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The behavioural and social aspects of malaria and its control

An introduction and annotated bibliography

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FOREWORD

Malaria is unique among diseases because its roots lie so deep within human communities. The most dangerous vectors of malaria thrive mainly within the village environment. Logically, the adult vectors remain close to their nocturnal source of human blood, and the developmental stages of these mosquitoes exploit the nearby accumulations of water that form where people have disturbed the natural drainage. The borrow pits made in the course of mud-brick construction, tyre tracks, and hoof-prints, for example, promote vector abundance in much of sub-Saharan Africa. Malaria then becomes a fixture of village life, exacting a continuous toll on the health of its host population while generating lethal outbreaks among visitors. As a result, malarious communities tend to be isolated, with their economies frozen at a subsistence level. Productivity is impaired, and the societies that develop in such sites tend to resist change. Affected communities adapt to their isolated state by developing behaviour patterns and social systems that help their members adjust to this reality.

The vertically organised anti-malaria programmes that were launched before the 1990s could be conducted largely without reference to the behaviour and the belief systems of the affected populations. Indoor residual insecticides, the hallmark of the eradication era, were applied uniformly across entire continents. Although residents frequently denied the government spray teams entry to their homes and removed the insecticidal sprays from treated walls, their active participation was largely irrelevant to the intervention. Current anti-malaria programmes, however, generally are organised horizontally and depend heavily on resident participation. The recently launched Roll Back Malaria (RBM) Programme relies mainly on insecticide impregnated bednets (ITNs) and combination drug therapy (CT). ITNs must be hung by the people who are to sleep under them and they must be reimpregnated in a timely manner, frequently at the user's expense. Failure to sustain this intervention would result in increased sickness and death due to exposure of relatively non-immune people to new

infections. CT requires a standard schedule of drug administration that relies on the cooperation and understanding of each affected person. Failure to adhere to the prescribed regimen would endanger the long-term efficacy of the regimen. Resident cooperation is even more crucial when environmental management or housing improvement becomes the intervention modality. These practical reasons drive our current need for a solid understanding of the behavioural and social factors that influence malaria risk and that may inhibit or facilitate particular intervention modalities. No longer can interventions be conducted uniformly across broad regions; the problems tend to be local.

This monograph commences with a thorough analysis of the perception of malaria as a disease. How is the condition identified? Does the designation suggest an unrealistic etiology in a manner that impedes corrective measures? Does malaria impress local people as an important disease? Perhaps these traditional perceptions provide useful clues that would otherwise have eluded students of the subject.

The effect of human movement on malaria is treated extensively. Migrants, tourists, and military personnel, of course, serve as fuel for the lethal malarial fevers. But far more complex is the effect of externally funded development projects, which create fundamental malaria-promoting physical, economic, and social change in a region. Exotic vectors and novel antigenic variants of the pathogen may thereby be introduced into a region. Human mobility exposes non-immune people to new malaria infections and creates new antigenic combinations that continuously confound the immune systems of the more sessile existing residents of endemic sites. If visitors to endemic sites experience such difficulty, how effectively does the presence of this disease impede social and economic change? The presence of migrants confounds antimalaria operations because such people tend to fall through the cracks of formal health-care delivery systems. The monograph provides a comprehensive and authoritative overview of the resulting complexity.

Although Western therapeutic regimens and case-management systems dominate in planned anti-malaria interventions, traditional practices and informally blended Western regimens comprise a large part of the mix. A section of the monograph discusses the difficulties imposed by the clash between "Northern" and traditional modes of response to disease episodes, while demonstrating that the North has much to learn from the South. These informally prescribed regimens threaten our developing reliance on strategies based on CT for preventing the loss of drug efficacy. The remedy-seeking attitudes of affected populations therefore become central to anti-malaria policy. Traditional case-management practices may render the strategy of CT unsustainable. An understanding of these social forces is essential.

Attitudes toward the use of ITNs are found here. The second of the two major legs of current anti-malaria practice depends particularly on the behaviour of the affected population; success is vulnerable to incompatible traditional attitudes and practices. Degree of ITN coverage constitutes a particularly crucial element in this strategy because insecticide-depleted nets would divert rather than kill vector mosquitoes. A troublesome scenario would present itself if numerous people who were once effectively protected against infection eventually failed to reimpregnate their nets. Relatively non-immune people would occasionally be exposed to infection while an increasing portion of the vector population would focus their bites on people, perhaps children, who slept unprotected. Motivation in ITN use becomes peculiarly important. ITNs may be misused by people who value them mainly as a measure for providing relief from pest mosquitoes and trials may not be sustained once the investigators leave. This monograph provides an objective overview of the opportunities and obstacles to ITN-based anti-malaria strategies.

Gender issues and the invisible role of women in determining the health-related practices of the household are also covered. Indeed, ITN-based and CT-based interventions depend powerfully on female participation and in a manner that will vary greatly between cultures. Women frequently shape the peridomestic environment in which the more important malaria vectors develop. They

nurse the sick and are themselves most likely to become sick. Primigravid and malnourished women, for example, are the most malaria-vulnerable of adults. The gender-related section of this monograph deals with a central and uniquely understudied facet of malariology.

The manner in which people interact with each other, identify needs, and make decisions is analysed here as well. Community-based anti-malaria interventions depend on the ability of the operating agency to overcome cultural barriers and to institutionalise new practices within the village environment. Obstacles deriving from politics and a sense of personal ownership and control may prove insuperable. These central issues complete this monographic analysis of the intersection between human attitudes and the causes and cures of malaria.

This volume concludes with an extensive annotated bibliography on the social science literature of malaria. The comments are detailed and unusually critical.

This compendium provides a valuable social science starting point for the design and evaluation of anti-malaria interventions.

CHAPTER ONE

INTRODUCTION:

Sociocultural and equity issues in malaria control

It is in the combination of the skills and methods of successive generations that good control of malaria emerges. When the insights of anthropology and education fully permeate the way in which environmental control is implemented and are not just added on as afterthoughts, and when the most sophisticated results of molecular biology are applied through appropriate simple technologies to epidemiological strategies developed decades ago, then real progress in control can be made. (Bradley, 1991:28)

Malaria is a threat to more than 40% of the world's population, and out of the more than 300 million acute cases each year between 1.1 and 2.7 million people die each year (RBM, 2002; WHO, 2000). The vast majority of malaria cases (90%) are in sub-Saharan Africa, where malaria constitutes 10% of the total disease burden. Children under five and pregnant women are most at risk, with *Plasmodium falciparum* being "the main cause of severe clinical malaria and death" (TDR/WHO, 2002; RBM/WHO, 2000). Malaria constitutes nearly 25% of all childhood mortality in Africa (WHO, 2000). According to the United Nations Children's Fund (UNICEF), "Malaria's cost to human and social well-being is enormous. [It] is a major cause of poverty and poverty exacerbates the malaria situation" (UNICEF, 2000:1). So too is the economic loss, which in Africa alone is estimated at more than $2 billion annually (WHO, 2000). According to the Roll Back Malaria Programme (RBM, 2002), "It has slowed economic growth in African countries by 1.3% per year, the compounded effects of which are a gross domestic product level now up to 32% lower than it would have been had malaria been eradicated from Africa in 1960." Because of the seriousness of the problem, the World Health Organization (WHO), the United Nations

Children's Fund (UNICEF), the United Nations Development Programme (UNDP), and the World Bank (WB) have joined forces in worldwide malaria control efforts, (Roll Back Malaria (RBM)), with the aim of reducing malaria mortality by 50% by the year 2010 (World Bank, 2001). The failure of previous initiatives can frequently be blamed on the lack of adequate consideration given to the social and behavioural aspects of malaria control, which, it is now understood, must be taken into account and incorporated into any programme. That crucial aspect of the new worldwide malaria control campaign is the focus of this volume.

While there is agreement that malaria is linked with poverty, there is some debate as to the primary direction of this relationship. The authors of this volume identify with those who point to the growing gap between rich and poor, the increase in marginalisation, and the swelling numbers of people living below an absolute poverty line of $1/day as the major causes of concern, even though we also recognize that malaria morbidity and mortality may lead to poverty. It is clear that the health of a burgeoning group of people will not improve unless poverty and expanding inequality are reduced and this includes the effort to control malaria on a large scale. The larger issues of poverty and inequality must be addressed if we are to be taken seriously in our quest to tackle malaria. But nothing can be accomplished without positioning the problem in social, economic, and political contexts as well as in a cultural one.

The 1978 WHO publication, A Bibliography on the Behavioural, Social and Economic Aspects of Malaria and Its Control (Sotiroff-Junker, 1978), should have re-established this principle more than two decades ago. Yet, with but a few exceptions, it appears relatively little attention has been given to these factors in malaria control efforts until recently. In 2001 the Partnership for Social Sciences in Malaria Control (PSSMC) was formally initiated at the London School of Hygiene and Tropical Medicine and the Centers for Disease Control and Prevention (CDC) for the purpose of maximising "the potential contributions that social sciences could and should be making to research and programmatic development in malaria control... "(*TDR News*, 2002; Williams et al, 2002). In our work we attempt to review the social and behavioural literature on malar-

ia since the Sotiroff-Junker publication, to re-emphasise its relevance, and to renew the call for the integration of such factors, along with the equally necessary biomedical, epidemiological, and parasitological concerns. This volume complements the work of the PSSMC and its Clearinghouse for Social Science and Malaria Literature.

Behaviour as a factor in health

Human behaviour – much of which is influenced by social, cultural, economic, and political factors – is clearly related to health, including the risk for infectious diseases like malaria. Whether it is intentional or not, human behaviour affects health-promoting and disease-preventing activities, in some instances increasing risk and in others reducing it. Inhorn & Brown have noted that "... human groups have often unwittingly facilitated the spread of infectious diseases through culturally coded patterns of behaviour or through changes in the crucial relationship among infectious disease agents, their human and animal hosts, and the environments in which the host-agent interaction takes place" (Inhorn & Brown, 1990:89-90). Beyond human behaviour as such, prevalent sociocultural factors – including political and economic parameters – also contribute to shaping how humans act, and therefore must be seen, in and of themselves, as epidemiological predictors of health and disease patterns.

Although people's behaviour may increase malaria risk, to change such behaviour is not easy. Indeed, there are many reasons why particular behaviours exist and they often are tied to considerable benefits in areas quite distinct from health. MacCormack has written that "the principal reason [for why people do not accept new kinds of health behaviour] is that the behaviour being advocated is inconvenient, produces unwanted side-effects, or does not give visible results" (MacCormack, 1984:86). Thus, it is not usually the case that "these people don't know any better," but rather that their native logic and rationality make sense within the realities and limitations of their local circumstances. As Good (1994) has pointed out, we should be careful to avoid thinking that "they" have "false beliefs" (not knowledge), which need to be changed, where-

as "we" have knowledge, which needs to be imparted. We should also heed Farmer's (1999) caution in his recent book, *Infections and Inequalities: The Modern Plagues*, not to exaggerate people's agency, or power, to effect beneficial changes for their own health and welfare.

The physical environment, and people's proximity and exposure to vectors or parasites, including microbiological and parasitological factors, are clearly essential for transmission of infection and constitute necessary and immediate risk factors. The primary point of this work, however, is to underscore that people's behaviour and how sociocultural factors affect their lives are equally crucial and constitute underlying risks for the spread of infection. These more fundamental risks must be addressed by any effort to control malaria on a worldwide scale. Certain sociocultural factors, such as poverty and social disenfranchisement, may place people at continuous "risk of risks" and may make the affliction from infectious and other diseases inevitable (Link & Phelan, 1995; Farmer, 1999). Inhorn & Brown (1990) talk about proximate cause versus the ultimate etiology of political and economic inequality. They suggest that although the presence of (proximate) microbiological risk factors is essential, it is not sufficient, since the ultimate causation is tied to sociocultural factors, in particular, to inequality. This point is established as well by Farmer (1999). Such an emphasis is nothing new, of course; it goes as far back as Hippocrates, the father of allopathic (Western) medicine, and was renewed by European social theorists and public health practitioners of the nineteenth century, including Rudolph Virchow, John Snow, and Peter Panum, to name but a few. With the advent of social epidemiology and medical anthropology in the 1950s and 1960s, represented by such publications as Benjamin Paul's *Health, Culture and Community* (1955) and Steven Polgar's *Health and Human Behaviour: Areas of Interest Common to the Social and Medical Sciences* (1962), there was a shift in twentieth-century thinking about sociocultural factors as being complementary to bacteriological ones. With the increase of such literature (based on innumerable studies) since then, any public health effort would be delinquent and shortsighted if it did not pay significant attention to how behavioural and social factors contribute to risk for and prevention of malaria infection.

The interrelationship between infectious disease and sociocultural characteristics is by now well established, although not fully accepted within international public health circles. In the current effort to mount an effective malaria control campaign, the connection needs to be re-emphasized and re-substantiated. As Etkin has put it:

> *To the extent that contemporary malaria control programs deviate little from their early design, and that too many studies still conclude that sociocultural variables should have been taken into account at the program's onset, the redundancy in recommendations for program design is apparently necessary... Because failure to deal even relatively superficially with the behavioral dimension squanders the technical sophistication and competence of mosquito control technology and the prophylaxis and chemotherapy of plasmodial infections.* (Etkin, 1991:59)

Brown has also noted:

> *There has been little written about social factors in the modern resurgence of malaria. This is because the focus of public health, and malariology in particular, has been narrowly fixed on the parasite and the mosquito vector. The bigger picture has been neglected – namely that increased rates of malaria morbidity, although directly influenced by changes in the parasite and vector, are more directly caused by human behaviours. Those behaviours are both related to individual culturally coded patterns and larger-scale sociological phenomena including the political-economic level.* (Brown, 1997a:130)

Malaria and other infectious diseases can be studied from a biological, ecological, or sociocultural point of view, and, indeed, considerable work has been done in each of these areas, with most weight given to the biological sphere (Inhorn & Brown, 1990:91). While this volume focuses on the sociocultural factors (and also on how human behaviour affects overall disease ecology), indicating their relevance for malaria control efforts, we agree that it is only with a combined, interdisciplinary approach that the best results may be obtained.

This is reflected in the American Anthropological Association's Working Group on Anthropology and Infectious Disease definition of the anthropological field of infectious disease as "the broad area which emphasises the interaction between sociocultural, biological and ecological variables relating to the etiology and prevalence of infectious disease" (Inhorn & Brown, 1990:90-91). It is clear that social scientists need to continue to work in concert with malariologists.

Explanatory models of diseases

One way to begin to understand the importance of sociocultural factors for malaria is to note the existence of different aetiological explanatory models – many tied to distinct ethnomedical traditions – that are also related to inclinations for particular preventive and therapeutic actions. From the time humans started to live in groups, they have had ideas (explanatory models) about why they became ill and what to do to try to prevent and treat illnesses – with certain persons thought to have special powers in this regard. Polgar's "fallacy of the empty vessel" (Polgar, 1963) emphasised that perceptions about disease aetiology and appropriate treatment did not only appear with the introduction of Western medicine, but are well grounded in the histories and traditions of most people (see also, Etkin, 1991). Different explanatory models are still prevalent throughout the world, in developed as well as in developing countries, and are primarily formed by cultural and sub-cultural ethnomedical norms, but also by more specific factors such as personal illness experiences or those of friends, relatives, and particular social groups. Most of these explanatory models vary, at least to some degree, from the biomedical model, even in developed societies.

It should be noted that individuals may hold several aetiological explanations for the occurrence of any one disease. Thus, for example, if two people are sitting on the front porch in the evening and both are bitten by mosquitoes but only one comes down with malaria, the person with malaria may be quite aware of how she got the disease but may be more concerned about why she got malar-

ia and her friend, who was also bitten, did not. Biologically, thoughts might focus on nutritional status, degree of immunity, and other such factors as being relevant, but thoughts about the "why me?" question are often more likely to concern witchcraft or personal factors, such as having committed a sin or transgressed a social taboo or some other offence for which malaria is then seen as a form of punishment.

Explanatory models that present such dual "how and why" explanations may not be a major problem to the malaria control effort if the "how" aspect does not conflict with conventional biomedical wisdom, and if preoccupation with the "why" aspect does not take precedence in terms of preventive and treatment action, thus delaying or inhibiting effective therapy and prevention. Unfortunately, that is often the case. What presents more of a problem, however, is when neither the single (how) nor the multiple (how/why) aspects of an explanatory model fit with a public health model. For example, when the "how" explanation is linked to hard work, cold weather, and a number of other factors (and the literature shows a prevalence of such correspondences), there is reason for concern. These aetiological perceptions often delay appropriate treatment and foster misguided preventive measures. In Chapter Three we explore the range of perceptions and how they may hamper effective and timely malaria treatment and preventive activities.

The point is that different explanatory models do exist. They are often deeply rooted in local culture and they guide behaviour. Effective malaria programmes need to be aware of these factors and to establish a public health alliance (including both a therapeutic and preventive union) with individuals and communities. While this may not immediately eliminate "false" notions, it may at least bridge the various explanatory models so that effective and timely treatment and preventive action can be taken. In Chapters Four and Seven, which focus on Western and local therapies and on bednets, we discuss this further.

Another major problem associated with malaria control programmes, even where the disease is supposedly treated and prevented appropriately, is that in dif-

ferent parts of the world certain signs and symptoms are given unique names, often not associated with malaria at all. The result is that life-saving hospital treatment is significantly and often fatally delayed. A child in the throes of malarial convulsions in East Africa will be said to have *ndege-ndege* (birds/butterflies), for which seeking the help of a traditional healer is felt to be the only appropriate treatment, since it is believed that an injection from a doctor will be fatal. Cultures create illness labels as well as diagnostic categories. Recognition that the presentations of certain types of malarial signs and symptoms may be uniquely classified as non-malarial diseases has significant therapeutic and preventive consequences and warrants the attention of any malaria control effort.

Consequences of sociocultural factors as an afterthought

As mentioned above, too often behavioural and sociocultural involvement has come too late and been too peripheral. Of course, this does not mean that any and all social science involvement in malaria control has been or will be sufficient or productive. The research carried out to date has not been of uniformly high quality, but it is widely agreed that inattention to the sociocultural factors was a major reason for the failure of earlier malaria control efforts. Communities were not invested enough to hold on to preventive programmes, and governments felt they lacked resources to go on providing the means to attack mosquito-breeding sites. According to Wessen, "Only in retrospect has it become fully clear that the failure of malaria eradication was in large part a failure at the social and organisation levels" (Wessen, 1986:iii).

Inhorn & Brown have asserted that, "Societies actively change their ecology so as to increase or decrease the risk of particular diseases" (Inhorn & Brown, 1990:110). And despite Alland's "minimax" theory – that cultural systems tend to favour practices which minimise the risk of disease and maximise the health and welfare of groups – this may not always lead to the reduction of infectious disease (Inhorn & Brown, 1997b:42). It may seem strange that people actively change their ecology in a way that will increase risk for disease. Yet,

as MacCormack wrote some time ago, "We sometimes modify our environment to gain nutritional or convenience benefit to the detriment of our disease status (and we then adapt to the new disease risk)" (MacCormack, 1984:81). Especially in hierarchically structured societies, those who benefit most from these ecological changes often are not those most at risk of the increased disease consequences. Rather, the worst consequences fall on the peasants displaced by dam construction, or the populations (a "servant" class) marginalised into urban slums or into a perpetual cyclical rural-urban migratory process.

The limitations of health education in malaria control

Health education in malaria control is offered as a means of ameliorating risky behaviour, but as Gramiccia observed more than 20 years ago:

> *There are four main reasons for the failure of health education in malaria control ... The first reason is the type of populations that suffer from endemic malaria in poor countries or in depressed areas with low educational standard and poor housing, hygiene and general environmental conditions. Accessibility to these populations is often difficult, and the medical facilities available to them are, to say the least, scarce... A second reason is that malaria is part of a socioeconomic depression complex from which people have difficulty singling out malaria for particular concern... The people cannot understand why malaria should be selected for elimination rather than poverty, hunger, or other diseases or conditions... The multiplicity of afflictions from which the people suffer takes away a good part of the motivation they might have for self-help in controlling malaria... A third difficulty is the nature of the disease itself, specifically the complexity of its epidemiology ...The fourth reason for failure of health education in malaria control is the methods currently employed. Generally speaking, they have not been well adapted to local situations.* (Gramiccia, 1981:386-387)

Gramiccia further stated that, "Any attempt at educating people in self-help in malaria control should take into consideration the many serious scourges affect-

ing the particular population and the order of priority given them by the people" (Gramiccia, 1981:388). Once again, we return to the need not only to single out the problem of malaria, but to attack it as yet another aspect in a much wider effort to intervene in improving people's lives. Messing (1973) noted this some 25 years ago in an article about public health in Ethiopia entitled "*Discounting Health*," in which he suggested that "health" was really far down the list of a community's main concerns. Of greater importance was what he called "subsistence anxiety," that is, concerns over security, employment, availability and productivity of land, and thus the accessibility of food. Considering the fundamental factors for health, these Ethiopians, like people everywhere, did not in fact "discount health," but were profoundly concerned with health and welfare issues, even if not voiced in terms of "health" as such, and perhaps not as it would be expressed by health personnel. How can people be healthy if they have neither security nor food? From next door in Somalia, Abyan & Osman observed, "The reasons we are dwelling on cash earning of the poor farmer [in Somalia] is to highlight the unlikely prospects for these farmers to be able to pay for their basic health needs, including prevention of disease, like malaria, unless their productivity is enhanced... [There is a] need to enhance the communities' economics to a degree that they can afford effective malaria control services for themselves" (Abyan & Osman, 1993:12, 27). Yet, although there is some recognition of malaria as a disease of poverty, solutions, like those suggested by Abyan and Osman, seldom centre on the reduction of poverty as such.

Public health workers are justifiably concerned about the seriousness of malaria, but for large proportions of the rural and urban poor, malaria may be perceived as a relatively minor malady in the hierarchy of problems with which they have to deal every day, problems such as hunger, unemployment, and security. Fungladda notes, "People in malarious areas have long regarded malaria as part of their everyday lives; they have been conditioned to live with it and with other scourges such as poverty, hunger, and other diseases. As we have already noted, villagers cannot understand why malaria should be selected for

elimination rather than their poor living conditions or any other disease" (Fungladda, 1991:89). This underscores the need for understanding not only people's perceptions and some of their cultural associations, but also the whole context of lives that give shape to these perceptions and behaviours. Another study from Ethiopia reported that, "The majority of individuals in the study area do not consider that the impact of malaria was serious" (Yeneneh et al, 1993:770). Moreover, the perceived hierarchy of specific health problems also determines behaviours, as reported in a study among university students in Malawi, which found that the perceived seriousness of and thus the attention given to malaria was minimised in the face of having to deal with people with AIDS (MacLachlan & Namangale, 1997).

While there may be certain similarities between disease perceptions of people from different cultures and countries, the studies mentioned here make it clear that perceptions, and consequent behaviour, cannot be assumed. Attention must be paid to local realities (including cultural characteristics) that are major influences in shaping ideas. Experiences that influence perceptions range from economic deprivation, to the spread of diseases considered more life-threatening than malaria, to war and social conflict. Moreover, perceptions may vary within a cultural entity, shaped by such factors as educational level, social status, and degree of exposure to an urban or cosmopolitan environment. While awareness of varying views of the disease is essential to the success of any anti-malarial programme, care must be taken not to assume that particular notions will always and necessarily lead to specific behaviours. Many other factors may play a role, and individuals may be quite comfortable in behaving in ways which, to an outsider, may seem contrary to commonly held perceptions. No malaria control effort can afford to overlook the multidimensional human contexts that create and support varying notions of malaria and its prevention, treatment, and control.

According to Brown, "the resurgence of malaria represents a significant challenge to social scientists and is associated with a recent call for a scientific

paradigm shift in malaria research" (Brown, 1997a:120). This shift "... was away from mosquito control – that required little concern for human behaviour, except permission to spray – to the new approaches in 'control' within PHC [primary health care] which require citizen participation" (Brown, 2000). It calls for an increased attention to the sociocultural environment (behavioural and social factors). Brown, an anthropologist, using a broad definition of culture that incorporates economic, social structure, and cognitive/belief issues, is obviously concerned with how cultural (in a more limited sense of that word) factors relate to malaria. But like an increasing number of anthropologists, he casts his net much wider, and in a truly ecological fashion, states that "the continuation of brutal poverty and hunger in much of the world is undoubtedly linked to large numbers of unnecessary deaths from malaria" (Brown, 1997a:122). Farmer, another anthropologist (and physician), who does define culture in a more limited way, similarly makes this wider point when he warns against seeing structural violence and mistaking it for cultural difference (Farmer, 1999).

Socioeconomic factors and risk

What must now be clear is our conviction that any review of factors for worldwide malaria control must give specific attention to issues of socioeconomic inequity and disease epidemiology. The scientific evidence for this is both overwhelming and accumulating. Socioeconomic factors are clearly related to health risks, including the risk for malaria. It is now well established throughout the world that morbidity and mortality rates are directly associated with socioeconomic status. The lower the status the higher the rates. In malarious regions, the poor are disproportionately at risk for the disease, and while there is general agreement about this association, there is less agreement about the directionality of the association, like the question in the old saying, "Am I sick because I am poor, or am I poor because I am sick?"

The World Bank, WHO, and other international agencies, while maintaining that good health is a human right, are also arguing that "investing in health" makes good economic sense, since improved health is seen as a prerequisite for devel-

opment, especially "sustainable development" (World Bank, 1993). In malarious regions it can be argued that the reduction and control of the disease is a prerequisite for economic development. While evidence has been gathered to show that development is a consequence of good health, the indications to the contrary, namely, that improved health is a result of (social) development, appear to us more convincing. Specifically related to malaria, there are those, such as Brown (1986), who argue that the proposition that "malaria blocks development" (implying that control of malaria would foster development) cannot be substantiated. Using the cases of Sardinia and Sri Lanka, Brown has shown that a drastic reduction of malaria did not result in increased social or economic development, as expected.

While we believe that development is primary, we certainly recognise that the reduction of malaria is a social good in and of itself and thus one element of an overall process of social development. It must be pursued vigorously. While control of malaria is by no means easy, it seems clear that it may be easier than the larger social development required by those who argue that health risks, including malaria, are the result of inequity and the economic stagnation experienced by larger and larger numbers of people. But while we argue for a focused attack on malaria, we cannot avoid noting that without attention to these larger matters – inequity and marginalisation – any improvement in health, including malaria, may be short-lived (see also Farmer, 1999). The future for malaria control, however, seems to hinge on the development of an effective vaccine, and it is assumed that such a vaccine could be successfully inserted into regular immunisation programmes. But based on recent economic studies, it is clear that even at $5/dose, there is not enough money in the health sector of most malaria-prone developing countries to cover the expected cost of malaria vaccination alone. "What will happen is that elites will be protected and the disease will continue with the poor" (Brown, 2000).

When arguing that development is a precursor for improved health (and a reduction of malaria), or the other way around, it is important to be clear about how development is defined. The concept of "development," especially as used

in the past, was almost exclusively considered in terms of economic development, or average economic growth. This was measured as an aggregate, without necessarily paying too much heed to the distribution of that economic growth, or being too concerned with measuring who benefited and who did not. It was felt that any growth implied that "all bottoms rise" (rafts as well as luxury liners), or that it would at the very least imply a "trickle down" of benefits to the poorest segments of the population. Thus any contribution to a nation's average Gross National Product (GNP) per capita was seen as development and considered as a public "good."

This definition has been challenged as inadequate and misleading, especially if touted as a means of poverty alleviation (Kim et al, 2000). And thus, for at least the past decade, the United Nations and other institutions have begun emphasising "social development." The United Nations Development Programme (UNDP) uses the term "human development." While both terms measure development according to a number of social (including health) indicators, they also incorporate economic indicators. What has been added is a concern for how economic growth is distributed, as shown by the use of such measures as the "gini-coefficient," which indicates the difference in income and wealth between the top and bottom 20% of a nation's population. Mata noted that the "... control of seriously debilitating diseases is attained through an improvement of sanitation, housing, and education – that is, the quality of life. Thus, social determinants of disease are the most important factors to identify when planning intervention programs" (Mata, 1982:877).

While there is widespread agreement about the appropriateness of a more socially egalitarian perspective on development, it has not yet been readily converted into practice. Certainly, we can find ample evidence of many large development projects that have done little in terms of social, or economic, development for the poor (Kim et al, 2000). In fact, there is substantial evidence that a number of development projects, and large-scale economic enterprises in general, have damaged the welfare of already disenfranchised groups and have increased,

rather than reduced, the risk of malaria for poor people (Silva, 1997; UNDP, 1999). Dam construction, extensive irrigation schemes, widespread agricultural use of pesticide, and the (permanent and cyclical) migration of large population groups in search of income as migrant labourers or as colonizers (e.g., in Brazil) of forest areas are only a few of the "development" activities which have been negatively associated with malaria (Brown & Whitaker, 1994; Dinham, 1993; Gruenbaum, 1983; Packard, 1986, 1997; Santos, 1983).

Some of these directed ecological changes are related to agriculture, while others are a result of development projects. "Development projects of dam construction, land reclamation, road construction, and resettlement in Third World countries have probably done more to spread diseases such as trypanosomiasis, schistosomiasis and malaria than any other single factor" (Inhorn & Brown, 1997:41; also see Coimbra, 1988; Gruenbaum, 1983; Oaks et al, 1991). In agriculture, one of the directed changes is the widespread use of pesticides, which has a direct effect on the spread of malaria. In 1976 the WHO's Expert Committee on Insecticides noted, "It is finally acknowledged that resistance is probably the biggest single obstacle in the struggle against vector-borne diseases and is mainly responsible for preventing successful malaria eradication in many countries" (Chapin & Wasserstrom, 1983:282-283). There is considerable evidence to show that resistance in many vectors is a side-effect of agricultural pesticide usage. "Throughout southern India the recrudescence of malaria now represents a social cost of growing high yielding rice – just as elsewhere in India and Central America it represents a social cost of producing cotton. Naturally, such costs are more easily accepted when they can be passed along to the rural poor, who in any case are more susceptible to infection" (Chapin & Wasserstrom, 1983:179-80). Farmer (1999) also points out that malaria gravitates primarily to the rural poor.

Human behaviour in the form of human settlement, mobility patterns, agricultural practices, and deforestation continues to be a factor affecting malaria prevalence. In Chapter Five we explore at length how mobility and population movements are related to malaria, including the increasing numbers of refugees

who have emerged as a result of sociopolitical factors such as wars and civil strife.

We concur with Packard & Brown that "Ignoring the social and economic determinants of malaria allows people in International Health to concentrate on mosquitoes and not to be concerned with thorny problems of poverty and inequalities in the distribution of land and capital resources... The social and economic benefits of malaria control continued to serve the needs of capital and the state, with only limited advantages for impoverished rural farmers or urban slum dwellers... Malaria control activities throughout the world may have created opportunities for exploiting new land resources, yet this did not necessarily produce 'development' in the sense of improved living standards of the majority of people inhabiting tropical regions of the world" (Packard & Brown, 1997:187-188; see also, Kim et al, 2000; World Bank, 1993).

Inhorn & Brown (1997) have suggested that the period from 1980 to the present has been a boom time for research, with more anthropological work on infectious disease than ever before. This is because medical anthropology has come of age, but due as well to the increased interest generated by the AIDS epidemic. It is also the result of the growing recognition that consideration of sociocultural and behavioural factors is imperative for widespread and effective malaria control. In this volume we review some of the literature on sociocultural and behavioural aspects of malaria control and annotate nearly 80 of what we believe are the most influential articles produced in the decades since the publication of the WHO/Sotiroff-Junker bibliography in 1978.

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CHAPTER TWO

HISTORY AND REVIEW OF MALARIA

[The female anopheline mosquitoes'] ability or competence to transmit malaria is governed by a complex interaction of environment, behavioural and biological features, including vector density, blood meal preference, feeding and resting habits, flight range, longevity, humidity and temperature... Hence, agricultural development, irrigation, availability of drugs and pesticides, knowledge of and attitude to the disease, nocturnal labour, etc., will all play a part in the local epidemiology of the disease. (Nevill, 1990:667-668)

Human beings have long been living with malaria. As far back as 2700 BC, medical writings in China and India allude to what is most likely malaria, and the disease is also described in the writings of Homer (Bruce-Chwatt, 1988). In one of the four Vedas of the Hindus, malaria is referred to as "a disease most dreaded affliction, King of disease." The Chinese referred to the disease as "Mother of Fevers." The relationship of fever to swamps and low-lying water was also recognised by the Greeks in the sixth century, and the Romans' attempts to drain large areas of swampland was probably motivated by the desire to reduce malaria. Protective measures against mosquitoes date back at least to 484-425 BC, when Herodotus observed that in parts of Egypt above the marshes, people slept in lofty towers that mosquitoes could not reach, while those in marshlands slept under nets. Marco Polo noted that the wealthier residents of the Coromandel Coast in India slept on bedsteads with curtains that could be closed at night. Historically, malaria was not confined to "tropical" climates. It disappeared from the United States and Northern Europe largely as a result of changes in human behaviour, including improved housing, self-protection using housing screens, etc., and only a small part of the decline was the result of direct primary health interventions (Brown, 1983).

Malaria and human history

The term malaria is Roman in origin, although the disease was not known by its present name until the mid-eighteenth century. Before then it was referred to variously as ague, intermittent fever, swamp fever, Roman fever, and death fever. Malaria or "bad" or evil (mal) air (aire) was a name derived from the miasma theory of causation. Humans are not the only species with malaria parasites: almost all vertebrates, from snakes on, are parasitised with species of *Plasmodium*, which have co-evolved with a particular mosquito vector. Yet, in the course of human cultural evolution, it seems that malaria became widespread only after the introduction of agriculture which increased human population density and provided breeding places for *Anopheles* mosquitoes.

Desowitz (1991) has argued that the hunter-gatherer way of life protected against malaria because groups were highly mobile and their numbers sufficiently small, so the chance for transmission from animal to human or human to human hosts was minimal, with few malaria carriers able to recirculate the infection through the mosquito and maintain continuous transmissions to humans. The hunter-gatherer was nomadic and did not stay in one place long enough to infect the local mosquitoes, or to be infected by them. Approximately 10 000 years ago – or more recently according to Desowitz (1991) – West African hunter-gatherers increasingly began to transform their way of life to a more settled form of slash-and-burn agriculture, which included the rearing of domestic animals. It was this shift from the hunter-gatherer model to a more sedentary slash-and-burn agricultural and cattle-raising way of life that gave rise to the conditions necessary to support the spread of human malaria (Livingston, 1958). The altering of the social and ecological environments by new agriculture allowed greater numbers of people to live in settled proximity with large numbers of animals. It also created peridomestic-puddled water, ideal breeding grounds for the *Anopheles gambiae* vector. Malaria became a human disease and the female mosquitoes could nourish their eggs on the steady food supply of human blood of the settled human agriculturalists.

Subsequently, with human migration, which "has always played a role in malaria transmissions" (Bruce-Chwatt, 1988:5), malaria was brought to the Nile Valley,

Mesopotamia, India, and South China. The conquest of the Americas affected the spread of the disease, as did the slave trade a few centuries later. Ways of dealing with malaria followed its proliferation, from administering the herb *qinghaosu* as a treatment in China more than 2000 years ago to employing the bark of the "fever bark tree" (Chinchona) in the seventeenth century and possibly much earlier, in South America, to the use of bednets as a preventive method, going back several millennia. Bruce-Chwatt (1988) has traced the use of hand-woven nets back to antiquity, finding mention of it in the Bible (Judith X:21) and in the writings of Herodotus discussing customs in Egypt. As an aside, it should be mentioned that a drug called artemisinin, refined from the qinghaosu plant in China some thirty years ago, has been found by many experts to be highly effective and it is currently (2002) widely used in China, Vietnam and South Africa. It is being argued whether or not it should be widely used in Africa and elsewhere where chloroquine resistance is widespread (McNeil, 2002).

Even the earliest civilisations recognised that unhealthy conditions could be created by a number of causes: natural disasters, destructive wars, or uncontrolled cultivation of land. In Western Europe, during periods of war and economic depression, the use and care of land declined, which favoured the transmission of malaria. This neglect of land and the lowering of its value rendered it less productive and intensely malarious. Thus, the direct association of agricultural neglect with this disease is most aptly captured in an Italian phrase, "malaria flees before the plough" (Najera-Morrondo, 1991).

Biology of the malaria vector and malaria parasite

The discovery of the malaria parasite by Laveran in 1880 was a milestone in the history of medicine, destroying the belief in the role of "telluric" or "miasmatic" factors and establishing the causal link of the microbes to disease (Bruce-Chwatt, 1988). At the end of the nineteenth century, Ross in India and Grassi in Italy independently described the life cycle of the malaria parasite in birds and humans.

Anopheline mosquitoes typically breed in stagnant, unpolluted surface waters. Eggs are laid on the water surface among floating vegetation. The larvae float horizontally just under the water surface, breathing air and feeding on small suspended particles. Typically, breeding sites for different species include forest pools, irrigated fields, lakes, and temporary rainwater puddles. For this reason, anopheline mosquitoes are mainly associated with rural settings. However, there are a few exceptions where malaria vectors have adapted to city life: on the Indian subcontinent and, to a lesser extent, in some cities in the Middle East and Brazil (Lines et al, 1994). In India, malaria transmission in town is often as intense as it is in the surrounding countryside because the local vector, *Anopheles stephensi*, has adapted to breeding in containers, particularly in overhead tanks (Deobhankar & Palkar, 1990). There are similar situations in Africa, but the main reason malaria transmission penetrates to urban centres in Africa is that the local vectors, *Anopheles gambiae* and *Anopheles arabiensis*, are extremely efficient. It is estimated that a single female *Anopheles gambiae* in every six houses is sufficient to maintain transmission in an entire community (Lines et al, 1994).

Malaria can be both an acute and a chronic disease, and it is caused by intracellular protozoa of the genus *Plasmodium* that are transmitted by the bite of female *Anopheles* mosquitoes. *Anopheles gambiae* is the most important vector in Africa and is among the most efficient for transmission of the disease. There are 120 Plasmodium species, of which four are of consequence to humans: *P. falciparum, P. vivax*, *P. malariae* and *P. ovale*. While there are considerable differences between the species in their pathogenecity and epidemiology, as well as subtle but important differences in appearance, development, and host-parasite relationships, all four species share a common basic life cycle. It is *P. falciparum*, however, that causes nearly all of the mortality in cases of malaria infection.

Natural transmission is dependent on a complex interaction between host, vector, parasite, and environment. The anopheline mosquito vector is infected via blood from an infected host (human); the parasite then matures to the sporo-

zoite stage in the vector, and invades its salivary glands. The mosquito infects other people by injecting sporozoites in the saliva while feeding on their blood (Nevill, 1990).

The sporozoites are then carried to the liver, where they leave the circulatory system. Each sporozoite penetrates a "building block" cell of the liver tissue and invades hepatocytes. Within the liver cell, the sporozoite rounds up and transforms into a "spore"-like form. During the succeeding two weeks, this spore replicates into thousands of merozoites (cyst-like structures) and the host liver cell is destroyed in the process. The merozoites then invade the red blood cells and increase in a series of two- to three-day cycles. The first clinical attack of intense rigour and sweating with high fever develops when a large number of red cells are infected and burst. As they continue to flood into the blood stream, the resulting merozoites attach to the surface of other red blood cells and create a continuous cycle of replication. In the case of *P. vivax* and *P. ovale*, dormant forms known as hypnozoites develop in the liver cells, remaining viable for up to 50 years (Krotoski et al, 1982).

The actual time required for the replication in the mosquito depends upon the species of parasite and on ambient temperature. With an average life span for most anophelines of less than one week, ambient temperature is critical to transmission. The timing of the relapse of *vivax* in different climates is variable and related to the seasonality of *Anopheles* breeding. A powerful variable in malaria transmission for anophelines is longevity (Targett, 1991:12).

Clinical manifestations in the human host

The relative susceptibility of a person to malaria infection depends on two main attributes: genetic factors affecting the ability of the parasite to penetrate and maintain itself within the erythrocyte, and levels of humoral immunity that may have developed following a series of previous infections during childhood or early adulthood.

Desowitz (1991) has speculated that it may be that malaria would have destroyed the first African agricultural pioneers if they had not evolved genetic characteristics that render them resistant to particular forms of the disease. Africans who lack the Duffy blood group surface antigen, for example, cannot be infected with *P. falciparum* (Institute of Medicine, 1996). Some Africans and people of African descent carry the sickle cell gene which partially protects against infection with *P. falciparum*. If a person inherits the genes, from both parents, this will eventually cause death from progressive sickle cell anaemia in the absence of modern medicine with blood transfusion, etc. However, in a person inheriting only one sickle cell gene from one parent and one normal haemoglobin gene from the other parent, the "sickle cell trait" modulates the symptoms of *P. falciparum*. Other hereditary abnormalities such as alpha and beta thalassemia and glucose-6-phosphate dehydrogenase (G-6-Pd) deficiency similarly protect against malaria disease. These traits do not reduce the chances of getting malaria, but rather the chance of dying from it (Brown, 1986).

For control efforts to be successful, the distinction between disease and infection needs to be understood. Infection with malaria does not necessarily result in disease. In highly endemic areas, childhood prevalence of infection exceeds 50%, but few will have acute symptoms (Institute of Medicine, 1996). The density of infection at which symptoms appear is also greater in early life and becomes lower with age because of rising levels of immunity (Smith, Schellenberg, & Hayes, 1994).

The clinical manifestations of malaria are varied, from episodic shaking chills to intense fevers to drenching sweats. Where malaria is common, infected individuals may have symptoms (often associated with flu, involving fevers, and sometimes periodic) that mimic other diseases, which makes diagnosis difficult. The fact that malaria does not have a distinctive symptomatology means that it is ethnomedically subdivided by a number of different disease labels. This was the case in early biomedicine, where the periodicity of the fever spikes was used to distinguish what we know as infection by different plasmodium species.

Case fatality and social epidemiological distribution of severe malaria

Most clinical episodes of malaria include febrile illness with non-specific symptoms. There are marked differences in the spectrum of severe disease in young African children, who may present with symptoms that range from listlessness to pyrexia, abdominal cramping, difficulty in breathing, mental disorientation, or convulsions. Anaemia is common, and coma also occurs. Certain features important in adults appear to be rather rare in children, including pulmonary oedema, hepatic failure, and acute renal failure. Other complications, such as hypoglycaemia, assume greater importance in children.

