota_interior-1007090.html.

Schmink, M, 1995, La matriz socioeconómica de la deforestación. De Bosques y de Gente: aspectos sociales de la deforestación en América Latina, edited by: Paz. M. UNAM. Mexico. Pp: 17-41.

Schmink, M and Wood, Ch, 1987, The political ecology of Amazonia. Edited by: Little, D. Peter and Horowitz, M.M. Boulder, Westview.

Snow, R. W., Peshu, N., Foster, D., Mwenesi, H., &Marsh, K, 1992, The role of shops in the treatment and prevention of childhood malaria on the coast of Kenya. Transactions of the royal society of tropical medicine and hygiene. 86(3): 237-239.

Tanner, M, Vilassoff, C, 1998, Treatment seeking behavior for malaria: a typology based on endemicity and gender. Social Science and Medicine. 46(4-5): 523-532.

Watts, S, 1997, Epidemics and History: disease, power, and imperialism. Redwood Books. Pp 214-228.

Wood, C.S, 1979, Human sickness and health, a biocultural view. Palo Alto, CA: Mayfield.

World Health Organization (WHO), 1992, World malaria situation 1990. World Health Statistics Quarterly. 45: 257-266.

World Health Organization (WHO), 1993, A global strategy for malaria control. Geneva: World Health Organization.

World Health Organization (WHO), 1997, World malaria situation, 1994. Weekly Epidemiological Record. 72(36): 269-276.

Young, M, D and Moore, D, V, 1961, Chloroquine resistance in *P. falciparum*. American Journal of Tropical Medicine and Hygiene. 10(3): 317-320.

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I attended primary, middle and high school in Colombia. I also attended medical school at the University of Antioquia in Medellín, Colombia. I came to Gainesville, Florida, to study for my master's degree in Latin American Studies with a concentration in medical anthropology.