P. falciparum causes a variety of pathophysiological and potentially lethal conditions in children that include severe malarial anaemia and fits, prostration, and hyperparasitaemia. Additional complications include splenomegaly, and renal and pulmonary pathology. A wide range of serious neurological sequelae has been reported. About 80% of deaths in adults are due to cerebral malaria (Institute of Medicine, 1996). Malarial anaemia is an important contributor to *P. falciparum*-associated morbidity and mortality. (See also MacDonald, 1965; MacDonald & Goeckel, 1964.)

Malaria during pregnancy can cause miscarriages, fetal death, intrauterine growth retardation, low birth weight, and premature delivery. Women pregnant for the first time are at particular risk for severe anaemia and sometimes death. During late pregnancy, resistance to malaria decreases, resulting in severe infection. Recrudescence and relapses of malaria during the second trimester is common because of immunosuppression associated with pregnancy.

People continuously exposed to malaria in endemic areas develop a degree of immunity that needs to be maintained with constant exposure. This acquired immunity is what differentiates endemic and epidemic malaria and why temporary interruption in malaria transmission in highly endemic areas might cause more harm than good in the long run. Asymptomatic persons may be more responsible than those with symptoms for infecting mosquitoes (Strickland,

1992) Furthermore, latent malaria may become symptomatic. Even after repeated infection, complete immunity seldom occurs. A partial immunity develops that is species- and strain-specific, yet there seems to be no cross-immunity between species.

Distribution and epidemiology of malaria in the world

Studies on *Plasmodium falciparum* in highly endemic regions show enormous genetic diversity and complexity, which is manifested through variations in allelic frequencies, as well as in actual genotypic variations in parasite populations.

The force of transmission of malarial infection requires the interaction of four epidemiologic factors: the human host; the malarial parasite; the *Anopheles* vector; and the physical, biological and socioeconomic environment. The level of transmission or the "force of infection" is determined by: 1) the prevalence of infection in man (reservoir); 2) characteristics of the local vector mosquitoes, including their density, feeding, and resting behaviour, susceptibility to infection, and their effectiveness as a vector; 3) the presence of a susceptible human population; and 4) local climatic conditions that affect vector breeding (Strickland, 1992). The force of infection depends on vector competence, which is a linear factor; abundance; temperature, which is an exponential factor; and narrowness of the host range, which is a squared factor. The annual fluctuations and sequence of malaria transmission in different areas are in turn dependent on seasonal variations of temperature, rainfall, and humidity. Due to the local variability of the vector and the intensity of transmission, there is a need for "microecologically germane" interventions to control malaria.

Not all regions where malaria is present are the same and four classifications have been used to indicate these differences. To simplify and clarify the system, the Institute of Medicine has classified malarial regions as:

- holoendemic – intense year-round transmission, where the population's level of immunity reaches a high level after early childhood;

- hyperendemic – seasonal transmission, where the level of immunity offers little protection from disease no matter the age group;
- mesoendemic – some malarial transmission and a low level of immunity;
- hypoendemic – limited malaria transmission, with little or no immunity to the parasite among the population (Institute of Medicine, 1996:33).

The habits and longevity of the vector mosquitoes largely determine the degree of endemicity of malaria. Endemic malaria may be highly stable, with low epidemic potential because of transmissions by mosquitoes that feed on humans by choice, have a long life (four to six weeks), and inhabit warm and humid climates. Endemic malaria, however, may also be less stable and punctuated by occasional brief epidemics because of transmission by mosquitoes that are as likely to feed on animals as on people or with higher chances of mortality and thus require large numbers to maintain transmission.

The degree of immunity acquired by a population is generally proportional to the degree of transmission and consequently may vary widely within a country and even within districts. For example, immunity may be lower in the plains areas of India than it is in the hilly, forested areas, where more efficient vectors thrive (Clyde, 1987).

Physical, biological, and social environments play an essential part in the epidemiology of malaria. For the larval and adult stages *Anopheles*, the physical environment depends on favourable climatic temperatures, humidity, rainfall, and/or the presence of standing or gently flowing water. Biologically, plants accumulating in small collections of water may support *Anopheles* breeding while domestic animals may be beneficial by diverting mosquitoes from feeding on people. Socially, factors encouraging the transmission of malaria include close proximity of houses to mosquito breeding sites, types of house construction that facilitate mosquito entry, failure to remove peridomestic collections of fresh water, and various activities and occupations that increase exposure to adult mosquitoes or promote mosquito breeding. Agricultural development, irrigation, availability of drugs, pesticides, knowledge of and attitudes toward the disease, migra-

tion, and nocturnal labour all play a part in the local epidemiology of the disease.

Biological research shows that the parasite is a fragile organism that has completely adapted to a parasitic life cycle. The terrible disease has "feet of clay" as Grassi described it in 1900. Malaria continues to exist only if the transmission cycle is uninterrupted. If any link in this chain were removed, the disease would disappear (Fantini, 1994).

Transmission of the disease and the intensity of malaria vary from season to season and from year to year. Differences in the malaria parasite and the mosquito vector and human populations as well as in climate and physical environment create a variety of malaria situations. According to WHO (1997), the major malaria situations can be categorised as follows:

- African savanna malaria. Eighty percent of the world's malaria and 90% of mortality from the disease is estimated to occur in Africa, south of the Sahara. Most of the population is infected early in life and the disease is most concentrated in children and pregnant women.
- Desert fringe and highland fringe malaria. This occurs in ecological transition zones, where populations with low immunity are subject to serious disease as a result of population movements, climatic changes, or altered patterns of agriculture. There is considerable risk of epidemics in such areas in Africa, Latin America, and Asia.
- Forest-related malaria. In Asia and the Americas, forest-related malaria presents a variety of situations where transmission is usually not conducive to vector control methods.
- Malaria associated with extensive agricultural development. Related to the influx of workers with little immunity, to irrigation, to other environmental modification, and to insecticide resistance.
- Malaria in periurban areas. In South-east Asia, coastal and marshland malaria is related to the presence of mosquitoes that breed specifically in brack-

ish water and can cause serious problems in periurban as well as in rural areas.

- Malaria in war zones and areas with sociopolitical disturbances. This is a consequence of displacement of populations, breakdown of health care, and disruption of agriculture that may increase mosquito breeding. Serious outbreaks may result.

In sum, the mosquito's ability to transmit malaria is governed by a complex interaction of environmental, behavioural, and biological features, feeding and resting habits, flight range, humidity, and temperature (Nevill, 1990).

Treatment and chemoprophylaxis

Treatment for malaria was not available to Europeans until the 1600s, when the Incas in Peru offered the decoction from the bark of a "fever tree" (cinchona). Modern-day quinine originated from cinchona. Current drugs to treat malaria such as doxycycline, proguanil and primaquine attack the liver stage, thus preventing the release of parasites into the bloodstream (Institute of Medicine, 1996). Others, such as chloroquine, quinine, sulfadoxine pyrimethamine (Fansidar), and mefloquine, kill the parasite within the red blood cells (Institute of Medicine, 1996). Resistance, however, greatly complicates drug strategies.

Chemoprophylaxis for malaria is recommended for to non-immune persons entering areas endemic for malaria to reduce, but not totally eliminate, the risk of infection. Chemoprophylaxis is also recommended for high-risk groups, such as infants and young children, pregnant women, and recent immigrants from malaria-free areas. Prophylaxis for small children is still debated because of the risk of long-term side-effects and selection for resistant parasite strains (Collins & Paskewitz, 1995; Collins et al, 2000). There also seems to be some consensus that drug administration can prevent natural immunity from occurring but may also delay the disease until the children are older (Collins & Paskewitz, 1995). A major public health problem arises from the balance of short-term individual protection and long-term community benefit. The kind of drug prescribed will

depend on the intensity of transmission, the pattern of drug resistance, and the length of stay in the malarious region. Also, in terms of maintaining treatment for the community, it is a difficult task, since only a portion of the community at any given time participates in the drug distribution programmes.

Drug resistance

In his recent review of drug resistance in malaria, Boland has noted that it is increasing rapidly and "... has emerged as one of the greatest challenges facing malaria control today" (Boland, 2002:1). Drug resistance leads to greater parasite longevity in the host, which, in turn, prolongs the period of infectiveness. Resistance is related to the intensity of transmission, drug pressure, and the level of parasite mutation. Understanding these factors will influence the methodology for malaria control. Mosquitoes are becoming increasingly resistant to certain insecticides and in certain cases have adapted to avoid insecticide-treated surfaces altogether (Institute of Medicine, 1996). Drug and insecticide resistance arises as a result of gene mutation and selection of resistant mutants (Beale, 1980).

Parasite drug resistance has affected the epidemiology of malaria. Chloroquine resistance dominates in sub-Saharan Africa, while mefloquine resistance has emerged in South-east Asia (where chloroquin resistance had become almost universal in the 1970s). One of the major implications of the diversity of resistance is to make it more critical that public health measures to control malaria be region-specific. A recent report by the United Nations Children's Fund (UNICEF) on the pattern of drug resistance concludes that: 1) Chloroquine-resistant *P. falciparum* has been documented in all areas of the world except North Africa, Haiti, the Dominican Republic, Mexico, and Central America; 2) Mefloquine resistance has been documented in South-east Asia, especially in Thailand, parts of Africa and South America, the Middle East, and Oceania; 3) Quinine resistance has been reported in South Asia, parts of Africa, and Brazil; and 4) Pyrimethamine/sulfadoxine (Fansidar) resistance has been documented in South-east Asia, the Indian subcontinent, the Amazon basin, Oceania, and

many parts of Africa, south of the Sahara (UNICEF, 2000). There are only a few reports of resistance in *P. vivax*.

A decision to give chloroquine at the health centre level, outside of self-treatment, will depend largely on a patient's clinical presentation, the expected level of immunity, possible previous treatment, the resistance pattern in the area, and the cost, availability, and toxicity of alternative drugs.

Malaria eradication, control, and prevention

It is important for public health and social scientists working on malaria control efforts to recognise the differences between past and present strategies. Prior to 1970, malaria eradication programmes were based on indoor residual spraying. Initial successes in the eradication efforts in Southern Europe, in India and other endemic areas that used indoor spraying of DDT resulted in near elimination. However, massive use of these pesticides with insufficient attention to agricultural consequences and economic development efforts has now resulted in major increases in insecticide resistance in *Anopheles* mosquitoes. Apart from physiological resistance, differences in behavioural traits between and even within vector species emerged. These variations include outdoor feeding (exophagy) and resting (exophily) and the development of behavioural resistance to the residual insecticides, such as avoidance of treated surfaces, all of which prevented adequate contact between mosquito and toxin (Collins & Paskewitz, 1995). The alternative was to reduce vector densities so as to stop transmission and treatment of all malaria cases so that the *Anopheles* control could then be relaxed, thereby producing "Anophelism without malaria" (Brown, 1986).

During the 1970s, however, following the failure of eradication efforts in many areas, the shift was made from eradication to control. WHO adopted a revised strategy based on a realistic assessment of an individual region. The two main strategies attempted by WHO involved first, a strengthening of basic primary health services to ensure adequate diagnosis, access to care, and treatment for individuals, while providing protective measures to the community by promoting insecticide treated bednets and environmental anti-vector measures that

would change the epidemiologic equilibrium of malarial transmission. However, continued widespread misuse of and belief in the efficacy of chloroquine as the preventive and treatment drug of choice despite documented high levels of chloroquine resistance have also hampered malaria control (see van der Geest, 1999 and Van Geldermalsen, 1999).

In the final analysis, malaria control measures, be they to prevent mosquitoes from feeding on humans, to prevent or reduce the breeding of mosquitoes, to destroy mosquito larvae, to eliminate malarial parasites in the human host, to attempt to prevent transmission to mosquitoes through mass drug therapy, or to protect susceptible hosts by way of chemoprophylaxis, must be coordinated by integrating available technology with an understanding of the epidemiology of the local malarial situation, which includes a consideration of the behaviour of both humans and the vector so as to be able to make the most appropriate and effective interventions.

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CHAPTER THREE

PERCEPTIONS ABOUT THE AETIOLOGY AND TRANSMISSION OF MALARIA

It is not uncommon for people to accept biomedical explanations for disease causation, and hold these views concurrently with other understandings of disease: for example, that malaria is caused by a mosquito bite and by drinking contaminated water. (Espino et al, 1997:237)

Cerebral malaria is commonly classified as a distinct condition attributable to supernatural forces. (Winch et al, 1996:1058)

Understanding people's perceptions of malaria, and the factors which influence these perceptions, must be a central part of mounting successful interventions by WHO to control malaria throughout the world (Ahorlu et al, 1997; Bradley et al, 1991; Lipowsky, Kroeger & Vazquez, 1992). People in different societies hold a variety of beliefs about the cause and transmission of malaria that vary according to cultural, educational, and economic factors, and have direct consequences for both preventive and treatment-seeking behaviour as well as for activities to control malaria. But this puzzle cannot be viewed simplistically, since a solution to "misguided" perceptions, in terms of current public health knowledge, is not just a matter of providing "correct knowledge." As Espino et al have noted, "Improving or increasing knowledge does not necessarily result in changes in perceptions or behaviour" (Espino et al, 1997:237). Indeed, behaviour is not just a consequence of knowledge and belief. Levels of alcoholism, community social and political divisions, or lack of control by women of household budgets, for example, are also significant determinants (Agyepong & Manderson, 1999:79; Winch et al, 1997).

Attention to these perceptions is critical to public health efforts for at least three primary reasons. First, beliefs that differ from the scientific explanation about the cause and transmission of malaria may lead to inaction, a delay in seeking appropriate treatment, or ineffective action, all with serious consequences. These attitudes may also inhibit effective preventive measures (e.g., community participation). Second, people often hold various, seemingly contradictory, views about malaria at the same time (Espino et al, 1997). Although they may concur with the scientific explanation of how transmission occurs, their preoccupation with why it occurs, for a particular person at a particular time, may be unique and at odds with orthodox public health knowledge. The explanation might be related to witchcraft or seen as the consequence of immoral or illegal actions, a logical conclusion since, as suggested by Helitzer-Allen, Kendall, & Wirima, "The complex transmission of malaria lends itself to spiritual etiologies... mosquitoes are present most of the time, but fever is a periodic occurrence" (Helitzer-Allen, Kendall, & Wirima, 1993:275). As a result, both appropriate and what is scientifically considered irrelevant or ineffective preventive and "treatment" actions may be taken at the same time. If health personnel denigrate the apparently (to them) ineffective behaviours, such as the wearing of an amulet, the unintended result may be to prejudice many against the appropriate use of the health services (Eisenberg & Kleinman, 1981; Paul, 1955; Polgar, 1963). Third, fevers and other severe and unstable varieties of symptoms, such as convulsions, are frequently not associated with malaria, obviating the need for treatment or preventive measures associated with these symptoms, which can have dire consequences for the sufferer.

Sensitivity in communicating malaria prevention, treatment, and control measures

As already noted in chapter two, the spread of malaria was a result of a shift in human social and economic activities from wandering in bands as hunter-gatherers to establishing a more settled agricultural existence that supported the concentration of a larger number of people and animals, large enough to

facilitate the transfer of malaria from animals to humans. Malaria in humans evolved in Africa: *Falciparum* descended from an avian ancestor and holoendemic malaria became established in western Africa (Rich et al, 1998). Thus, Africans have had to deal with the consequences of this disease for millennia (see Bruce-Chwatt, 1970, 1979, Bruce-Chwatt et al, 1980, for the history of malaria). This long history has resulted in the use of a range of different terms and disease categorisations, which may all relate to malaria but which may not necessarily be perceived as such. Moreover, these terms are not necessarily translatable into the English word "malaria." However, as Winch et al have found, "Appropriate choice of terminology has been found to be critical for the development of effective health communication interventions" (Winch et al, 1996:1057).

In most countries in Africa, outsiders are faced with a real communications challenge since there are from six to more than ten different terms for what we call malaria – or its different manifestations. These terms may also have a number of subcategories. An awareness of the use of a wide range of labels, related to the tremendous variability in symptoms (or clinical presentation of malaria), is highly significant for understanding people's perceptions and their preventive, treatment, and malaria control behaviour. For example, Winch et al write, "Cerebral malaria is commonly classified as a distinct condition attributable to supernatural forces. In this case the control of 'regular malaria' may not be seen as a priority as it is not perceived to be dangerous, while cerebral malaria, although perceived as dangerous, may not be seen as controllable through either vector control or chemotherapy," because it is not perceived as malaria (Winch et al, 1996:1058). It should also be noted that "local illness terms are in a constant state of flux, so that [cultural] 'rules' that make sense now might be entirely inappropriate in a few years" (Winch et al, 1996:1065; see also Gordon, 2000).

Even when perceptions about appropriate treatment and preventive actions may in general correspond with the scientific public health position, necessary actions may not be taken because it is often thought that people at certain stages of their lives, such as very young children or pregnant women, must be

treated with special care. In some cases it is believed that young children should not be in contact with the highly toxic (to them) impregnated bednets, and pregnant women should not ingest bitter substances such as chloroquine. Researchers in the Sudan reported that a large proportion of those studied believed that "chloroquine may cause abortion" (Elzubier et al, 1997:384). This conclusion was reached not only because of chloroquine's bitter taste and the association of bitter substances with traditional abortifacients, but because of the widespread use of an overdose of chloroquine for the specific purpose of bringing about abortion. A similar perception was found among inhabitants of the Pacific Coast of Guatemala where "people think that chloroquine causes abortion and breast milk to dry up" (Ruebush, Weller, & Klein, 1992:451). A study in Malawi found that "many women reported having been told by health-care workers not to consume bitter substances during pregnancy. [Yet], these same women reported receiving chloroquine, a very bitter medication, from ante-natal clinics" (Schultz et al, 1994:68). Thus, pregnant women are often given mixed messages, which can negatively affect compliance.

From Sri Lanka we learn that "poor compliance with chemotherapy [is a result of] the common perception that side-effects of chemotherapy are far more debilitating than the disease and uncertainty as to the validity of the 'cure'" (Jayawardene, 1993:1169). This is even more compelling for the use of prophylaxis for malaria prevention. Many link efficacy of drugs with toxicity and, as found in a study in Tanzania, these aspects are "... felt to go hand in hand: the greater the demonstrable effects of a 'dawa' (drug/medicine/treatment), the greater the potential for toxicity" (Winch et al, 1997:764). The effect of strong (toxic and effective) anti-malaria drugs was of particular concern to mothers of young children. A "strong" drug is good for getting rid of the sickness, but it may be too "strong" for certain age groups and people in particularly vulnerable conditions (i.e., pregnant women) (McCombie, 1996).

Classification of foods, medicines, and diseases as either "hot" or "cold" (not necessarily in temperature) is also prevalent among people in malarial zones in Africa, as it is in Latin America and Asia. Following the belief that therapy is

dependent on establishing a balance, if an anti-malarial preventive or therapeutic medicine is perceived as "hot," it will not be taken for the "hot" disease of malaria. In the Amazon region of Brazil, for example, Coimbra has noted that malaria is categorised as a "hot" disease and if popular ideas of health and disease are based on the belief that health depends on a proper balance between "hot" and "cold" elements, "it makes sense that people will not pay much attention to explanations relating mosquitoes and 'plasmodiums' to the transmission of malaria" (Coimbra, 1988:256-257). Similarly, a study in Sri Lanka reported that people with malaria did take orthodox anti-malarial drugs, but expended a great deal of money on "cold" foods, following the belief "that both the disease and the modern anti-malarial drugs have a 'heating' effect, which should be neutralised by special ['cold'] foods" (Konradsen et al, 1997:129). Thus, in Sri Lanka, by far the most expensive part of malaria "treatment" was the purchase of these special, and emically necessary, foods.

In other places, as reported from Ghana, for example, Agyepong noted that the common perception is that what is "good for one person is not necessarily good for another. Consideration should be given to the person as an individual and what suits him or her in choosing a particular therapy" (Agyepong, 1992:134). This notion may derive from the way people experience treatment by traditional healers, whose therapies may vary for individuals who show the same symptoms. People have grown to expect that therapy will be adjusted to the patient's personal characteristics, and that such things as the specific constitution and even character of a person will affect the treatment that is deemed appropriate. Factors such as the season and the phase of the moon, as well as the specific background of the individual and the social context, are also expected to influence appropriate therapy. An understanding of how people are treated by traditional healers and what they consider "appropriate treatment" in general may be crucial in providing guidance in how best to go about making changes to improve malaria prevention, treatment, and control. We expand on the practices of traditional healers in Chapter Four.

How misperceptions inhibit preventive and treatment actions

Examples of "misperceptions" people hold that may inhibit appropriate preventive and therapeutic actions abound. In Tanzania and Ghana it has been reported that malaria is considered a result of excessive heat and overwork (Ahorlu et al, 1997; Gessler et al, 1995; Winch et al, 1994). In Ghana, "malaria is perceived as an environmentally related disease caused by excessive contact with external heat which upset the blood equilibrium" (Agyepong, 1992:131). In parts of Guatemala it is thought that malaria is caused by "bathing too frequently or by drinking un-boiled water" (Ruebush, Weller, & Klein, 1992:451). And elsewhere in Guatemala malaria is thought to be derived from "exposure to cold or wet conditions; weakness or poor general health; problems related to hygiene; and poor eating habits or eating too much of the wrong foods" (Klein et al, 1995:384). Yet Guatemalans in these studies were quite knowledgeable about the role of mosquitoes in the transmission of malaria, although "few knew how mosquitoes acquired their infections or understood the risk of having an untreated person in their midst" (Klein et al, 1995:383). A study from Uganda similarly found that poor diet and environmental conditions (as well as the bites of mosquitoes) were perceived to cause the disease (Kengeya-Kayondo et al, 1994:267).

Examples of misperceptions about malaria are reported in research from all over the globe. A study in the Philippines found "a general disbelief in the mosquito as a vector of malaria, and [therefore] doubts about the efficacy of bednets" (Espino et al, 1997:223). This was also the case in a study from Tanzania, which reported that for those studied "there is no close association made between mosquitoes per se and malaria" (Gessler et al, 1995:127; see also van Geldermalsen & Munochiveyi, 1995). Researchers in Ethiopia found that 77% of those studied "thought that malaria could not be prevented: this probably arises because of incorrect ideas about its transmission" (Yeneneh et al, 1993:770). A study from Hainan, China, stated that though "people do not necessarily understand that mosquitoes are the vector of malaria," unlike in the Philippines,

there was still a high use of bednets (Tang et al, 1995:51). In The Gambia it is believed that close association with cattle, and, by extension, with nomadic pastoralists such as the Fula people, will cause malaria (Aikins, Pickering, & Greenwood, 1994; Aikins et al, 1993). Similarly, in Sri Lanka, while on the one hand "the bite of the mosquitoes is presented [in some folk poems] as more menacing than the life-threatening dangers from certain wild animals... " strangely, on the other hand, "local peasants did not recognise any connection between fevers and mosquitoes... [and] mosquitoes were... not recognised as a disease vector" (Silva, 1991:158). These seemingly contradictory perceptions people can and do hold at the same time, complicating their compliance with drug regimens and preventive activities.

Links between malaria and supernatural forces are common. In The Gambia and in Kenya, malaria, especially in children, is often perceived as the result of the child being possessed by an evil spirit or devil (Aikins et al, 1993; Mwenesi, Harpham, & Snow, 1995). A study from coastal Kenya also found that mothers did not make a connection between mosquitoes and malaria in their children, nor did they recognise many of the children's (convulsive) symptoms as related to malaria (Mwenesi et al, 1995). In some ways, convulsions in a child may quite "naturally" be seen as the child being possessed by a foreign force (devil or spirit) that is making the child's body twist and shake. It is also clear that while people recognise the symptoms of certain regular febrile illnesses such as malaria, the symptoms of cerebral malaria, which may be quite different and include convulsions, will not be related to malaria precisely because of its different and quite dramatic presentation.

In Tanzania, as in Kenya, convulsions (also known as *ndege-ndege*) in young children are not associated with malaria (which, of course, they usually are). People believe that if a child with *ndege-ndege* is given an injection, he or she will surely die (Mwenesi, 1993). Thus, children with convulsions are usually taken to traditional healers but not to a health centre or hospital (Tarimo, Urassa, & Msamanga, 1998; Winch et al, 1996). Because of this, an anti-malaria project in Bagamoyo District, Tanzania, recommended that "instead of crit-

icising traditional healers, we have incorporated them into project activities, and some have served as members of village mosquito committees" (Winch et al, 1996:1065). Similarly, for adults in this district in Tanzania, it was found that certain febrile illnesses that are especially common during the "cold" rainy seasons, and which cause severe fevers, were perceived to be caused by "spirits, witchcraft and sorcery." As a class, these illnesses are known as "fevers which do not accept hospital treatment" or "out-of-the-ordinary fevers" (Winch et al, 1994:68). However, other *homa ya malaria* (malaria fevers) are recognised as malaria and modern medicine is sought for their treatment (Winch et al, 1996). From Malawi we have learned that "A few people said that people die when they have *malungo* illnesses, because of an overdose of chloroquine" (Helitzer-Allen, Kendall, & Wirima, 1993:280).

These differing and often conflicting perceptions, as delineated some time ago by G. M. Foster (1976), may stem from a dualistic aetiological perception, common among many people who think about disease causation in either "naturalistic" or "personalistic" terms. The "personalistic" aetiological perception includes the belief that certain diseases may be caused by purposeful intervention of an agent, which may be human, non-human, or supernatural. This way of perceiving disease causation sees the sick person as a victim, with no room for accident as an explanation. Oaks et al explain:

> *The significance of the perceptions [which people in many regions have] that there are many causes of malaria is that people may feel that there is no way to control malaria. Mosquitoes can be avoided, but [if malaria also has other causes] it is difficult to avoid hard work, getting wet or cold, or eating "contaminated" food. As a result, people are unwilling to participate in time-consuming malaria control activities [and people may also believe] that methods of treatment such as chloroquine do not work for all forms of malaria.* (Oaks et al, 1991:266)

The researchers go on to state quite strongly that "The importance of 'nonscientific' and traditional theories of illness causation to malaria control should not be underestimated... since they summarise the communities' perception of

the local epidemiology of malaria and their perception of risk" (Oaks et al, 1991:272). Based on knowledge of local realities, new ideas should be introduced in as harmonious ways as possible, allowing old perceptions to be amended and new perceptions to be adopted. An antagonistic approach, especially one which involves labelling people ignorant and unscientific peasants, has been found over and over again not to meet with much success, either in the short or long run. A formal recognition of differences and a negotiation of mutually agreeable solutions (through cultural "accommodations") should be employed and will help form the basis of successful malaria control efforts.

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CHAPTER FOUR

THE ACCEPTANCE AND USE OF WESTERN TECHNOLOGY VERSUS LOCAL METHODS IN MALARIA TREATMENT

As one mother reiterated when referring to convulsions in children: 'We know what we can treat ourselves and what you can treat for us'. (Mwenesi, 1994:30)

Just as health treatment-seeking behaviour can be influenced by a variety of factors, including local beliefs about disease, access, costs, and attitudes toward health-care providers (both Western and traditional healers), sources of treatment for malaria are similarly affected. Treatment modalities can be separated into three different categories: 1) home or self-treatment, including both herbal/traditional treatment and pharmaceutical/antibiotic use; 2) traditional techniques; and 3) the official allopathic or "Western" medical sector, including hospitals, clinics, dispensaries, private practitioners, and village health workers (McCombie, 1996; Ahorlu et al, 1997). Multiple treatment – and polypharmacy practice – is common, both in the concurrent use of different types as well as in the sequential use of various sources of treatment.

A hierarchy of resort

Individuals often use a combination of self-treatment, traditional medicines, and more than one clinic or health-care provider, what is known as a "hierarchy of resort" (McCombie, 1996). In a review of the literature of studies conducted throughout the world, McCombie found that there was a large range of variation in treatment-seeking patterns, with use of the official sector ranging from 10% to 99%, and resort to self-purchase of drugs ranging from 4% to 87%. Exclusive use of traditional healers and/or herbal treatments seems to be rare except in the most remote areas, while combining traditional remedies with "Western" methods is common. In a study of the sociomedical aspects of

malaria control in Colombia, for example, researchers found that even though chloroquine was usually used, it was most often combined with plant remedies. This suggests both a long tradition of herbal treatment in this area and an acceptance, if only partial, of Western medicines (Lipowsky, Kroeger, & Vazquez, 1992). Severity of illness may be related to this hierarchy of resort, with the use of multiple treatments: as one treatment fails and the illness worsens, people may take recourse in other, more drastic or costly means to alleviate it (McCombie, 1996).

When people employ a hierarchy of resort in seeking treatment for malaria, home treatment usually serves as the first line of defence. Although both allopathic medical services and those of traditional healers are used to prevent and treat symptoms of what we and sometimes even the patients know to be malaria, most malaria patients are treated at home. A multi-country study by Susan Foster found that "self-treatment in Africa, especially in rural areas where about 75% of the population live, is the rule rather than the exception" (Foster, 1995:29). Cost and convenience are obvious reasons for home treatment, especially in countries where "structural adjustment policies" are in place; yet perceptions also play a significant role. In terms of a hierarchy of resort, it is the perception of the great majority of people in countries throughout the world that most illnesses should first be treated at home, and only when such treatment fails and the illness persists, or worsens, should other types of therapies be sought. If it is perceived that health workers treat most patients rudely, that they do not have the appropriate drugs, or that the general quality of their services is inadequate, this will also influence a first preference for home treatment (Yeneneh et al, 1993). Home treatment may, of course, result in incorrect or incomplete regimens or dosages, and it may also cause delays in taking a severely sick person to a health facility in a timely fashion (Fungladda, 1991; see also McCombie, 1996.)

Although a range of anti-malarials is available in the market, the fact that many of those who "self-treat" purchase their medicaments from poorly-informed shopkeepers and drug sellers is a significant reason for concern about misin-

formation on appropriate treatment (Massele et al, 1993). From a village setting in Sri Lanka we learn that "Malaria tablets circulated freely within the village, they were passed around according to need... Keeping a few tablets in stock was important, just in case, 'why should we take those tablets when we have no fever? Better store them for when we get sick?'" (Jayawardene, 1993:1175). Indeed, this behaviour is found throughout the world and may be one of the leading reasons for drug resistance. From a study in Zimbabwe we are informed that because of the bitter taste of chloroquine, many people believe that any bitter substance may cure malaria. "Traditional malaria medication is based on the use of substances such as pepper, salty water, and bitter fruits, roots, and leaves and barks of certain trees. Most of these substances are ground into powder and boiled in water, to be taken as a drink, or added to food" (Vundule & Mharakurwa, 1996:57-58). The effectiveness of these substances is, of course, highly questionable. Nonetheless, a number of other traditional anti-malarial therapies have been found to have active ingredients effective against malaria.

In a study of treatment-seeking behaviour among women in Uganda, researchers found that their subjects resorted to the use of local herbs first. Taking antibiotic tablets bought from local shops or left over from a prior illness was also quite common. A very small number of respondents reported going to a clinic/hospital as a first line of action, but there was general agreement that informal self-treatment was sought before pursuing formal care (Kengeya-Kayondo et al, 1994). Similarly, in a study of treatment-seeking behaviour for malaria in Somalia, researchers found that the first choice of treatment was use of local herbal remedies, the second line was irregular and unprescribed doses of chloroquine, and the last resort was to visit a doctor or hospital (Abyan & Osman, 1993).

Other factors influencing mode of treatment

In addition to consideration of the most appropriate treatment methods, there are various other ways by which people make decisions to seek care for spe-

cific stages of an illness. Social networks may play an important part. Indeed, many decisions about where to seek care are influenced by lay references. This may be especially true in Africa, where people may be affected by a network of kin, neighbours, and friends who constitute a "Treatment Management Group" (Janzen, 1978) and contribute to diagnosis and selection of treatment sources, both of which may have an impact on the course of treatment (Igun, 1987). Who makes the decision within the household, whether it is the mother or the father, may play an important role in which kind of treatment is sought, and this can vary by region, community, and even individual household. For example, in Ethiopia researchers found that treatment-seeking determinations were usually made jointly by both parents (Yeneneh et al, 1993). In contrast, along the Kenyan Coast among the Mijikenda and Luo[1], researchers found that the male head of household generally made decisions. Social roles played an important part in the decision-making process, especially ideas about who "owns" the child. This idea of "ownership" of children is an important consideration when studying treatment-seeking behaviour in patrilineal and matrilineal societies. Since the child belongs to the patrilineage, it is the male head who makes decisions. In the Kenyan study, the male head of household (usually the husband) decided both about diagnosis as well as the type of treatment to be used. In the absence of a husband, male in-laws in the case of widowed women, and brothers or fathers in the case of unmarried women, made the determinations. A primary reason for this was to keep matters within the household and to protect the male head's position within it. In the local belief system, malaria is sometimes thought to be caused by sorcery, which can be practiced by kin against kin. Illnesses are therefore kept hidden within the household until the local healer dispels the threat from other kin or performs the necessary counteractive measures (Mwenesi, 1994).

Another important issue for malaria control efforts is who receives treatment, since children under age five are most at risk for severe malaria, and morbidity and mortality for this group is especially high due to low immunity (Massele et al, 1993). Local recognition that this group deserves special treatment is vital in decreasing morbidity and mortality and can be a challenge to health

education. Some studies have shown that at the local level, this age group is often recognised as requiring special care. In a study of anti-malarial drug utilisation by women in Ethiopia, researchers found that the under-five age group was identified as the most malaria-vulnerable and most in need of treatment. Severity of illness was seen as the primary determinant in seeking treatment (Yeneneh et al, 1993). In a similar study of malaria treatment in Malawi, researchers found that clinic attendance was positively correlated with young age of the child, defined in this study as less than four years (Slutsker et al, 1994). Gender of the child is also a factor, as discrimination may result in better care for males than for females. This was found to be the case in Malawi, where researchers learned that, among clinic attendees, male children were more likely to receive the correct dosage of chloroquine than were females (Slutsker et al, 1994). This could be gender discrimination by clinic workers or a more widespread gender bias across the entire culture. Outside the clinic, parents may be more inclined to bring male children to the clinic in the first place and within the clinic, health workers may give better treatment to male children.

Pregnant women, especially if they are primigravida, are another group at high risk because of suppressed immunity during pregnancy[2] (Okonofua et al, 1992). For young pregnant women, however, cultural prejudices may play a role in barriers to treatment, especially if the women are unmarried. In a study among pregnant and non-pregnant adolescent girls in Nigeria, researchers found that community premarital pregnancy was resented and associated with shame. Most parents hid their unmarried, pregnant daughters at home to avoid the humiliation, and the daughters themselves stated that they did not want to be seen in public because of the negative attitude toward premarital adolescent pregnancy. Thus many of these adolescents were more likely to practice self-medication for malaria, rather than using the village health facility (Okonofua et al, 1992).

Another problem in treating pregnant women for malaria is the very common belief that chloroquine tablets can cause abortion and there is substantial evidence to suggest that excessive use of chloroquine can indeed precipitate abor-

tion (Phillips-Howard et al, 1998; Phillips-Howard & Wood, 1996; Schultz et al, 1996). Few women in the Afgoi Women's Organisation in Somalia advocated use of chloroquine tablets for pregnant women (Abyan & Osman, 1993). In a study of malaria treatment practices among mothers in Guinea, researchers found that lack of chloroquine usage was significantly associated among urban women with the belief that the pills would cause miscarriage. The fear pregnant women may have of losing their babies as a result of taking chloroquine far outweighs their concern about contracting malaria and they thus avoid use of the drug. This was not found among women in rural areas, however. The discrepancy may have been due to exposure to chloroquine and its use: those in rural areas may have had less exposure than urban women to the idea that chloroquine causes abortions and so were not as disinclined to its use during pregnancy (Glik et al, 1989). It should be pointed out, however, that severe malaria during pregnancy can lead to fetal death (Alecrim, Espinosa, & Alecrim, 2000; Phillips-Howard, 1999; Steketee, Wirima, & Campbell, 1996).

Self-treatment and use of anti-malarial medications/drugs

Self-treatment is the most common mode of action in malaria cases, especially in rural areas of Africa, where 75% of the cases of malaria occur (Foster, 1995). In a study of home treatment of febrile children in Togo, researchers found that 83% of children were treated with an anti-malarial drug at home, with chloroquine from a street market or vendor being the drug of choice for 94% (Deming et al, 1989). In a review of the treatment-seeking literature, McCombie (1996) also found that care of most malaria episodes begins with self-treatment, and that nearly half of all cases were treated solely with these methods.

Despite the potential dangers of failed treatment due to chloroquine-resistant strains of malaria, chloroquine continues to be the most widely available and widely used drug in many areas of the world. But indiscriminate and partial chloroquine use may significantly contribute to the growth of resistant strains.

In most countries, the four main distribution or supply networks for drugs are the public sector; the private, non-profit sector; the private commercial sector; and the private "unofficial" or "informal" sector. Many drugs are purchased in the private sector, which includes both official "ethical pharmacies" as well as "unofficial" outlets like drugstores, general stores, market sellers, and street peddlers (Foster, 1991).

There are various reasons why people choose to patronize pharmacies, shops, and even illegal drug sellers in addition to and instead of health centres. First, and perhaps foremost, is the ease of purchasing drugs and obtaining "immediate" treatment. In a study in Maiduguri, Nigeria, the researchers found that immediate attention for both consultation and treatment was the single most important reason for patronizing retail pharmacies rather than health clinics (Igun, 1987). Another important factor was "availability of unadulterated drugs at all times," since the pharmacy was open during hours when the health clinics were closed (Igun, 1987). The inadequacies of the health delivery system in Nigeria were legion, including overcrowded outpatient clinics and wards, non-availability of drugs due either to insufficient resources or mismanagement of funds, and preferential treatment based upon "who you know." In a similar study in Ethiopia, reasons for failing to complete a full course of treatment included unpleasant taste of the drug, "the drug was too strong," and subsidence of malaria symptoms, which made further use of the drug "unnecessary" (Yeneneh et al, 1993).

Since self-treatment is so common, it is likely to continue as the main resort for the majority of malaria cases in the future. In fact, were people in many developing countries to cease self-medicating and to seek care in health facilities, it would be disastrous, as most of these institutions would be unable to cope with the large influx of cases that would result. According to Foster, "patients are actually doing the health services a financial favour by self-medicating" (Foster, 1995:32). Nevertheless, self-treatment of malaria entails many potential dangers. First, home treatment may result in delays in taking patients with severe malaria to health centres (Menon et al, 1988). Caretakers may wait

until the condition resolves on its own or when the illness does not resolve and indeed worsens, it may be too late, as a delay of even a couple of days may prove deadly in cases of severe malaria. In a study of treatment of childhood malaria among mothers on the Kenyan Coast, researchers found that mothers were treating their children with anti-malarials within 24 hours of the onset of illness. However, the average time lag between taking children to the hospital and the onset of illness was three days (Mwenesi, 1994). Second, if chloroquine is used first at home and then administered again at the clinic, there is a chance of overdosing if clinic staff are unaware that medication has been previously used. Third, the spread of chloroquine-resistant malaria strains may be increased by indiscriminate and improper use of the drug (Mwenesi, 1994).

Improper or inappropriate use of anti-malarial drugs is the result of a number of factors. Illiteracy may be a significant issue: people who are unable to read the instructions on or in the medicine packages may not understand the correct dosage (Mburu, Spencer, & Kaseje, 1987). If health workers do not correctly explain how to use drugs, if the health workers themselves are misinformed, or if the medicine is bought at a shop where incorrect or little information is given, the potential for misuse is high (Djimde et al, 1998). Underdosing is the most common result (McCombie, 1996). In fact, anti-malarials are frequently shared among family members (Ruebush et al, 1995) and since the full course of treatment is usually not completed, tablets are saved for the next bout of illness (McCombie, 1996). Failure to complete treatment is common, whether the drugs are bought from the unofficial sector or obtained from a health-care clinic (McCombie, 1996). In a study in Ethiopia, researchers found that mothers with more than two children were more likely to stop treatment after the symptoms went away, rather than completing the full course of anti-malarials, in order to save the remaining pills for the other children (Yeneneh et al, 1993).

Another factor in underdosing relates to the large numbers of people who purchase drugs from shops or illegal vendors who recommend the wrong amount (Djimde et al, 1998). In a study of the treatment of malaria in Dar es Salaam,

Tanzania, researchers found that shopkeepers and drug sellers receive no formal education on the proper treatment of malaria. Since the people interviewed in the study did not have adequate knowledge about chloroquine dosage (only 30% of patients and 20% of shoppers knew the correct dosage), the researchers concluded that the customers were not receiving adequate information from shops and drug sellers (Massele et al, 1993). In Maiduguri, Nigeria, researchers learned that diagnosis and treatment of malaria was being handled by retail pharmacists, as well as by people who had no qualifications for working in the pharmacy and were licensed to sell only proprietary non-poisonous drugs (Igun, 1987). Researchers noted a similar activity in Saradidi, Kenya, where shopkeepers both supplied and prescribed drugs. With many people asking for advice about the proper dosage, shopkeepers influenced the amount of drugs taken (Mburu, Spencer, & Kaseje, 1987; van der Geest, 1999). Even if people do visit health facilities, they may not necessarily receive the correct advice. A common problem associated with low-level health facilities is overprescription of too many different drugs. Health workers may overprescribe drugs to appear to be "good doctors," which may create confusion about which medication is really needed. Further, when patients reach the pharmacy they may ask again for help, this time from the worker at the counter, who in effect fulfills the prescribing role, even though sufficient knowledge to do so is lacking (Foster, 1991).

Traditional treatment methods and healers

Since traditional treatment methods and healers may often be the first line of treatment for malaria, it is important to understand how, why, and what kinds of traditional methods are used. This is particularly crucial since many control programmes in the past have ignored the ways that traditional medical systems and local people deal with the disease (Lipowsky, Kroeger, & Vazquez, 1992). Many cultures, especially in Africa, combine religion, sorcery, health, and interpersonal conflict into a unified system of belief and practice, making it necessary to consider all aspects of the social and economic environment in studying treatment-seeking behaviour for malaria (Gessler et al, 1995b). Historically, this was also the case in Italy (Brown, 2002).

The use of herbal remedies in the treatment of malaria is widespread. They are often an inexpensive alternative to Western antibiotics (Ruebush et al, 1995; Silva, 1991; Tona et al, 1999). In Somalia, the aetiological connection between malaria and the mosquito has probably been recognised for a long time, and as a consequence of the long historical interaction between local culture and malaria, Somalis have developed many of their own treatment practices, including consumption of "Khat" leaves (a mild drug-like substance), fresh camel milk, purgative herbs such as "Carmo" leaves, black river fish, reciting verses of the Quaran, and massaging ill people with a mixture of sesame oil and lemon juice (Abyan & Osman, 1993).

Traditional healers may be consulted for a number of reasons - social, economic, therapeutic, and psychological. In a review of treatment-seeking behaviour, McCombie (1996) found that, even if most people preferred self-treatment, traditional healers were most often consulted for cases of convulsions, splenomegaly, and anaemia, even if these symptoms were not associated with malaria. Indeed, traditional healers serve a variety of important roles. In a study of the use of traditional healers in the malaria volunteer programme in Thailand, villagers preferred the traditional healers, many of whom were actually "injection doctors," specialising in administering treatment via injections. Villagers felt more comfortable having their fingers pricked by someone with previous experience in handling needles, and they felt that they were more able to complain about their symptoms and receive a sympathetic response (Okanurak, Sornmani, & Chitprarop, 1992). In a study in Ethiopia, researchers also found that traditional birth attendants are believed to understand women's and children's problems and consequently are more likely to have a better rapport with mothers. Including indigenous and/or other traditional specialists as volunteer malaria workers may increase access to anti-malaria drugs for some hard-to-reach mothers and children (Yeneneh et al, 1993).

Perceptions about the cause and appropriate methods to be used can play a large role in the type of treatment chosen.[3] The absence of a true symptom complex, combined with variations in cultural perceptions and interpretations

of symptoms, makes identification of malaria cases difficult. Indeed, the identification of malaria-like illnesses is highly variable. Diagnosis can be subsumed either under one large illness category or several illness terms can be used, based on the different manifestations of the illness (Igun, 1987). Thus, the variability of symptoms may lead to different treatment methods. For example, along the coast of Kenya researchers found that the use of traditional methods and healers depended on different clinical manifestations of the illness (Snow et al,1992). In Tanzania, researchers also found that local residents made use of treatment methods based upon different types of patients (male, female, pregnant female, young child) and different presentations of the disease (Gessler et al, 1995a). In a more serious and potentially deadly example, other researchers in Kenya reported that convulsions (an indication of severe cerebral malaria), while considered life-threatening, were attributed to supernatural causes and anti-malarial drugs and anti-pyretics were counterindicated when convulsions occurred, and were actually withheld or withdrawn from children having convulsions (Mwenesi, Harpham, & Snow, 1995). This disease concept is also common in Tanzania, where it is considered dangerous for children with *ndege-ndege* (convulsions) to receive "Western" treatment.

Different aetiological explanations for malaria can lead to different treatment methods. For example, where malaria is thought to be of supernatural origin, treatment is usually within the domain of traditional medicine. On the other hand, those illnesses thought to be due to natural causes can be cared for through more modern methods and treatment therapies. The two are often combined, sometimes simultaneously, especially in Africa (Igun, 1987). Moreover, many cultures do not have an illness concept or general category that corresponds to the biomedical term "malaria." In light of the many difficulties in diagnosing malaria cases, it is important to study local disease categories and illnesses that correspond to malaria, since the concept of what is and is not malaria can affect treatment-seeking behaviour (McCombie, 1996).

Among Mijikenda mothers in Kenya, malaria is perceived as a chronic disease, but not a particularly severe one. Since this explanation of malaria does not

account for it becoming a severe condition convulsions, anaemia, and splenomegaly are not considered related to it and are thought to have their own ethno-etiologies and treatments, not necessarily the same as those for malaria. Moreover, the type of treatment used for convulsions at hospital is not consistent with traditional expectations, reason enough for mothers to avoid taking children with these symptoms to hospitals. Injections are the primary form of treatment in these instances, but it is these procedures that are believed by mothers to cause the death of children with convulsions at hospital. Perhaps most paediatric malaria deaths occur in hospital emergency wards because that is where children are brought when their illness is often too far advanced to respond to treatment. Unfortunately, these deaths only serve to reinforce the idea that children with convulsions who are brought to health clinics do not survive the treatment, especially the "strong" (or "hot" as it would be called elsewhere) injections, administered there (Mwenesi, 1994).

Use of health-care facilities

Considerable variations can be found in the use of the official health sector in the treatment of malaria. Part of this variability lies in cultural practices, but other barriers play a large role as well. Clinic attendance usually shows an urban versus rural differentiation. Even though malaria is usually most prevalent in rural areas, either because of difficulty of access to health facilities or because of the presence of more traditional methods, clinic attendance is usually lower. In a review of the literature, McCombie (1996) found that urban areas usually present lower rates of malaria, while at the same time showing higher rates of attendance at health facilities. Self-treatment, both with anti-malarial drugs and traditional remedies, was higher in rural areas due to differential access to health facilities, income levels, educational level, and prevalence of the disease.

McCombie also found that access to health facilities, severity of illness, and cost were the main impediments to health-centre use. Indeed, concern over cost of treatment is a primary reason for non-use of health clinics, as well as

being a primary motivator for self-treatment, the main problem being ability, not willingness, to pay (Foster, 1991). Herbal treatment is practically free (Ahorlu et al, 1997), while certain allopathic anti-malarials can sometimes be purchased individually at shops, decreasing the cost of a single course of treatment. Visits to health centres, however, may entail additional and sometimes prohibitive costs, including travelling expenses and time lost from productive activities.

Another significant concern is the timing of malaria, which often does not overlap with the "seasonality" of available income from agricultural-based economic activities.[4] Seeking care at health clinics requires money. In many countries malaria appears during the rainy season, when cash reserves from the previous harvest are at their lowest. Thus those seeking care at this time of year are less able to afford it due to loss of time that would be used for productive activities as well as the low cash reserves (Foster, 1991).

Commuting time to hospital or clinic can also be a serious concern. The non-monetary cost and inconvenience of attending health centres may be underestimated in studies of health-centre attendance (Snow et al, 1992). In a study of the use of shops in the treatment of malaria along the coast of Kenya, researchers found that mothers preferred to purchase drugs from over-the-counter stores close to home because the women did not have to go themselves and could send siblings of the sick child or other family members to buy medication while they stayed home and attended to their household duties and other productive activities (Snow et al, 1992). The hours of service are yet another factor, since shops may be open and more convenient in emergencies that occur at times of the day when health facilities are closed (Mburu, Spencer, & Kaseje, 1987).

Since malaria is a major problem in rural areas, the remote location of many villages can serve as a barrier to treatment. Quite simply, if caretakers cannot reach the facilities, they cannot use them. This was a major problem as well as a primary reason for the purchase of drugs from shops in the above-mentioned study in Kenya (Mburu, Spencer, & Kaseje, 1987). Similarly, in a study

of malaria treatment practices among mothers in Guinea, researchers found that rural mothers who lived farthest from health facilities were less likely to attend them and were more tardy in administering medication to sick children than women who lived closer to health clinics (Glik et al, 1989). There are other, more subtle reasons responsible for the difficulties of treating malaria at rural health centres. Transportation is often arduous in remote areas, making timely delivery of supplies problematic. Preventing drug pilfering along the supply route and ensuring that most drugs reach their intended destinations is a concern as well. Finally, preventing deterioration of the drugs during transport can be formidable (Foster, 1991). All of these problems with the supply and quality of drugs at rural health centres can negatively affect people's desires to seek treatment there.

Other barriers to the use of health centres include the long waiting times common at many rural health facilities, as well as shortages of medicines. In a study of self-treatment in a rural area of western Kenya, researchers found that fewer than one in four people went to the rural health centre or to a hospital during any stage of their illness, even though these facilities were free and readily accessible. Reasons included the long wait times at the clinics, the often brusque manner of the overworked staff (who frequently dealt with 50 to 60 patients in a morning), and the frequent shortages of drugs. Furthermore, there was concern and doubt about the effectiveness of the treatments (Ruebush et al, 1995). This was also found to be a problem in a similar study along the Kenyan Coast, where Sokoke mothers preferred to make a 40-kilometre journey to a district hospital in Kilifi District, rather than attending the government dispensary in the area that was much more accessible. They considered the "muzungu" (white) doctors in the malaria clinic to be more qualified, and they believed that they would receive better treatment, even though the rural dispensaries offered fee-free services, while the hospital in Kilifi District charged (Mwenesi, 1994).

The attitude of the health staff may be yet another reason for avoiding official health facilities. When staff are brusque or condescending (due to ethnic, perceived class differences or other reasons), patients may not be comfortable

asking questions to clarify dosage schedules or they may feel belittled. Indeed, the quality of the interaction between health staff and patient is often neglected in studies of health-clinic attendance (Foster, 1995), even though this may be an important deterrent to facility use. In a study of childhood treatment of malaria along the Kenyan Coast, researchers found that 55% of mothers who were given medication for their children did not understand instructions and did not ask clinic staff for verification. The reason they gave for their failure to make inquiries was that health-centre staff could be harsh and rude when asked too many questions (Mwenesi, 1994). Health staff may not carry out their proper roles, and may in fact engage in illegal sale of drugs because of poor salaries. This was found to be the case in a study in Ethiopia, where some of the health agents were found to be selling anti-malarial and other drugs illegally (Yeneneh et al, 1993).

If malaria morbidity and mortality are to be reduced, treatment-seeking behaviour is one of the primary issues that must be addressed. Delays in seeking treatment at health centres, inappropriate or inadequate use of anti-malarial drugs, and the use of traditional herbal treatments and the role that healers play in treatment all contribute to the high rates of malaria morbidity and mortality in developing countries. An understanding of the social and cultural motivating factors is essential to any malaria control effort, as is integrating a social-behavioural approach and the use of already existing literature on this subject into the design of malaria control programmes.

Notes

1 The Luo are an ethnic group who primarily live in western Kenya, but this study was conducted among a group of Luo who had migrated to a coastal town.

2 For a more detailed discussion of women and gender roles in relation to malaria, see Chapter Seven.

3 For a more detailed discussion on the cultural perceptions of malaria and its etiology, see Chapter Three.

4 For further discussion about interactions between human behaviour and seasonality of malaria, see Chapters Two and Five.

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CHAPTER FIVE

MALARIA TRANSMISSION AND CONTROL: HUMAN MOBILITY, REFUGEES, AND RESETTLEMENT

... a great deal of lip-service has been paid to mobility and other human factors by those involved in planning anti-malaria and other public health activities but too little of a practical nature and insufficient detail has been done about these factors in the field.(Rajagopalan et al, 1986:880)

Human population movements have also played a significant role in malaria transmission. Since the environment was set for the introduction of malaria to humans in West Africa some 10 000 years ago, changes in settlement patterns and migration carried the infection to the great riverain centres of civilisation in Mesopotamia, India, South China, and Egypt (Bruce-Chwatt, 1988). Today, population growth, resulting in resource pressure and redistribution of people from rural to urban areas as well as cyclical migration, is an important factor in malaria transmission. This population rise has also been a primary cause of mobility, which is now easier than ever due to increasingly sophisticated technology and expansion of modern transportation. Natural and man-made disasters further stimulate movement, both small-scale and large-scale, especially by swelling the numbers of refugees (Prothero, 1977). Why, how, and where people move can have profound effects on the distribution and incidence of malaria; moreover, population movements can hinder anti-malaria interventions (Prothero, 1965). Understanding and controlling malaria among mobile populations requires knowledge of population distribution, settlement patterns, the nature and quality of housing, and administrative and social organisation, as well as the economic activities in which people engage (Prothero, 1965). Different types of mobile populations present different kinds of problems, each requiring a unique understanding and solution.

How mobility affects malaria transmission

Population movement is one of the most important forces in modern-day malaria transmission and distribution in large measure because it is intimately connected with agricultural development and urbanisation (Oaks et al, 1991), affecting malaria transmission in four principal ways.

1) Certain kinds of movement can expose individuals to a variety of health hazards (Prothero, 1977). For example, movement from one type of ecological condition to another can result in new, or increased, exposure of non-immunes. Movements also bring different groups into contact with one another and thus increase the likelihood of malaria transmission. Non-immune people who move into malaria-endemic regions may be at risk for severe illness since they have not yet built up natural defenses against the parasite through repeated and constant infection (Prothero, 1965). Conversely, infected people who move into malaria-free regions may introduce the parasite into new areas if these regions contain an appropriate vector.

2) Migrants in new areas often live in conditions that are of lower quality than those of settled populations (Oaks et al, 1991). The living quarters of recently arrived immigrants are usually crowded, often located near *Anopheles* breeding sites, and so poorly constructed that they offer little protection against mosquitoes and the malaria they transmit.

3) The kind of work that highly mobile people perform and the conditions under which they work often result in increased exposure to the vector. Illegal activities – such as gem mining, gold prospecting, cattle herding in protected areas such as natural parks, and certain types of hunting – are usually performed during the night, when various vector *Anopheles* are most likely to be biting. Since the nature of these activities requires a high degree of mobility, the people who participate are placed in increasing contact with mosquitoes while being less likely to have access to health care. A related problem is the instability of the types of work in which highly mobile pop-

ulations are involved. Since employment may be seasonal, there are periods when these groups have no money for malaria treatment. The time of day when activities occur varies by occupation and may also play a role in risk of malaria transmission. In the Brazilian Amazon (Coimbra, 1988), rubber-tappers usually leave their homes in the hours before dawn and thus are easy targets for mosquitoes. Also, possibly to supplement their small reserves, new settlers often engage in hunting and fishing at night, exposing themselves to mosquitoes during peak biting hours (Coimbra, 1988).

4) Mobile populations are not usually reached by government malaria control programmes. Most studies upon which these efforts are based treat human groups as stable entities and do not account for possible mobility (Oaks et al, 1991). Thus mobile populations fall out of the loop of most public health efforts since temporary homes often cannot be identified and therefore do not receive services.

Types of mobility

Understanding the different types of mobility in which people engage is important to the success of public health programmes aimed at malaria control (Martens & Hall, 2000). Prothero (1977) divides human movement into two major temporal categories: migration and circulation. Migration involves change of residence and is usually a permanent event, while circulation refers to movement away from a place of residence, with eventual return. Circulation implies a temporary, often seasonal, movement. Circulation may take place daily, for instance, commuting from one community to another for economic activities such as work in a mine. Circulation may also be periodic, for a series of days or weeks; it may be seasonal, for a period of months; or it may be even more long-term. Whatever the length of absence from home base, circulation implies that there is a recognised residence to which the person or people eventually return (Prothero, 1977). Such movement may also include pilgrimages or attendance at funerals, religious festivities, and other similar events.

Much of the mobility in recent history has been from rural to urban areas for populations in search of greater job opportunities in cities. Due to rapidly expanding urban environments, there is often mobility within mobility, either within the city itself, or between cities and the countryside. Under the framework described above, such movements can be described as circulation, frequently urban/urban, referring to movement either within the same city or between cities. Rural/urban movements between the countryside and the city are also common, often involving visits to relatives still living in rural areas (Prothero, 1977).

Rural/rural movements also occur and may be due to seasonal factors. For example, people who rely upon herding cattle for their survival must move to where the pasturage and water sources are located, and these depend on the season. Historically, in Somalia, major north/south movements have been the result of travelling from permanent water sources to areas where pasturage is better, but where water is only available in the wet season (Prothero, 1977). People also move temporarily to take advantage of economic opportunities during harvest times, an unfortunate consequence of which is that they may enter a certain area at the time when mosquito density is highest and thus expose themselves to increased risk of malaria. In the Naya region of Colombia, for example, there are two periods of higher than usual human density – March/April and August/September – when temporary population movement occurs because of agricultural conditions. Unfortunately, these periods of the year correspond to peak distribution of anopheline populations and consequently secure continuous and intense malaria transmission (Sevilla-Casas, 1993).

A very special form of mobility is that of internally displaced people (usually moving within one country) and refugees (usually having moved from one country to another) caused by civil unrest, war, ethnic strife, famine, and a range of other factors. Refugees and internally displaced populations are particularly vulnerable to the risk of malaria, as the camps in which they live are often in environments prone to vector breeding (Rowland & Nosten, 2001). The refugee camps resulting from complex humanitarian emergencies in different parts of

the world create significant risks for malaria, the prevention of which requires applied anthropological research to formulate interventions that are applicable to the particular social, cultural, and physical environments of these camps (Williams & Bloland, 2001). The poor conditions of these camps also make it difficult to screen refugees for malaria (Sullivan, 2000). Yet another aspect is the impact that the movement of a large refugee population has on the geography of malaria. Kazmi & Pandit (2001) studied the shift in the spatial pattern of malaria in the Northwest Frontier Province in Pakistan between 1972 and 1997 and related it to the influx of more than two and a half million Afghan refugees. Shah et al (1997) have also linked the chloroquine resistance and upsurge of falciparum malaria in Pakistan to this influx of Afghan refugees.

Motivations for mobility

Mobility results from a variety of underlying motivations, and different groups that move have many reasons for doing so. Perhaps the most obvious cohort comprises people who relocate for economic reasons, such as migrant workers, refugees from war or famine, and resettlers and other people displaced by changing patterns of land usage. These people often move to urban areas from the countryside, with a consequent rise in urban malaria. They live in areas on the periphery of the city, which, being the most recently settled, are usually crowded and ecologically disrupted, making for easy transmission of disease. Moreover, many of these labourers work in the city for part of the year and then return to the country, where they become reinfected. When they return to the city once again, they may bring malaria back into the urban community, resulting in a cycle of constant reinfection (Oaks et al, 1991).

Occupations that by their very nature involve constant movement also put people at risk. In a study on the effect of population movement and malaria persistence in Rameswaram Island, Sri Lanka, researchers found that fishing was a major occupation because of the island's physical characteristics. Most of the local inhabitants are fishermen or are involved in other aspects of the fishing industry. They live in temporary camps, and because of the transient nature of

their lives, the national malaria programme cannot maintain permanent surveillance and treatment. Consequently, most of the people who become ill do not receive treatment. When the fishermen return home to their villages, they carry the infection back with them, creating foci for transmission in areas where immunity is low. Thus, the movement of the fishing population plays a large part in maintaining the high prevalence of malaria both in Rameswaram Island as well as in the coastal areas of the mainland, where many of the fishermen's permanent homes are located (Rajagopalan et al, 1986).

Another example of instability is found in the gold-mining communities of the Brazilian Amazon, which draw a population of temporary workers. The transient nature of the mining camps they establish not only does little to protect against local ecological conditions, but also contributes to malaria transmission. Typical dwellings are open-sided, and canvas or palm fronds usually serve as a roof. The absence of walls makes it possible for mosquitoes to enter the sleeping areas freely throughout the night, making it impossible for malaria control teams to spray the habitations with insecticide (Coimbra, 1988).

Illegal activities also play a large role in economically motivated human movement. In a study of malaria and mobility in Thailand, researchers found that many people were involved in illegal or fringe activities, such as unlicensed logging, poaching of endangered species, cattle and goods smuggling, drug trafficking, and gem mining on the Thai/Cambodian border. Because of the clandestine nature of these activities, most take place at night and during peak biting hours for malaria vectors. Moreover, for obvious reasons, people who take part in these activities usually need to stay hidden, so malaria infections among such groups are extremely difficult to monitor and treat. Malaria in this group contributes to the persistence of the disease in the entire region and potentially affects others who live in or pass through it (Singhanetra-Renard, 1993).

Another important factor in human mobility is resettlement, for economic gain or due to political upheaval and natural disasters that result in refugee movements. The Mahaweli Development Programme in Sri Lanka was established in

1977 and provided for the opening of new lands for resettlement between 1983 and 1986, resulting in a large influx of new settlers. Many of those involved were evacuees who had lost their land because of development of irrigation schemes in their home areas. Others were people who had requested farmland offered by the Mahaweli Development Scheme. In a study of the social cost and coping strategies of malaria cases among settlers, Jayawardene (1993) found that there was a steep rise in malaria case incidence resulting from many non-immune or semi-immune settlers moving into the new area, which was hyper-endemic for malaria. Among the new settler families that the author followed, 50% were slide-positive for malaria at any one time during the 10-month duration of the study (see also Gruenbaum, 1983).

Migrants may also move into new areas because of population pressure in their places of origin. In Thailand, Singhanetra-Renard (1993) found that new migrants settled, of necessity, in the foothill and upland areas because this was the only land available. These sites also happen to be close to malaria vectors. Land-poor families were forced into swidden farming and their fields were usually located on the fringes of forested areas, where vectors breed either in small pools or in shady clearings on scrubland.

In the Brazilian Amazon it is common for settlers to clear forest areas to create land for agriculture. Such human encroachment into new territory disturbs the ecological balance, brings about a rapid increase in possible breeding sites for anophelines, and causes a change in feeding habits among the vector species, from feeding on wild animals to feeding on humans. Since settlers usually build their residences next to thoroughfares (including railroads), perhaps for convenience or to capitalise on the opportunity to sell goods to the occupants of passing vehicles, these roads have often been built by blocking small rivers and streams, or by building drains for streams that the road crosses. Both strategies produce hundreds of small ponds, ideal breeding environments for anophelines and for exposing settlers in dwellings built next to these roads and ponds (Coimbra, 1988).

Other changes to the environment may seem innocuous, but have deadly consequences. In the Naya river basin of Colombia, settlers who plant fruit trees next to their houses inadvertently increase vector densities adjacent to their dwellings. Fruit trees encourage the growth of bromeliads, epiphytes that grow on other plants and have leaves arranged to collect small pools of water within the plant, making them excellent breeding sites for certain vector anophelines (Sevilla-Casas, 1993).

Religious pilgrimage is another factor that influences human mobility (Prothero, 1965). Non-immune pilgrims may pass through malaria-endemic areas during their journey and contract the illness in the process. Conversely, pilgrims may then serve as carriers for the parasite into new areas. Infected pilgrims can then spread the disease to non-immunes arriving from different areas, who, in turn, bring the parasite back to their place of origin (Prothero, 1965). The conditions at pilgrimage sites are crowded and thus favour malaria transmission, which is density-dependent. Rameswaram Island in Sri Lanka, for example, in addition to being an important fishing centre, is also a holy place for Hindus and attracts pilgrims year-round from all over India and Nepal. If these pilgrims come from malaria-endemic areas, they may play a part in maintaining malaria prevalence in the island. Indeed, the source of chloroquine-resistant *Plasmodium falciparum* strains on the island hypothetically has been traced back to pilgrims from northern India, where the resistant strains have been documented (Rajagopalan et al, 1986).

An important pilgrimage for Moslems is the Haj to Mecca, in Saudi Arabia, where there is no malaria. Since people from vastly different areas converge in this one small area, non-immunes may encounter a variety of diseases, especially malaria, for which they might never be at risk in their homelands. While travelling home, the pilgrims may introduce the parasite not only to their own areas, but also to any community through which they pass, provided it has the proper vector (Prothero, 1965). Such mobility thwarts the possibility of "regional eradication."

Nomadic groups are, by definition, highly mobile, which makes collection of basic information, let alone malaria surveillance and treatment, difficult. Nomads may not always have defined routes of movement, and often their paths vary, making it difficult even to locate them and to include them in anti-malaria programmes such as insecticide spraying and other treatment efforts (Prothero, 1965). The temporary nature of the nomadic dwellings themselves has presented a problem in malaria control programmes in the past: the surfaces may not retain the toxic effects of insecticides very well, partly because the materials of which they are made are very absorbent. The dwellings themselves may frequently be dismantled and re-erected, which decreases the effectiveness of the insecticide. In fact, the inside of the dwelling, where the insecticide is sprayed, may be the outside the next time it is built (Prothero, 1965). Similarly, the nature of the hunter-gatherer existence is also highly mobile. Since nomads often live in fringe areas or in forests, and since preserving their way of life from government regulation or control may sometimes depend on avoiding detection, malaria case detection (and any other public health measure) can be extremely difficult to sustain in these groups (Singhanetra-Renard, 1993).

Compliance and prophylaxis among travellers

An altogether different type of highly mobile group is made up of people from non-endemic, mainly industrialised countries, who spend time in malarious regions. This population includes travellers, either for business or pleasure; expatriates from industrialised countries; and military troops deployed to areas where malaria is endemic. Because of the ease of international travel by air, travellers are increasingly visiting malaria-endemic countries and cases of imported malaria (malarial infection acquired in another country but subsequently diagnosed in the home country upon return) have consequently risen (Froude et al, 1992). Research designed to study malaria risk in this type of population is usually fraught with difficulties related to problems of enlisting a suitable study population and eliciting compliance and follow-up from people who are highly mobile. Most studies cover a limited time frame; the lack of longitudinal data makes it difficult to observe compliance over a period of time and recall bias

may present a problem in data analysis. Moreover, the quantitative nature of most of these studies makes it difficult to uncover the behavioural motivations behind travelers' non-compliance with malaria-preventive measures.

Despite these limitations, certain types of travellers can be identified as high-risk groups. Individuals born in malaria-endemic countries who have moved to industrialised nations sometimes are at higher risk than others, perhaps due to lack of awareness to seek preventive advice before travel has commenced, including ignorance of their own reduced immunity status from having lived a period of time in a non-malarial environment. In a chart review of 51 patients diagnosed with imported malaria in the Bronx section of New York City between 1986 and 1991, researchers concluded that people born in malaria-endemic areas are at higher risk than other travellers, and these people are also less aware of the need to use prophylaxis, which should be short-term (Froude et al,1992). After moving to the United States, they may have lost their acquired immunity to the disease and perhaps may not perceive the malaria risk to be as great as it is because in their homelands they had some immunity and therefore have not become as sick. Upon return, and without any chemoprophylaxis or acquired immunity, these people may be at high risk due to a false sense of security.

Similarly, in a Scottish study among people who had travelled or worked in Northeast India or in Pakistan in the previous five years, researchers found that most travellers used no preventive measures against malaria because they did not consider malaria to be dangerous and were unaware of the growth in chloroquine-resistant malaria or thought it was not present in the areas they visited (Walker & Qayyum, 1981).

A study of compliance with malaria prophylaxis among a cohort of Dutch travellers identified other high-risk groups (Cobelens & Leentvaar-Kuijpers, 1997), including younger travellers; people who engaged in adventurous travel, such as backpacking and travel to rural areas; and those with extensive travel experience, common among business travelers. Compliance also varied by travel

region: 45% of travellers to South America complied, 52% to West Africa, 53% to South-east Asia, 60% to the Indian subcontinent, and 78% to East Africa. This level of compliance may have been due to better pre-travel advice among travellers to East Africa, or a greater perceived risk of malaria among travellers to this region. Unfortunately, due to the quantitative nature of this study, it is impossible to know the true explanations for failures to use chemoprophylaxis. Had a more qualitative approach been used, it may have been possible to understand better the lack of compliance with chemoprophylaxis, as well as its differential use based on travel destination.

Compliance with prophylaxis regimens may also involve forgetfulness, either due to lack of motivation or because travellers had been given confusing, often conflicting, advice. In a malaria prophylaxis survey among British travellers who phoned for pre-travel advice to the malaria reference advisory service in England, researchers found that compliance fell among those travellers who were given complicated advice and among those who also contacted more than one service and were given conflicting information (Phillips-Howard, Blaze, & Bradley, 1986). Another serious problem is that those who fall ill with malaria while travelling may not seek treatment for their symptoms, perhaps because they do not recognise them as such, do not have adequate knowledge of the local health-care facilities, or travel in remote areas far from health services. In a study of the behavioural aspects of Swiss travellers, researchers found that two-thirds of the study population did not seek medical attention in local settings, even though they exhibited symptoms and had been given pre-travel advice to do so (Schlagenhauf et al, 1995).

Expatriate workers are also at high risk, mostly because they live abroad for long periods of time and may have fears of long-term side-effects of prophylaxis (especially retinal toxicity, which may be irreversible). Expatriates may also have been given conflicting advice about prophylaxis, leading to misunderstanding about its efficacy. For example, in a study of malaria prophylaxis among expatriate aid workers in the Solomon Islands, researchers found that break-

through infections (infections acquired despite use of prophylaxis) were quite common, even though use of prophylaxis was almost universal. Such infections may have led to misconceptions about the efficacy of the drugs and the perception that the "tablets were no good." Researchers also found that only 49% of workers were taking the recommended regimen. The majority of expatriates stated that they were uncertain about the correct dosage because they had received advice from various sources (O'Brien, 1993). Fear of chloroquine resistance may account for the problem in part. Another factor may be the serious physical and psychological side-effects of such anti-malarials as mefloquine. A large number of expatriates choose to treat the disease as the locals do. Breakthrough infections may be due to low dosage or to drug-resistant strains or to the use of counterfeit drugs with inadequate or no active ingredients. Whatever the case, such experiences contribute to a general mistrust of the available drugs.

Similarly, in a study of malaria prophylaxis among long-term expatriate mineworkers in Ghana, researchers found that the major reason for failure of compliance was ambiguous advice about prophylaxis, with fear of side-effects from long-term use the other major reason for failure to use preventive drugs. A final problem among expatriates is delay in seeking medical treatment upon return to the home country, where worry over malaria declines (Degan & Glennon,1993).

Malaria and the military

The military are yet another highly mobile group exposed to malaria all over the globe. Indeed, malaria has played an important, sometimes decisive, role throughout military history. Since ancient times, malaria has contributed to the success and defeat of military campaigns. Alexander the Great, the icon of military strength, after conquering most of the "known world," succumbed to the disease in 323 BC at the age of 33 (Beadle et al,1993). The problems of malaria among fighting troops have been among the main factors spurring malaria research in the past, especially at institutions such as the Walter Reed Army

Research Institute in the United States, which has tested more than 250 000 anti-malarial drugs (Bruce-Chwatt, 1985). In fact, the U.S. military has been the largest single funder of malaria research (Desowitz, 1991).

During World War II, U.S. troops fighting in South-east Asia, a region highly endemic for malaria, experienced difficulties related to the disease. Even though malaria resulted in few deaths, soldiers experienced significant morbidity and this resulted in great manpower drains on both combat troops as well as on medical personnel. It is estimated that for every man wounded in battle in this region, more than 100 were evacuated sick (Shanks & Karwacki, 1991). On the Indo-Burma Front in 1942, the single most important cause of illness was malaria; and altogether, between the years 1941 and 1944, malaria and PUO (pyrexia of unknown origin) accounted for one half of all hospital admissions among troops in this region (Bruce-Chwatt, 1985).

In Vietnam, U.S. combat troops in enemy areas were particularly hard hit, in part because of the fighting conditions and in part because of enemy forces, who may have had more acquired immunity to the disease and provided an unseen reservoir of malaria. The parasites thus infected mosquitoes and then infected soldiers fighting behind enemy lines. Personal motivation, however, may also have played an important role in malaria risk; that is, there may have been little incentive to use malaria protection when it was apparent that a case of malaria would remove the soldier from combat, providing a potentially life-saving remedy to or at least a break from the rigours of fighting (Bruce-Chwatt, 1985). Compliance with chemoprophylaxis was therefore understandably low, perhaps due to anti-malaria pills that were never received, were lost or forgotten, or were not used because of side- effects such as nausea or diarrhoea (Powell, 1978).

More recently, malaria prevention was not a primary concern among U.S. troops deployed to Somalia during Operation Restore Hope in 1992. The main combat region lay along the Jubba River, and many of the reasons for low compliance

related to survival concerns in a highly exposed combat environment. Some marines stated that they felt bednets hung on poles above their cots made them larger targets and patrol troops could not use nets since they bedded down in sleeping bags. The use of the insect repellent "DEET" was also thought to be ineffective and unpleasant. In some areas, showers were not available for six weeks and many soldiers found the insecticide causing dust to cake on their skin. Finally, sub-optimal chemoprophylaxis was common, mainly because of side- effects or forgetfulness among soldiers with little sleep and highly irregular schedules (Ledbetter, Shallow, & Hanson, 1995).

The effects of malaria on troops are exacerbated by the fact that most soldiers rapidly deployed to malarious regions have no acquired immunity to the parasites. In addition, combat conditions are less than ideal for providing protection against the disease. A highly mobile group, soldiers often go on leave after their tour has ended, bringing the parasites back to base and even to their countries of origin (Newton et al, 1994). This is of particular concern if the soldiers originate from a country where malaria was once common. If public health surveillance is not effective, malaria imported by soldiers could theoretically contribute to re-establishing the disease in places where it had been virtually eradicated. In a study of Soviet soldiers fighting in Afghanistan in the early 1990s, researchers found that even though a large number of malaria cases were brought back from the battlefield, public health surveillance was adequate enough to avoid an upsurge of the disease in formerly malarious, and still susceptible, regions of what was then the U.S.S.R. (Sergiev et al, 1993).

Mobility and economic development

Development projects are another important factor in the transmission of malaria. Economic programmes have often been launched at the sacrifice of health concerns. Economic development has also been closely tied with resettlement schemes, which themselves have given impetus to so much human movement in recent decades. Development strategies can contribute to outbreaks of malaria (and other diseases) in four important ways.

1) As in other types of human movement, the parasites and their vectors may be brought by the settlers to their home areas and introduced to new locations. Dam building is a good example: it changes the local ecology and increases vector breeding sites, which can occur either within the reservoir itself or in pools created by seepage. The building process itself requires a large number of workers, who often come from other areas of the country (Hyma & Ramesch, 1980). Non-immune workers may thus be exposed to malaria, or workers from endemic areas may bring it with them to the building site (Oaks et al, 1991).

2) Development activities may increase or even create the conditions necessary for vectors and disease agents. For example, in the Basin area of the Brazilian Amazon, new highways, dams, and colonisation projects have attracted thousands of migrants. The massive influx of people has resulted in rapid environmental changes, with marked increase in the malaria rate (Coimbra, 1988). Agricultural settlements often contribute in large part to such environmental/ecological changes, bringing deforestation, changes in water use, and alterations in the relative concentration of domestic to wild animals – with an accompanying change in species available to vectors. All of these processes can increase mosquito larval development sites as well as vector-to-human contact.

3) Human encroachment into new, previously uninhabited territory puts people into contact with malaria and previously unencountered zoonotic diseases, increasing health hazards.

4) Physical and psychological stress caused by dislocation and adapting to a new environment contributes to an overall decline in the general health of a population and can ease the way for opportunistic infections, including malaria. A consequence of such processes is that disease and ill health may themselves lead to underproduction and departure of settlers, which may then cause increases in the total operational costs of the project (Kloos, 1990).

The irrigation development project in the Awash Valley of Ethiopia is a good example of how resettlement schemes can exacerbate or even contribute to health problems. After the 1974 revolution, the new government undertook a socialist "transformation" of the country. Part of this effort was to place more emphasis on resettlement, aimed at overcoming famine, overpopulation, land degradation, and other economic problems. Resettlement thus became an integral part of a national policy aimed at overall social and economic development. During 1984 and 1985, a large resettlement programme resulted in the movement of 600 000 drought victims, who were, in effect, internally displaced persons from northern and central Ethiopia to the western area of the country. In a study of the health aspects of this programme, Kloos (1990) concluded that malaria, as well as a number of other infectious diseases and psychological stresses, were found to be larger health hazards in the new settlements than they had been in the areas from which settlers originated. Since new settlers came from non-endemic areas of the highlands, moving resulted in high morbidity and mortality from malaria among migrants (Negusse, 1988).

Considering mobility in malaria control

Human mobility creates an obvious problem for malaria control efforts: how to monitor, treat, and conduct preventive health programmes in a constantly moving, or unstable, population. Wise use of anti-malarial measures and monitoring of populations is essential in serving such populations (Kloos, 1990). However, localised and even large-scale movements of people may make these efforts difficult to administer (Prothero, 1965). Cross-border and intra-country movement is not uncommon. Cross-border movement of people from countries without malaria control to those with control programmes has provided renewed sources of the infection. This occurred historically in Southern Rhodesia (Zimbabwe), where migrant workers from Northern Rhodesia (Zambia), Nyasaland (Malawi), and Mozambique – countries where malaria control programmes were weak or non-existent – provided a constant source of infection (Prothero, 1965).

Similarly, in border areas of Thailand, infected Burmese, Karen, Shan, and Laotians often cross the border, either as political refugees or to visit family members who live on the Thai side (Singhanetra-Renard, 1993). Coming from countries without strong malaria control programmes, this population can re-introduce the parasite into Thailand and make malaria that much more difficult to control.

Movement also often results in physical stress: undernutrition and malnutrition may play a role in lowering immune system resistance to infection and put individuals at risk for a variety of ailments, not the least of which is malaria. Quite simply, the psychological stress of dislocation and the sociocultural and economic pressures of adapting to a new environment put people at increased risk for disease (Prothero, 1977). Finally, migrants and highly mobile people are sometimes ethnic minorities who live in remote geographic areas, where they depend on fringe activities for their livelihood. They are often poorer and less educated than more stable populations. Control programmes need to consider all these variables, in addition to the economic pressure behind the high mobility of such groups. However difficult these populations are to serve, they should not be ignored.

The economic, political, and cultural reasons forcing vector-human contact deserve attention. Unfortunately, most societies are segmented, and though some may act out of purely humanitarian concern, this is by no means the rule. Indeed, most people may be influenced more by self-interest than by concern for the total public health. The poorer population segments not only live in areas where risk for malaria is higher and control programmes are less effective, if present at all, but they are also highly mobile in their search for better living conditions. Attention to the infection disease risk consequences of inequity and consequent migration must be highlighted for those involved in malaria control efforts. The health of the mobile and disenfranchised directly affects the health of others. So long as their problems with malaria are disregarded, effective vector control campaigns risk failure, and malaria transmission continues (Singhanetra-Renard, 1993).

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CHAPTER SIX

BEDNET USAGE AND ITS ACCEPTANCE AT THE LOCAL LEVEL

It is clearly more difficult for villagers to appreciate the benefits of the insecticide than those of the nets. Great emphasis needs to be placed on the insecticide and its beneficial effects from the outset for any large-scale programme to be sustainable... Most of the variation in retreatment rates were found to be attributable to economic and political factors. Some women cited lack of control over the household budget as reason for not retreating their nets.(Winch et al, 1997:761, 766-767)

Having presented the many factors that affect the spread of malaria, we now turn to highlighting programmes that have found some success in controlling the spread of the disease and upon which future efforts may depend. At present, the primary recourse in preventing malaria, at least until a suitable vaccine is found, is to break the chain of transmission between mosquito vector and human host. Since the groundbreaking research of Bradley and Greenwood in The Gambia (Bradley et al, 1986), which showed a significant inverse correlation between bednet usage and mortality, much hope has been pinned on the use of bednets in malaria control. A large body of literature has been generated on this subject, much of it indicating that treated bednets do indeed offer some degree of protection. Thus, studies aimed at uncovering local attitudes toward bednet usage as well as other means used to prevent mosquito bites are critical for they reveal a multiplicity of local variations and point to the need for behavioural and anthropological approaches in the design and implementation of malaria control programmes. It is clear, however, that the success of this work relies heavily on community cooperation. In recent years, as a way of stimulating local acceptance and developing sustainability of the intervention, a number of researchers have endeavoured to foster community participation in the implementation of bednet trials.

The benefits of insecticide-impregnated bednets

Although different methods for preventing insect and mosquito bites are currently in use, the one that has received most recent attention in relation to malaria control is the use of insecticide impregnated-bednets. Generally made of nylon, polyester, or cotton (Sexton, 1994), these coverings are most often treated with permethrin, although deltamethrin and lambdacyhalothrin are also utilised. Treating the nets with insecticide provides double protection: not only does it safeguard the person (or people) inside the net, but it also kills most insects that alight. Moreover, if the person inside the net is suffering from malaria, by preventing mosquitoes access to the gametocytes, they [the mosquitoes] cannot be infected, which limits the further spread of the disease. With an untreated net, mosquitoes can still bite through and infect a person whose arm or leg lies next to it. The opportunity for this decreases with insecticide-impregnated bednets, since they offer the double protection of both the net and the insecticide.

For hundreds, perhaps thousands of years, people have used means other than bednets to protect themselves from insect bites, including burning cow dung and wearing long, light robes. The purpose of these measures is to eliminate the nuisance of mosquito bites, not to prevent malaria infection. Eliminating the nuisance may also be the major motivation for using bednets. Purchasing a bednet today entails a substantial outlay of cash, which in some areas of the world, especially Africa, may be a great burden. Instead, people prefer to spend their money in smaller amounts, even if this means that they end up outlaying more in the long run (Aikins, Pickering, & Greenwood, 1994). Quite simply, if local residents do not have the money up front, they cannot purchase bednets and thus resort to other, less expensive methods, including burning various substances such as mosquito (pyrethrum) coils, leaves, dung, and wood fires to repel mosquitoes (Ziba et al, 1994).

The disadvantage of these less costly methods is that they work while people are awake and able to keep the coils burning or the fires stoked, but offer no

protection during the night, when people are sleeping and can no longer maintain them. Bednets, on the other hand, protect throughout the night, so long as they are used and hung correctly and individuals do not leave them for significant periods of time. Of course, this method relies on there being places to hang the nets and dedicated sleeping areas in people's "homes." And bednets offer no protection during the early evening hours before people retire to sleep.

The efficacy of bednets is tied to the peak biting hours of the local mosquito population, when malaria transmission is most likely. If the peak hours occur while people are still awake, bednets presumably are less effective (Choi et al, 1995). However, if peak biting hours occur while people sleep, it seems probable that insecticide-impregnated bednets are highly effective, if used correctly (Choi et al, 1995). Peak hours may vary by location (Harrison, 1978) and may also be modified by bednet interventions. For example, *Culex quinque fasciatus* begin biting in the early evening hours and continue throughout the night. While night biting is very common among malaria vectors, especially *Anopheles spp*, it is not universal (Harrison, 1978). It is important, therefore, to know the specifics of local variation in mosquito species and their peak biting hours when designing an insecticide-impregnated bednet intervention.

A number of studies have investigated whether bednets actually provide protection against malaria morbidity and mortality. Snow et al (1988), in a trial of untreated bednets in The Gambia, showed that the nets could reduce the number of infective bites, but not enough to significantly reduce morbidity from malaria. The researchers distributed nets at random to villagers and studied malaria rates in groups that received a free net versus those that did not. The researchers found no significant decrease in the incidence of clinical attacks of malaria among those who received bednets. More important, however, was the fact that malaria cases in the group of children sleeping under nets did not decline compared to those children without nets. Although nets were properly used, researchers observed that a significant number of the children left their nets during the night, which may have had some impact on the rates of malar-

ia transmission. Further, mosquitoes bit through the net to people's arms and legs lying adjacent to the covering (Lin, 1991). This led the researchers to conclude that the findings of previous studies, which had shown a certain amount of protection from nets, may have been biased by an increased number of infective bites to unprotected individuals sleeping close to bednet users. Rather than biting the person under the net, the mosquitoes may have been deflected, in a sense, to those sleeping next to it. So instead of demonstrating a decrease in overall malaria morbidity among bednet users compared to unprotected individuals, the increased number of infections among the non-users may have given the appearance of protection for users. These findings were based upon the measurement of the difference in the rate of infection between the two groups rather than a documentation of a total decline in morbidity among bednet users. However, if the net had been treated with insecticide, some of these insects would have died and posed less of a risk to all individuals, those sleeping under nets as well as those not (Bermejo & Veeken, 1992).

The value of using insecticide-impregnated bednets has been confirmed by other investigations as well. Thomson et al (1996), in a study about the relationship of geographic location with insecticide-impregnated bednet usage and malaria incidence in The Gambia, found that, irrespective of ethnic group, area, habitat, and distance from the River Gambia, malaria prevalence decreased with insecticide-impregnated bednet usage. The main reason for this was not only that mosquitoes were kept away from sleeping people, but also that the mosquitoes would die when coming into contact with the insecticide. Bednet usage was also greater in villages close to the River Gambia. Where the mosquito-biting nuisance was high (near the river), people protected themselves with bednets and experienced a lower rate of malaria. Where mosquito biting was low, people let their guard down, thinking the risk was reduced and did not use bednets as frequently, with a consequent higher rate of malaria.

What bednet studies reveal

Considering the research that has been conducted, is there a consensus that insecticide-impregnated bednets do provide protection? To answer this question, researchers have assimilated the various field trials in order to determine whether insecticide-impregnated bednets really are effective. Bermejo & Veeken (1992), in a review of the field trials of insecticide-impregnated bednets, found that treated bednets are effective in preventing malaria mortality and morbidity. However, the researchers further refined this work and looked at the efficacy of insecticide-impregnated bednets in areas of low, moderate, and high malaria endemicity. The protection from bednets was most pronounced in areas where transmission is low to moderate. In areas of high endemicity, insecticide-impregnated bednets lose some of their efficacy, and they are not as effective in preventing subclinical infection per se as they are in preventing cases of serious malaria disease. This may not be disadvantageous, as exposure to malaria produces immunity; without exposure to malaria, individuals lose their immunity and are thus at increased risk for severe illness (Greenwood, 1991). In a different type of review, Choi et al (1995) performed a meta-analysis in which 10 field trials were rated for scientific rigour, possible bias, comparability of study groups, and the quality of the study design and execution. The researchers found that insecticide-impregnated bednets are effective in preventing malaria, resulting in an approximate 50% decrease in the incident rate ratio, regardless of locality. Moreover, they found that permethrin-impregnated bednets are more effective than those treated with deltamethrin.

Such studies have their limitations, however. Inherent flaws, due in part to the specific nature of malaria and in part to the difficulty of working in field conditions, may lead to false conclusions about the effectiveness of insecticide-impregnated bednets. For example, many studies have included only those individuals who visited and were diagnosed at a local health clinic, the people most likely to seek treatment (Choi et al, 1995). The information from such studies also relies upon whether or not symptomatic individuals visit a clinic. Since many malaria infections are asymptomatic, the selection of subjects among clin-

ic attendees may grossly underestimate the prevalence of malaria in a population (Choi et al, 1995). Another concern is publication bias: studies with positive results may tend to be published more readily than those with negative conclusions, and information from failed trials may not be available for comparison (Choi et al, 1995).

Moreover, the fact that malaria is seasonal, has an uneven age distribution, and affects pregnant women more severely may bias some studies. During pregnancy (first pregnancy, mainly), women's immune response is lowered, and women are thus at higher risk for malarial illness (Greenwood, 1991).[1] Children age five and under are also more at risk for severe illness, as they have not yet developed sufficient immunity (Greenwood, 1991). Studies that are not longitudinal and that take measurements at only one time of the year (Winch, Pickering, & Greenwood, 1994), or trials that do not consider that bednet usage may be seasonal, may be biased as well (Bermejo & Veeken, 1992).

The logistical difficulties of carrying out community interventions have often precluded random selection of subjects, resulting in selection bias (Bermejo & Veeken, 1994). True double-blind trials are not possible. Bermejo & Veeken (1994) have reported that the effect of the insecticide on decreasing mosquito population is often so noticeable that the group with insecticide-impregnated bednets as well as the field staff would know which nets have been given to which group. In addition, incorrect usage of bednets and lack of knowledge about their use during the trial could lead to false conclusions. Studies that do not include some form of user instruction before and during distribution of the insecticide-impregnated bednets, and that do not check for proper usage during the study, may result in bias (Binka & Adongo, 1997). Finally, many studies have concentrated on bednet acceptance, to the exclusion of the insecticide. However, if the insecticide is not accepted along with the bednet, retreatment of nets may be low, and the insecticide-impregnated bednets will offer scant protection from malaria, even though the nets may be used over time (Winch et al, 1997).

Community acceptance of bednets

However effective the insecticide-impregnated bednet may be, if it is not accepted or used correctly by the local population, its efficacy is severely limited. Studies on local perceptions, acceptance, and use of insecticide-impregnated bednets as well as other anti-mosquito and insecticide methods in the local community prove invaluable. Social and behavioural research in this area is instrumental to the implementation of research projects or control programmes, as numerous studies have concluded (Winch et al, 1994; Thomson et al, 1996; Binka & Adongo, 1997).

Various cultural and behavioural factors may influence bednet acceptance and use. Demographic patterns are important, such as length of settlement in an area, which can result in political differences and "insider" versus "outsider" conflicts. In Bagamoyo District, Tanzania, researchers found that those who had been living in the older, longer-settled, and central parts of the study village used insecticide-impregnated bednets at a lower rate than those in newer, recently settled, and peripheral parts of the study village, where the highest rates of bednet usage were found. These differences were found to be due mainly to economic and political factors resulting from factionalism in the centre of villages and stronger social cohesion and leadership among newer settlements in the outlying areas (Winch et al, 1997). Rural versus urban differences also play a role. In Ghana, researchers found a higher rate of insecticide-impregnated bednet acceptance and usage in rural versus urban areas. This factor was related to a greater desire among rural dwellers, who are subject to a larger mosquito population, to avoid the nuisance of mosquitoes while sleeping at night (Agyepong & Manderson, 1999).

Ethnicity is another important factor that affects acceptance and use of insecticide-impregnated bednets. Four studies in The Gambia (Thomson et al, 1996; Aikins et al, 1993; MacCormack & Snow, 1986; Bradley et al, 1986) reported a marked difference in bednet usage based upon ethnic differences. Mandinka, Wolof, Fula, Joli, and Serahuli are the primary ethnic groups in the area. Thomson

et al (1996) found that bednet usage was independently associated with each group because of different economic activities based upon ethnicity. Researchers reported that Fulas were the least likely to use bednets. Mandinka, Serahuli, and Joli traditionally cultivate rice; Wolofs grow groundnuts as a cash crop; and Fulas are pastoralists and depend on cattle herding. The difference in bednet usage was based partly on the split between agriculturalists versus pastoralists, the pastoral lifestyle being less conducive to using and maintaining such coverings. These varying economic activities also resulted in different historical settlement of villages, with those located near the River Gambia being the closest to mosquito populations. People living in these areas experienced more acutely the need to use bednets to avoid mosquito bites, even if they did not perceive the connection between mosquitoes and malaria.

Yet another reason for this differential use of insecticide-impregnated bednets based on ethnicity in Ghana may be that other groups believe that the Fula cause malaria, resulting in feelings of belittlement on the part of Fula group members and their consequent refusal to use insecticide-impregnated bednets (Aikins et al, 1993). This prejudice may be due to conflicts that are seen in other parts of the world as well between populations that lead a nomadic lifestyle and those that are more settled. Nomads are sometimes viewed as "backward" because of their traditional, highly-mobile lifestyles, and they are often the objects of criticism and rebuke.[2] In a study of the Mandinka, researchers observed that bednets were preferred because of the group's living arrangements. In Mandinka households, all co-wives sleep in one room, and bednets serve as a barrier to create a small amount of privacy. In a sense, bednets are a surrogate for bedroom walls (MacCormack & Snow, 1986). In contrast, most Wolof and Fula households rarely have more than two beds per room, an arrangement that provides for a greater degree of privacy and less need for bednets to create it.

Access to bednets within the household is another relevant issue: who owns them and who actually sleeps under them. Gender differences may play an impor-

tant part. In The Gambia, Aikins et al (1993) found that young girls slept under nets significantly more often than young and adolescent boys, who more frequently slumbered on verandas without bednets. Variations between areas even within the same country may also show different rates and patterns of bednet usage. Agyepong & Manderson (1999) found that in urban areas of Ghana, the majority of bednets were used for children (64%), or for children and their mothers (24%), while in rural areas, bednets were more common, and when restricted they were used mostly by mothers and children (50%). However, in another study in rural Ghana, Binka & Adongo (1997) hypothesised that children are not assumed to need privacy, hence their need for bednets may be superseded by the adults' desires for privacy. In The Gambia, MacCormack & Snow (1986) observed that as children mature, they pass through a variety of shared sleeping arrangements. They also noted that children have low status in the family hierarchy and thus little claim on expensive goods such as bednets. Finally, in a community-based insecticide-impregnated bednet trial in Tanzania, people stated that since they did not have enough money to buy nets for the whole family, they purchased them only for adults (Makemba et al, 1995).

It therefore may be informative to know whether children sleep with adults under nets and thus remain protected. Special attention should be given to this issue, since children are one of the groups most at risk for malaria transmission (due to low immunity) (Greenwood, 1991), and may not be protected by insecticide-impregnated programmes that emphasise increased privacy as an advantage of bednet use. Studies of bednet usage, then, should look at sleeping patterns within the household and at whether the target populations that are most at risk are sleeping under the nets. MacCormack & Snow (1986) are among the few researchers who have carried out such work.

Bednets obviously serve a variety of functions other than protection from malaria. Defence against bites, whether from mosquitoes or other types of biting insects, is of primary concern in many communities (Agyepong & Manderson, 1999; Thomson et al, 1996; MacCormack & Snow, 1986). Ensuring uninterrupt-

ed sleep by cutting down on the irritation from the buzzing sound of mosquitoes is a factor as well (Agyepong & Manderson, 1999). Personal hygiene and cleanliness may also be considered. Opaque fabrics (without holes) are preferable in The Gambia since they provide protection against the dust of the harmattan winds (MacCormack & Snow, 1986). Finally, decorative value, used as a sign of prestige (Agyepong & Manderson, 1999), and protection from roof droppings (Aikins, Pickering, & Greenwood, 1994), small insects, rats, lizards, and snakes (MacCormack & Snow, 1986) have all been found to be advantages of bednet usage.

Another important factor that may reduce acceptance of insecticide-impregnated bednets is the use of other anti-mosquito methods. In Ghana, Agyepong & Manderson (1999) found a total of 30 different means or combinations of mosquito deterrents. Use of these methods, in lieu of bednets, has to do with what time of day mosquitoes are perceived to be nuisances. For example, in Ghana mosquitoes are perceived to be most bothersome during early evening hours, when people are still awake and bednets are of little use. As a consequence, mosquito coils are purchased instead of bednets (Agyepong & Manderson, 1999). Type of housing construction is another issue. In hot climates, inhabitants may sleep outside, where there is no place to hang a net, as in Ghana, where flat roofs serve as beds (Aikins, Pickering, & Greenwood, 1994).

Financial considerations may also be of great importance, although the results are inconsistent. A study in The Gambia (Aikins et al, 1993) found no significant relationship between income and bednet usage. In contrast, Ziba et al, (1994) found that in Malawi, use of malaria prevention measures (bednets, insecticides, mosquito coils, other insect repellents, burning leaves, spreading or burning dung, or burning wood fires), was income-dependent. In households where the head earned a larger than average income, use of commercial methods (mosquito coils, insecticide spray, bednets) was more common. In fact, households with moderate or greater income levels were eight times more likely to use a commercial (purchased) product. Use of inexpensive, and less effec-

tive, natural methods (burning leaves, dung, or wood) was associated with lower income.

Not to be overlooked is how bednet usage relates to means of payment and income distribution. Because of seasonality of crops and income generated from them, local residents may prefer to purchase a net after the harvest, when they have more ready cash than during other times of the year, when their resources are low. However, if the mosquito density is low during these times, spending money on insecticide-impregnated bednets may not be perceived as a high priority (Binka & Adongo, 1997). But when the need is perceived as greatest, people may not have the resources to pay for protection. In Ghana, women like to make cash payment for bednets, but also favour other means of payment, such as exchanging crops from their farms or paying in installments (Binka & Adongo, 1997). Yet even if the money is present, bednets may not be a priority. In Ghana, Aikins, Pickering, & Greenwood (1994) found a low level of bednet usage and related this to the reduced value assigned to their acquisition. Re-treating them may not have the obvious advantage of a new commodity purchase. There was also a fear among some women that if they acquired bednets, men would repossess the items. The fact that bednets were scarce in local markets may also have had some influence on their low status in the community. In contrast, in areas where bednets have historically been used for a long time, there is greater use and appreciation. In the area of The Gambia where Aikins et al (1993) conducted their study, bednets had been in use for more than 100 years; 98% of bednet users had seen their parents use them during their childhood, and perhaps due in part to these factors, 86% of the study subjects were bednet users.

Seasonality and bednet usage

Seasonality is an important consideration in bednet usage, not only in how it affects the use of nets, but also in the perceived risk of malaria related to when the mosquito population is largest. Bednet use may fluctuate based upon perception of mosquito nuisance, which in turn may be related to seasonal vari-

ations in mosquito density (Hewitt et al, 1996). Indeed, the primary concern may be with avoiding the nuisance of bites, over and above fear of malaria transmission. Perceptions about risk of malaria transmission may be associated with mosquito density, even if the link between malaria and mosquitoes is not made (Winch et al, 1994). In Tanzania, in a region of year-round malaria transmission, Winch et al (1994) found that local residents described mosquitoes as being more abundant during the long rains, the times when the locally recognised *homa ya malaria* (most similar to clinically-recognised malaria) was thought to be a problem. Residents did not differentiate *homa* illnesses based upon symptomatology, but rather on the time of year in which the illness occurred. Febrile illnesses during the short rainy seasons were more often ascribed to witchcraft and sorcery, since the mosquito populations were small during these times. Thus, sustained use of bednets in this region was not high because of local perceptions of when the peaks of malaria illness occur, based on seasons and peaks of mosquito density. Generally speaking, when the mosquito population peaks, bednets are used, but when the population declines, residents may not perceive the need of continued bednet use in order to avoid transmission of malaria in regions where it is continual. Comfort may also take precedence. Bednet usage often declines during periods of high heat and humidity, since the nets decrease wind currents and make sleeping difficult (Winch et al, 1994).

Therefore, if mosquitoes and malaria transmission are not cognitively linked in local ethnomedical thinking, residents may not perceive the need to protect themselves from malaria by using insecticide-impregnated bednets (Winch et al, 1994). Rather, they may simply use bednets to protect against mosquito bites, and when the mosquito population declines or the nets make sleeping uncomfortable, the bednets are put away (Hewitt et al, 1996). Further, local residents may not truly understand the value of insecticide-impregnated bednets and re-treatment. Rather than spending the extra money to pay for re-treating bednets, people may opt for cheaper means of anti-mosquito methods, which are not as effective in preventing malaria transmission (Winch et al, 1997).

How perceptions of malaria affect bednet use

Local perceptions of seasonality of insect population and malaria transmission are not the only factors that affect bednet use and acceptance. Perceptions of the cause of malaria and the manner of its transmission are also important: How and why does one person become infected when his neighbour does not? That is, the seemingly random nature of malaria infection may lend itself to supernatural explanations rather than to naturalistic or scientific ones.[3] In The Gambia, Aikins et al (1993) found that people, especially those in rural areas, believed that malaria is due to possession of the ill person, particularly if it is a child, by an evil spirit or devil. This springs from witnessing the convulsions typical of severe malaria in children. If the cause of malaria is thought to be due to spirits and witchcraft, no means of biomedical prevention will suffice in stemming the tide of the infection and thus cannot play an important role in the use of malaria-prevention methods (Winch et al, 1994).

Yet even knowledge of the relationship between mosquitoes and malaria transmission may not be sufficient to encourage bednet usage. In Ghana, Agyepong & Manderson (1999) found that knowledge and practice do not necessarily have a linear relationship. In their study, the researchers learned that knowledge of an association between mosquitoes and malaria was not related to literacy or formal education, and did not predict bednet usage. Residence in urban areas with more access to informal health information via the media, however, was associated with understanding of an association between mosquitoes and malaria. But this still did not predict bednet usage, since failure to associate fever with mosquitoes was not related to prevention of bites. The primary reason for bednet usage in this study pointed to avoidance of the nuisance of mosquito bites during periods of high mosquito density, and not necessarily to prevention of malaria.

Differences in local terminology and perceptions of malaria illness can also create a barrier to bednet acceptance and use. Malaria may have a number of local translations, depending on the severity of the illness and also on what time of

the year it occurs. For example, in Tanzania, Winch et al (1994) found that *malungo* was the umbrella term for a number of locally-recognised febrile illnesses (most likely malaria). Because *malungo* occurred during the dry season, local residents did not believe that mosquitoes were the cause since the insects were very rare during this time. The researchers further found that the most frequently used word to describe febrile illness was *homa*, which also refers to illnesses that physicians would classify as malaria. *Homa* illnesses are broken down into two categories: *homa* illnesses that are mild and go away on their own or without treatment, and *homa* illnesses that are severe, "out-of-the-ordinary fevers," and are not easily treated. Furthermore, during the rainy season, febrile illness is sometimes termed *homa ya matatizo* (fever-of-problems) and is thought to be caused by hard work in the fields. Similarly, in The Gambia (Aikins et al, 1993), malaria illness is described as "Fula hot body," and is thought to be contracted from cattle, Allah (the cause of all happiness and misery), rains (water, breathing humid air, and time of year), drinking too much fresh cows' milk during the rainy season, or eating mangoes. Obviously, if mosquitoes are not connected to malaria transmission, the need to prevent mosquito bites using bednets cannot be properly appreciated.

Insecticide use and application

Even if insecticide-impregnated bednets are purchased and used correctly, they must be re-treated every 6 to 12 months, as insecticide effectiveness wears off over time (Winch et al, 1997). So not only must the bednet itself be emphasised in control programmes, but also the insecticide that is applied to it. Maintenance of the insecticide must be recognised and accepted, even though it may be difficult for local residents to discriminate between the immediate benefits of the insecticides rather than the nets (Winch et al, 1997). In addition, re-treating bednets entails an extra cost over the initial purchase. In order for insecticide-impregnated bednet programmes to be effective, people will need to gain an appreciation for the insecticide, enough to convince them to invest in its added costs (Winch et al, 1997).

Local acceptance of the insecticides may also be influenced as much by inherent properties of the insecticide, such as toxicity, as by local terms used to translate the name of the insecticide, the meanings attached to these terms, and perceptions of the insecticide within the community (Winch et al, 1997). In Tanzania, *dawa* is the term used for translating "insecticide" into the local language. However, *dawa* does not merely refer to the insecticide used for bednets; it has a broader range of meanings and can refer to any substance that produces recognisable effects, including drugs provided by the clinic or pharmacy, treatments given by traditional practitioners, agricultural insecticides, mosquito coils, rodent poison, and other chemicals in general. In addition, *dawa* is divided into local/indigenous/traditional types and European/foreign/modern types. The local types of *dawa* include treatments obtained from traditional healers as well as plants used either for medicinal purposes or burned to eliminate mosquitoes. The European, modern type of *dawa* refers to factory-made prescription drugs, insecticides, and poisons. Foreign *dawa* is considered to be far stronger and more effective than traditional *dawa*, and the permethrin used to treat bednets is included in this category. Local residents relate efficacy to toxicity: the greater the efficacy, the greater the toxicity, which may concern some users. Since permethrin is so strong, many women were concerned about its toxic effects on children and were reluctant to have their nets treated.

The method of re-treatment may also cause heightened concern over toxicity, since villagers who re-treated nets had to wear gloves, and people were instructed not to touch the insecticide. What was particularly worrisome to villagers was being told to burn or bury the bag used to carry the bednet home because it implied the toxicity of the bednet and possible negative effect on any child who might come in frequent contact with it. Yet observed effects of the insecticide were minimal. The most common side-effects of exposure to the insecticide were runny nose and nasal irritation within the first few days of net re-treatment, and the researchers concluded that this did not appear to be a major reason not to re-treat (Winch et al, 1997). While pyrethroids are considered moderately hazardous by WHO, the dosage used to re-treat nets is most likely safe for human beings (Lin, 1991). However, even moderate side-effects may

cause concern, especially if people are not informed that the insecticide is safe. Side comments and advice given by those who re-treat nets may have unintended effects, and in fact may often discourage acceptance of the insecticide. Extra effort should be made so that those who are treating the nets and using them know that minor side-effects could be experienced but are not cause for alarm. Evidence has also shown that some individuals do not want their bednets to be re-treated in the same solution used by other people (Zimicki, 2000).

Washing of the nets emerged as a problem in a number of studies and needs to be addressed, since the act removes the insecticide. In Ghana, Binka & Adongo found that mothers washed their nets when young children dirtied them with faces and urine. One young woman remarked that the urine and faces of her children made the net smell and would even spoil the net if it were not washed (Binka & Adongo, 1997). Who would want to sleep under or near a bednet so soiled? The concern is also understandable when it is recognised that bednets are expensive and people want to preserve them as best they can. The important point is teaching these mothers that, after washing, the nets are no longer as effective and must be re-treated. One solution may be to incorporate the insecticide into soaps used to wash the nets, so that they are re-treated every time they are washed, or to develop bednets with insecticide incorporated into the fibre (Binka & Adongo, 1997; see also Miller et al, 1999).

Still another concern is hesitancy to bring in soiled bednets for re-treatment. Researchers in Bagamoyo District, Tanzania (Winch, et al, 1997) told villagers not to wash their nets until it was time to re-treat them, only to find that some people felt that it was shameful to bring in a dirty net. As a result, some avoided returning their net for re-treatment altogether. Thus, researchers may have inadvertently undermined re-treatment by discouraging washing of bednets.

Finally, there is the issue of lack of access to household resources. In Tanzania, women reported that a wife may want to re-treat the nets, but lack the money, while the husband, who controls the household budget, may not consider re-

treating bednets a high priority (Winch et al, 1997). It may also be that people consider it fruitless to re-treat bednets not currently in use (Winch et al, 1997). Additionally, where permethrin is considered strong and effective, residents may not think it necessary to re-treat nets if insects are still being destroyed, which makes it difficult to determine whether the nets really are performing this function, whereas treating nets on a regular basis ensures that the insecticide is still effective. (Winch et al, 1997). The question is knowing when the insecticide is depleted (6 or 12 months), as there are economic implications.

Sustaining the effort

Sustainability of the intervention is an important part of the matrix of using insecticide to prevent and control malaria. Initial acceptance of the insecticide might taper off after researchers have left the community. The study design itself may influence acceptance and may even document a higher level of acceptance than actually exists. In an insecticide-impregnated bednet trial in Ghana (Binka & Adongo, 1997), bednets were provided free of charge and local residents rarely complained of insecticide side-effects. However, researchers later realised that the low number of reported side-effects may actually have been due to the fact that within the local culture it was considered unacceptable to complain about something provided at no charge. One wonders whether once the researchers leave, and the insecticide-impregnated bednets are no longer free, local residents who do not like the insecticide will refrain from making purchases when left to their own resources.

This scenario is exactly what happened in an insecticide-impregnated bednet trial in Bagamoyo District, Tanzania (Winch et al, 1997). The programme was conducted in seven phases, with the first round focusing primarily on acceptance of the nets and providing information for policy improvement for the second phase, which emphasised the insecticide. In the first phase, insecticide-impregnated bednets were re-treated free of charge. In the second phase, however, a charge was instituted and some residents disliked this change in poli-

cy. Some stated that since the foreigners (the researchers) were still present, they should continue to pay for re-treatment, just as they had in the past. The initial subsidisation of the nets and insecticides may have had a negative effect on the acceptance of the insecticide in the long term.

This example demonstrates yet again the problem with instituting vertically organised insecticide-impregnated bednet programmes. Community involvement is essential, and a number of researchers have worked locally in order to garner participation and encourage long-term sustainability of the effort. Education and collaboration are considered the key features of such initiatives (Ziba et al, 1994). One suggestion for achieving success has been the use of village health workers in collaboration with community members, women's social clubs, cooperatives, and school leaders, all trained to initiate and monitor community-sponsored insecticide-impregnated bednet programmes (Sexton, 1994).

In an attempt to put theory into practice, Makemba et al have been working in the Bagamoyo Bednet project in Tanzania, a community-based malaria-control and research effort designed to "develop and document a sustainable system for the distribution and promotion of impregnated nets in a rural area of coastal Tanzania... [and to] evaluate the impact of the nets on the mosquitoes which transmit the disease and on the epidemiology of malaria" (Makemba et al, 1995:52). The project postulates that any bednet intervention must fulfil four basic functions: to provide information, education, and communication; ensure procurement, distribution, and reimpregnation of the bednets; incorporate periodic monitoring and evaluation; and possess adequate financing. Working from these premises, a village-nominated committee was set up in the community to help sell, distribute, and treat the nets. The committee helped on distribution days, promoted proper usage of the nets, and assisted in teaching villagers who had problems setting up the nets.

Acceptance of the price of the nets did not seem to be an obstacle. The researchers found that even though medical services were free in Tanzania at the time of the study, villagers did not object to paying for the nets (perhaps

because they didn't consider them to be part of health care but rather as a part of anti-mosquito efforts). However, one of the main issues in the purchase of nets was a matter of trust in the government. In the past, villagers had been given receipts promising payment for crops, but had never received what was due. Issuing receipts to purchase insecticide-impregnated bednets was cause for concern since many wondered whether they would ever receive the items. In a subsequent trial, the routine was changed and bednets were distributed at the time of purchase. But although village leaders were consulted extensively about committee composition, they were not invited to attend the pre-distribution seminar in which committee members discussed how best to distribute, sell, and impregnate the bednets. This oversight caused some leaders to react with indifference and animosity to the project. In later trials, this problem was remedied and an effort was made to include the leaders more fully in the programme.

Other major issues that surfaced in the studies included migration of people out of the area with their nets, which would cause obvious problems in re-treatment; the dissolution of committees because of internal disagreements; and concern over payment, since people did not have enough money to buy nets for the whole family, only for adults. The researchers concluded that insecticide-impregnated bednets should be "procured through a central organisation and sold to the villagers at an affordable price, with the money passing through a village mosquito net committee revolving fund. Two areas that must be addressed here are affordability, and the management of the revolving fund" (Makemba et al, 1995:57-58). To encourage sustainability of the project, a revolving fund is being established in each village to pay committee members and to purchase nets and insecticide after the project ends.

The acceptance and proper use of insecticide-impregnated bednets is a complicated matter. Study results vary by country, as well as between regions and communities within an individual country. Local differences relating to cultural preferences and practices, political organisation, and individual perception and belief all contribute to this complexity. Nevertheless, understanding these

issues is paramount to successful introduction of insecticide-impregnated bednets into new areas, as well as the continued sustainability of such programmes. Some broad generalisations may be made, such as issues of seasonality, sleeping patterns, perceptions about the relationship of mosquitoes to malaria, and concerns over financial matters. generalisations provide an outline of issues that demand attention, but within such broad categories exist a myriad of local variations. In order to have any degree of success, designers of insecticide-impregnated bednet trials must pay close attention to these differences, and use a high degree of cultural sensitivity and appreciation for such variation, while working with the local community to develop a sustainable, community-endorsed effort.

Notes

1 For further discussion on the relationship between women, pregnancy, and malaria, see Chapter Six.

2 For further information on the relationship between nomadism, human mobility, and malaria, see Chapter Five.

3 For further explanation on the perceptions, aetiology, and transmission of malaria, see Chapter Three.

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CHAPTER SEVEN*

GENDER RELATIONS AND THE SPECIAL ROLES OF WOMEN IN MALARIA RISK AND CONTROL

*Contributed in part by Pritha Sen

We focus on the importance of gender relations for malaria control, and argue that an understanding of gender differences in the determinants and consequences of malaria, and of gender relations within the household and community, are keys to ensuring effective malaria control at community level... Despite the importance of malaria as a public health problem, there is relatively little literature on malaria that takes into account the possible influence of gender factors and gender relations. (Tanner & Vlassoff, 1998:524,526)

Although the issue of gender in health has often been lumped together with other sociocultural variables, we believe that it deserves to be given special attention and therefore have devoted a separate chapter in this volume to examine the gendered patterns of the risk of infection, the cultural definition of sex and gender, the power dynamics involved in economic relations between men and women, and how all of these factors have an impact on the design and implementation of malaria control programmes. While we realise that men engage in some activities (such as hunting) that put them at increased risk for malaria in certain circumstances, in general, women bear the greater burden because of issues related to poverty, access to health care, and control of resources.

In all societies men and women play different roles, have different needs, and face different constraints. Gender roles differ from the biological roles of men and women in that they are socially and culturally constructed, although they may overlap. Women's biological roles in child bearing may extend their gen-

der responsibilities of child rearing, food preparation, and household maintenance. Thus it is gender roles that segregate responsibilities between men and women in social and economic activities, access to resources, and decision-making and authority. But these roles can and do shift with social, economic, and technological change. Factors such as the introduction of new crops and technologies, mounting pressure on land, or increasing poverty or migration can alter the roles of men and women in agriculture. The World Bank has identified some of the economic and social factors that influence gender-based difference, including institutional arrangements; the formal legal system; sociocultural attitudes, and ethnic and class-based obligations; and religious beliefs and practices.

World Health Organization scientists Vlassoff & Bonilla note how little is known about women's health in non-industrialised countries, save for those aspects pertaining to the reproductive cycle. Research on the social and economic factors leading to sex [and gender] differences in exposure to disease, intensity of infection, duration of incapacity, care given during illness, access to and utilisation of services, impact of illness on production and domestic work, social activities and personal life, has been extremely limited (Vlassoff & Bonilla, 1994:38).

Gender and the study of infectious diseases

Because it is a central aspect of structural inequality, gender is one of the key variables in the socioeconomic condition of a society and influences the risk for infectious diseases. According to anthropologist and feminist Henrietta Moore, one cannot pursue any sort of social science without the concept of gender (Moore, 1988). Reviews of health statistics show that while health information generally includes economic status, social statistics, and health condition, data are rarely presented in separate gender categories (Tanner & Vlassoff, 1998).

Due to the "invisible" or informal nature of women's productive contribution, the invisibility of which is itself an influence of gender bias, their reproductive role receives the most attention. According to the World Bank, incomplete data of total productive activity mask the dynamic interaction and potential for synergy across sectors, including the "invisibility" of much of women's work, limiting a gender analysis and an understanding of gender/poverty interactions (World Bank, 2000). Indeed, women are traditionally defined only in relation to their reproductive capabilities. Discussions on pregnancy and childbirth dominate the literature of women's health, and, in particular, examinations of infectious diseases in women focus on the effect that the infection has on the woman's reproductive capabilities and on the health of the unborn child. In the specific case of malaria, for example, most of the research conducted that can be classified as female-cantered consists of observation of "parasite localisation in placental malaria and the resulting clinical consequences of pre-term delivery and low birth weight of the foetus" (Beeson et al, 1990:464-472). Other concerns for women, such as unsafe working conditions, long hours at difficult tasks that pose occupational hazards, and the impact of inadequate sanitation and deteriorating environmental conditions – all of which are related to health – receive little time or study.

Vlassoff & Manderson emphasise that by incorporating gender in the anthropological study of infectious disease, "the social analysis goes beyond the description of biological or sex differences and affords a more holistic understanding of the determinants and consequences of health and illness" (Vlassoff & Manderson, 1998:1011-1012). Indeed, examination of gender analysis in malaria reveals how the economic and productive abilities, both within the home and outside, social roles as well as personal attitudes and perceptions (Vlassoff & Bonilla, 1994), are influenced by ideas of being male and female and how these factors shape the epidemiology of malaria. Beyond sexual differences between men and women, Ortner & Whitehead (1981) note that cultural references to sex differences vary and even biology is not considered definitive, as men's and women's roles are the results of social relations. Gender analysis, however, allows for the identification of disease categories by location and cul-

ture "which relate differentially to men and women" (McCombie, 1996:934), as well as recognition of a woman's individual illness experience.

Theoretical framework of gender

In the simplest of terms, the World Bank defines gender analysis as "seeing what our eyes have been trained not to see." Gender analysis can significantly increase efficiency, sustainability, and equity in interventions for health as well as rural and agricultural development. Systematic gender analysis provides a fuller perspective from which to determine sectoral priorities and the strategies required to address them. Evidence from many countries shows that women usually do not benefit automatically from development projects, including those associated with health. Of particular concern are the negative consequences in the treatment of women and children from the imposition of structured adjustment policies to stimulate national economic development (i.e., Beneria & Feldman, 1992). Lately, however, the United Nations Development Programme has developed a gender equity index by which development (in social as well as economic terms) is measured (UNDP, 2000; see also Johnson & Wilson, 2001). By alerting planners and implementers to gender-differentiated outcomes, gender analysis can reduce the inequitable impact of sectoral interventions.

In her analysis of the origin of the traditional association of women with childbirth, Moore (1988) examines the stereotypical association of women with nature and men with culture. Women are "of nature" because of their capacity to create life, while men are "of culture" as a result of their involvement in political and economic realms. Ortner & Whitehead (1981) note that social scientists have fostered a naturalist perspective on sex and gender. This biological association of women with nature and men with culture leads to associating women with a domestic sphere, focused on inter-familial and intra-familial relations, and men with the public sphere.

But gender analysis must move beyond the nature-culture dichotomy that narrowly defines men and women with respect to their biological capabilities.

Therefore, gender analysis on the transmission of infectious disease in general and malaria in particular should leave behind purely naturalist, biological explanations to include sociocultural factors and differential power relations in understanding why women have the social roles that they do and why men have theirs. And the focus of inquiry should be on how these social roles affect their risk of malarial infections. This focus on epidemiological analysis allows for understanding the cultural construct of gender and its influence on the transmission of disease, beyond the mere acknowledgement of sex and biological differences. Moreover, as Bujra identifies, "while gender may be a universal social category, its categorical imperatives differ widely and may vary not only between societies, but even within the same society, according to situation and social location" (Bujra, 1978:19).

Bujra goes on to state that "In gendered illness narratives, clinical symptoms of disease can be understood not just as manifestations of culture and society, but also as the individual's knowledge [and perception] about the body, the self, and their relationship to the more intimate aspect of her life world" (Bujra, 1978:20). Thus, a "gender" perspective provides a more holistic understanding of the interactions between and among individuals because it is based on cultural and social constructs and experiential differences between the sexes (Rathgeber & Vlassoff, 1993). The gender framework of Rathgeber & Vlassoff requires that women's and men's health be understood within specific sociological, cultural, and economic contexts, taking into consideration economic or productive activities both within and outside the house, as well as personal attitudes, perceptions, and needs of men and women.

Implication of gender and economics on the risk for malaria

The interdependence of gender and the economics of malaria becomes clear when we look at the differential access men and women have to financial resources in holoendemic areas. In a 1992 Public Health Forum at the London School of Tropical Medicine and Hygiene, Mills stated that the economics of

malaria are contingent on the answers to five major questions: "1) who actually gets malaria, 2) what the resource costs of malaria are, 3) what determines an individual's or community's demand for malaria control measures and treatment, 4) what the characteristics of the various means to satisfy this demand are, and 5) what policies follow from the comparison of the costs and consequences of different means of supply" (Mills, 1991:142). By incorporating gender into the economic analysis of malaria, it is evident that each one of these questions will be answered differently by men and women. For example, studies conducted in the Caribbean and in Ghana revealed a higher risk for malarial infection for women than for men, which the authors attribute to the gendered division of labour, which governed the higher frequency of water contact, and, as a consequence, the higher risk of malaria infection for women. In particular, the Caribbean-Ghana study showed that "Men's water contact occurred in the context of economic activities such as fishing, transporting bananas for sale, and collecting sand and stones for roadmaking; women's water contact occurred in the context of domestic tasks including collection of water for household purposes, washing clothes, supervising children's play and personal hygiene" (Vlassoff & Bonilla, 1994:42). Understanding this pattern for risk of malaria would influence the recommendations for prevention of infection.

Both women's and men's health are strongly conditioned by the political and economic environment and the cultural belief systems in which they live. In most countries, females differ from men in their access to and control over productive resources and face different social constraints that affect their status in society. Some constraints relate to cultural norms of physical mobility, while others stem from the gendered division of labour and segregation of women in the economy. There are also time constraints on women because, as primary caregivers, they must fulfil childcare, household chores, and market responsibilities. Analysis of men's and women's time allocation captures the interdependence between the market and household economies. It is well documented that women work longer hours than men do throughout sub-Saharan Africa. But because it is not officially counted as employment, much of women's productive work is unrecorded.

A thorough understanding of the gender-related dynamics of decision-making, resource allocation, and financial responsibility and authority within a household is critical to disease-control programmes. Using collective terminologies like "family labour," "hired labour," and "farmers" may mask gender-linked aspects of social and economic behaviour and may contribute to incorrect assumptions about the targeted (and seemingly undifferentiated) population. Studies illustrate how knowledge of the division of labour by gender, including types of work and times of day that work is performed, can provide a foundation for preventive strategies. The differences between assumed and actual divisions of labour of men and women may lead to inaccurate estimates of risk and of disease prevalence, especially in women.

Bonilla & Rodriguez (1993) studied the time losses and reassignment of labour within the household as a result of malaria and the intrafamilial struggle to minimise any losses due to malaria illness in a rural community in Colombia. They reported a higher prevalence of disease burden among men (59%) than among women (41%). However, when the time losses are separated by gender, the analysis of the impact of disease burden showed a lack of symmetry between gender-specific prevalence of malaria and the gender-specific costs of malaria. They concluded that, "although the disease burden was greatest amongst adult males, the indirect economic burden of the disease was greater for women" (Bonilla & Rodriguez, 1993:1113). For example, women assumed 64% of all tasks normally undertaken by the sick person (much more than was the case for men when women were sick), which could be due to postponement or reduction of domestic tasks by females (a greater amount of time spent by females caring for the sick persons during an episode of illness), and female replacement of males in farm production.

In a case study conducted on the purchase of Permethrin Impregnated Bednets (PIBs) in Benin, Rashed et al showed that women's access to income was one of the key determinants of the use of bednets. The researchers found that the "resource costs" or the price of PIBs and the "acquisition of consumption goods" such as chloroquine were the major obstacles impeding their purchase and use

by women (Rashed et al, 1999). More importantly, the variable access to cash resulting from the seasonal production of cash crops hindered female purchase of the bednets. "Money produced by the sale of crops which [came] from the family farm [was] controlled by men... and women [had] little or no access to cash or credit" (Rashed et al, 1999:995). The authors note that a women's capacity to negotiate the amount of income set aside for food and health care is based more on a woman's influence on the man of the household than on any power to make such decisions directly. Tanner & Vlassoff also found that "Although the women [carried] the major share of the responsibility for the well-being of the household [in Benin], this responsibility [was] rarely matched by autonomy to make decisions or by access to necessary resources" such as permethrin-impregnated bednets. (Tanner & Vlassoff, 1998:526).

Paradoxically, women could not fulfil their socially assigned obligations as care-givers because the economic resources they needed to do so were controlled by men. Lack of access to resources reduces the availability of effective treatment and inhibits women from using available health services, which may be a determinant of tropical diseases, as women cannot obtain preventive or therapeutic drugs for themselves and their families, putting both women and their children at greater risk (Ettling et al, 1989). Moreover, studies conducted in India report that because women delay or postpone treatment, their recovery period is longer when compared to that of men because these women return to normal domestic duties while they are still debilitated.

Mothers, regardless of their sociodemographic characteristics, make the first diagnosis of illness in their children by defining and interpreting bodily and behavioural changes. They also believe that they know when it is appropriate to treat at home and when they should contact a health worker (Mwensi, 1994; Mwensi et al, 1995). It is this individual recognition of malaria based on local concepts that forms the basis for treatment-seeking behaviour. However, decision-making processes for health care in different types of households and settings depends generally on the social structure and who "owns" the child, an important consideration in both patrilineal and matrilineal societies.

In the Mwenesi study, mothers were treating their children promptly (at home), within 24 hours of onset of illness, although the lag time between onset of illness and taking a child to a health facility was three days. Some of the reasons for the lapse by the mothers were predisposing factors, including perception that the illness was mild, partner was absent, other important matters to attend to, and lack of someone to mind the ill child's siblings (Mwenesi et al, 1995). Programmes of malaria control must not only convince these mothers that malaria is a major problem but the fathers as well. It is the fathers who have the most power in these families and it is they who must be convinced of the seriousness of the matter and encouraged to facilitate in the expeditious treatment of a child showing signs of malaria. These mothers must be empowered to change their behaviour by addressing other concerns and responsibilities brought about by structural inequalities so that they will not always be prevented by these overarching social and economic problems. Economic powerlessness is real for most people who suffer from malaria (Zaidi, 1988). Although mothers are responsible for both water use and the health and cleanliness of their children, the decision to change behaviour has to be sanctioned by the husband in the household and by the community as a whole (McCauley, West, & Lynch, 1992).

These multiple influences of gender on access to resources call for a shift in the choice of malaria control initiatives. If control measures such as bednets are to be effective, public health officials must find ways of overcoming women's lack of power and financial resources by convincing men of the need for treatment and of the efficacy and merits of PIBs in preventing contact with *Plasmodium falciparum*-carrying mosquitoes.

Women's social status, poverty, and infectious diseases

Poverty is one of the key determinants of health. It is both a cause and a consequence of ill health. And ill health can lead to poverty by interfering with the individual's capacity to produce while at the same time requiring the fam-

ily's few remaining resources to pay for treatment. The poor are less likely to have access to health services or to have savings to get them through the periods when they are sick and unable to work. WHO has devoted a whole issue of its Bulletin to inequities in health and has called for action and research focusing on poverty-related issues (WHO Bulletin, 2000).

Although both males and females in areas of endemic tropical diseases suffer from discrimination due to class inequality, poverty, and deprivation, women are particularly disadvantaged and marginalised due to structural factors within society. Indeed, tropical diseases are often described as "diseases of poverty": It is the poor and underprivileged that are most at risk and experience the most mortality because of precarious living conditions and often inadequate health services. Seventy percent of the people in abject poverty are women (Buvenic, Gwin, & Bates, 1996). Since poverty and its contributing factors have been identified as one of the key determinants of women's health, one of the fundamental challenges to social development is alleviating women's poverty and empowering women to combat discriminatory practices.

Malaria is widespread in the Cameroon and is one of the major causes of maternal morbidity and mortality. Using a community-based, prospectively collected data-set, Kuate (1997) provides an example of the relevance of women's status on health using five indicators, including education, women's labour force participation, marital status, prevalence of polygamy, and ethnic affiliation. One of the most important findings of the study is that the burden of illness rests disproportionately on the economically disadvantaged women and on women with low social status. Excess morbidity was found among women who were not employed, women living in poor neighbourhoods, and those living in households without modern amenities.

The impact of poverty and social status on women's health is a universally acknowledged issue. The World Bank Status Report on Poverty in sub-Saharan Africa (SSA) reports that gender analysis of household survey data for a group of SSA countries confirms the enormous diversity in household structure and

composition and shows that poverty is related to family systems. A simple distinction between male and female heads of households does not adequately capture the diversity of family systems and how they allocate resources, but it does provide a crude measure of difference. However, analysis of households on the basis of headship provides useful information on the structure and characteristics of different households in SSA (World Bank, 2000). Where women have more control over the income/resources of the household for which female headship may be seen as a proxy, the pattern of consumption tends to be more child-focused and oriented to meeting the basic needs of the household, including health.

Vundule & Mharakurwa (1996) note, however, that many women in rural areas, as in Zimbabwe, are de facto heads of households because their husbands are working away from home. And yet, in all-female Focus Group Discussions, 60% of respondents said that decision-making at the household level concerning when and where to seek health care was the responsibility of the male head of household. If women are de facto heads of households, why are they not making crucial decisions concerning the welfare of their families? A gender analysis would reveal that there is a discrepancy between understanding who financially runs a household and who actually makes decisions, and who controls cash flow and funds. To do this kind of analysis, men in the same population, including those who are temporary economic migrants, would need to be interviewed and their responses compared to the women's to ascertain if what people say happens is actually what happens.

Evidence in SSA points to gender disparities in access to and control of assets in each of the three categories used in the report: human capital assets (health and education); directly productive assets (labour, land, and financial services); and social capital (social and political participation at various levels). Health risks of poverty are far greater for females than for males. In most developing regions, women lag behind on virtually every indicator of social and economic status. Women control fewer productive assets than men do. Women are more vulnerable to adverse changes in social and environmental conditions (World

Bank, Status Report, 2000). Working harder, eating less, and supported by fewer social services, poor women are increasingly vulnerable and susceptible to diseases, infection, and nutritional problems. This powerlessness is itself a serious health hazard, forcing women to struggle harder if they are to break the cycle of poverty for themselves and their families.

As Moore has observed, even when women may possess some political power, they often lack the legitimacy to exercise this power in a public forum because of preconceived notions that a woman's role is restricted to the domestic sphere (Moore, 1988). In rural Sudan, for example, the consent of the village men is necessary for women's participation in communal activities outside their homes. Locally-accepted gender roles also influence the participation of women in malaria control programmes at both the household and community levels. Many governmental malaria control programmes are targeted to educate the at-risk female population for prevention and treatment of malaria because they believe that as the primary caregivers, "women should be at the front and centre of all action strategies" (Vlassoff & Bonilla, 1994:37). However, officials of these programmes fail to understand that the female population in holoendemic areas, even when "educated" and knowledgeable, do not necessarily have the social and political status to involve themselves in community programmes, nor do they have the economic capital to act individually to control the spread of malaria infection.

A gender analysis of control programmes reveals that the state inadvertently maintains and promotes a "central political authority" that is focused around the male wage earner with a dependent family, but then seems to ignore this fact by focusing prevention on mobilising women in the eradication of malaria by expecting them to commit funds they do not possess for preventive agents and goods. Public policy has a definitive and important role in promoting gender-inclusive growth and poverty reduction and on reaching out to the poor women to reduce their "political deficit" (World Bank, 2000).

Gender-specific risks and the control of malaria

Women and children are at greatest risk for malaria in both high and low endemic areas for both biological and social reasons. Women have a biological predisposition for contracting malaria. Pregnant women are most at risk in areas of high and continuous transmission, particularly during their first pregnancy, and also under conditions of unstable malaria, which do not permit acquired immunity development. In non-immune individuals, malaria during pregnancy causes abortions, still births, and delivery of low-birth-weight babies. Women also suffer from suppressed immunity because of low nutritional status (and on average this is lower than for men), which can put [them] at high risk for severe malaria infection. Primigravidae women, most of whom are pregnant adolescent girls, are likely to manifest the most severe forms of the disease (Institute of Medicine, 1996).

Similarly, women are socially predisposed to contract malaria. Schultz et al (1994), in a Knowledge-Attitudes-Practices (KAP)-like survey of child-bearing Malawian women to determine the use of antenatal services, found that the women's level of education was the only significant predictor of ANC care, continued attendance, and delivery in hospital. Eighty-seven percent of the women interviewed considered malaria to be a problem during pregnancy and identified it as "causing abortion," "illness in the mother and the baby," and "birth of a small baby." Almost 93% of women who carried their pregnancy into the second trimester attended the antenatal clinic at least once. Perceptions regarding the effects of malaria during pregnancy were similar regardless of age and pregnancy history or ANC attendance: 79% of the women were aware of the need for anti-malarials during pregnancy. The authors conclude that it is critical for health promotion messages to be targeted toward the less educated to ensure their utilisation of antenatal services.

In a case study in Malawi in a village of Yao and Chewa peoples, Helitzer-Allen, Kendall, & Wirima (1993) conducted focus discussions with 160 non-pregnant and pregnant women. They reported the commonly held belief that treatment

for the *malungo* illness from supernatural causes had to precede treatment for the *malungo* illness from natural causes in order for it to be effective. An analysis of the disease perception of malaria in this region revealed that there was a strong female-gendered identification of fever with supernatural causes; women believed that the power of the spirits was greater than the medicines of the Western world. Similar findings were obtained in studies in rural Kenya with regard to treatment-seeking behaviour, which reported that the convulsions and coma resulting from cerebral malaria originated from the will of the divine (McCombie, 1996). The treatment sought by female residents of Malawi and Kenya was directly related to what the women caregivers perceived as the etiology of the illness. While women were told that "digging holes to allow water... to seep into the earth, cover pit-latrines, and [place] the maize garden far away from the house, the importance of mosquito-preventing acts were not explicitly followed because villagers did not associate the *Anopheles* mosquito vector as the most important *malungo*-inducing factor. This and similar kinds of reasoning prevented a confidence in and use of anti-malaria drugs [such] as chloroquine; [it was believed that]: *malungo* from the spirits was incapable of being treated by conventional biomedical medicine" (Helitzer-Allen, Kendall, & Wirima, 1993:276-277).

One revealing observation from a study conducted by Okonofua et al (1992) in Nigeria was that although women correctly identified the cause of malaria, men and traditional healers asserted that the disease was caused by being in the sun for too long, bad water, and too much sex. The Helitzer-Allen study found that the underlying reasons for not taking chloroquine to prevent *malungo* (fever) was because the women were afraid of its harmful effects on the foetus. Culturally proscribed foods during pregnancy as well as other aborificients are commonly thought of as "being bitter-tasting," (Helitzer-Allen, Kendall, & Wirima, 1993:281) (as is chloroquine), a characteristic of food thought to induce abortion in this Malawian community. But the fact that the majority of women do not take chloroquine or other anti-malarials does not mean that they do not believe it can have a preventive effect on any type of *malungo*, rather that "it does not have any effect on the most serious type of *malungo*" and that "they

get other types of *malungo* anyway even if they take chloroquine" (Helitzer-Allen, Kendall, & Wirima, 1993:282).

The final analysis of the Malawian and Kenyan studies reveals that non-use of chloroquine and other anti-malarials is not a result of misinformation or disbelief in the healing power of Western treatments of malaria, but rather that certain malarial symptoms are identified as indicative of a "traditional" illness for which "Western" treatment is deemed inappropriate, or the belief that the Western antimalarial has other consequences, such as producing abortion, which is to be avoided much more than a bout of malaria.

Women and community

Working in the public arena while still having and demanding household commitments are the most frequent constraints encountered by women as community health workers (CHWs). In assessing the involvement of women in a community project of control and management of malaria in Sudan, Rahman et al (1996) found that women volunteer health workers, *murshidat*, played an important role in health promotion and motivation prior to vector control. Yet household commitments and difficulties in communication with the public were the main gender-related factors that were deterrents to women's involvement in health activities.

On the other hand, in assessing the effectiveness of community-based malaria control programmes in Tigray (Ethiopia), Ghebreyesus et al (1996) found three reasons for women's underutilization of CHWs to be both sociocultural and structural: 1) the heavy workload of women leaves them little time to attend to their own and their young children's health needs; 2) distance to the CHW village, when combined with work responsibilities, proves a significant barrier to care; and 3) lack of knowledge about the importance of early diagnosis and treatment also inhibited use of such services Other reasons included male dominance in decision-making, women's habit of not expressing needs, and the possible perception of sexual disloyalty when a woman seeks care from a male CHW. Part of the solution to these barriers would be to select and enable more

women to become community health workers, but then they would need assistance in being able to live up to their other domestic commitments, as mentioned above.

Often, many programmes that are conceptually sound fail to be effective because the "microclimate" that influences decision-making is not considered at the programme-planning and operational stages. We need to comprehend how diseases are "engendered" in a culture or social setting so that we can support sustainable prevention and control programmes. These perspectives acknowledge the importance of recognising women as active partners and their gender roles as crucial in any research effort. Factors affecting women's use of community health services in endemic areas, sex of health personnel, perceived quality of care, cultural conflicts between biomedical and local norms, as well as social distance between health personnel and patients, cost of services, and fear of stigmatising diseases should all be investigated in depth.

The role and contribution of women as household guardians, community members, income earners, and primary educators cannot be overlooked in planning community-based services in developing countries. Information related to malaria control and prevention should be tailored to households, with special attention to decision-making structures: who is likely to receive the information and to pass it on within households and who is likely to use it. The gender perspective will also contribute to recognising that differences in power and status between health provider and patient may affect diagnosis and treatment.

Women may have to ask permission from others in the households before being permitted to seek care. In some cultures, women cannot visit health centres unaccompanied, and the lack of male escort may make it impossible for women to act upon their need to go for treatment. Health services are often insensitive to women and tend to blame them when they come late for treatment. Many strategies for malaria control and prevention have not been able to be sustained or implemented due to the failure to incorporate an interdisciplinary and gendered perspective in the design of such programmes as well as insufficient consideration of the general social and cultural context of infection and disease.

Incorporating gender-related analysis into malaria control

Despite the importance of gender as a risk factor for malaria, relatively little of the malaria literature takes into account the possible influence of gender factors and gender relations. To answer complex questions regarding women's health and, in particular, the gendered patterns of risk, prevention, and treatment of malaria, we need relevant measures, and this underscores the need for disaggregated data and analysis by gender. More psychosocial and biobehavioural research is needed to determine how women's status and social disadvantage influence malaria risk and inadequate use of health services in order to ensure equitable as well as more effective delivery of services and to break the vicious cycle of disadvantage. No less important is the need to enhance the communities' and especially women's economies to a degree that they can afford effective malaria control services for themselves. Gender-specific data are essential not only to assure that women are being reached, but also to make sure that resources are equitably and effectively distributed and shared. While a current review of the literature on gender-related differences in the impact of malaria reveals that many countries in Africa and Asia have been targeted as a focus for gender-related malaria research, much is needed by way of ethnographic analysis in various regions to affect positive changes in gender roles that would improve women's health in general and infectious disease control in particular.

Simply put, the risk, prevention, and treatment associated with malaria are significantly distinct for men and women. Inclusion of gender provides a social context in which to discern how individual behaviour, cultural traditions, and social norms manifest differentially in men and women and how these manifestations of gender influence the transmission of the disease. In the future, perhaps the greatest challenge for malaria control programmes will be to conduct a systematic social and gender analysis that is tailored to reflect the subtle nuances of culture and politics (and power) within both communities and households.

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CHAPTER EIGHT

COMMUNITY PARTICIPATION AND INVOLVEMENT IN MALARIA CONTROL

Although bridges, latrines, and laundry sites can indeed be built, without [behavioural] studies there is no assurance that these facilities will be used (and much experience to show that they may not be). Any effort to change human behaviour must rest on such studies. Without them there is little point in proceeding with expensive manipulation of the environment.(Dunn, 1979:503)

... for successful malaria control, whether today or tomorrow, people's participation is absolutely essential, and in the future, much will depend on the 'community-will'. (Sharma & Mehrotra, 1986:844)

Discussions thus far have highlighted how sociocultural and behavioural aspects of health and illness of people in malaria-endemic areas are important factors in malaria control. Local sociocultural variability and understandings of disease and preventive practices, differences in vector habitat and human behaviour, and endemicity mean that one particular intervention cannot be applied to all areas. The choice of control methods appropriate for a specific community or region requires an understanding of how various factors affect the local epidemiology of malaria, such as deforestation and population movement (Chapter Five), local perceptions of the etiology of malaria and its causes (Chapter Three), the manner in which people decide whether a given treatment of preventive measure is efficacious and patterns of treatment-seeking behaviour during episodes of illness (Chapter Four), and here, the role that the community as a whole plays in planning, implementing, and evaluating malaria control programmes.

With the resurgence of malaria in places where it was thought to have been eradicated, such as South-east Asia, South Asia, and Central America, any expectation of global eradication of malaria was abandoned. The one lesson learned from these global elimination programmes is that malaria cannot be dealt with as a single and uniform problem throughout the world, susceptible to one global control strategy alone (Spielman, 2000). Evidence in the malaria eradication literature has shown that although it was possible to reduce and even interrupt transmission by spraying, it was impossible to maintain efficient surveillance without a solid health infrastructure. As Wessen argues, "... only in retrospect has it become fully clear that the failure of malaria eradication was in large part a failure at the social and organisational levels" (Wessen, 1986; iii). Nichter (1984) asserts that, in the absence of a sociocultural perspective, the themes of community participation and bottom-up planning are largely rhetoric.

Over time, vertically organised malaria control programmes have given way to more horizontal, primary health care programmes, especially after the Alma Ata Conference in 1978. The traditional approach to malaria education has been to stress the biological and medical facts to the exclusion of the sociocultural and behavioural aspects of malaria control, while it is clear that to make a difference, both of these approaches must be merged to attack the threat of malaria in a comprehensive manner. In this chapter we will emphasise how important it is to have participants from the target communities involved in the planning and implementation phase of any malaria control effort.

Defining a community

Before we can ascertain what community participation entails, we need to understand what is meant by a community. Anthropologists have long defined different societies as being organised in diverse ways, with varying social structures and often conflicting social groups, differentiated by class, religion, ethnicity, and lineage. Identifying and understanding the community and its dynamics is not simple. Although an in-depth description of communities and com-

munity organisations is beyond our scope here, and although we acknowledge that communities can be non-geographically based associations, for the purpose of this chapter we agree that communities are dynamic social units and the geographical area in which they live is the main common factor.

Agueldo (1983) has defined a community as a group of people living in a particular area and therefore having shared values, cultural patterns, and social problems. Chand (1989), however, observes that even within a defined geographical area, a community is made up of different groups. Understanding this is crucial in developing health programmes, since not all members will be motivated to participate in these efforts in the same way. Another concept valuable to our understanding of a community is the feeling that members have of belonging to a particular group, which gives a special motivation and willingness to work for the good of that group. This explanation (a sense of belonging, a joint problem, and a shared approach) can play a crucial role in the success or failure of programmes aimed at disease prevention or control.

Malaria control and community participation: successes and failures

Just as there are difficulties and variabilities in defining "community," the term “community participation” is also not clear-cut. Community participation and community involvement have been used synonymously. However, WHO draws a distinction. Participation may be a simple passive response, while involvement is when people take an active part in decisions as well as activities. Communities are not silent participants in programmes that have been determined elsewhere. Rifkin, Muller, & Bichmann see participation characterised by activeness, choice, and the possibility of that choice being effected (Rifkin, Muller, & Bichmann, 1988).

Community participation can also be defined as "a process whereby specific group(s) living in a defined geographic area and interacting with each other, actively identify their needs and make decisions to meet them" (Bermejo &

Bekui, 1993:1145). Individual efforts in any infectious disease control effort are not sufficient to obstruct transmission; community involvement is crucial and should go beyond "compliance." But with so much community variability, there is the need for cultural sensitivity in planning health programmes. Nichter (1984) suggests that a "community diagnosis" must be carried out using a participatory approach before any health or economic development interventions can be effectively planned. Thus we strongly suggest that a high degree of community participation is essential for dealing with diseases where control depends on behavioural changes, as it does with malaria.

Using case studies of the Ghana Guinea Worm Eradication Programme and the Nicaraguan Tuberculosis Control Programme, Bermejo & Bekui (1993) have identified the main determinants of community participation in disease control programmes and have developed a framework of variables that affect participation, including government support and decentralisation; community segmentation and social environment; managerial capacity of the provider and inter-sectoral cooperation; epidemiology of the disease; and relevance of community participation to the task at hand. The framework they have developed can be relevant to malaria as well. All too often, the people in the community are not involved in the decision-making process. Yet community members not only can contribute to vector control and broad epidemiological surveillance for keeping local malaria incidence under control, but they are essential for the success of such work. In India, Rajagopalan & Panicker (1986) observed that many times people go along with programmes that are forced upon them without truly participating in these efforts. This acquiescence is often mistaken for cooperation. Frequently, the community's concerns and objectives are not the same as those of the disease-control professionals, and many of the programmes implemented in this way have eventually failed for lack of genuine community participation.

Successful efforts are those that take community needs into account from the very beginning. In the programmes of the Vector Control Research Centre (VCRC) in Pondicherry, India, Panickar, Bheema Rao, & Rajagopalan (1984) noted that

community participation was encouraged in the planning stages and an integrated approach was undertaken. The community's primary expressed need of providing clean drinking water and electricity was addressed first, and once resolved, vector control measures were linked to economic incentives. In the study village, for example, it was noticed that the presence of algae reduced the number of larval development sites. Since algae could be used for making cardboard, the villagers were given financial incentives to grow, harvest, and sell the algae. The success of this project demonstrates that outsiders must be willing to listen to and help meet the needs expressed by the community, even when these needs are ancillary to the focus of the outside public health implementers, and, if public health efforts to control infectious diseases can also be combined with an income-producing side project, so much the better.

But encouraging participants must be done with care, since opposition to programmes can be highly politicised, as was the case in Nicaragua. Garfield et al (1986) provide a historical analysis of a campaign organised to include the support of the population affected. The proponents saw an opportunity in the nationwide literacy campaign to promote the malaria control programme, which supported the decentralisation of malaria control activities and the integration of malaria efforts with the nationwide primary health-care system. They believed in the philosophy that "only people can educate people." Women played a very important role in the campaign and both popular media and non-formal educational methods (street theatre, bonfire meetings, etc.) were used extensively. However, some of the publicity was met with opposition and the campaign became heavily politicised, which could have led to a backlash. Garfield, however, argues that due to the high level of participation, past apathy was overcome, malaria incidence four months after the initiation of the campaign was reduced, and a significant number of new cases were averted, in spite of negative publicity campaigns, which promulgated such misinformation as "the pills are from Cuba and Russia in order to brainwash the people into communism" (Garfield et al, 1986:873).

Competing political ideologies can also contribute to the success or failure of community-based disease control programmes. Silva (1997) provides an interesting breakdown of malaria control efforts in Sri Lanka, seen from differing and opposing viewpoints. Silva's analysis places the origin and development of malaria control within a colonial context and points to the need to "decolonise malariology":

> *... to the colonial rulers the control of malaria was necessary in order to open new territories and consolidate their position in the tropics. In contrast, to the nationalist leaders, successful malaria control was a matter of self-realisation... To the leftist intellectuals, malaria was yet another manifestation of colonial exploitation and poverty. Finally, to the peasantry, it was yet another burden on them, though often not the most significant of the difficulties they faced.* (Silva, 1997:196)

For programmes to succeed not only should communities be involved in both planning and implementation but (as part of the overall approach) there must also be a willingness to address community expressed priority needs even when these are not directly related to the control of malaria.

Community volunteer networks

Ault (1983) asserts that understanding the socioreligious customs, migration patterns, multiple healing traditions, land tenure, and national development plans is key to the success of malaria control efforts. According to Ault's work in Sri Lanka, various traditions of community volunteering in local public works projects can be used to establish a malaria volunteer programme. In multicultural and multiethnic Sri Lanka, where Buddhism, Hinduism, and Islam coexist, important social customs for the different population groups (including purdah, the seclusion of Muslim women from the public; shramadana, the conduct of regular and cooperative volunteer manual labour for local public work projects; arthacharya, constructive services for the benefit of the community; and sarvodaya shramadana, a national social movement) have not been incorporated

into self-help programmes in the Anti-Malaria Campaign. Ault suggests that it would be beneficial to do so. Incorporating the community's traditions and customs would increase its effectiveness and reduce wasted time and effort. For example, spray teams have had difficulty in accessing Muslim households because under purdah, unrelated men are prohibited from the home when only women are present. Also, among the Tamil groups, low-caste spray-team members and fever-detection caseworkers have been denied entrance to the homes of higher-caste Tamils (Ault, 1983). Amendments in how best to proceed must be sensitive to these sociocultural norms so that the goals of the control efforts can be accomplished.

Community support and village-based volunteer workers have also played an integral role in malaria programmes in Guatemala, Ethiopia, and Thailand. Okanurak & Ruebush (1996) found that one of the factors that influences the success of a malaria programme is the level of endemicity. In highly endemic areas, where there is great demand for malaria therapy, volunteers are well regarded by the community and neighbours. Since malaria is one of the more important causes of morbidity in these regions, the volunteer workers are seen as a valuable resource. Consistent with earlier findings, the authors also found that traditional healers outperform others. "One of the best ways to ensure community involvement in the implementation... is to allow community residents to select their own village-based workers... the malaria control implementers need to be more sensitive to residents' preferences when deciding on the qualities they are seeking in a volunteer worker" (Okanurak & Ruebush, 1996:163). Many communities have chosen traditional healers. In several Latin American countries, a network of volunteer workers was established for active case detection and these networks have become a mainstay for malaria surveillance and anti-malarial drug treatment in many malaria control programmes (Ruebush et al, 1990; Ruebush & Godoy, 1992; Ruebush, Weller, & Klein, 1994).

Okanurak & Sornmani (1991, 1992) studied the impact of traditional healers (volunteers from the community) on the performance of Thai malaria volunteers, whose practice is based on the belief that diseases are caused by an

imbalance of the four elements – water, air, earth, and fire – with treatment aimed at restoring equilibrium. The researchers concluded that the traditional healers participated in the malaria surveillance more actively and performed better at malaria case detection than non-traditional healer volunteers. Cited as the main reason for this phenomenon was that the traditional healers were recruited from within the community as volunteer community malaria workers. They held more social status in the community and engendered the belief that they were the best people to handle health problems, whether malaria or other diseases. This perception is borne out by the extent to which they are utilised for their healing services. The authors caution, however, that due to the tendency of these healers to administer sophisticated and dangerous drugs, it is important to make them aware of their boundaries For if they are not trained properly, their prescribing practices could lead to side-effects and drug resistance (Okanurak & Sornmani, 1991, 1992).

Health education and training

The Health Belief Model remains one of the predominant conceptual frameworks for health education and promotion and assumes a linear relationship of knowledge to behaviour; in other words, that a change in community knowledge will lead to a change in behaviour (Rosenstock, 1966). That is, if an individual or the community has adequate knowledge and the rationale for the prevention or treatment of illness, they will comply or adhere to the regimen. Malaria control programmes based on this model have failed to take into account the importance and magnitude of the impact of perceptions of personal locus of control, aspects of ownership, and a variety of other socioeconomic factors, besides knowledge of "appropriate action," that affect health services utilisation by the people of a particular community. For communities to select intervention programmes for malaria control, it is imperative for those administering the programmes to understand the context of the disease in that community and the variety of factors that motivate and inhibit action, thus putting into question the value of the Health Belief Model.

Gramaccia (1981) has identified four important reasons for why health education has failed in malaria control programmes at the community level in many countries: 1) health education will have little chance of success with an audience that has low education, poor housing, lacks physical and social resources, and is apathetic; 2) population groups have accepted malaria as part of their lives and would rather have attention focused on the causes of their poverty and poor living conditions; 3) people have difficulty in understanding the complexities of malaria etiology and epidemiology; and 4) existing control methods have often been formulated without sufficient knowledge of the target population and the situations in which they live.

Stone (1989; see also 1992) notes that health messages are often delivered as "flat statements," with no attempt to integrate the content of the messages with local knowledge or concepts. She suggests that there should be a closer "fit" and a creative use of "appropriate analogy" between local health concepts and modern messages, what some have called "an experience-near" form of health education (Nichter & Nichter, 1986; Ramakrishna, Brieger, & Adenyi, 1990; Green, 1986; Were, 1985). MacCormack (1984) has suggested that people can accept biomedical concepts if those ideas are put into locally recognised analogies and forms that are understandable.

Moreover, if the population that is being served does not share the education and knowledge of the Western-trained professional, conflict may develop in the meeting between the knowledge and beliefs of the local communities and what the professional tries to impart. It is therefore suggested that Western-trained professionals learn about community structures and explore ways of employing them in the management of diseases. Fiwavo (1993) argues that what has been overlooked in medical and public health studies is an awareness of the many possible reasons for a patient's or a community's behaviour. Clearly, the professional needs to have some understanding of these non-medical ("non-scientific") factors influencing behaviour. As Dunn has written, "Neglect of intra-community human factors, lack of emphasis on research by health educators,

and limited recognition that education should also be a community responsibility," might be some of the factors limiting community self-help (Dunn, 1979:511-512).

Integrating behavioural research into control programmes

The application of social and behavioural science research to malaria should have two main objectives: to help researchers understand and reduce social and behavioural barriers that hinder the acceptance and use of preventive measures by individuals and communities, and to promote early and effective treatment of clinical cases of malaria, especially among young children (Oaks et al, 1991). Doing qualitative research and understanding a community's beliefs and behaviour is critical to the success and sustainability of community-based malaria programmes. From past experiences we have learned that anthropological parameters cannot be ignored in malaria control initiatives.

Yet, we also know that these parameters often compete with the knowledge and value systems of the public health professionals. Thus, how well both sides are able to communicate with each other and forge a coherent programme among themselves as well as with the community will be an indicator of a successful effort. What is needed is an understanding of the people, their attitudes toward health and illness, and their concept of an acceptable health-care programme. Successful malaria control efforts also need to acknowledge and address the country-specific social, economic, and political circumstances as they are expressed in local communities (Manderson, 1998).

Of equal importance to the target populations and communities, however, is a similar scrutiny and analysis of the health services themselves and, in particular, of the malaria control bureaucracy. Understanding the character of this bureaucracy and how it is perceived is an important aspect in understanding the community's reaction to the health system, and, more specifically, to the malaria control programme and programme personnel. The effectiveness of con-

trol programmes for most tropical diseases, particularly malaria, relies on early and frequent treatment to affect the disease reservoir in infected human hosts. But to be effective, the control programmes must also establish a therapeutic or public health alliance with the community based on mutual trust and respect.

In their research in Malawi, Helitzer-Allen, Kendall, & Wirima (1993) demonstrated how ethnographic research into a community's illness experiences, aetiological perceptions and symptoms of fever, and beliefs about prevention and treatment can provide the missing links between purely epidemiological research and strategies for programme implementation. The Malawi research was an in-depth study in which three researchers actually lived among the study communities for several months, participating in all village activities and identifying key informants. In-depth interviews and focus-group discussions with pregnant women, husbands of pregnant women, and women who recently gave birth was carried out, and information from this multimethod research was incorporated into the malaria control programme to forge an effective link with the community to control malaria in the area.

A similar study was carried out by Kengeya-Kayondo et al in Uganda using focus-group discussions and semi-structured interviews (Kengaya-Kayondo et al, 1994; see also Kengeya-Kayondo, 1993). An important finding of the study was that all the women interviewed used a more general word, *omusujja*, to describe fevers, and did not have a specific name for malaria that fit the case definition. The researchers were also able to link the cause for *omusujja* to diet and environmental conditions, not only to mosquitoes. This insight was important for malaria control programme planners since "for health education purposes, malaria control messages that translate malaria into *omusujja* will not address malaria specifically" (Kengeya-Kayondo et al (1994:272). In Ghana, Agyepong (1992) observed that other linguistic concepts needed to be used in order to form a bridge into the linguistic and perceptive reality of the community to have a significant impact. These studies all confirm that health communication messages should be designed and evaluated with the full participation of the target population, and care must be taken to understand and appropriately inte-

grate scientific knowledge in juxtaposition with ethnomedical perceptions and practice, so that what might often be seen as highly conflicting explanatory models used by the community on the one hand and the public health professionals on the other can be bridged into a solid control effort.

Indeed, instead of the conventional top-down, quick-fix model, malaria control programmes must give way to more creative bottom-up approaches. Existing traditional knowledge should be assessed before designing and implementing malaria control efforts. Local communities and planners, using their different perceptions and knowledge, should negotiate together how best to implement programmes to improve community health. In more recent research in an endemic urban area in Colombia, Nieto, Mendez, & Carrasquilla (1999) conducted a Knowledge-Attitudes-Practices (KAP) study to assist in the design and implementation of a primary care approach for malaria control. We are rather sceptical of the value of such KAP studies, since, as pointed out earlier, in terms of our critique of the Health Belief Model, it is quite clear that there is not a "logical" or linear connection between knowledge and attitudes on the one hand and a "consequent" action on the other. However, this KAP study ensured that focus-group discussions were carried out to provide information that formed the basis for a cross-sectional quantitative questionnaire. Using the data obtained from the above methods, and from previous epidemiological and entomological studies, an intervention programme was designed, derived in part from public health professionals being fully cognisant and largely respectful of the community's perceptions, knowledge, and ways of living. The community was thus inclined to be more open and respectful to the value of the perceptions and knowledge of the public health professionals. The design of the intervention programme was an interactive process. Members of the community participated in developing educational materials, eliminating mosquito sites, and encouraging diagnosis and treatment by community health workers. As a result, the authors expect to see a decrease in malaria incidence.

Williams et al (1999) used a three-pronged approach to study a community perspective on the efficacy of malaria treatment options for children in the Lundazi

District in Zambia. A rapid community ethnographic assessment technique was used to determine perceptions and attitudes about malaria. Also implemented was a fourteen-day in vivo drug efficacy trial comparing clinical and parasitological efficacy of chloroquine with paracetamol in children under five, and a qualitative survey to examine the perceptions of caretakers of children under five of drug efficacy. Results from this study were used to guide the implementation of a national malaria treatment policy for information, education, and communication, as well as health worker training in support of the new drug policy by the Zambian government. It also revealed to the community an understanding of their original beliefs and the context of their lives. The authors subsequently found that perceptions of the efficacy of chloroquine were beginning to shift in the community, denoting a readiness to accept a new form of first-line therapy.

Preventive measures need some level of commitment and continuity that the people of poor rural communities often cannot tend to, considering their poor living circumstances. Many health programmes have failed because they did not understand the local context within which people lived their lives and especially, that the economic margin within which the recipients lived their lives was so slight that they would not risk what little security they enjoyed by trying new and untested procedures.

Effective communication between the medical sector and the communities should involve "re-interpreting and use of modern pharmaceuticals along ethnomedical principles," which will make it possible for community members to be involved more in the malaria control programmes rather than remaining passive recipients of the strategies that are alien to them (Agyepong, 1992:136). Agyepong also argues that if the right set of health information is given to the community and to households, there is no reason for the community not to treat uncomplicated episodes of malaria at the community level. From discussions in previous chapters we know that most people in any given population in most rural communities tend to self-medicate. Therefore, through improving health messages and making them more "experience near" (understandable

by the local population within their context), community health-care providers can figure out ways of supporting and improving the efficacy of self-care within the communities they serve.

Employing a multistage random sampling procedure, Vundule & Mharakurwa (1996) conducted a household survey of primarily women to assess the knowledge and perceptions of and compliance with malaria control programmes in rural Zimbabwean communities. Women were selected because they are usually de facto heads of households. The authors found that householders' level of understanding about the purpose of spraying programmes was strongly correlated with having their homes sprayed or having at least some rooms sprayed. Knowledge of malaria transmission was associated with taking measures to prevent mosquito bites and malaria. In this context, educational messages should educate all villagers about the way malaria is transmitted and inform the villagers explicitly that the reason for spraying is to kill the mosquito vectors of malaria. In addition, malaria workers should be reminded to pay particular attention to exploring and interacting with the community about other factors that are of concern to them, e.g., possible harm to pets and fear of abortion.

Supporting a paradigm shift

In future, new approaches of action research like the Vundule & Mharakurwa study cited above should be developed to understand how best to implement new vector-control measures and the most appropriate approaches to education concerning human behavioural changes, the biomedical-behavioural continuum, and environmental alteration. These approaches could be conducted by using multiple methods of qualitative techniques, such as rapid assessment procedures, key-informant interviews, consensus modelling, etc. More evaluative research of the applicability of present learning models to bring about behaviour change among high-risk populations is also needed. The limitation of many traditional KAP surveys is that they are based on unfounded assumptions of cause and effect and do not seek to delve into the motivation or the "why" behind behaviour. Using integrative approaches incorporating both qualitative

and quantitative methods can overcome some of the shortcomings often found in KAP studies.

Infectious disease epidemiology can no longer depend on or explain away complex social factors that influence illness behaviour by relying only on quantitative data analysis. Ethnomedical data obtained by using both quantitative and qualitative methods will enable us to capture the whole picture. This approach will help resolve what Dunn has termed the "epidemiological paradox," the epidemiologists' "decreasing ability to deal quantitatively with causal assemblages as their size and complexity increase, and as their scope extends into the psychosocial domains" (Dunn, 1979:500). If such a paradigm shift is not forthcoming, "epidemiological rigor in infectious diseases research will be more akin to rigor mortis" (Nations, 1986:119). The acceptance and incorporation of community involvement using a multimethod approach will lead to a better understanding of communities and facilitate establishment of the necessary and most appropriate collaboration through which an alliance of mutually respectful partners will work together to successfully control malaria.

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CHAPTER NINE

CONCLUSION: MALARIA CONTROL AND ITS DEPENDENCE ON SOCIOCULTURAL UNDERSTANDING, SOCIAL DEVELOPMENT, AND EQUITY

Malaria is a disease of poverty... Because ignorance, apathy, lack of means or access to medication often prevent them from seeking help early enough, the most serious manifestations of tropical diseases are invariably seen among the underprivileged (Reuben, 1993:473).

In the previous chapters, and in the annotated bibliography that follows, we have endeavoured to make clear how crucial it is to consider the behavioural and social aspects of malaria control and to acknowledge that the sociocultural environment is significant in the epidemiology of malaria. Indeed, the success of the worldwide malaria control initiative depends on serious attention to these factors. While the value of doing this is generally accepted within public health circles, it has received only superficial attention. The interrelationship between infectious disease and behavioural and sociocultural factors needs to be re-emphasised and made a central part of malaria control strategies.

In this volume we have tried to show that human behaviour is related to risk for malaria, and that such behaviour is influenced by a range of cultural and social factors, including different explanatory models about etiology and appropriate preventive and treatment actions, which are not precipitously pushed aside by the provision of "correct" knowledge – in this case, biomedically derived information about the causes, symptoms, and appropriate preventive and therapeutic actions regarding malaria. A considerable gap remains between "correct scientific knowledge" and the accepted practices and beliefs about malaria held by disparate groups of people.

The social science literature on malaria shows quite powerfully that sociocultural, political, and economic circumstances not only influence behaviour, but are themselves key factors in determining both immediate and more fundamental risk factors. Tanner & Vlassoff are two of the many authors who make similar statements in this regard, namely that "Perceptions of illness, knowledge and understanding of illness are socially and culturally constructed, as are actions taken with regard to treatment" (Tanner & Vlassoff, 1998:525).

While most attention is placed on understanding the behaviour and significant sociocultural factors of the communities of potential malaria sufferers, it is also important to understand the sociocultural and behavioural characteristics of the health system itself, the predominant environments within health facilities, and the factors influencing the behaviour of health personnel. Relatively little malaria research attention has been turned toward the health-care system and dominant attitudes on the part of health personnel as factors influencing acceptability and utilisation of preventive and curative malaria services. Yet innumerable studies have shown that the attitude of health personnel is a crucial influence on the level of general health services use. Much can be learned in this regard from the manner if not the substance of the positive therapeutic alliances quite often established between traditional healers and their patients, which is one of the chief reasons why people continue to seek these services. Hongvivatana (1991:72), for one, states that "What is critically needed is... behavioural analysis of the [malaria] control bureaucracies at various levels, just like studies of human behaviour, values and belief systems, social structure and relations in the target population."

For effective interventions to take place it is not only important to know how people behave, but also the various reasons for this behaviour. Not all behaviours are the result of consciously made reasoned action – there are "norms," circumstantial factors, and the influence of "important others" that often drive what people do. Yet it is still important to understand the rationale for action – to the degree that people have agency or power over what they do – of people living within specific sociocultural contexts. Their reasoned actions may

seem quite illogical to an outsider, but by our understanding the circumstances of people's everyday lives these "illogical" actions may be seen to be quite logical within the possibilities that people feel they have available. Hongvivatana has noted, "The existing evidence seems to indicate the need to understand more of the way lay people think and act which is, in essence, of concrete life situations, not less rational than the way health professionals think and behave" (Hongvivatana, 1991:72)

Therefore, while health education is important and should certainly be a main activity of the anti-malaria initiative, especially if it uses language, images, and metaphors that are "experience near," that is, make sense relative to the everyday experiences of the target population, imparting knowledge is not enough. Even with "correct" knowledge, people may not necessarily act in a way that to public health professionals seems in their own best self-interest. We must be aware that our view may be too focused and too limited, and that a number of other factors influence behaviour. To mount an effective and appropriate initiative we need to gain answers to the "why" questions. For this, qualitative research methods (often in concert with quantitative studies) are the most appropriate. While the ability to generalise, through the use of quantitative methods, may ultimately be of great value, we need first of all to be concerned about ascertaining validity, to be certain that our research results actually reflect reality and that our studies actually "measure" what they purport.

We have also tried to show that one reason people may not act in their own (or their children's) supposed best self-interest, relative to risk for malaria, has to do with economic activities, where agriculture, irrigation, pesticide use, dam construction, and a range of other income-producing efforts may come with an increased risk for the disease. It may be quite difficult to make positive interventions here, since some of these larger economic activities benefit a select population group, while placing the most vulnerable groups at increased risk without necessarily improving their economic well-being. Other, smaller-scale activities by poor people place them at increased risk when they try, in various ways, to improve their economic situation. Their precarious circumstances

make it difficult for them to prioritise health, or the prevention of malaria, if this is seen to jeopardise income (and food for the family) or be costly in time or money. The totality of life circumstances must be considered when interventions are proposed in what appears to be, but is not, one aspect of their lives: changes in behaviour affecting health have consequences in people's lives far beyond their health. We should, of course, also realise that poverty alleviation programmes positively affect malaria treatment and prevalence.

People's behaviour and reasoned actions are integral to sociocultural norms and a striving for economic benefit in often very difficult circumstances. Behaviours that may pose high risk for malaria, but are integrated within a sociocultural system and driven by expectation of economic gain, may have both economic and social benefits and may be difficult to change despite the possession of appropriate knowledge about the risk factors for malaria.

While we believe that approaches which seem to work in one place may have wider applicability elsewhere, we would also insist that success of interventions will depend on a sensitivity to local specificities and variations. We think it is unrealistic to give a formula for an approach that will bring success to the worldwide malaria control initiative in all instances. Yet we strongly urge that people's total sociocultural and economic circumstances, their behaviours, and the reasons for them, must be studied and made known. The success of the malaria control initiative depends on the incorporation of such knowledge when formulating interventions.

More than 20 years ago Fred Dunn called for behavioural research before and during the planning stage for malaria control efforts. Yet even now it seems that when such research is carried out, the results are not fully incorporated into the planning process. Part of the problem may be with some of the studies themselves; many of them may be overly and exclusively descriptive, which, without a thorough analysis of the reasons for certain behaviour or associated risk factors, will make them of limited use in planning. But other studies, many

of which we have referred to in this volume, can be seen to be directly relevant in guiding the malaria control effort.

Several studies have highlighted people's puzzlement over the focus on malaria. When living in poverty, and faced with a range of serious problems, many of which are life-and-death issues, people wonder why outsiders pay such attention and resources on what they see as a minor concern within the range of problems they face everyday. Thus, there are those who argue that an attack on malaria must be integrated within an overall development initiative attacking a full complex of community problems, including poverty. From this perspective, malaria control truly becomes a social and economic (and human) development activity.

Many researchers suggest that "malaria is a disease of poverty" (e.g., Reuben, 1993:473), as are infectious diseases in general (e.g., Farmer, 1999). "The major risk and burden of disease are concentrated in the poorest segment of a population, often of a low social class, that always has a high proportion of women and children" (Tanner & Vlassoff, 1998:525). We agree with those who state that the focus of an effort to control infectious diseases must prioritise interventions for the benefit of the poorest and most disenfranchised segments of populations and must be tied in with overall social and human development efforts (UNDP, 1999). But it should also be noted that the health of the disenfranchised directly affects the health of other groups – if their health is disregarded, the health of others will also be at risk (Singhanetra-Renard, 1993). And, unfortunately, that (rather than because it is the "right thing to do") may serve as the major motivation for a concern for the health of the poor. It is our intention that the message of this book not only highlights the importance of sociocultural factors in malaria control, but makes clear that the fight against malaria and other infectious diseases is inseparable from the striving for social and economic as well as political equity.

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SOCIOCULTURAL AND EQUITY ISSUES IN MALARIA CONTROL

Brinkmann U, Brinkmann, A. (1991) Malaria and health in Africa: the present situation and epidemiological trends. Tropical Medicine and Parasitology*, 42, 204-213.*

Abstract: The World Health Organization does not give any data on the malaria situation in Africa in its regular reports because of the "insufficiency and irregularity of reporting." Estimates on the total number of cases and the number of deaths vary considerably. They range from 35 million to 189 million per year depending on whose figures one uses. An intensive search of the literature using computer-based systems identified more than 1000 titles on the epidemiology of malaria. Out of them and from other sources finally, 426 articles were used to describe the current malaria situation and observable trends in Africa. Major findings were that malaria is responsible for about 40% of fever cases, mortality is about 5 per 1000 per year, case fatality ranges from 2-24%. Admissions for malaria account for 20-50% of all admissions in African health services although only 8-25% of persons with malaria visit health services. Self-treatment is more common in urban areas (more than 60%) but an increasing number of people use some form of self-protection in rural areas (2-25%). The resistance of malaria parasites to chloroquine and other drugs is widespread. Chloroquine resistance has reached a prevalence of about 30% at the RII level in most countries. Malaria incidence shows annual growth rates of 7.3% for Zambia, 10.4% for Togo, and 21.0% for Rwanda. The data for Burkina Faso show a downward trend of 14.7% during the years from 1973 to 1981. Since then, malaria incidence has been increasing at 11.0% per year. Hospital data reported from Zambia indicate that mortality is rising 5.2% per annum in children and 9.7% per annum in adults. Reasons for the increase of malaria and its role for development are discussed.

This literature review is mainly epidemiological in focus, although the authors make a point of emphasising the relationship between malaria and development in Africa, which leads them to a discussion of human behaviour. The authors discuss their major findings from an exhaustive search of the literature on the epidemiology of malaria. Topics discussed include: morbidity from malaria in Africa; resistance to chloroquine and other anti-malarial drugs, and how they complicate malaria control;

and trends in the epidemiology of malaria. Specific examples are given of Rwanda, Mayo Kebbi District in Chad, and Brazzaville, P.R. Congo. The authors close with a discussion of the reasons for the increase in malaria and its role in economic development.

Brown P.J. (1981) Cultural adaptations to endemic malaria in Sardinia. Medical Anthropology*, 5, 311-339.*

Abstract: Endemic malaria was a primary ecological variable that historically affected traditional Sardinian culture. While the biogenetic impact of malaria has been looked at in detail, this paper examines the hypothesis that key features of traditional Sardinian culture had adaptive value against the ecological threat of malaria because they limited exposure of certain social segments to the malaria vector, Anopheles lamranchiae. The concept of cultural adaptation is first developed. Cultural adaptations analysed include: settlement pattern; pastoral transhumance; social organisation of production; restricted mobility for pregnant women; and the folk medical beliefs of Intemperie and Colpo d'Aria. These cultural traits are predicated on a folk etiological theory of malaria in which the disease was caused by "bad air," but they function to reduce exposure to mosquitoes and thereby limit malaria rates for certain social groups. It is argued that this mode of analysis can aid in understanding the interaction between diseases and the persistence of particular cultural patterns.

Sardinia serves as a model here for establishing a more general theory about cultural adaptations to malaria. This article gives an interesting explanation for the persistence of certain cultural traits based on the theory that such traits helped to reduce disease among segments of the population. The central hypothesis of the paper is that "key features of traditional Sardinian culture had adaptive value against the ecological threat of malaria because they limited exposure of certain social segments to the malaria vector." The author analyses cultural adaptations with the overall argument that these cultural traits reduced exposure to mosquitoes and consequently limited malaria rates among certain social groups.

Brown P.J. (1986) Socioeconomic and demographic effects of malaria eradication: a comparison of Sri Lanka and Sardinia. Social Science & Medicine*, 22, 847-859.*

Abstract: The relationship between disease control, population growth, and economic development is examined through a comparison of changes subsequent to malaria eradication campaigns in Sri Lanka and Sardinia. Both islands were similar

in terms of malaria morbidity and mortality rates as well as a history of massive malaria eradication campaigns using DDT immediately after World War II. The critical comparative distinction is that Sardinia had a much lower population density than Sri Lanka. In both cases, the anticipated effects of malaria control were increased agriculture production in endemic zones coupled with a relief of population pressure in non-malaria areas. This has not happened. Patterns of demographic change, marked by sharp declines in general mortality and accelerated population rates, are similar in both cases. Malaria control has resulted in economic development in neither case, however, and this is explained using ecological and political-economic analyses.

This article outlines the history of malaria eradication programmes in Sardinia and Sri Lanka, emphasising economic development and population growth in order to elucidate the relationships between these forces and malaria eradication. There is an interesting reinterpretation of existing research in order to give ecological and political-economic analyses for why malaria eradication has not resulted in economic development in either Sardinia or Sri Lanka, as was expected. Issues discussed are the ecological and epidemiological settings of Sri Lanka and Sardinia and effects of malaria control there in relation to demographic changes, population growth, economic growth, and malaria eradication.

Brown PJ. (1997) Malaria, miseria, and underpopulation in Sardinia: the "malaria blocks development" cultural model. Medical Anthropology*, 7, 239-254.*

Abstract: Until the late nineteenth century, endemic malaria was a serious public health problem in Sardinia, as in much of southern Italy. As the poorest region of the new Italian nation, Sardinia was characterised by poor health, very low population densities, low agricultural productivity, and weak state authority associated with banditry. In this context, however, malaria was singled out as a key underlying problem for the situation of "internal underdevelopment." This paper describes the scholarly Italian literature about the relationship of malaria and economic productivity as a cultural model that can be labelled as "malaria blocks development" (MBD). Anti-malaria programmes, including the state control of the distribution of quinine as well as land reclamation projects, played a major role in the decrease of malaria mortality in the first part of this century. Based on the logic of the MBD model, the decrease in malaria was expected to decrease an obstacle to "natural processes" of economic development. During the Fascist era, scientifically based anti-malaria efforts formed a key element in centralised attempts for agricultural intensification and encouragement of immigration from overpopulated parts of the coun-

try. Immediately after World War II, Sardinia was the site of a successful American-sponsored eradication project that represented one of the first uses of DDT against an indigenous *Anopheles* vector. Hypotheses based on the MBD model about the nature of economic change after the removal of malaria are not supported. Nevertheless, variations of the MBD cultural model continue to be used in the field of international health to the present day.

An interesting reinterpretation of the malaria eradication campaign in Sardinia, in this article the author describes what he terms the "Malaria Blocks Development" (MBD) cultural model, in which malaria has been reported to be the key underlying problem for economic development. The author asserts, however, that this model is not valid, since economic change has not necessarily followed malaria eradication. Many variations of the MBD are still used today in international health campaigns. The author argues that the MBD places the cause of poverty in the physical environment (which increases risk of malaria), rather than in the social milieu. As such, the MBD model diverted attention from social inequities and, in Sardinia, became a conceptual tool for the intellectual and political status quo.

Bruce-Chwatt LJ. (1988) History of malaria from prehistory to eradication. In: Wernsdorfer WH, McGreggor I, eds. Malaria, Principles and Practices of Malariology*, vol. 1, 1-59. Edinburgh, Churchill Livingstone.*

Serving as an excellent introduction to the history of malaria, the chapter begins with a short discussion of the role of malaria in human pre-history, then moves to an emphasis on malaria in European, particularly Western European, history. Also discussed is the history of scientific investigation into malaria aetiology and transmission, with special attention to the contributions of Koch and Ross. The history of the modern period and eradication attempts, especially in Sardinia by the Rockefeller Foundation and in the Panama Canal, are described in connection with various methods of control (anti-larval means such as kerosene and Paris Green Dust; chemoprophylaxis using quinine and Cinchona; and land draining in relation to resettlement). Major epidemics, such as those in Russia, Sri Lanka, and Brazil, are also discussed.

Chapin G, Wasserstrom R. (1983) Pesticide use and malaria resurgence in Central America and India. Social Science & Medicine*, 17, 273-290.*

This article gives a review and historical analysis of the kinds of effects that agricultural activities and pesticide use might have had on the resurgence of malaria

in India. It relies heavily on an explanation of the political and economic situation in relation to malaria eradication. At times the authors deliver a scathing criticism of those in control of decision-making processes related to pesticide use and malaria control, and the article places the blame for malaria resurgence on improper pesticide use in agriculture. There is also a good description of the interrelationship between health, social conditions, the political context, and agriculture, and the overriding forces and decision-making power of international companies and government agencies. This article was the source of much controversy, and generated subsequent correspondence, criticism, and debate, and is included in this bibliography because of the debate that it engendered.

Hyma S, Ramesh A. (1980) The reappearance of malaria in Santhanaur Reservoir and environs: Tamil Nadu, India. Social Science & Medicine *[Medical Geography], 14D, 337-344.*

Although this article is included in the "poverty" section because one of the conclusions of the study is that poorer sections of the village populations and migrant labourers demonstrate higher rates of malaria, it could just as easily be listed under "development" or "mobility," since these are also discussed. These three issues are interrelated and often go hand in hand. The focus of the article was on the renewal of malaria transmission in relation to a water development project and its environmental impact. The article also discusses risk groups based on occupation, gender, and housing location and design. The authors stress that an understanding of the dynamics between culture, ecology, and economic development is necessary in order to interrupt the cycle of malaria transmission.

Inhorn MC, Brown PJ. (1997) The Anthropology of Infectious Disease: International Health Perspectives*. Amsterdam, Gordon and Breach Science Publishers.*

This book is an especially good source for the anthropology of infectious diseases. The introduction provides a good background to the subject and offers a theoretical and historical analysis, as well as making a convincing case for how anthropology can be central to infectious disease research. The second chapter, "The Anthropology of Infectious Disease," has a particularly good discussion of malaria, although other infectious diseases are also discussed. Topics in this chapter include biological approaches (micorevolutionary studies, macroevolutionary studies); ecological approaches (theoretical models, research examples in disease ecology); and sociocultural approaches (human behaviour and infectious disease transmission: the-

oretical models and research examples). The fifth chapter, "Culture and the Global Resurgence of Malaria," gives an especially rich discussion of the interrelationship of cultural factors with malaria resurgence and includes the current state of malaria in the world; historical background to the rise, fall, and re-emergence of malaria; and three ways in which culture has contributed to malaria resurgence (economic and demographic variables, social factors, and ideological factors). The remainder of the book covers infectious diseases other than malaria and serves as a good general source for the study of anthropology of infectious diseases.

Mata L. (1982) Sociocultural factors in the control and prevention of parasitic diseases. Reviews of Infectious Diseases, 4, 871-879.

Abstract: Control and prevention of parasitic disease depends on an adequate knowledge of interactions among factors such as human behaviour, the environment, and the life cycles of parasites. Sociocultural factors in large part determine transmission and persistence of parasites. The main determinants are poverty, low educational level, deficiencies in home technologies, high demographic density, and ruralism. Selected interventions designed to improve any of these situations may fail if they are applied in an isolated manner. The holistic implementation of interventions has proved successful in the control and prevention of parasitic infections in several parts of the world. The implementation of several kinds of interventions simultaneously, that is, a holistic approach, combined with an awareness of a society's infrastructure, can produce favourable results. For such an awareness - when it provokes action - can improve the overall quality of life.

Although this article is not specifically about malaria, it gives excellent suggestions for control programmes that can also be applied to malaria control. The emphasis of the article is on the holistic approach to parasitic disease control, with special attention given to the role of sociocultural factors. In addition to identifying the main factors that determine transmission and persistence of parasitic disease in developing countries, the author also gives a brief description of various parasitic diseases common to tropical and developing countries, malaria being one of those discussed. The article is broken down into sections entitled priorities for control and prevention; sociocultural factors and acquisition of infections; main determinants of parasitic infection; and the "holistic" approach.

Packard RM, Brown PJ. (1997) Rethinking health, development, and malaria: historicising a cultural model in international health. Medical Anthropology*, 17, 181-194.*

This article served as an introduction to an issue of Medical Anthropology dedicated to malaria. It touches on many of the key points about malaria and economic development and gives a good theoretical and historical background to the issues surrounding malaria control and economic development. Topics discussed include the history of health and health policy; placing the health and development model in a historical context; denaturalising malaria and development; and the links between malaria and health.

Sharma VP, Mehrotra KN. (1986) Malaria resurgence in India: a critical study. Social Science & Medicine*, 22, 835-845.*

Abstract: In 1953, the Indian National Malaria Control Programme (NMCP) was started. Encouraged by the results, and the fact that insecticide resistance in vector species may evolve and become an obstacle, in 1958 the control programme was converted to the National Malaria Eradication Programme (NMEP). By 1964, malaria was eradicated from 88% of the area and the programme was in the advanced stages of spraying in the remaining parts. At that time, local outbreaks that occurred in 1965 and increased in later years could not be contained due to the shortages of DDT. As a result, large areas in consolidation and maintenance phases reverted to the attack phase. In addition, the infrastructure in general health services was not adequate and mature enough to take up surveillance and vigilance. This produced a large number of secondary cases due to the re-introduction and relapse of malaria. Added to this was the problem of urban malaria, the control of which was the responsibility of local bodies. Malaria cases increased in towns and started diffusing to the rural areas, due to inadequate staff and the shortages of malarial larvicidal oil (MLO). Later, it turned out that while it was technically feasible to eradicate malaria from 91% of the population, the strategy of indoor spraying of DDT to interrupt transmission did not succeed in 9% of the population, despite more than 12-14 years of regular spraying. During the years of resurgence, there was no research support to the programme, so that technical problems were not properly appreciated, understood, and tackled. The reservoir of parasites that were present throughout the country started multiplying and spreading to newer areas due to the presence of vectors in high densities. Thus malaria resurged and reestablished itself even in areas that were at one time freed from the disease. The analysis of the pattern of malaria resurgence revealed that malaria outbreaks preceded the true problem of insecticide resistance. It is noteworthy to mention that malaria resurgence occurred in towns where the control measures were non-insecticidal and in regions that were not under the influence of insecticide-resistant vectors. The study also revealed that resurgence occurred before the introduction of a high-yielding varieties programme in the country and had no relationship to either the cotton or rice growing or intensive agriculture.

A reply to the earlier, controversial article by Chapin and Wasserstrom (1983) in *Social Science and Medicine*, this article gives a review of statistics and studies in order to make the case that malaria resurgence in India was not directly connected to pesticide use in agriculture. The authors argue that malaria resurgence occurred prior to the real problem of insecticide resistance, and that malaria resurgence had no relationship to cotton or rice growing, or to intensive agriculture. The authors place the blame for resurgence on an inadequate health infrastructure that could not do proper surveillance or vigilance of malaria eradication activities; urban malaria, which was the responsibility of local government; and no research support to the programme, which resulted in a lack of understanding of technical difficulties that went unresolved.

Sotiroff-Junker J. (1978) A Bibliography on the Behavioural, Social and Economic Aspects of Malaria and Its Control. Geneva, WHO.

This is the only other bibliography that has been compiled on the social and behavioural aspects of malaria with a short one-page introduction that discusses the need for such a bibliography. There are no annotations in this bibliography; it is simply a listing of articles relevant to the matter, divided into various detailed sections that should make finding articles on a particular topic easy. This bibliography is outdated, as are the articles in it, unless they are to be used for historical purposes.

Different aetiological perceptions

Agyepong IA. (1992) Malaria: ethnomedical perceptions and practice in an Adangbe farming community and implications for control. Social Science & Medicine*, 35, 131-137.*

Abstract: Malaria is a parasitic disease about which there is much biomedical knowledge on causation, prevention, treatment, and control. Attempts at eradication, as well as control, in the past have been mainly a technical and bio-medical endeavour. With the policy shift from worldwide eradication of malaria to control as part of primary health care, there is increasing interest in studying all possible determinants of the problem, at local as well as regional levels, as part of the search for an effective intervention. This paper presents the results of a study into community perceptions and practice relating to causation, treatment, and prevention of malaria in a rural Adangbe farming community in southern Ghana. Malaria is common in this community. Crude parasite rates among adolescent girls (10-19 years old) in

the community were 49% toward the end of the major rainy season, and 47% in the early dry season. The symptoms and signs of the disease are readily described by lay people as well as by traditional healers. Diagnosis and treatment of uncomplicated episodes of malaria at home, according to ethnomedical perceptions, is the predominant behaviour in this community. Very few cases of uncomplicated malaria are sent to health facilities. Ethnomedical perceptions of malaria causation and treatment on which this self-care is based are different from conventional biomedical ones. Malaria is perceived as an environmentally-related disease caused by excessive contact with external heat, which upsets the blood equilibrium. Many community members do not connect it with the mosquito in theory or practice. Implications for approaches to control are discussed.

In addition to being cited often in the literature, this article is insightful and very respectful of local knowledge and traditions. It also gives very good suggestions for future control efforts. The main focus of the study was the community as a whole, but adolescent girls are looked at in particular. The aim was to investigate community perceptions and practice in relation to malaria causation, treatment, and prevention in a rural community in southern Ghana. A variety of study techniques were used: Questionnaires were administered to adolescent girls; blood samples were taken; and discussion groups, as well as in-depth and informal interviews were done with community members, leaders, and local healers. Although the author found that "the signs and symptoms of malaria are recognised by lay people as well as traditional healers," cases are rarely sent to health clinics, and this may be due to difference between ethnomedical perceptions of malaria causation and treatment. In this community, malaria was thought to be related to the environment and to result from too much external heat, which disturbs blood equilibrium. Furthermore, mosquitoes are not connected with control attempts. The author concludes with a discussion of how to tailor control programmes to communities such as this, and emphasises the need for communication between different sectors that provide health care.

Espino F et al (1997) Perceptions of malaria in a low endemic area in the Philippines: transmission and prevention of disease. Acta Tropica*, 63, 221-239.*

Abstract: Qualitative methods were used to gather data on community perceptions of malaria in Morong, Bataan. People recognised an illness that they called "malaria" through a discrete set of symptoms: high fever and intense chills, with or without a severe headache. Self-medication was common. Enquiry into perceptions of cause and prevention of the disease revealed a complex mixture of beliefs involving environmental conditions, the mosquito vector. and parasites, but also included various ideas about dirty water, diet, hunger, and conditions of hygiene. The

implications of these findings for disease control, and the relationship between knowledge and practices, are discussed.

The methodology of this multidisciplinary survey study is very thoroughly explained and rigorous. The aim of the study was to investigate perceptions about malaria in Morong, Bataan, Philippines. The study was divided into three parts: in-depth interviews; observation of a cohort of households; and completion of a cross-sectional interview survey. Study subjects were selected purposefully and not randomly. Perceptions related to malaria involved a complex mixture of ideas relating to environmental conditions, the mosquito vector, and parasites, and beliefs about dirty water, diet, hunger, and hygiene. The authors conclude with a discussion about malaria control. Especially noteworthy is their recognition that practice does not always follow knowledge and that those who plan control strategies need to keep this in mind.

Helitzer-Allen, DL, Kendall C, Wirima, JJ. (1993) The role of ethnographic research in malaria control: an example from Malawi. Research in the Sociology of Health Care*, 10, 269-286.*

This is a very well done, in-depth ethnographic study. Because the researchers spent eight months living and talking to subjects, the resulting study succeeds in explaining the motivating factors behind the behaviour observed. The aims of the study were to investigate: "(1) the different illnesses which have *malungo* [the local term for febrile illness] as a symptom in Malawi communities, (2) the structure in which *malungo* as a symptom is understood and its higher functional purposes, (3) resources for health care, (4) the prevention and treatment options available to community members, and (5) the therapy choices they make for each category of illness." Interviews were done from among the following target groups: pregnant women, women who had recently given birth, traditional birth attendants, health workers, traditional advisors, and traditional healers. Focus-group discussions were held among the following target groups: pregnant women, women who had recently given birth, and husbands of pregnant women. The authors discuss the results in terms of beliefs about the illness complex, its etiologies and symptomatology; beliefs and practices affecting control programmes; and prevention and treatment of malaria. They conclude with a discussion of the importance of ethnographic research in planning sustainable control programmes.

Mwenesi, HA et al (1995) Perceptions of symptoms of severe childhood malaria among Mijikenda and Luo residents of coastal Kenya. Journal of Biosocial Science*, 27, 235-244.*

Abstract: Effective community-based malaria control programmes require an understanding of current perceptions of malaria as a disease and its severe manifestations. Quantitative and qualitative surveys of mothers on the Kenyan coast suggest that fever is conceptualised in biomedical terms, whereas the aetiology of severe malaria is perceived to be of more complex cultural origin. This is reflected in the treatments sought for convulsions. The results are discussed in the context of ethnographic factors. To be effective, future health information programmes must take cultural beliefs into account.

This article delves deeply into the cultural roots and meanings behind how and why people think about malaria, at least in the area where this study was conducted. This article is very region-specific, but it is also a good example of the kind of information needed in future studies. The study consisted of a cross-sectional questionnaire survey of mothers of children under ten years of age. To gather preliminary data, an ethnomedical survey was done. The authors discuss local terminology, ethno-etiologies, and treatment practices for malaria. The authors found that fever is thought of in biomedical terms, but convulsions are given a supernatural explanation. Ethnographic information plays an important role throughout the discussion of the results. The authors conclude by giving suggestions for control programmes, emphasising that cultural factors are of primary importance to the success of such efforts.

Oaks SC et al (1991) Social and behavioural aspects of malaria. In: Oaks, SC et al, eds. Malaria Obstacles and Opportunities*, 257-277. Washington, DC, National Academy Press.*

This chapter gathers together many of the significant facts about the social and behavioural aspects of malaria, as well as describing many of the major trends in the research. The purpose of the article was to explain the role of social scientists in malaria control from a historical perspective. It also emphasises their important role in future control efforts. The authors discuss, among other things, agricultural development, population movement, and urbanisation. They pay close attention to: "(1) local perceptions of malaria and its causes, (2) the manner in which people decide whether a given treatment or preventive measure is efficacious, (3) patterns of treatment-seeking behaviour during episodes of malaria, and (4) the role that

the community as a whole plays in planning, implementing, and evaluating the control program." The authors also discuss factors that favour malaria transmission, and acceptance and use of control methods. The authors conclude with a research agenda, which points to the areas most needing attention by social scientists working in malaria control.

Ruebush TK, Weller SC, Klein RE. (1992) Knowledge and beliefs about malaria on the Pacific coastal plain of Guatemala. American Journal of Tropical Medicine and Hygiene*, 46, 451-459.*

Abstract: Surveys of residents of the Pacific coast of Guatemala revealed a lack of knowledge and many misconceptions about the transmission and treatment of malaria, which could adversely affect malaria-control measures and anti-malarial therapy. Although mosquitoes are known to play an important role in malaria transmission and are thought to become infected by biting individuals with malaria, 75% of people interviewed believe that the mosquitoes can also acquire infections from contaminated water or by biting snakes and frogs. Furthermore, most residents believe that malaria can be acquired in other ways, such as by bathing too frequently or by drinking unboiled water. Although self-treatment of malaria with oral and injectable drugs purchased at stores and pharmacies is very common, less than 10% of the respondents were aware of the correct curative dose of chloroquine. Chloroquine injections are preferred to tablets and believed to be approximately three times as potent as tablets of the same concentration. Nearly two-thirds of the interviewees believed that pregnant and lactating women with malaria should avoid the use of chloroquine because it may cause a spontaneous abortion or dry up breast milk. Similar surveys of National Malaria Service workers and village malaria workers revealed higher levels of knowledge, although the village workers had many misconceptions about malaria transmission. An educational campaign directed at correcting some of these misconceptions should result in more appropriate self-treatment of malaria and greater acceptance by residents of personal protection methods and vector control and drug treatment programmes.

The aim of this qualitative study was to investigate local residents' knowledge and beliefs about the symptoms, causes, treatment, prevention, and control of malaria, and how such concerns might affect the success of control measures. Open-ended interviews, as well as true-false questionnaires, were used. The only potential drawback is the small sample size of the study, but the authors remedy this by using "consensus analysis," i.e., people living in the study area belonged mainly to the same cultural group. The authors found that poor knowledge and many misconceptions about malaria treatment and transmission existed in the community. They also

found that even though National Malaria Service workers and village malaria workers had been previously found to have a higher level of knowledge than lay persons, the malaria workers still had many misconceptions about malaria transmission. The authors conclude by suggesting that an educational campaign could help improve malaria knowledge and acceptance of control efforts in the community.

Tang L et al (1995) Social aspects of malaria in Heping, Hainan. Acta Tropica*, 59, 41-53.*

Abstract: This paper presents findings from a study conducted in Heping Town, Qiongzhong County, Hainan Province, China. The study, conducted in 1992, used qualitative as well as quantitative methods to gather social, cultural, and behavioural data associated with the acquisition, transmission, and prevention of malaria, and the diagnosis and treatment of disease. These methods included focus groups, key informant and other in-depth interviews, and observations, as well as a household survey and tests of schoolchildren of knowledge of malaria. The study is among the first to our knowledge that has utilised this broad mix of methods for tropical disease research in China.

Although the writing in some parts of the paper could use some improvement, this article is included because it is one of the few written on social and behavioural aspects of malaria in China. It offers some insightful suggestions about why bednets are not always used. The authors bring up the topic of ethnicity, but do not venture a guess as to whether malaria infection and bednet usage differs by ethnicity. The aim of the study was to use quantitative and qualitative methods to investigate social, cultural, and behavioural data related to acquisition, transmission, prevention, diagnosis, and treatment of malaria. The authors found that bednet use was greater than knowledge of malaria transmission, but that observed bednet use was significantly less than reported. They also found that many people had inadequate knowledge about malaria transmission and their own vulnerability to infection. The article includes a discussion of malaria risk based on location and mobility and housing construction. The authors conclude that there is great need to develop appropriate interventions to reduce malaria transmission in mobile groups that stay in high-risk areas.

Vundule C, Mharakurwa S. (1996) Knowledge, practices, and perceptions about malaria in rural communities of Zimbabwe: relevance to malaria control. Bulletin of the World Health Organization*, 74, 55-60.*

Abstract: A survey of 411 household heads was undertaken in Gokwe District, Zimbabwe, to assess villagers' knowledge, practices, and perceptions about malaria and the implications for malaria control. Our results show that although the government has sustained an annual indoor insecticide-spraying programme for over four decades, about 50% of respondents did not adequately understand its purpose, with 26% believing that the programme was intended to kill domestic pests, not including mosquitoes. During the 1991-92 spraying cycle, 72% of the villagers had their homes sprayed; however, 21% refused to have some rooms in their homes sprayed. Householders' understanding of the function of the spraying programme was significantly related to their compliance with it ($P < 0.05$). A total of 82% of respondents reported not taking any measures to protect themselves from malaria. Taking preventive measures was significantly related to knowledge of the causes of malaria ($P < 0.05$). The study shows the importance of involving communities in a control programme intended for their benefit and of informing them about available options for protection against malaria.

In this oft-quoted article, the authors looked at perception and knowledge about malaria and the malaria-spraying programme in rural Gokwe District, Zimbabwe. They attempted to use this information to understand levels of compliance. The article gives a good explanation of ethnomedical perceptions about malaria and its treatment. The study was based on household-based interviews using a closed questionnaire of female heads among households randomly selected from lists obtained from village leaders. The authors found that understanding about transmission, treatment, and prevention was low, even though knowledge of malaria morbidity was widespread. They discuss "sociodemographic characteristics of the study participants, perceptions, and knowledge about malaria, morbidity, and utilisation of health services, treatment of malaria, personal primary prevention measures, and compliance with the malaria spraying programme" The authors conclude that communities need to be educated and involved in malaria control, and that incorporating information on malaria and its prevention in primary school curriculum may be a way of increasing such knowledge.

Winch PJ et al (1996) Local terminology for febrile illnesses in Bagamoyo District, Tanzania and its impact on the design of a community-based malaria control programme. Social Science & Medicine*, 42, 1057-1067.*

Abstract: This paper reviews results of several ethnographic studies that have examined the issue of local terminology for malaria in Africa, then presents findings from an ongoing study in Bagamoyo District, Tanzania. The study used a mixture of qualitative and quantitative interview methods to examine local perceptions of malaria

and malaria treatment practices. Although the local term *homa ya malaria* or malaria fever appeared on the surface to correspond closely with the biomedical term malaria, significant and often subtle differences were found between the two terms. Of perhaps greatest importance, common consequences of malaria in endemic areas such as cerebral malaria in young children, severe anaemia, and malaria in pregnancy were not connected with *homa ya malaria* by many people. A set of guidelines is described that were used to determine how best to promote acceptance and use of insecticide-impregnated mosquito nets, given these results. It is demonstrated that the position of the term used to denote malaria in the local taxonomy of febrile illnesses has important implications for the design of health education interventions.

An insightful article that focuses on ethnographic research in order to integrate it into a field programme, this is a good example of how problems arising in day-to-day administration of an insecticide-impregnated bednet programme can be addressed by social science research. The paper also explains and emphasises how necessary an understanding and sensitivity to the local people and their culture is to the success of a bednet programme. The data for this study were collected during a larger study of insecticide-impregnated bednets. There were also group meetings of local government officials, religious leaders, teachers, and health workers. Local terms for malaria were investigated and compared, and a questionnaire survey was done on a random sample of people. The authors found that cerebral malaria in young children and severe anaemia and malaria in pregnancy were not often connected with *homa ya malaria*, the local term for malaria fever. Subtle differences between the local and biomedical terms for malaria may affect health education interventions. The authors conclude with a guideline of how best to promote acceptance and use of insecticide-impregnated bednets in light of differing local taxonomies for febrile illness.

Human mobility

Coimbra CEA. (1988) Human factors in the epidemiology of Malaria in the Brazilian Amazon. Human Organisation*, 47, 254-260.*

This culturally sensitive review article discusses some of the key issues of mobility in relation to malaria transmission and control that are specific to the Brazilian Amazon. Topics covered include general epidemiological features; ecology, human activities, and malaria; and sociocultural variables and malaria control. Because human mobility is such an important factor in malaria transmission in the Brazilian Amazon, a large part of the article is dedicated to this topic. Also discussed are

perceptions about malaria, its transmission and treatment. The author gives suggestions for how to improve control programmes by paying more attention to the nature of the community and its culture and calls for a more holistic approach, placing more emphasis on horizontal linkages in health actions rather than top-down designs. It is suggested that applied anthropology play an important role in community-oriented programmes.

Jayawardene R. (1993) Illness perception: social cost and coping-strategies of malaria cases. Social Science & Medicine, *37, 1169-1176.*

Abstract: This paper looks at illness perceptions and lay management of malaria in the context of new settlements in Sri Lanka. While new settlement places unique pressures on the population, there are several trends observed that have relevance for programme planning and implementation.

A critical account of the social costs of new settlements in the Mahaweli Development Programme, Sri Lanka, is the focus of this article. The purpose was to investigate illness perceptions and lay management of malaria in a population living at the fringes of social protection. It has been quoted often in the literature and gives insightful explanations for documented behaviours. Direct quotations provide a greater understanding from an insider's point of view. The article is a sensitive analysis of a high-risk population of displaced individuals. Malaria cases were identified through clinical symptoms, without the use of blood smears. Patients were interviewed using an open-ended, unstructured format. Within the resettlement area, unstructured interviews were also conducted among male and female heads of household. The author found that malaria imposed not only monetary burdens, but also more subtle problems, such as loss in time devoted to productive labour. In short, "malaria imposed an additional stress upon an already fragile structure. The overall picture was lack of control: of the physical environment, of income, of their own health, of their family structure and stability." The author concludes with a discussion of the relevance of this data to programme planning and implementation.

Prothero RM. (1965) Migrants and Malaria in Africa*. Longmans, Green and Co., Ltd.*

Although this book is old and out-of-date, it is included because it has been quoted often, perhaps because it was one of the first works to draw attention to the issue of migrants. It may still serve as a historical source on this topic. Divided into six chapters, the text covers, in order: the nature of the relationship between

migrants and malaria; background of malaria (parasites and mosquitoes, the distribution of malaria, malaria in Africa, attitudes to malaria, malaria control and eradication, the WHO and malaria eradication, and malaria eradication in 1962); migrants in particular (mobility in the past, pastoral movements, nomadic pastoralism, transhumance, pilgrimage, local population movements, changes in settlement patterns, recent population mobility, downhill movements, trading movements, labour migration, characteristics of labour migration, and West, East, Central, and South Africa); the Republic of the Sudan (geographical diversity, pilgrim movements, population movements within the Sudan, and the Blue Nile malaria eradication pilot project); the Horn of Africa (problems of data, malaria eradication pilot projects, the 1958 malaria epidemic, Somali pastoralism, Northern Somalia, water supplies and malaria, pastoralism and politics, politics and public health, pastoralism and public health); and finally, East and South-central Africa (labour migration, differential rates of migration, labour migration in Tanganyika, population stability and instability in Kenya, Zanzibar, and Pemba, the Kigezi pilot project in south-west Uganda, migrant labour and malaria control in South-central Africa, the Copperbelt and Kariba, peripheral malaria control in Southern Rhodesia).

Prothero RM. (1977) Disease and mobility: a neglected factor in epidemiology. International Journal of Epidemiology*, 6, 259-267.*

Abstract: There is much historical evidence of the spread of disease through human mobility. Today, in spite of medical advances and international health measures, there is still much cause for concern. There is now more mobility, facilitated by modern transport and sometimes precipitated by major natural and manmade disasters. Redistribution of population is occurring in the developing world, particularly massive rural-urban movements. Population mobility has contributed to the transmission of malaria and prejudiced programmes for control and eradication; but mobility and other human factors have not been adequately studied. Parasites and vectors receive more attention than do people. Epidemiological studies need to pay greater attention to the nature and variety of population movements and to their differing impacts upon disease and health. It is essential to distinguish between migration (involving change of residence) and circulation (movement away from residence with subsequent return). In tropical Africa, various spatial and temporal dimensions can be applied to differentiate within these two major categories of mobility. In turn, there are various associated physical and psychological health hazards.

Although this article was published before the 1978 cut-off date for this bibliography, it is included because it is widely quoted and provides an example of one of

the early investigations of malaria and human mobility. The information may be a little out of date by now, but it serves as a good historical background. The author begins with a discussion of the history of malaria in relation to human mobility (plague in Europe, slavery, and the introduction of malaria to the Americas), and then develops a typology based on different kinds of mobility and the various health hazards and public health problems associated with different types of movement. The author concludes by stressing that epidemiological studies need to pay more attention to human population movements.

Rajagopalan, PK et al (1986) Population movement and malaria persistence in Rameswaram Island. Social Science & Medicine*, 22, 879-886.*

Abstract: The role of population movement on the persistent transmission of malaria in Rameswaram Island was studied. The majority of inhabitants of the island are fishermen, who engage in perennial fishing. They move from one coastal place to the other and stay in temporary camps depending on season and fish availability. Such seasonal fishing camps attract fishermen from the mainland coastal villages also. The parasitological and entomological studies carried out in these places reveal that some of the camps are highly vulnerable to the movement of individuals with malaria infection and highly receptive. Rameswaram, being a holy place, receives pilgrims from all over India and Nepal. *Plasmodium falciparum* cases recorded from the pilgrims of North India indicate the danger of the possible introduction of chloroquine-resistant parasites in the island. Also, a large number of passengers in transit from various countries, many of whom are at risk of malaria transmission, stay on the island before or after visiting Sri Lanka. Such population movements being a continuous and regular feature are significant and result in failures in the operational programmes.

A short article about the influences of human ecology in malaria epidemiology in Rameswaram Island, Sri Lanka, an important fishing and pilgrimage centre, it includes a foreword by R.M. Prothero. Even though the focus of the article is on epidemiological quantitative data rather than on qualitative analysis, the article provides an adequate portrayal of the dynamics affecting malaria transmission in an area of high human mobility. The study consisted of mass blood surveys done within one week of fishing camps being set up. Fever surveys were also done thrice weekly to determine if local transmission was occurring. Fishermen movement was also monitored and insect collection was done. Information on tourist movement was obtained from the Department of Tourism, and data on malaria incidence were provided by the National Malaria Eradication Programme. The author found that some fishing camps were highly vulnerable and receptive to the movement of malaria-infected individ-

uals. Malaria persistence in Rameswaram Island is also maintained by Hindu pilgrims from other parts of India, as well as by travellers from other malaria-endemic countries who stay after visiting Sri Lanka. The author concludes that such population movements result in the failure of malaria control programmes on Rameswaram Island.

Sevilla-Casas E. (1993) Human mobility and malaria risk in the Naya River basin of Colombia. Social Science & Medicine*, 37, 1155-1167.*

Abstract: This paper develops and tests a methodology for examining the manner and the extent to which human mobility can be associated with malaria risk within an endemic area. The paper presents entomological, epidemiological, and mobility results obtained from macro-data and micro-data. Results indicate that malaria is concentrated in the delta zone of the Naya River basin, where the circulation of people for economic reasons occurs at a time when vector densities are high. High human density combined with high vector density ensures continuous and intense transmission of malaria. In attempting to measure intensity of transmission, microscopic analysis of parasitaemia was found to underestimate prevalence, showing it to be very low or negligible, whereas serological data collected during the same period of time reveal that prevalence is high, and similar for both sexes. Serological data also indicate that prevalence increases with age, particularly from adolescence on. Since mobility for agricultural purposes involves able-bodied males and females, there seems ample justification for concluding that human mobility into certain areas increases the risk of infection for adults, particularly when such mobility coincides with peak rainfall and vector densities. Micro-level data are critical in pinpointing causation and small area variations in risk. Thus the beach is a high-risk area within the delta region, particularly for adults, and this is likely to be because of high vector biting rates in the beach environment. One conclusion is that micro-analysis of behaviour, when linked to epidemiological data, is particularly useful in defining and locating areas and groups at highest risk; using such information to achieve intensive coverage on a small scale may be more cost-effective than attempting to achieve vector or chemotherapeutic control over a wider area for all groups.

Quoted often in the literature, this article results from an interdisciplinary study that looked at both the micro- and macro-perspectives of malaria and mobility in the Naya River basin of Colombia. The macro-perspective focused on information that allowed evaluation of overall endemicity and mobility in the entire lowland Naya basin. The micro-perspective looked at timing and spacing of daily economic activities in two villages in the zones of highest endemicity. This paper presents the entomological, epidemiological, and mobility results from the study. Household surveys were done, as was an ethnography of village life, a survey of circulation

patterns, and measurement of malaria prevalence during peak times of malaria transmission. The author found that malaria is concentrated in the delta zone of the Naya River basin and that human mobility into certain areas for agricultural purposes increases risk during times of the year when mosquito populations peak. Certain groups are more at risk than others, and microanalysis of behaviour in conjunction with epidemiological information may be important in defining and locating groups and areas particularly at risk. The author concludes by discussing how such information could be used to provide more efficient and cost-effective coverage for vector or chemotherapeutic control.

Singhanetra-Renard A. (1993) Malaria and mobility in Thailand. Social Science & Medicine*, 37, 1147-1154.*

Abstract: This paper examines the relationship between malaria transmission and migration in three northern Thai villages. Data and observations indicate that land-poor families forced into swidden farming have greater contact with the primary vectors in Thailand which breed in small pools in forested areas and shady clearings on hilly scrub terrain. Once infected, migrants from an endemic locus can introduce the parasite into an area with no transmission but potent vectors, thus becoming the cause of explosive epidemics; equally, non-immunes carrying out agricultural activities in or across forest and border areas can themselves be subject to seasonal morbidity. In addition to agricultural activities on clearings near forested areas, clandestine forest activities and cross-border traffic contribute to the high prevalence of malaria in Thai border villages. Illegal economic activities such as logging, poaching, cattle and goods smuggling interfere with vector-suppression campaigns and prompt detection of infected cases, and ultimately increase human infection not only within the mobile population, but also within the passive population of villages to which the migrants return periodically. Control measures therefore need to take into account the economic pressures which determine a high degree of mobility, the ethnic diversity of the groups who depend on fringe activities for their economic welfare, and the difficult geography of the areas in which they live. As long as economic circumstances forcing human-vector contact receives inadequate attention, better alternatives to current vector-control campaigns (which are not effective among migrants) are not tried and malaria transmission continues.

This article has been quoted very often in recent years. The study was well planned, and the resulting article offers an excellent, insightful analysis of the information obtained from the investigation. The aim of the study was to investigate the relationships between malaria transmission and migration in three northern Thai villages. The protocol for the study consisted of in-depth interviews, participant obser-

vation of agricultural activities, and questionnaire interviews of confirmed malaria patients. Village headmen, village health officers, and officers of the malaria control programme were consulted, as were patient records of malaria clinics. Field observations were also done in another area, in order to generalise from the primary in-depth study. The author concludes by emphasising the need for control programmes to take account of the economic pressures that result in a high degree of mobility, the ethnic diversity of groups that may depend on fringe activities for their livelihood, and the difficult terrain of areas where fringe groups often live. The author points to migrant groups as an important link in the continued threat of malaria transmission, and suggests that better alternatives be tried in targeting these groups.

Expatriates and malaria

Fegan D, Glennon J. (1993) Malaria prophylaxis in long-term expatriate mineworkers in Ghana. Occupational Medicine (London)*, 43, 135-138.*

Abstract: The role of malaria chemoprophylaxis for long-term expatriates has not been re-evaluated since the emergence of widespread multi-drug resistance. A survey of 106 expatriates working in a mine in Ghana (holoendemic for malaria) was conducted to determine the compliance with malaria chemoprophylaxis. Overall, 64% took regular chemoprophylaxis. Of the long-term expatriates (five or more years in areas with holoendemic malaria), 48.4% either took malaria prophylaxis very irregularly or not at all. The main reasons for failing to comply were fear of long-term side-effects and conflicting advice on prophylaxis. This reluctance to take long-term chemoprophylaxis highlights the need to re-emphasize the importance of anti-mosquito measures, prompt treatment of fevers, and perhaps consider abandoning chemoprophylaxis in those expatriate workers with ready access to hospital care.

This study was based on the use of fixed-format questionnaires that were given to 106 expatriates working in a mine in Ghana to determine compliance with malaria chemoprophylaxis. The researchers found that the main reasons for non-compliance were fear of side-effects, as well as confusion resulting from conflicting advice about prophylaxis. The authors conclude by suggesting that in this community emphasis needs to be placed on the importance of anti-mosquito measures, prompt treatment of fevers, and possibly abandoning chemoprophylaxis among expatriates with easy access to hospitals. Since this was a closed-ended survey, it is impossible to fully understand the reasons behind failure to use chemoprophylaxis. Furthermore, the low sample number may have lead to significant bias. Nevertheless, the article is included as an example of the type of behavioural studies that have been done among

expatriates, much of them relying on quantitative data and using closed-ended survey techniques.

O'Brien J. (1993) Malaria and prophylaxis among expatriate aid workers in the Solomon Islands: 1987 to 1992. Tropical Doctor*, 23, 26-27.*

This study relied upon information gained from a survey sent to all British expatriate aid staff and their families. It relies on quantitative data analysis and because of this may be biased. At the very least, it does not provide the type of data necessary to really understand what was going on in this community and is included for the same reasons as the previous work. The purpose of the study was to measure the incidence of malaria among these expatriates, to identify the pattern of chemoprophylaxis usage, and to analyse the case distribution based on geographic area, sex, and age of groups. The authors found that the majority of the expatriates were uncertain about the correct dose regimen because of confusion resulting from conflicting advice from various sources. The author concludes that more efforts need to be made so that expatriate workers "get the message" about malaria prophylaxis.

Cobelens FG, Leentvaar-Kuijpers A. (1997) Compliance with malaria chemoprophylaxis and preventative measures against mosquito bites among Dutch travellers. Tropical Medicine & International Health*, 2, 705-713.*

Abstract: Self-reported compliance with a malaria chemoprophylaxis regimen of proguanil (PG) plus chloroquine (CQ) was assessed in a cohort of 547 Dutch travellers who visited a single travel clinic when journeying to various areas endemic for falciparum malaria. Five hundred and three (92%) had taken PG/CQ prophylaxis, but only 326 (60%) reported regular and uninterrupted use throughout the journey and four weeks afterwards. Compliance differed by travel destination, namely, 45% in South America, 52% in West Africa, 53% in South-east Asia, 60% in the Indian sub-continent, and 78% in East Africa. Parasitologically confirmed falciparum malaria occurred in 5 travellers (0.9%), including 3 of 24 non-compliant travellers to West Africa (12.5%). Apart from destination, independent risk factors for non-compliance were young age, extensive travel experience, and adventurous travel. Compliance with protection against mosquito bites was 80% for wearing long-sleeved shirts and long-legged trousers after sunset, 73% for use of repellents, 56% for sleeping under bednets, and 37% for keeping the sleeping quarters free of mosquitoes. Although 440 travellers (80%) reported to have taken two or more of these measures at least once, only 88 (16%) had done so on a daily basis. Daily use of

bednets was reported more frequently among subjects who were non-compliant with chemoprophylaxis. Compliance regarding malaria chemoprophylaxis should be improved, particularly in high-risk areas such as sub-Saharan Africa, with extra attention to young, adventurous travellers. More emphasis should be placed on prevention of *Anopheles* bites.

This article is better than most on this topic, although it relies mainly on quantitative information, a description of trends rather than the reasons behind them. All visitors to an Amsterdam clinic were asked to participate, completing a questionnaire (self-reported) and providing serum samples before departure. A second questionnaire (self-reported) and serum samples were taken six weeks after return. The authors found that compliance varied by travel destination, and that independent risk factors for non-compliance included young age, extensive travel experience, and adventurous travel. They conclude that chemoprophylaxis compliance should be improved in travellers to high-risk areas like sub-Saharan Africa, and that young, adventurous travellers should be given extra attention. Because of the quantitative nature of this study, it is impossible to fill in the gaps in order really to understand why different travellers failed to comply to chemoprophylaxis.

Phillips-Howard PA et al (1986) Malaria prophylaxis: survey of the response of British travellers to prophylactic advice. British Medical Journal (Clinical Research Edition)*, 293, 932-934.*

Abstract: A cohort study was conducted to determine the compliance of travellers with chemoprophylactic advice given over the telephone by the malaria reference advisory service. Travellers who visited their general practitioner first for advice about malaria prophylaxis were often advised to consult a specialist service. Compliance fell in travellers who were given complicated information and those who received conflicting advice when they contacted other advisory services. After returning to Britain, 48% of the travellers reported that they were fully compliant with prophylactic advice; over a third of the travellers studied did not maintain prophylaxis on their return.

In this cohort study, a 20% random sample was done among callers to the malaria reference advisory service in Britain. The subjects completed a questionnaire over the telephone before departure and questionnaires were then sent to participants six weeks after return. The researchers found that compliance fell in travellers given complicated or conflicting advice. Forty-eight percent of travellers reported full compliance, but over one-third did not complete the regimen upon return. The authors suggest that malaria advice be standardised.

Schlagenhauf P et al (1995) Behavioural aspects of travellers in their use of malaria presumptive treatment. Bulletin of the World Health Organization*, 73, 215-221*

Abstract: The use of stand-by treatment for malaria by travellers depends on their knowledge, attitudes, and behaviour. We examined the behavioural aspects of a cohort of travellers from Switzerland to low-risk malarial areas who, on recruitment, were provided with a kit containing medication for stand-by treatment, guidelines on the diagnosis of malaria, and materials for collection of blood samples for later confirmation of malaria. All subjects were urged to seek medical advice at the first signs of possible malarial symptoms. Illness (fever as the main indicator) was reported by 123 of the 1 187 participants, often accompanied by shivers/chills (36.6%), headache (35.0%), gastrointestinal symptoms (69.9%), and myalgia and/or arthralgia (41.5%). Two-thirds of those ill failed to seek medical attention despite their symptoms and pre-travel advice. Only 9 (7.3%) were actually beyond the reach of medical attention. The stand-by treatment was self-administered by 6 travellers, only one of whom had confirmed malaria. Two non-serious adverse events were reported. All users consulted a physician after administering the presumptive treatment. This stand-by approach is limited by inappropriate behaviour and poor malaria awareness. These negative factors can be mitigated by development of an improved kit containing a simple test for self-diagnosis.

A mainly clinical study, this article fails to uncover the subtle reasons behind the observed behaviours. It is included because it is at least an attempt to understand how knowledge, attitudes, and behaviour affect malaria treatment among travellers. The aim of the study was to investigate the use of stand-by (presumptive) treatment for undiagnosed malaria. Travellers from Switzerland were recruited and given stand-by treatment kits, guidelines on malaria diagnosis, and materials for blood sample collection for later confirmation of malaria. The researchers found that two-thirds of those who became ill failed to consult medical advice, even though they had been advised to do so. The authors concluded that stand-by treatment is limited by inappropriate behaviour and inadequate malaria knowledge on the part of travellers and therefore an improved kit with a simple test for self-diagnosis is needed. This study provides information about the behaviour of travellers, but fails to adequately uncover their attitudes and knowledge.

The military and malaria

Beadle C, Hoffman SL. (1993) History of malaria in the United States Naval Forces at war: World War I through the Vietnam conflict. Clinical Infectious Disease*, 16, 320-329.*

Abstract: Malaria has had a major influence on military campaigns for thousands of years. In this paper we summarise the experience of U.S. Navy and Marine forces with malaria during wars of the twentieth century. During World War I, there were 4 746 new cases of malaria, 68 373 sick-days because of malaria, and 7 deaths due to malaria; during World War II, there were 113 256 new cases, 3 310 800 sick-days, and 90 deaths; and during the Korean War, there were 4 542 new cases, 50 924 sick-days, and no deaths, since most infections were with *Plasmodium vivax*. During the Vietnam War, there were 24 606 cases of malaria, an estimated 391 965 sick-days because of malaria, and 46 deaths due to malaria. With the worldwide resurgence of malaria, the spread of drug-resistant strains of *Plasmodium falciparum*, the emergence of chloroquine-resistant *P. vivax*, and the increasing resistance of *Anopheles* mosquitoes to insecticides, malaria continues to be an enormous threat to U.S. Navy and Marine Corps personnel deployed to the tropics and sub-tropics.

Investigating and explaining how malaria has affected combat readiness in the U.S. military is the purpose of this paper. It is relevant to this bibliography because it also gives reference to behavioural variables that may increase risk for malaria (e.g., inadequate application of DDT because of the perception that the enemy could smell it, or non-compliance with prophylaxis, motivated by the hope of contracting malaria in order to get out of combat). The authors include a short discussion of the history of malaria in military campaigns. They also review the annual reports of the Surgeon General of the Navy for active-duty naval personnel admitted to naval, army, and air force treatment facilities. They conclude with a brief discussion of the worldwide resurgence of malaria, the increasing insecticide resistance of *Anopheles* mosquitoes, and the problems of drug-resistant strains of *P. falciparum* and *P. vivax*, relating these issues to how they will affect military troops deployed to the tropics and sub-tropics in the future.

Bruce-Chwatt LJ. (1985) John Hull Grundy lecture. Mosquitoes, malaria and war; then and now. Journal of the Royal Army Medical Corps*, 131, 85-99.*

This very technical article was written by one of the foremost malariologists of our time. It is an excellent source of historical information and statistical data from British, Australian, and American sources. It collects and consolidates these facts,

while also attempting to compare the past malaria situation with new problems that could arise in conflicts in tropical areas. In addition, the author includes information about behavioural factors relevant to malaria transmission during military campaigns (e.g., night training, hasty housing construction, reasons for not complying with personal protection measures, and other behavioural factors that increase risk). The author concludes with an optimistic discussion of the efforts within the U.S. military to develop anti-malarial drugs.

Harrison M. (1996) Medicine and the culture of command: the case of malaria control in the British Army during the two world wars. Medical History*, 40, 437-452.*

The aim of this mainly historical article is to examine "the culture of command," the attitudes, approaches, and styles of leadership in the British Army and how these influenced medical services, and specifically, the prevention of malaria. The article is concerned primarily with overall historical trends, but does give some examples of how day-to-day behaviour and attitudes have influenced malaria control in the British military. For example, rumours about anti-malarial drugs causing sexual impotence made these drugs unpopular, or troops in North Africa being issued shorts that exposed their legs to mosquito bites in the evening. This is a good background article, but provides a limited explanation of behaviour and malaria from the average soldier's point of view.

Ledbetter E, Shallow S, Hanson KR. (1995) Malaria in Somalia: lessons in prevention [letter; comment] [published erratum appears in Journal of the American Medical Association*, 1995 Jun 21;273(23):1836].* Journal of the American Medical Association*, 273, 774-775. Comment on:* Journal of the American Medical Association*, 1994 Aug 3;272(5):397-399.*

A short letter published after U.S. military involvement in Somalia, this reports the results of a small study done on soldiers returning from combat in a malaria-endemic country. Although the sample size was small and the analysis may not inspire confidence in the results, the authors offer some insightful suggestions not found in many other articles on this subject, e.g., that marines did not like using bednets because they required poles, which the marines felt made them larger targets; and using the insecticide DEET was considered ineffective and unpleasant, especially since it caused dust to cake on skin and showers were not available for up to six weeks' time in some places. The authors give other results, and reasons for failure to comply with chemoprophylaxis. They conclude that further study of behavioural

aspects of non-compliance should be a priority, and that more user-friendly methods are needed before malaria ceases to be a problem in infantry troops in areas of heavy malaria exposure.

Newton JAJ et al (1994) Malaria in US Marines returning from Somalia [see comments]. Journal of the American Medical Association*, 272, 397-399.*

Abstract: OBJECTIVE – To identify malaria in U.S. Marines returning from Somalia and to determine their compliance with chemoprophylaxis. DESIGN – Case series. SETTING – The U.S. Navy health care system. PATIENTS – Consecutive sample of 106 U.S. Marines diagnosed with malaria after returning from Somalia in 1993. MAIN OUTCOMES MEASURES – Identification of the incidence and clinical features of imported malaria. Determination of compliance with chemoprophylaxis in this cohort. RESULTS – As of December 20, 1993, there were 112 cases of imported malaria in 106 U.S. Marine Corps personnel returning from Somalia. *Plasmodium vivax* accounted for 97 (87%) of 112 malaria cases, and *Plasmodium falciparum* accounted for eight (7%) of 112 cases. Mixed infection with *P. vivax* and *P. falciparum* was noted in six (5%) of 112 cases, and a single case of *Plasmodium malariae* was identified. Patients with *P. falciparum* malaria were diagnosed a mean of 20.9 days (range, 1-82 days) after returning to the United States compared with 91.8 days (range, 7-228 days) for *P. vivax* infection (P < .0001). The self-reported chemoprophylaxis compliance rate was 56%; however, only 45 (50%) of 90 patients were given an optimal chemoprophylaxis regimen. CONCLUSIONS - Noncompliance with personal protective measures and chemoprophylaxis contributed to the largest outbreak of imported malaria in U.S. military personnel since the Vietnam conflict. Since military personnel frequently go on leave after deployment, health care providers throughout the United States must be aware of the presence of imported malaria from Somalia.

An account of the risks of imported malaria after deployment of troops to a malaria-endemic country is the focus of this article and an important issue since military personnel often go on leave after deployment. This article covers the clinical and epidemiological features of the outbreak that occurred after Operation Restore Hope. Its main purpose is neither social nor behavioural, but it could provide a good background article for further investigation of these issues. The authors concluded that "noncompliance with personal protective measures and chemoprophylaxis contributed to the largest outbreak of imported malaria in U.S. military personnel since the Vietnam conflict."

Treatment: Acceptance and use of western versus local methods

Ahorlu CK et al (1997) Malaria-related beliefs and behaviour in southern Ghana: implications for treatment, prevention and control. Tropical Medicine & International Health*, 2, 488-499.*

Abstract: A research infrastructure was established in two ecological zones in southern Ghana to study the variables of malaria transmission and provide information to support the country's Malaria Action Plan (MAP), which was launched in 1992. Residents' beliefs and practices about causes, recognition, treatment, and prevention of malaria were explored in two ecological zones in southern Ghana using epidemiological and social research methods. In both communities females constituted more than 80% of caretakers of children one to nine years old and the illiteracy rate was high. Fever and malaria, which are locally called *Asra* or *Astridi*, were found to represent the same thing and are used interchangeably. Caretakers were well informed about the major symptoms of malaria, which correspond to the current clinical case definition. Knowledge about malaria transmission is, however, shrouded in many misconceptions. Though the human dwellings in the study communities conferred no real protection against mosquitoes, bednet usage was low while residents combated the nuisance of mosquitoes with insecticide sprays, burning of coils, and herbs, which they largely considered as temporary measures. Home treatment of malaria combining herbs and over-the-counter drugs and inadequate doses of chloroquine was widespread. There is a need for a strong educational component to be incorporated into the MAP to correct misconceptions about malaria transmission, appropriate treatment, and protection of households. Malaria-control policies should recognise the role of home treatment and drug shops in the management of malaria and incorporate them into existing control strategies.

Undertaken to support Ghana's national Malaria Action Programme (MAP), this study gives good qualitative data about the relationship between cultural/community perceptions and malaria treatment-seeking behaviour. There are excellent direct quotations and insightful suggestions for future malaria control policies. The study was conducted in two ecological zones of Ghana, and a combination of epidemiological and social research methods were used, including focus-group discussions with parents of children less than ten years old, discussions with political and opinion leaders selected by gender, and household surveys with pre-tested semi-structured personal interview questionnaires of caretakers of children one to nine years of age. Children were also followed up and tested for fever/malaria by taking the temperatures and blood smears of those with a history of clinical diagnosis of malaria and

in-depth interviews were conducted of caretakers of children with malaria. The study found that in both ecological zones, females represented more than 80% of caretakers of children under ten years of age, and that they had good knowledge about the major symptoms of malaria. Bednet usage was low, and home treatment of malaria by combining herbs and store-bought drugs with inadequate doses of chloroquine was widespread. The researchers concluded that a strong educational component should be included as part of the MAP programme, and that the role of home treatment and drug shops in the management of malaria should be given more attention in malaria control initiatives.

Djimde A. et al (1998) Use of antimalarial drugs in Mali: policy versus reality. American Journal of Tropical Medicine and Hygiene*, 59, 376-379.*

Abstract: Inappropriate use of anti-malarial drugs undermines therapeutic efficacy and promotes the emergence and spread of drug-resistant malaria. Strategies for improving compliance require accurate information about current practices. Here we describe Knowledge-Attitude-Practice surveys conducted among health providers and consumers in two Malian villages, one rural and one peri-urban. All sanctioned providers limited their first choices of anti-malarial drugs to those recommended by the national malaria control programme and reported using correct dosing regimens. However, the majority of consumers in the two villages chose non-recommended treatments and reported sub-optimal treatment regimens when they used recommended drugs. Anti-malarial drugs were also widely available from unsanctioned sources, often accompanied by erroneous advice on dosing regimens. This study demonstrates that even when the most peripheral health providers are well trained in correct use of anti-malarial drugs, additional measures directly targeting consumers will be required to improve drug-use practices.

Although not quoted as often as some others in this bibliography, this study is an interesting attempt at being inclusive by investigating all sources of anti-malarial drugs. As such, it gives an interesting discussion of unsanctioned providers of drugs. However, since it is a Knowledge-Attitudes-Practice (KAP) study, it does not venture into explaining the motivating factors behind human behaviour, and relies heavily on statistical and quantitative analysis rather than on qualitative data. The study was conducted by two medical anthropologists and two medical students and consisted of structured interviews with physicians, nurses, trained midwives, lay midwives, and lay health workers at clinics and medical stations in Mali. Pharmacists and pharmacy sellers were also interviewed. Marketplaces and private vendors were also surveyed, and to elicit candid responses, an interviewer dressed incognito as a farmer. The researchers found that all sanctioned providers named their first choic-

es of anti-malarial drug as those recommended by the national malaria control programme and stated that they used correct dosing regimens. However, the majority of consumers chose non-recommended treatments and reported sub-optimal treatment regimens when using the recommended drugs. Anti-malarial drugs were also widely available from unofficial sources, often accompanied by incorrect dosing advice. The researchers concluded that even though peripheral health providers may have correct knowledge of anti-malarial drugs, consumers still need to be targeted in order to improve drug-use practices.

Foster S. (1995) Treatment of malaria outside the formal health services. Journal of Tropical Medicine and Hygiene*, 98, 29-34.*

Abstract: Self-medication for malaria is widely practiced around the world, and although many home treatment episodes are successful, the risk of under- or overdosing is always present. Reasons for the widespread use of self-medication range from the distance and cost of seeking care from formal health services to cultural beliefs that suggest that traditional care is more appropriate, and even that modern care may be fatal. Nevertheless, self-medication constitutes an important resource for malaria treatment, and much could be done to improve self-medication practices. Measures to be taken include dissemination of clear messages about malaria as a part of health education, formulation of realistic treatment policies which take account of resource constraints, lowering or removal of economic barriers, especially user charges, and further research into cultural beliefs about malaria and ways to promote compatibility of beliefs with appropriate treatment. If these suggestions could be taken into account in developing malaria treatment strategies, the chances of success would be greatly enhanced.

This descriptive review article gives suggestions for future control activities. It explains why studying self-treatment of malaria is important, including its widespread use throughout the world (and reasons for this) and the ever-present risk of under- or overdosing. Since self-medication is such an important resource for malaria treatment, the author gives suggestions for improvement and concludes that malaria control programmes would benefit from taking these suggestions into account.

Igun UA. (1987) Why we seek treatment here: retail pharmacy and clinical practice in Maiduguri, Nigeria. Social Science & Medicine*, 24, 689-695.*

Abstract: This study, based on interviews with 418 persons treated for various health problems at two retail pharmacies in Maiduguri, Nigeria, sought to know why the

population uses retail pharmacies as outpatient clinics. The most frequent reasons given by the respondents is "expeditious action in consultation and treatment," followed by "efficacy of treatment given" and "convenience" (nearest source). Except for age, there was no significant relationship between the reasons given and demographic background factors. The single most important advantage of retail pharmacy treatment over hospital treatment cited is "expeditious treatment" followed by "availability of unadulterated drugs at all times." The majority of respondents were in the habit of using retail pharmacies whenever they have illness episodes. Relatives and friends constituted the social network of significant influence over the decision to seek treatment at a particular retail pharmacy. The range of health problems reported for treatment was very wide, with malaria the most frequently reported, and the most frequent treatment given was antibiotic chemotherapy by injection or orally.

This article gives a very good, inclusive, and detailed summary of behavioural theories relevant to malaria treatment-seeking behaviour, with special emphasis on those relevant to Africa. Using an open-ended survey method, the author interviewed 418 people treated for various health problems at two retail pharmacies in Maiduguri, Nigeria. Malaria was the most frequently reported health problem. The author found that "expeditious action in consultation and treatment" was the single most important reason for using the pharmacy and that relatives and friends had most influence in deciding at which pharmacy to seek treatment. The author freely admits that the study population is self-selected, in that they were interviewed at the pharmacy and had already made the decision on their own to seek treatment there. Nevertheless, the article gives a valuable analysis of "pharmacy" treatment and the excellent review of behavioural theories is an added bonus.

Lipowsky R, Kroeger A, Vazquez ML. (1992) Sociomedical aspects of malaria control in Colombia. Social Science & Medicine*, 34, 625-637.*

Abstract: A household interview survey combined with a serological survey on the incidence of malaria attacks and prevalence of antibodies has been carried out in rural and urban areas of the pacific coast of Colombia. Additional information on people's knowledge, attitudes, and behaviour toward malaria was collected by means of participant observation and informal interviews. The results show that people incorporate modern and traditional elements into their concepts of the disease and treatment strategies. Deficiencies of the official control programmes are shown from the population's point of view. Some human factors that influence malaria transmission are discussed and an estimate of the accuracy of self-diagnosis is presented.

This comprehensive study uses both quantitative and qualitative techniques to explain malaria-related behaviour, the subtle cultural dynamics behind it, and how to integrate behavioural data into control strategies. The purpose of the study was to "describe and analyse the attitude of the population of the Pacific Coast of Colombia toward the locally-operating malaria control programme, with special emphasis on the beliefs and behaviours concerning malaria which still influence its management by the people." The study consisted of a "household interview survey combined with a serological survey on the incidence of malaria attacks and prevalence of antibodies" in both rural and urban areas. The researchers concluded that both modern and traditional elements were incorporated by people into their concepts of disease and treatment strategies. The article includes a description of the weaknesses of the official control programmes told from the people's point of view and discusses human factors that influence malaria transmission, including the value of self-diagnosis. The author concludes that the current treatment practices for malaria are ineffective in reducing the human infection reservoir, and so transmission persists.

McCombie SC. (1996) Treatment seeking for malaria: a review of recent research. Social Science & Medicine*, 43, 933-945.*

Abstract: A review of literature on treatment seeking for malaria was undertaken to identify patterns of care seeking, and to assess what is known about the adequacy of the treatments used. There is considerable variation in treatment-seeking patterns, with use of the official sector ranging from 10-99% and self-purchase of drugs ranging from 4-87%. The majority of malaria cases receive some type of treatment, and multiple treatments are common. The response to most episodes begins with self-treatment, and close to half of cases rely exclusively on self-treatment, usually with anti-malarials. A little more than half use the official health sector or village health workers at some point, with delays averaging three or more days. Exclusive reliance on traditional methods is extremely rare, although traditional remedies are often combined with modern medicines. Although use of anti-malarials is widespread, underdosing is extremely common. Further research is needed to answer the question of what proportion of true malaria cases get appropriate treatment with effective anti-malarial drugs, and to identify the best strategies to improve the situation. Interventions for the private and public sector need to be developed and evaluated. More information is needed on the specific drugs used, considering resistance patterns in a particular area. In order to guide future policy development, future studies should define the nature of self-treatment, record multiple treatments, and attempt to identify the proportions of all cases that begin treatment with anti-malarials at standardised time intervals. Hypothetical questions were found to be of

limited usefulness in estimating rates of actual treatments. Whenever possible, studies should focus on actual episodes of illness and consider supplementing retrospective surveys with prospective diary-type methods. In addition, it is important to determine the specificity of local illness terms in identifying true malaria cases and the extent to which local perceptions of severity are consistent with clinical criteria for severity and symptoms of complicated malaria.

This is an excellent resource on current studies on malaria treatment seeking. It is a very thorough literature review, the purpose of which was to "examine the literature on treatment-seeking for malaria, to examine potential determinants of treatment-seeking patterns, and to assess what is known about the adequacy of the treatments used." The only drawback is that it is not a meta-analysis in the formal sense, although it included all literature on the topic that could be located. The author found that there is a wide variation in treatment-seeking patterns, but that the majority of malaria cases receive some type of treatment and that multiple treatments are common. Close to half of all cases depend exclusively on self-treatment. The author gives suggestions for research, including priority areas.

Mwenesi H, Harpham T, Snow RW. (1995) Child malaria treatment practices among mothers in Kenya. Social Science & Medicine*, 40, 1271-1277.*

Abstract: A study of 883 mothers with children aged 0-9 years was undertaken in Kilifi District on the Kenyan coast in order to examine child malaria treatment practices. Quantitative and qualitative methods were used to investigate whether complications of childhood malaria were recognised as well as decision-making dynamics in treatment-seeking and the extent and reasons for the use of proprietary treatment. Childhood malaria was perceived as a mild, everyday illness, not preventable but treatable. The link between malaria and mosquitoes was not recognised. Mothers recognised convulsions, anaemia, and splenomegaly but did not link them to malaria. Anti-malarial drugs were not given or were withdrawn from children suffering from these conditions. Ill children were treated promptly by purchase of over-the-counter drugs at retail outlets. The health education implications of these findings are discussed.

Cited often in the literature, this article gives insightful explanations, rather than just descriptions, for behaviours. It also provides excellent suggestions for integrating behavioural research into malaria control programmes. The purpose of the study was to investigate whether complications of childhood malaria were recognised by mothers, and to get information on mothers' management of the disease.

The article contains their findings. The authors conclude by giving suggestions for improving health education, and how such changes may better the treatment of childhood malaria.

Okonofua FE et al (1992) Influence of socioeconomic factors on the treatment and prevention of malaria in pregnant and non-pregnant adolescent girls in Nigeria. Journal of Tropical Medicine and Hygiene*, 95, 309-315.*

Abstract: The influence of socioeconomic factors on the treatment and prevention of malaria was investigated in 45 pregnant and a control group of 47 non-pregnant adolescent girls in the rural community of Imesi-Ile, Nigeria. The study consisted of focus-group discussions and a house-to-house survey. During the survey, clinical and anthropometric measurements were taken of the girls and they were assisted in completing a prepared questionnaire, which sought information on their methods of treatment and prevention of malaria. The results showed a higher incidence of malaria parasitaemia, anaemia, and fever episodes in the group of pregnant adolescent girls. Both groups use identical methods for the prevention of malaria but only a few pregnant girls as compared to non-pregnant girls receive modern hospital treatment for the malaria. In particular, pregnant unmarried girls were less likely to receive antenatal care, to use the local health centres for the treatment of malaria, and to adopt appropriate measures for the prevention of malaria. This trend was not due to aversion to hospital treatment, since most people in the community prefer modern treatment of malaria to traditional or religious methods of treatment. The low utilisation of hospital treatment by the pregnant girls was found to be due to perceived high cost of treatment at the health centres and to lack of privacy. We conclude that a malaria treatment service that utilises modern methods and is both cheap and confidential will be preferred by pregnant adolescent girls in Imesi-Ile.

This article offers an interesting analysis of cultural prejudices that may impede treatment-seeking behaviour among pregnant and non-pregnant adolescent girls in Nigeria. The authors used both quantitative and qualitative research methods and while the discussion of the qualitative data is good, it would have been even better expanded and with more explanation. Nevertheless, the article does present a good picture of the cultural dynamics at play in the study community. Through various instruments, the authors found that these girls rarely utilised the health centre for antenatal care or malaria treatment, primarily because of perceived high cost of treatment as well as the shame associated with being an unmarried pregnant young woman out in public. The researchers concluded that a malaria service that uses modern methods and is cheap and confidential might improve service to pregnant adolescent girls in this area of Nigeria.

Ruebush TK et al (1995) Self-treatment of malaria in a rural area of western Kenya. Bulletin of the World Health Organization*, 73, 229-236.*

Abstract: Reported are the results of a study of residents' knowledge about malaria and anti-malarial drugs and of their treatment-seeking behaviour in a rural area of western Kenya. The study subjects were generally well informed about the symptoms of the disease. Malaria was perceived as a relatively mild illness, much less severe than acquired immunodeficiency syndrome (AIDS), measles, difficulty in breathing, and diarrhoea. Self-treatment was extremely common: of 138 episodes of febrile illness, 60% were treated at home with herbal remedies or medicines purchased at local shops, and only 18% received treatment at a health centre or hospital; no treatment was sought by the remainder. Commercially available chloroquine preparations were perceived as more effective than either antipyretics or herbal remedies for the treatment of malaria, and injections were regarded as more effective than oral medications. 4-Amino-quinolines were used to treat 58% of febrile illnesses but in only 12% of the cases was a curative dose of ≥ 25 mg/kg body weight employed. Even attendance at a health centre did not ensure adequate treatment because of the common practice of sharing medication among family members. Greatly increased attention should be paid to the role of home treatment of malaria when policies are being developed for the management of febrile illnesses in sub-Saharan Africa.

Another frequently cited article, this offers an analysis of self-treatment for malaria in rural western Kenya and attempts to give some explanation for why the observed behaviour occurs, rather than simply describing it. In this study, female heads of households were the principal informants and open-ended interview formats were used. Topics covered included rank order of perceived severity of the disease, opinion about the efficacy of common anti-malarials, and methods of treatment. The availability of over-the-counter medications was assessed by visiting shops where they were sold. Children at health centres were also interviewed, and their temperatures and blood smears taken. The researchers found that study subjects were generally well informed about the symptoms of malaria, but that it was thought of as a relatively mild illness. Self-treatment was the most common course of action and even attendance at the local health centre did not ensure proper treatment because medication was often shared among family members. The authors concluded that home treatment should garner more attention in the formulation of policies for the management of febrile illnesses in sub-Saharan Africa.

Snow RW. (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, 237-239.*

Abstract: A community survey of 388 mothers in a rural and peri-urban population surrounding a district hospital on the coast of Kenya revealed that the preferred choice of treatment for childhood febrile illnesses was with proprietary drugs bought over the counter at shops and kiosks (72% of interviews). Sixty-seven percent of the mothers who reported using shops claimed they would buy chloroquine-based drugs. Preventive measures such as mosquito nets were uncommon (6.2%), but the use of commercial pyrethrum mosquito coils was reported more frequently (46.4%). Separate investigations of treatment given to 394 children before presentation at hospital with severe and mild malaria was consistent with the reports in the community of high usage of shop-bought anti-malarials and anti-pyretics. The involvement of the private sector in peripheral health care delivery for malaria is discussed.

Quoted repeatedly in the literature on treatment-seeking behaviour for malaria, this article offers excellent suggestions for the application of behavioural data to control measures. The purpose of the study was to investigate the sources used by Kenyan mothers to prevent and treat malaria in an area of stable, high endemicity. This study was done as a larger case-control study on the risk factors associated with the development of severe, life-threatening malaria. Subjects were recruited from within the community and age-matched within the community and with control from outpatients with a primary diagnosis of malaria. standardised interviews were done among 388 mothers in a rural and peri-urban population surrounding a district hospital on the coast of Kenya. The preferred choice of treatment was over-the-counter drugs bought at shops and kiosks. Mosquito net use was not common, and pyrethrum mosquito coils were most preferred. The authors concluded with a discussion of the involvement of the private sector in peripheral health care delivery for malaria and the need for education to improve consumer knowledge of correct dosage of anti-malarials.

Bednet usage

Aikins MK, Pickering H, Greenwood BM. (1994) Attitudes to malaria, traditional practices and bednets (mosquito nets) as vector control measures: a comparative study in five West African countries. Journal of Tropical Medicine and Hygiene, *97, 81-86.*

Abstract: Five West African communities were visited to assess the knowledge of the cause of malaria and to document traditional ways of treating and preventing the infection. Knowledge of the cause of malaria was low in the five communities visited. People were more concerned about mosquitoes being a nuisance than a cause of the infection. Various herbs were used as mosquito repellents. Malaria was treated by a number of traditional practices, including herbal remedies. Bednets were used to a varying extent, from 44% (Ghana) to 86% (The Gambia) to protect against mosquito bites, but also for other purposes such as privacy, decoration, and protection from roof debris dropping on the bed.

This article gives comparative information for five countries in Africa. It reviews a pilot study in which the use of bednets and attitudes to malaria were investigated in four West African countries and compared with findings from a larger study in The Gambia. The focus of the study was on local terminology associated with malaria, the extent of health education campaigns, the availability of Western and traditional treatments, and the use of bednets and local constraints to their use. A structured questionnaire was used after being finalised by discussions with key informants in each location. The use of bednets was found to be particularly high in The Gambia, in part due to the high sociocultural value of nets in local communities. In addition, married women with an increasing number of co-wives were found to use nets both for protection against mosquito bites as well as for privacy. By contrast, the low level of bednet use in Ghana was attributed to the practice of sleeping on flat roofs, where there is no place to hang nets; the scarcity of nets in local markets; and their low sociocultural value in society. In Senegal and Sierra Leone, the low level of bednet use is associated with the high use of local herbal repellent, anti-insect sprays, and mosquito coils as well as with financial constraints. The article suggests that public health programmes be geared toward informing people of the relative cost of buying a bednet compared with frequent purchases of insect repellents. Also emphasised should be the additional uses and benefits of nets, such as providing privacy, warmth, and protection from roof droppings. In areas where people sleep on open rooftops, the design of nets should be adapted to make their use feasible. Programmes should also aim to increase the local understanding of malaria in these communities.

Aikins MK et al (1993) A malaria control trial using insecticide-treated bed nets and targeted chemoprophylaxis in a rural area of The Gambia, West Africa. 4. Perceptions of the causes of malaria and of its treatment and prevention in the study area. Transactions of the Royal Society of Tropical Medicine and Hygiene*, 87, Suppl-30.*

Abstract: Perceptions of the causes of malaria, its treatment, and prevention were studied among 996 adults selected randomly from 73 villages and hamlets in a rural area of The Gambia. Structured questionnaires and other interview techniques were used for data collection. Malaria has no specific name in the study area; it is commonly referred to as *Fula kajewo* (Fula fever). Only 28% of the respondents knew that mosquitoes transmitted malaria. However, most people believed correctly that August to October was the main malaria season. Eighty-six percent of the subjects were bednet users. The majority of nets were produced locally and were usually white in colour and made of sheeting fabrics. Usage of nets was correlated with ethnic group, age, and polygamy, but not with education, income, occupation, or ownership of certain items indicative of high social status. Analysis of expenditure on mosquito coils indicated that non-users of nets spent 43% more on coils than did users. Bednets have been used for a long time in the study area; 98% of users saw their parents using them during their childhood.

Binka FN, Adongo P. (1997) Acceptability and use of insecticide impregnated bednets in northern Ghana. Tropical Medicine & International Health*, 2, 499-507.*

Abstract: A district-wide study was undertaken in a rural population of northern Ghana to identify factors influencing the acceptance and use of insecticide-impregnated bednets (IIBNs). A series of focus group discussions were conducted during two years of implementation of IIBNs to gauge community reactions to the introduction of the nets and a structured questionnaire was administered to approximately 2 000 randomly selected individuals. Although the IIBNs were accepted and used because they provided protection from mosquito bites, seasonal factors, patterns of use, and questions of cost were key factors likely to influence the dissemination and effectiveness of bednets. Use of the bednets was highly seasonal: almost all recipients used their IIBNs in the rainy season (99%), corresponding to the period of high mosquito density; 20% used them in the dry seasons, the period of low mosquito density. Mothers with young children were more likely to wash the bednets frequently (because the children soiled the bednets with faces and urine), resulting in no protection from the insecticide. Provision of wider bednets, plastic

sheets with the bednets, or possible incorporation of the insecticide in washing soaps could improve protection for young children. The success of the promotion of IIBNs in malaria control programmes will depend on the cost of the package and the time of year that it is delivered. Financing mechanisms for individual and village groups are discussed. Social research effectively monitored the intervention in this study, and it should be included as an important component of national malaria control programmes.

This article presents the results of a study conducted in a rural area of northern Ghana, aimed at identifying factors that affect acceptance and use of insecticide-impregnated bednets (IIBNs). This article is of interest because of its emphasis on social science research in IIBN trial design and implementation. It is not only descriptive, but the authors also sought to explain the motivating factors behind acceptance and use of bednets. The study was conducted over two years of IIBN implementation, during which time focus-group discussions were held to identify community reactions to the introduction of bednets. A structured questionnaire was also administered to approximately 2000 randomly selected individuals. The researchers found that IIBNs were accepted and used because they offered protection from mosquito bites. However, dissemination and acceptance of bednets was affected by seasonal factors, patterns of use, and questions of cost. Mothers with young children were most likely to wash nets frequently, resulting in no protection from the insecticide. All these factors affect the success of an IIBN programme, and the authors concluded that social science research is instrumental to addressing these concerns, as well as the ultimate success of IIBN field trials.

Choi HW et al (1995) The effectiveness of insecticide-impregnated bed nets in reducing cases of malaria infection: a meta-analysis of published results. American Journal of Tropical Medicine and Hygiene*, 52, 377-382.*

Abstract: The use of insecticide-impregnated bednets to minimise human-vector contact may reduce the incidence of malaria. Consequently, several field trials have evaluated their effectiveness as a malaria prevention strategy. A meta-analysis of published reports of field trials that measured the incidence of infections was performed to provide a measure of the effectiveness of insecticide-treated bednets in preventing clinical malaria. Subsetted analyses were performed on the ten field trials to calculate pooled incidence rate ratios of infection among the study groups. For the studies comparing insecticide-impregnated bednets with untreated bednets, the summary incidence rate ratio for acquiring malarial infections was 0.757 (95% confidence interval [CI] = 0.612-0.938), representing a reduction of 24%. For the stud-

ies comparing permethrin-impregnated bednets with controls without bednets, the summary incidence rate ratio was 0.497 (95% CI = 0.417-0.592) (Rothman-Boice heterogeneity statistics = 17.27 [P = 0.004] and 23.55 [P = 0.0003], respectively). These data suggest that insecticide-impregnated bednets are effective in preventing malaria, decreasing the incidence rate ratio by approximately 50% in field trials performed to date.

The authors did a rigorous and extensive review of the field trials that tested effectiveness of insecticide-impregnated bednets and their success in reducing malaria infection. This is a highly structured review since established criteria for inclusion of studies, organising the data, and analysing the results were used to rate the studies. An extensive literature search was conducted, and the bibliography sections were scanned to find articles not found in the previous search. Selected articles were double-blinded and the methods and results sections were independently rated for scientific vigour by two epidemiologists. The articles were rated for possible biases and compatibility of study groups, as well as quality of study design. The researchers concluded that insecticide-impregnated bednets do indeed provide effective prevention from malaria, resulting in a decrease in an incidence rate ratio of about 50% in the field trials that were evaluated. However, the authors wisely assert that publication bias may also affect their conclusions, since studies with positive results may be published more often than those with negative findings. If this is true, a review of the current field trials may result in overconfidence about the overall effectiveness of IIBNs.

Hewitt SE et al (1996) Self-protection from malaria vectors in Pakistan: an evaluation of popular existing methods and appropriate new techniques in Afghan refugee communities. Annals of Tropical Medicine and Parasitology*, 90, 337-344.*

Abstract: Experimental huts were used to measure the impact of several techniques for self-protection from malaria vectors in Pakistan. An electric fan, pyrethrum coils, untreated curtains, pyrethroid-vapourizing mats, and permethrin-impregnated curtains reduced the total catches of blood-fed *Anopheles stephensi* by 27%, 36%, 47%, 56%, and 65%, respectively. The most marked effect of all the interventions was in reducing the numbers of mosquitoes entering the huts, although all the techniques, except for the untreated curtain, also reduced the proportion of feeding mosquitoes inside. Although the trends seen were similar for both anopheline (all *An. stephensi*) and culicine mosquitoes, they were more pronounced in the culicines. Social surveys were conducted on current self-protection practices. The social and economic constraints associated with each of the various techniques are discussed. All the

strategies were shown to offer a degree of protection and their use should be encouraged. Impregnated curtains seem especially promising. Pyrethroid-impregnated bednets have been widely promoted in eastern Afghanistan since 1991 and have the advantage of providing protection when people sleep outside during the summer. However, surveys show that some owners stop using their nets in late autumn, despite the continued risk of malaria. People should be encouraged to use their bednets as impregnated curtains rather than putting them into storage.

From 1993 on, the distribution and promotion of impregnated bednets in refugee communities in Pakistan and eastern Afghanistan has led to their widespread use in these areas. This article assesses the efficacy of various alternative means of self-protection either in absence of nets or in conjunction with them. This is a valuable article in that it was done in a refugee community, where problems with malaria can be particularly acute. However, since electricity is often scarce in such communities, techniques that require electricity may have limited use. Results of social surveys on self-protection practices against malaria revealed that the most popular methods were enshrouding oneself in a *chaddar* (cloth blanket) while sleeping, and using fans. Another method cited was the use of mosquito coils. The intervention introduced vaporised mats and impregnated curtains in these communities as control measures used successfully in conjunction with others. Surveys also revealed a high use of bednets in the summer when people slept outside, primarily to curtail the nuisance effect of mosquitoes and other insects. During the cooler months, however, when P. falciparum transmission reaches its peak, people were found to sleep indoors without their nets. It was recommended that nets be used as impregnated curtains during these months since curtains had proven particularly effective and fitting in trials in traditional mud houses. The authors conclude that all techniques investigated were effective. The use of bednets as treated curtains showed particular promise, as they would save owners money by reducing rodent damage to nets that were otherwise stored when not in use.

Kroeger A et al (1995) Insecticide-impregnated bed nets for malaria control: varying experiences from Ecuador, Colombia, and Peru concerning acceptability and effectiveness. American Journal of Tropical Medicine and Hygiene*, 53, 313-323.*

Abstract: Between 1991 and 1994, an intervention programme with permethrin- and lambdacyhalothrin-impregnated bed-nets was carried out over a period of nine months in each of five endemic, malarious areas of Ecuador, Peru, and Colombia. This programme was evaluated through household surveys, blood sampling, in-depth longitudinal studies, and entomologic analysis. Eighty-four communities (including

approximately 35 000 individuals) were paired according to malaria incidence, size, and coverage with bednets and then randomly allocated to intervention and control groups. The results showed that peoples' acceptance of the measure was related to their perception of an immediate protective effect against insects. The effectiveness of the bednets, measured as a reduction of malaria incidence in intervention communities as against control communities, showed large variations between and within the study areas. The protective efficacy varied between 0-70% when looking only at the post-intervention differences between intervention and control groups. The average protection was 40.8% when considering a four-month incidence of clinical malaria attacks and 28.3% when considering a two-week malaria incidence. Important factors for the success of the bednet programme were insect susceptibility to pyrethroids, high coverage with impregnated bednets, high malaria incidence, good community participation, high mosquito densities when people go to bed, and a high proportion of *Plasmodium falciparum*. In one area, where DDT spraying in the control communities was executed, the effectiveness of bednet impregnation was slightly better than that of spraying.

Between 1991 and 1994 an intervention programme with impregnated bednets was carried out over a period of nine months in endemic, malarious areas of Ecuador, Colombia, and Peru. This article evaluates the effectiveness of the programme as well as its applicability under field conditions. The analysis of people's acceptance of the programme included participant observation, measurement of bednet use, and user satisfaction surveys. Blood sampling, in-depth longitudinal studies, and entomological analysis were also used. It was generally observed that community participation and acceptance of the intervention was high in those areas where people perceived an immediate protective effect of the impregnation, or even noticed the disappearance of head lice and bedbugs. This perception varied according to resistance of vectors to pyrethroids, concentration of insecticides in bednets, and the peak of mosquito-biting rates, which in some areas of Ecuador and Peru was later than in others, thereby decreasing the early biting of mosquitoes before most people go to bed. Widespread use of bednets in four of the five study areas prior to the intervention also increased their overall acceptance in local communities. In Catacaos (north-eastern Peru) prior use of bednets was scarce and irregular due to high temperatures and sleeping practices: The average number of persons per bed was three compared to one or two in the other study areas. As a result, the acceptance of impregnated bednets in this community was particularly low. This article concludes by suggesting that communities be educated about the proper use and care of impregnated bednets and emphasises that bednet impregnation should not replace but rather complement other control measures.

MacCormack CP, Snow RW. (1986) Gambian cultural preferences in the use of insecticide-impregnated bed nets. Journal of Tropical Medicine and Hygiene*, 89, 295-302.*

Abstract: In field trials of permethrin-treated bednets in a large Mandinka village, 95% of people were already sleeping under locally made nets, which lasted about six years and cost about US$9.00 ($1.50 per year). Two permethrin dips annually was an additional $0.60 per year (1985 prices). Non-immune children slept in beds shared with adults, and people wanted nets for many reasons, not just malaria protection. Fifty-eight percent of people preferred opaque sheeting to open netting since sheeting gave more privacy, lasted longer, and gave better protection from very small insects, dust, rats, etc. White was the colour preferred by 90% of interviewees. Comparing Mandinka with Wolof and Fula, there were ethnic differences in net owning and the proportion of children sleeping in beds with a mattress.

In field trials of impregnated bednets carried out initially in a large Mandinka village in The Gambia and followed by trials in nearby Wolof and Fula villages, it was found that there were ethnic differences in net owning and in the proportion of children sleeping in beds with mattresses. This article reviews the findings of these trials and provides an overview of net preferences, acceptability, and willingness to treat nets with insecticides and to pay for them, as well as net washing and sleeping patterns. Interviews were conducted in randomly selected Mandinka, Wolof, and Fula villages. The majority of people surveyed expressed a strong preference for white over coloured nets, citing their clean and attractive appearance. As a result, nets were washed frequently (two or three times a month) and some people asserted that they resented being asked not to wash. In the Mandinka village, a large minority cited their preference for opaque, heavy nets because they gave privacy, lasted longer, and protected against rats, snakes, and roof droppings. Of those preferring lighter netting, most cited their coolness in the hot season as a benefit over opaque nets. In comparison to the Mandinka village, where 95% of people owned bednets, only 1% of Wolof and 4% of Fula people were found to be sleeping under nets. Financial constraints and sleeping patterns were cited as the major factors behind low bednet use. Due to the prevalence of cattle herders among Fula people and the scarcity of rice farmers among both Fula and Wolof people, their villages tend to be situated further away from swamps and mosquito breeding sites, thereby decreasing the perceived necessity of bednets in these communities. Moreover, unlike in Mandinka communities, where bednets are used as part of marriage settlements, Wolof and Fula people tend not to attribute a high sociocultural value to bednets, which results in lower overall use.

Miller JE et al (1999) A new strategy for treating nets. Part 2: Users' perceptions of efficacy and washing practices and their implications for insecticide dosage. Tropical Medicine & International Health*, 4, 167-174.*

Abstract: The conventional way to treat a mosquito net with pyrethroid insecticide is to apply a standard dosage every six to twelve months, and to avoid washing the net until just before retreatment. In some places, nets are normally washed much more often than this, so it may be more appropriate to apply smaller amounts of insecticide after each wash. The choice of strategy must take into account not only biological effectiveness, but also users' perceptions of this effectiveness and their net-washing habits. We used focus groups to compare users' responses to nets treated with different dosages and chemicals. One hundred current net users in urban Dar-es-Salaam were each given a net that had been pretreated either with premethrin (200 or 500 mg/m^2), lambdacyhalothrin (3 or 15 mg/m^2), or with water. Neither participants nor investigators knew which group had received which treatment. Focus-group discussions were held after two, eight, and twelve weeks. Participants greatly preferred treated nets. Low doses were perceived to be less effective, especially after eight and twelve weeks. After twelve weeks most participants had washed their nets, despite requests to the contrary. Dirty nets were regarded as unhealthy and socially unacceptable. Few participants experienced side-effects or expressed fears about the safety of treatment. We conclude that asking people to refrain from washing their nets is unrealistic and a "low-dose frequent-treatment" strategy of insecticide application may be more appropriate in the long run. At first, however, low doses give perceptibly inferior protection. An initial high (loading) dose, followed by frequent lower (maintenance) dosages, might solve this problem.

In this innovative study, researchers realised that cultural perceptions and practices about cleanliness affect the washing and thus the effectiveness of insecticide-impregnated bednets. It is a highly qualitative study, perhaps resulting from the influence of an anthropologist as part of the research team. Focus-group discussions were used to compare net users' responses to nets treated with varying dosages and chemicals and although neither participants nor researchers knew which group had received which treatment, low doses were perceived as less effective. For health and social reasons, most people washed their nets within twelve weeks, though they had been asked not to do so. The investigators concluded that asking people not to wash their nets is not realistic but a "low-dose, frequent-treatment" strategy may prove a more suitable tactic for keeping insecticide-impregnated bednets (IIBN) effective against mosquitoes. Dosages need to be kept at a level that is effective against anophelines as well as culicine mosquitoes, which are perceived as nuisance biters and generally need a higher dose. If people are still being bitten by mosquitoes, they may perceive the IIBNs as ineffective, and thus cease using them.

Sexton John D. (1994) Impregnated bed nets for malaria control: biological success and social responsibility. American Journal of Tropical Medicine and Hygiene*, 1994, 50(6) Suppl., 72-81.*

Abstract: Malaria is a serious public health problem in numerous countries of the world. In Africa alone, it is estimated that more than a million children under five years of age die each year from this disease. The problem has become more critical with the development of *Plasmodium falciparum* resistance to chloroquine, the high cost of replacement anti-malarials, and vector resistance to the cheaper insecticides such as DDT. Emphasis now is on sustainable control programmes that can be implemented by communities with assistance from primary health care providers. This has led to a re-examination of impregnated bednets (IBNs) that serve as a physical barrier to break human-vector contact. Over the last decade, bednets impregnated with inexpensive and long-lasting pyrethroids used in Africa and Asia have shown their utility in reducing human-vector contact, inoculation of humans with sporozoites, clinical episodes of fever, and high levels of parasitemia. One study in The Gambia demonstrated that mortality in young children was significantly reduced, and the results of that study have led to the initiation of large-scale mortality studies in different epidemiologic areas in Africa. This paper reviews current bednet materials, recommended insecticides, an impregnation technique, costs, and the importance of community participation. As a malaria control option, IBNs appear to be very promising, but further entomologic and epidemiologic assessments, including mortality studies, are needed. Future use of IBNs should be considered as part of a larger programme that includes other vector-control measures, proper case management, appropriate use of antimalarials for prevention in specific target groups, surveillance, and programme monitoring with attention to changing epidemiologic situations and developing technology.

This review article provides a general overview of the epidemiologic, entomologic, and sociocultural factors associated with impregnated bed nets (IBNs) used on a community-wide basis. It has been quoted often in recent years and provides insight into IBN utility, evolution, current use, community participation, cost, and future application, while referring to some relevant studies conducted in various regions of the world. Among the benefits cited for using IBNs is their long-term durability and utility, their ability to protect against biting organisms other than mosquitoes and to enhance privacy, their easy maintenance and installation, as well as their relatively low cost. The article emphasises the importance of community involvement in IBN programmes and shows that village health workers who collaborate with community members can be the key to success. It also recommends that women's groups, cooperatives, school leaders, and other community groups be encouraged to

participate in intervention programmes and trained to ensure their cultural and social appropriateness. In order to enhance the availability and acceptance of bednets, the article further suggests that successful programmes will be contingent upon the social marketing of IBNs; government collaboration with local communities and merchants to encourage the cheap production of bednets locally; and full use of local primary health care resources to help educate community members about the benefits and proper use of IBNs.

Winch PJ et al (1994) Seasonal variation in the perceived risk of malaria: implications for the promotion of insecticide-impregnated bed nets. Social Science & Medicine*, 39, 63-75.*

Abstract: Bednets (mosquito nets) impregnated every six months with pyrethroid insecticides are a simple, low-cost malaria control method well suited to conditions in sub-Saharan Africa. As large seasonal variations in levels of net usage may seriously limit the potential impact of the nets on malaria transmission, a study was conducted on local definitions of seasons, perceptions of seasonal variation in mosquito populations, and incidence of febrile illnesses in Bagamoyo District, Tanzania, to aid in the design of a communication strategy for promoting sustained use of the nets. Both the diagnosis and treatment of febrile illnesses are affected by what season people think it is, by what illnesses they think are common in each season, and by their perceptions of how abundant mosquitoes are. During dry seasons, when mosquitoes are scarce and malaria is thought to be unlikely, it will be difficult to attain high rates of net usage, necessitating the development of locally appropriate messages and communication materials that explain how it is possible that malaria can be a threat even when mosquitoes are few. Cultural consensus analysis was found to be a particularly valuable tool for understanding the reasons behind large variations in local perceptions of seasonality.

This valuable article presents a highly detailed and qualitative study that uses a non-standard approach to integrate larger forces of seasonality into cultural perceptions about disease and how these influence bednet usage. This highly ethnographic study seeks to explain the "why" behind human behaviour in relation to bednet usage. The investigators used cultural consensus analysis and conducted focus-group interviews (13) and key informant interviews (30), as well as a questionnaire survey among randomly selected participants (567) identifying "local definitions of seasons, perceptions of seasonal variation in mosquito populations and incidence of febrile illness" in Bagamoyo District, Tanzania. The aim was to help design an effective strategy for promoting sustained use of nets in the area. The investigators found that during the dry season, when mosquito populations decline

and malaria is not considered a threat, "it will be difficult to maintain high rates of net usage," concluding that education about how malaria can be a threat despite low mosquito densities is necessary. However, this assumes a linear relationship between knowledge and practice, which may not necessarily be the case.

Winch PJ. (1997) Social and cultural factors affecting rates of regular retreatment of mosquito nets with insecticide in Bagamoyo District, Tanzania. Tropical Medicine & International Health*, 2, 760-770.*

Abstract: Insecticide-treated mosquito nets have an impact on mortality and morbidity in young children under controlled conditions. When integrated into larger control programmes, there is the danger that rates of regular retreatment of the nets with insecticide will drop, greatly limiting their effectiveness as a public health intervention. In Bagamoyo District, Tanzania, rates of retreatment dropped significantly when payment for the insecticide was introduced. A series of neighbourhood (hamlet) meetings were held in all study villages to discuss concerns about the insecticide and ways to increase rates of retreatment. Although changes were made in the procedure, rates of retreatment remained lower than expected and showed marked variation within as well as between villages. We then conducted unstructured key informant interviews as well as informal discussions in a village with strong variation between different sectors of the villages in rates of retreatment. While logistical problems were most frequently cited as reasons for not bringing nets for retreatment, political and social divisions within the community provided a better explanation. This is borne out by the low response to rearrangements in logistics, which made retreating the nets significantly easier for households, and the higher response when changes were made in the channels of communication as well as the logistic features. It is clearly more difficult for villagers to appreciate the benefits of the insecticide than those of the nets. Great emphasis needs to be placed on the insecticide and its beneficial effects from the outset for any large-scale programme to be sustainable.

Widely quoted in the literature, this is a very thorough investigation of the social and cultural issues surrounding retreatment of bednets with insecticide. The study was undertaken in order to identify reasons why rates of retreatment of nets dropped following introduction of a payment scheme for insecticide. neighbourhood meetings were held to discuss concerns about the insecticide as well as unstructured key informant interviews and informal discussions. The researchers found that logistical problems were most often given as reasons for not bringing nets for retreatment. However, they concluded that political and social divisions were perhaps better explanations. The investigators suggested that more emphasis needs to be placed on the

importance of the insecticide at the beginning of large-scale programmes, as participants may not appreciate the benefits if they are not fully informed.

Gender relations

Kuate DB. (1997) Effects of socioeconomic disadvantage and women's status on women's health in Cameroon. Social Science & Medicine*, 44, 1023-1042.*

Abstract: Research on the effects of socioeconomic disadvantage and women's status on women's health is important for policy makers in developing countries, where limited resources make it crucial to use existing maternal and child health care resources to the best advantage. Using a community-based data set collected prospectively in Cameroon, this study attempts to understand the extent to which socioeconomic factors and women's status have influences on women's health. The most important finding is that the burden of illness rests disproportionately on the economically disadvantaged women and on those with low social status. The long-term effects of social disadvantage are apparent in the excesses of morbidity among women who are not employed at the time of their children's birth, women living in poor neighbourhoods, and those living in households without modern amenities. The maternal morbidity patterns during the postpartum period indicate that the women's reports of their recovery and health status from childbirth extend far beyond the first few weeks on which previous studies have focused. From a theoretical perspective, this study has demonstrated the importance of the "intermediate" framework for the study of women's health: the operations of effects of a number of background characteristics are mediated by more proximate determinants of women's health. These results remain robust even after controlling for other measured factors and after correcting for unmeasured heterogeneity and sample selection, which helps to dismiss the potential influence of some artifacts. While this study suggests that there are opportunities within the existing health care system for meeting many of the health care needs of the socially disadvantaged, further biobehavioural and psychosocial research is needed to determine how women's status and social disadvantage influence the demand for health care services, in order to ensure equitable as well as a more effective delivery of health care services and to break the vicious circle of disadvantage.

Gender dynamics are a central concern of this article, which is important because it is one of the few articles that looks specifically at women's social status and connects low status with poor health. Unfortunately, it is not concerned with low social status in relation to malaria alone. However, malaria is mentioned as an important factor in maternal health in Africa, since women are more vulnerable to malaria dur-

ing pregnancy; malaria also causes complications during pregnancy for both the mother and the foetus. This is the type of study that needs to be done specifically about malaria in relation to women's status in society, their education level, and traditional constraints. This article results from a two-year longitudinal survey study on women in Cameroon designed to investigate the effects of socioeconomic disadvantage and women's status on women's health. The five variables used to measure women's status include women's education, women's labour force participation, marital status, prevalence of polygyny, and ethnic affiliations. The authors note that the most important finding is that economically disadvantaged women and those of low social status bear the burden of illness disproportionately. They emphasise the importance of a theoretical perspective when discussing women's health and discuss future needs for research in this area, especially research on how women's status and social disadvantage affect their demand for health services.

Mwenesi H. (1994) Mothers' definition and treatment of childhood malaria on the Kenyan coast, TDR Social and Economic Research Projetct Report, 13, 1-48. Geneva: WHO.

Quoted often in the literature, this study focused on mothers primarily because they are the primary caretakers of children. Gender dynamics and social constraints play a limited role in the discussion, even though these factors affect mothers' abilities to seek care for their children as well as for themselves. The author does stress that those whose behaviours are targeted must be empowered so that they are able to change their behaviours, which includes whole communities, but mothers are especially important if child health is to be improved. The article focuses mainly on perceptions and attitudes in relation to malaria, rather than on social dynamics. Among the topics discussed are ethnoetiologies about malaria, who diagnoses malaria within the household, management of malaria at home, treatment-seeking behaviour, who makes the decisions about treatment within the household, and relevance of this information to malaria control. The most important point is that malaria health education may have been based on an incorrect premise: even though mothers in this study did not have accurate knowledge of malaria, they still had a correct perception gained through empirical observation and experience.

Rahman SH et al (1996) Gender aspects and women's participation in the control and management of malaria in central Sudan. Social Science & Medicine*, 42, 1433-1446.*

Abstract: This work was designed to study the contribution of women in central Sudan in the control and management of malaria, with particular emphasis on gen-

der-related aspects that define women's role and participation. The Blue Nile Health Project (BNHP 1980-1990) was launched in 1980 mainly for control of water-associated diseases in central Sudan. The BNHP model was chosen to conduct this work. The study showed that women were actively involved in the implementation of the BNHP strategies as health instructors (*murshidat*), who constituted 75% of the staff of BNHP unit of health education as members of village health committees (VHC), where they constituted 40% of the VHC members and were also recipients of the project services. All *murshidat* were interviewed, whereas multistage random sampling for VHC members and recipient women in 40 villages was used to select a sample to be interviewed. The results showed that the *murshidat* and VHC women members played a major role in the motivation, organisation, and health education of local communities prior to campaigns of environmental sanitation and vector control. Household commitments and difficulties in communication with the public were the main gender-related factors that contributed negatively to women's activities. Cases of malaria have considerably more socioeconomic impact than other common diseases, especially with regard to women's household commitments and work. Recipient women were more concerned with aspects of self-protection, management of family cases of malaria, and health education programmes. They were less involved in drying mosquito breeding sites and spraying activities of insecticides that had been reluctantly accepted because of allergy and bad odour. Although the majority of women considered anti malarials to be less harmful than effects of malaria itself on pregnancy, they did not realise the role of malaria chemoprophylaxis during pregnancy. This needs more health education. The study showed that the BNHP programme was very successful in recruiting women in control and management programmes. Health planners are therefore urged to persuade the subordinated communities of women in many African countries like Sudan to play a more active role in the health programmes and welfare of their communities.

This article is included as an example of an actual programme where women are actively involved and contribute much to the programme's success. The aim of the study was to look at how women in central Sudan contribute to control and management of malaria, emphasising gender-related issues that affect women's role and participation in the programme. However, the article does not emphasise gender dynamics as much as would be desired, perhaps because of the study design. The study was done using questionnaires, so qualitative data is limited. Women were categorised into three groups: Blue Nile Health Project (BNHP) staff, members of the Village Health Committee (VHC), and recipients of health services. Records of BNHP activities were examined for each group, and then those in each group were interviewed. BNHP records were also examined for project achievements. The study found that women were the majority (75%) of the staff of BNHP unit of health edu-

cation, and that women made up 45% of VHCs. The main gender-related factors that limited women's activities were household commitments and problems in communicating with the public. The authors also found that women did not adequately understand the need for chemoprophylaxis during pregnancy, and that health education should target this problem. The authors concluded that the BNHP programme was very successful in recruiting women and that health planners should try to persuade women, who are typically subordinated in communities in many African countries like Sudan, to participate.

Rashed S et al (1999) Determinants of the Permethrin-Impregnated Bednets (PIB) in the Republic of Benin: the role of women in the acquisition and utilisation of PIBs. Social Science & Medicine*, 49, 993-1005.*

Abstract: An important aspect of malaria control strategies has been the use of prophylactic measures such as impregnated bednets; however, adoption of this strategy has been slow and uneven. This study considered the factors determining Permethrin-Impregnated Bednets (PIB) use in the context of a PIB promotion project in a rural area of Benin undertaken between 1992 and 1995. Quantitative data, on sociodemographic characteristics, malaria knowledge, attitudes, and practices, were gathered from 191 households of PIB users and non-users for comparative purposes using a questionnaire format. Qualitative data were collected from 23 focus group discussion sessions and 16 semi-structured interviews. Women's income, men's educational level, and women's participation in communal organisations were the principal variables distinguishing user households from non-user households. Recourse to non-Western medicine and, in particular, to medicinal teas, which are considered preventive or curative, correlates negatively with PIB use. The qualitative data shows that informants consider exposure to the sun, especially while engaged in agriculture work, a principal cause of malaria, and that PIB adoption is not considered justified in a context where there is a quasi-chronic shortage of financial resources and where confidence in efficacy of non-Western medicine prevails. Because they have primary responsibility for the health of their families and are more aware of children's vulnerability to malaria, women are more inclined than men to want to buy PIBs. However, because the household head, who is most often male, sets family consumption priorities using family income, women often have to resort to buying PIBS using their own income, which is often considerably lower than that of men. Support for community initiatives directed to women's work, linked with intensive effort to sensitise men to the mechanisms of malaria transmission and principal groups at risk, is seen as a means to increase PIB acquisition and use.

A very recent article that points to the gender dynamics that limit women's abilities to use malaria prevention measures, this also shows that the same problems that other studies have been describing for years still persisted in 1999. This may be due to the design of control programmes in general, but it may also be that a gender-sensitive approach has not been used in this particular area of Benin. The study used a variety of techniques. Quantitative data on socio-demographic characteristics, malaria knowledge, attitudes, and practices were gathered using questionnaires and people were divided into groups depending on whether or not they used Permethrin Impregnated Bednets (PIBs). Qualitative data were gathered from focus groups and semi-structured interviews. The researchers found that women's income, men's educational level, and women's participation in communal organisations were the most important factors distinguishing PIB user households from non-users. The authors note that women are more inclined than men to want to buy PIBs, mostly because women have primary responsibility for the health of their families although the household head, usually male, determines spending priorities. Women often have to use their own income, which is usually much less than men's, to buy PIBs. It is concluded that PIB acquisition and use could be increased by community support of women's work, and by making an effort to sensitise men to how malaria is transmitted as well as the principal risk groups.

Tanner M, Vlassoff C. (1998) Treatment-seeking behaviour for malaria: a typology based on endemicity and gender. Social Science & Medicine*, 46, 523-532.*

Abstract: A main component of current malaria control strategies to reduce malaria-related mortality and severe morbidity is early diagnosis and treatment at peripheral health services such as village health posts and dispensaries. This strategy has been promoted mainly by sensitising the population with regard to the available service offered and by providing classical biomedical descriptions of symptoms and signs of malaria. This strategy represents important challenges for successful implementation and maintenance. Early treatment depends upon prompt recognition of symptoms and signs of malaria in the household, i.e., mainly by women. Early treatment also requires that appropriate health services and medication are accessible and used. In this paper we argue that the success of malaria control depends upon an approach that is gender-sensitive and takes into account the level of endemicity in a given setting. The level of endemicity determines which group of the population is at highest risk for infection, morbidity, and mortality, and is strongly related to gender considerations. The paper develops a typology that combines the key factors of gender variables with epidemiological features. It consequently outlines an approach to community-based, effective malaria control tailored to a given endemic setting. Finally, we suggest that the proposed framework could be validated for its potential application to the control of other communicable diseases.

A literature review in the field, this article also provides a table with a good summary of the major gender-related issues in selected articles, particularly in relation to malaria control. The authors develop a theoretical framework or "typology" that combines key gender variables with epidemiological factors. The paper also provides an excellent "gender framework for tropical disease research," the purpose of which is to give recommendations for future disease research. Such a framework also demonstrates that these ideas could be applied to other communicable disease. The authors' main argument in this paper is that a gender-sensitive approach that takes into account the level of endemicity in a setting, which is strongly related to gender issues, is necessary for malaria control. This is an excellent background paper that covers key issues in a gendered analysis of malaria.

Vlassoff C, Bonilla E. (1994) Gender-related differences in the impact of tropical diseases on women: what do we know? Journal of Biosocial Science*, 26, 37-53*

Abstract: This paper explores the importance of gender differences in the impact of tropical diseases on women. Malaria and schistosomiasis are used as examples, but most of the observations also apply to other diseases endemic to developing countries. The distinction between sex and gender is discussed and evidence of sex and gender differences in the determinants and consequences of malaria and schistosomiasis, particularly their economic, social, and personal dimensions, is reviewed. Issues on which research and intervention studies are needed are identified.

In this review article the authors state that malaria and schistosomiasis are used as specific examples of the impact of tropical disease on women, although many other tropical diseases are also discussed. The authors draw from many different views, including economic, social, and personal dimensions in relation to malaria and schistosomiasis. Issues discussed include sex differences in morbidity and mortality from tropical diseases (including economic activities and exposure, structural adjustment policies, social determinants, knowledge about tropical disease, lack of salience about non-reproductive health concerns); and gender differences in consequences of tropical diseases (economic consequences, effects on women when others are ill, effects on women when they themselves are ill, effects on others when women are ill, costs of treatment, social consequences, stress, and negative reactions to formal health services). The main point of the paper is that understanding non-reproductive health among women in developing countries is important because little is known, and also because effective interventions depend on understanding these issues. The authors conclude by defining issues that need research and intervention.

Vlassoff C, Manderson L. (1998) Incorporating gender in the anthropology of infectious diseases [see comments]. Tropical Medicine & International Health*, 3, 1011-1019.*

Abstract: The paper focuses on key issues in research and control of infectious diseases and demonstrates the utility of combining a gender perspective with anthropological investigation, both for understanding disease and for designing and evaluating interventions for its control. Based on a definition of gender as opposed to sex, it illustrates, with the help of a gender framework for tropical diseases, how this concept is applied. It argues that gender-sensitive research is essential to the understanding of the nature of the disease, its prevalence, distribution, determinants, and consequences. Examples are taken from anthropological studies on infectious diseases, including research on urinary schistosomiasis, malaria, leprosy, leishmaniasis, and onchocerciasis. How gender-sensitive qualitative research can guide the design and evaluation of appropriate interventions for the prevention and control of infectious diseases is also discussed.

Another review article, this paper is very similar to the 1994 Tanner and Vlassoff article published in *Social Science & Medicine* and discussed earlier in this bibliography. As in the previous article, this article is not specifically about malaria, but it mentions studies of other infectious disease research that could also be applied. In contrast to the previous article, this one focuses on the usefulness of combining anthropological research with a gender perspective in infectious disease control. Because of this, there is more of an emphasis on anthropology. Issues discussed include definitions of "gender" versus "sex," conceptualising gender and disease, gender and prevalence of disease, gender and distribution of disease, gender and determinants of disease, and gender and consequences of disease. The article concludes with a discussion of gender-sensitive interventions and their implications for disease control.

Community involvement in malaria control

Ault SK. (1983) Anthropological aspects of malaria control planning in Sri Lanka. Medical Anthropology*, 7, 28-49.*

A good overview of the Anti-Malaria Campaign (AMC) in Sri Lanka is found here, although the discussion at times is rather technical and full of "development" jargon. However, most of the major issues are covered, and cultural factors (such as purdah in Islam, which may be given special consideration in malaria control) do play a role in the discourse. Issues include malaria control theory and cultural and

behavioural studies in parasitic disease control programmes (sociocultural and ethnographic studies in WHO malarial control programmes, and social and soundness analysis in USAID malaria control projects). The author discusses the evolution of malaria control programmes in Sri Lanka and concludes with a description of the present malaria control programme in Sri Lanka, giving reference to socioreligious customs and control; issues over therapeutic referral for malaria under a pluralistic medical system; ethnopharmacology and malaria treatment; ethnicity, migration patterns, and village social traditions and how they relate to control; agricultural and irrigation practices; and river basin settlement projects and land tenure. The author concludes by calling for more complete anthropological research studies, especially on agrarian societies experiencing transition to market economies, which would greatly benefit malaria control programmes.

Bradley D. (1991) Malaria - whence and whither? In: Malaria: Waiting for the Vaccine. Targett, GAT, ed. New York, John Wiley & Sons.

In this book chapter, the author offers a quick overview of malaria control programmes. The author places the discussion within a framework of risk group vs. public health approaches. The chapter also gives excellent suggestions about the integration of economic development initiatives with public health concerns. Topics covered include lessons from past malaria control programmes; future needs for malaria control (including a "rational microepidemiology," detailed community pathogenesis, and socioeconomic understanding of malaria in small communities); and issues in control strategy and manpower. The author calls for a greater integration of the intellectual disciplines involved in malaria control, with anthropology and education playing vital roles.

Dunn FL. (1979) Behavioural aspects of the control of parasitic diseases. Bulletin of the World Health Organization*, 57, 499-512.*

Although this article is rather old and some of the information in it may be outdated, it has been quoted often and some of the suggestions about the role of the anthropologist in providing behavioural information and insight into parasitic disease control is still valid. The article provides a theoretical outline and description of the purpose and usefulness of behavioural studies in infectious disease control and the author gives excellent suggestions about how to integrate other types of research, such as economic and epidemiologic studies. Topics discussed include the intellectual discontinuity between behavioural disciplines and the physical and biomedical sciences; field methods in medical behavioural research; categories of health-related behaviour; and objectives in behavioural research (pre-programme and pro-

gramme planning; and support and evaluation of programmes). Particular diseases the author discusses and lists priorities for behavioural research include schistosomiasis, filariasis, American trypanosomiasis, African trypanosomiasis, and malaria.

Ghebreyesus TA et al (1996) Community participation in malaria control in Tigray region, Ethiopia. Acta Tropica*, 61, 145-156.*

Abstract: During the Ethiopian civil war, from 1974 to 1991, the Tigrean People's Liberation Front established a primary health care system in Tigray in which community residents helped to plan and implement health services through health committees and community health workers (CHWs). To strengthen and update this system, a Community-Based Malaria Control Programme was initiated in 1992. The primary objectives of the Programme are to reduce malaria morbidity and mortality and to prevent malaria in pregnant women through early diagnosis and treatment of cases, chemoprophylaxis during pregnancy, and vector control by environmental management. A secondary objective is to introduce a cost-sharing scheme for eventual development of a village revolving fund. A total of 681 volunteers chosen by their communities have received malaria training and serve a rural population of 1 682 319 (CHW/population ratio 1:2 500). The principal success of the programme at this stage is that a significant proportion of the rural population at risk for malaria is now being treated at the village level. During the last major transmission season from September through November 1993, each CHW treated a mean of 45 178 clinical malaria cases per month. Underutilisation of treatment services by women and children under five years and low chemoprophylaxis coverage of pregnant women have been documented. After focus-group discussions with community members and CHWs to identify the reasons for these problems, changes in programme policies were made to improve coverage of these groups. Since 1992, considerable progress toward meeting programme objectives has been made, and continued evaluation will allow for interventions that should strengthen malaria control efforts in the region.

This article is an example of how community village health workers can be used for malaria control, and how social science research can be used to understand the community and provide information for ongoing improvement of programmes. It is not so much a study as a report on activities, success, and improvements to the Community-based Malaria Control programme in Tigray region, Ethiopia, following an investigation using focus groups to discover why services were not being used. In particular, discussions were held because women and children under five were not using treatment services, and because chemoprophylaxis among pregnant women was low. The article discusses focus group findings, giving special attention to cultural norms, knowledge, and perceptions about malaria in the community. Changes were

made to the programme following the discussion groups and the changes are discussed. The authors also discuss the applicability of such a programme to areas that may not have as strong a tradition of community responsibility as the Tigray region, where feelings of community responsibility seem to be especially strong.

Heinrich M. (1985) The anthropology of malaria control. Central Issues in Anthropology*, 27-40.*

Abstract: With Mexico as example, this article discusses various problems associated with attempts to eradicate malaria. It is shown that present methods do not even provide sufficient control of the disease. It is suggested that the interaction between the eradication programme personnel and the inhabitants of the community be studied. In such future studies, emphasis should also been [sic] given to the knowledge of the people in the community about the disease, its cure, and prevention. Such studies might enable the development of a better approach to long-term malaria control.

Although this article is a bit dated, and some of the suggestions for future research have already been done, it offers interesting suggestions for how malaria control programmes can benefit from the input of social scientists in general, and from anthropologists in particular. This article gives a reinterpretation and description of malaria control from an anthropological perspective, although it is not based on any substantive research. Of special note is the author's concept of "living with" malaria versus the predominant stance of past malaria control programmes which focus on "combating" malaria. Also noteworthy is the author's emphasis that the interactions between malaria programme personnel and the inhabitants of the community be targeted for study. The author uses Mexico as a case study, beginning with a rather lengthy description of malaria control programmes in that country. Topics also discussed include the history of anti-malaria efforts worldwide; perceived reasons for lack of success of malaria control programmes (technological, administrative, and financial as well as less concrete cultural factors); and difficulties arising from the technological bias of many anti-malaria campaigns.

MacCormack CP, Lwihula G. (1983) Failure to participate in a malaria chemosuppression programme: North Mara, Tanzania. Journal of Tropical Medicine and Hygiene*, 86, 99-107.*

Abstract: A malaria prophylaxis programme for 100 000 children in one rural district of Tanzania was carried out under the very favourable conditions of 1) a gov-

ernment genuinely committed to rural public health, 2) a well organised system of village government for distribution of the drug to children, and 3) free chloroquine supplied without interruption by WHO to the project area. The project failed to suppress malaria for a combination of the following reasons. Small delays in distribution because of poor communication, vehicle breakdowns, bad roads, key people being away or too busy resulted in the drug not being available for ingestion at regular intervals. Local leaders excluded a few children from families with marginal social status. Some people were not convinced that regular chloroquine taking might prevent children's malaria and therefore saved it to treat fever in all family members. Various survey techniques were used to discover why children might refuse to swallow tablets, and as many as 28% of children complained of vomiting, as many as 56% complained of itching, and other unfavourable qualities of chloroquine were indicated.

This paper is included because it reports on the reasons for the failure of an actual programme, many of which are sociocultural in origin. The article gives a thorough discussion of the behavioural reasons within the community for the programme's failure to reduce malaria morbidity and mortality. The objectives of the investigation included: "1) to identify aspects of project organisation and function which might account for delayed, irregular, or inadequate distribution of chloroquine to children; 2) to identify children's likes and dislikes about the drug which might affect their compliance rate; 3) to identify community views about the drug which might affect compliance and regularity of distribution; and 4) to make recommendations for future malaria control programs." Village leaders, school children, children younger than school age, and mothers were interviewed using open-ended techniques and questionnaires. The authors found that the project failed to suppress malaria because of logistical difficulties of supply and distribution in a remote area. Equally important were community perceptions about the malaria pills and concern over their side-effects. Exclusion of socially marginal children was also a problem. The authors concluded that lack of understanding was not responsible for programme failure, but rather a combination of the above-named factors.

MacCormack CP. (1984) Human ecology and behaviour in malaria control in tropical Africa. Bulletin of the World Health Organization*, 62, Suppl-7.*

A thorough discussion of the interrelated factors involved in malaria control in Africa is the focus of this oft-quoted article. The emphasis here is on human behaviour in relationship to the wider landscape of malaria transmission and control. In addition to discussing where malaria programmes have gone wrong in the past, the author offers insightful suggestions for improving such programmes in the future. Topics

specifically covered in relation to malaria control include ecology and adaptation, human host versus parasite and vector; self-help strategies, and research priorities (preventing mosquitoes from feeding on humans, reducing mosquito breeding, destroying adult mosquitoes, eliminating malaria parasites from human hosts.) An excellent discussion of behavioural and cultural issues is intermingled with these broader categories. The author states that, "most abstract scientific concepts in malaria control are easy for illiterate villagers to grasp if they are presented using analogies that link the concept with African folk ideas rather than European folk ideas." The decisive point, says the author, is that people fail to accept new behaviour, not because of lack of knowledge but because the change is inconvenient, causes unwanted side-effects, or does not give readily apparent results.

Manderson L. (1998) Applying medical anthropology in the control of infectious disease. Tropical Medicine & International Health*, 3, 1020-1027.*

Abstract: This paper focuses on two roles of anthropology in the control of infectious disease. The first is in identifying and describing concerns and understandings of disease, including local knowledge of cause and treatment relevant to disease control. The second is in translating these local concerns into appropriate health interventions, for example, by providing information to be incorporated in education and communication strategies for disease control. Problems arise in control programmes with competing knowledge and value systems. Anthropology's role conventionally has been in the translation of local concepts of illness and treatment, and the adaptation of biomedical knowledge to fit local aetiologies. Medical anthropology plays an important role in examining the local context of disease diagnosis, treatment, and prevention, and the structural as well as conceptual barriers to improved health status. National (and international) public health goals, which respect local priorities, are uncommon, and generic health goals rarely coincide with specific country and community needs. The success of interventions and control programmes is moderated by local priorities and conditions, and sustainable interventions need to acknowledge and address country-specific social, economic, and political circumstances.

A review article that uses malaria as one example to support a more general theoretical framework, the focus of the paper is on the two roles of anthropology in infectious disease control: The role of identifying and defining local concerns and perceptions of disease, and the role of translating local concerns into appropriate health interventions. Included in the author's discussion are belief, anthropology, and public health; rapid anthropological assessments, local taxonomies, and aetiology; prevention of infectious disease and change of behaviour; compliance with treatment; and the political economy of disease control. The author states that the

success and sustainability of programmes depends on their ability to acknowledge and deal with country-specific social, political, and economic issues.

Okanurak K, Ruebush TK. (1996) Village-based diagnosis and treatment of malaria. Acta Tropica*, 61, 157-167.*

Abstract: Village-based volunteer workers have played an important role in malaria diagnosis and treatment in many different settings for more than 35 years. Two of these programmes stand out in terms of their size and longevity: the Volunteer Collaborator Network of Latin America and the Village Voluntary Malaria Collaborator Programme of Thailand. The success of these programmes is based on a tradition of active community participation and sustained commitment and support from the national malaria control programmes. As epidemiological conditions and programme priorities change, these programmes will have to be sufficiently flexible to keep pace. Perhaps the greatest challenge facing these single disease, vertical programmes in the future is their integration into the general health services in a manner that will preserve their best features.

This article is included in this bibliography because it gives an overview, history, and description of the strengths and weaknesses of the two oldest village malaria volunteer programmes in the world in Guatemala and Thailand. It provides a sensitive analysis of how important the local community is to the success of these programmes. The article points out the strengths and weaknesses of each programme and gives recommendations for how they could be improved. Specifically addressed in relation to both programmes are the history and administrative structure; factors responsible for the success of the programmes; problems and lessons learned; and future recommendations. The author emphasises that these programmes will need to remain flexible to keep up with the changing dynamics of malaria transmission. The greatest challenge, according to the author, will be the successful integration of this vertically oriented malaria programme into the general health services.

Ruebush TK, Weller SC, Klein RE. (1994) Qualities of an ideal volunteer community malaria worker: a comparison of the opinions of community residents and national malaria service staff. Social Science & Medicine*, 39, 123-131.*

Abstract: Since the late 1950s, most malaria surveillance and treatment in rural areas of Latin America has been carried out by networks of unpaid community malaria workers, known as Volunteer Collaborators, who are selected and supervised by staff of the national malaria services (NMS) in each country. In spite of the free and readily accessible anti malarial treatment available at these Volunteer

Collaborator posts, many residents continue to seek treatment elsewhere and in most cases take doses of anti malarials that are insufficient to cure their infections. To identify ways in which the Volunteer Collaborator network could be made more attractive to residents and to improve the process of selection of new workers, we asked community residents and Guatemalan NMS workers to rank order, according to their importance, eleven qualities or characteristics of an "ideal" volunteer malaria worker. Community residents preferred someone who is available to take care of patients at all times of the day, is a responsible person, and has a general knowledge of medicine. No significant differences were noted in the rank orders of male and female residents or literate and illiterate residents. National Malaria Service workers also preferred someone who takes care of patients at all times of the day, even when busy. In addition, they wanted individuals who recognise the importance of their work as a Volunteer Collaborator, but choosing volunteers who had a general knowledge of medicine was not important. By modifying the procedures used to select Volunteer Collaborators so as to identify candidates with the qualities preferred by residents, it should be possible to increase acceptance and improve the performance of these volunteer workers.

A novel approach for studying the problems of malaria volunteer programmes is described here. Although many attempts have been made at setting up malaria volunteer programmes, few studies have been done that target who the people themselves would like to be working as volunteers in their communities. Techniques used in this study encompassed observational data of evaluator selection, training and supervising of volunteers, and open-ended interviews of community residents and National Malaria Service (NMS) workers. The researchers found that residents' wishes for community workers included someone who is available at all times of the day, who is responsible, and who has a general knowledge of medicine. The NMS workers differed in their opinions only in that they also wanted someone who considered being a volunteer an important responsibility. The NMS workers did not consider it important for a malaria volunteer to have a general knowledge of medicine. The authors suggest that selection procedures should be changed so that people with the preferred qualities will be identified as volunteers, which should improve acceptance and performance of these workers.

Silva KT. (1997) "Public health" for whose benefit? Multiple discourses on malaria in Sri Lanka. Medical Anthropology*, 17, 195-214.*

Abstract: The malaria control policies and programmes that evolved in Sri Lanka from 1990 onward can be seen in the light of divergent discourses in relation to

this "tropical disease" on the part of the ruling elites and scientific community, nationalist leaders, leftist activists, and the peasantry in general. The "public health" concerns in malaria control were mediated and to some extent undermined by the divergent interests represented by the ruling elites on the one hand and the peasantry on the other. This analysis helps to situate the origin and development of malaria control within a colonial context. It points to the need to decolonise malariology and malaria control policies and programmes.

An interesting breakdown of the history of malaria control in Sri Lanka, seen from differing and often opposing viewpoints, is presented here. The author raises a good point in noting that malaria control should take into account past control attempts in order to be sensitive to local history, especially where colonialism was involved, and in light of this, malaria control programmes should be "decolonised." The main argument of the paper is that malaria control in Sri Lanka since the end of colonialism has not been merely a public health concern, but also a contentious issue about which the rulers and the ruled, as well as rival political groups, have all held very different opinions. The only criticism of the article is that the discussion of motivations of past leaders may be slightly simplistic. One wonders whether past leaders were as unconcerned about public health as the author implies, or perhaps political and economic expediency were such overriding concerns that public health concerns were forced to remain backstage. In any case, the author gives a thorough and convincing analysis of the political forces at play in the history of malaria control in Sri Lanka. Eras in malaria control that are defined and discussed include: the Pre-Eradication Era (1900-1944); the Eradication Era (1945-1963); and the Post-Eradication Era (1964-1990). The author also discusses the differing political viewpoints in Sri Lanka in relation to malaria control, and groups them into categories: the Colonial/Scientific Discourse, the Leftist Discourse, the Nationalist Discourse, and the Peasant Discourse. The author states that for a malaria control policy to be effective it must take into account the opposing perspectives and interests that shape both public and scientific approaches to malaria.

Wessen AF. (1986) Introduction: Resurgent malaria and the social sciences. Social Science & Medicine*, 22, iii-iv.*

An introduction to an issue of *Social Science & Medicine* dedicated to malaria, this brief piece nevertheless gives a succinct description of the problem of resurgent malaria. The author discusses the history of malaria eradication, and argues that the failure of eradication was directly related to failures at the social and organisational levels.

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