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Malaria in Urban and Peri-Urban Areas
in Sub-Saharan Africa

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by

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Patricia Billig, M.A., MPH, managed the EHP activity under which this report was produced. For the past 15 years, she has worked in public health issues as an environmental health and toxicology specialist. In 1996 she joined the Environmental Health Project as Senior Technical Director. In that capacity, she has worked with counterparts internationally on the public health aspects of developing a strategy for the control and prevention of malaria in Africa. The report on urban malaria in Africa is but one of several activities on the topic in which she has played a lead role.

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The views expressed in this document are those of the authors. No institutional endorsement by the individuals mentioned in the appendix or their institution is implied.

1 INTRODUCTION

1.1 Urbanization and Malaria Control

Until fairly recently, malaria was considered mainly a rural disease. If the disease appeared in urban areas, it was thought to have been brought in by visitors from rural areas. However, rapid growth of urban populations has led to an increased incidence of malaria in urban areas of sub-Saharan Africa, Asia, and Latin America.

Urbanization is proceeding especially rapidly in sub-Saharan Africa. It is estimated that 43% of the population in sub-Saharan Africa will live in urban areas by the year 2000. There is increasing concern that urbanization is having a significant impact on malaria epidemiology. Although formal urban development typically reduces mosquito densities, the informal development occurring in sub-Saharan Africa often simply changes the vector species composition, as has been well documented in Dar es Salaam, Tanzania; Edea, Cameroon; and Benin City, Nigeria (Feachem and Jamison 1991, Robert et al. 1993, Wagbatsoma and Ogbeide 1995). In addition, certain factors characteristic of current trends in urbanization in sub-Saharan Africa appear to favor the creation of vector breeding habitats. Densely populated communities on the periphery of cities, where most new growth takes place, have emerged in areas that were once rural. Human activities frequently remain the same as in the rural villages from which the people have migrated. Small garden plots, irrigation activities, excavation associated with building, and the nature of the housing provide vector breeding sites.

Anopheles gambiae, the primary malaria vector in Africa, for example, has been known to exploit even transient water sources. In South Asia, experience has confirmed that *An. stephensi* has adapted to breeding habitats within urban areas, specifically in water storage tanks. Some Indian cities are now considered endemic for malaria. In some cases, transmission in urban and peri-urban areas of sub-Saharan Africa is intense but seasonal, and for shorter time periods than in rural areas (Akogbeto et al. 1992).

Clearly, this evidence of changes in vector species composition and habits within densely populated urban areas suggest new possibilities for prevention and control of malaria in these areas. Cost-effective interventions may include targeted environmental management as well as appropriate case management and personal protection.

To increase understanding of the epidemiology, transmission patterns, and potential control options for malaria in these settings, the Environmental Health Project (EHP) carried out three specific tasks:

1. A review of the technical literature on urban malaria epidemiology and transmission patterns,
2. A technical consultation of experts representing key organizations interested in malaria control to discuss current knowledge of urban malaria, and
3. Preparation of a summary description of an approach used by EHP in several field projects to assess urban malaria transmission.

This report includes the products of these three tasks.

1.2 Urban Malaria Paper and Technical Consultation

The technical literature review is included in this report as Chapter 2. It was principally authored by Dr. McWilson Warren. Although many studies on urban malaria have been conducted, an overview identifying common findings or differences among these studies did not appear to be available. Review and analysis of the available data and information were needed to determine:

- The magnitude of the problem of urban malaria in sub-Saharan Africa and likely future trends,

- Transmission patterns in urban and peri-urban locations and implications for prevention and control interventions, and
- Successful malaria prevention and control strategies in urban and peri-urban locations.

Chapter 2 summarizes published work to date and some work in progress on various aspects of urban malaria in sub-Saharan Africa, including vector composition, epidemiology, transmission patterns, and potential prevention and control alternatives.

EHP convened a technical meeting of malaria experts sponsored by the U.S. Agency for International Development (USAID) in Arlington, Virginia, on February 11–12, 1999. The 27 participants included representatives from the London School of Hygiene and Tropical Medicine; CDC; WHO; the World Bank; L'Institut Français de Recherche Scientifique pour le Developpement en Cooperation, Laboratoire de Paludologie, in Dakar, Senegal; Harvard Institute for International Development; USAID; and EHP.

In full group discussions and break-out sessions, participants discussed current knowledge about malaria in urban areas of sub-Saharan Africa, the estimated magnitude of the problem, data gaps, and potential techniques and opportunities for assessing and controlling urban malaria.

Appendix A contains names and addresses of participants, the agenda, and a list of issues raised.

1.3 Rapid Assessment Approach

Based on previous experience with rapid assessments for urban malaria and input from the technical meeting, EHP summarized the potential components of a rapid assessment for malaria in urban and periurban environments. The rapid assessment approach seeks to answer three questions: (1) Is malaria present? (2) If so, is it likely of local origin? (3) What are the local transmission factors? Obtaining this information begins the process of developing effective malaria prevention and control interventions. This summary is provided as Chapter 3.

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2 A LITERATURE REVIEW OF URBAN MALARIA IN SUB-SAHARAN AFRICA

The post-World War II era has been characterized by a rapid increase in the world's population, especially in developing or lesser developed areas in Latin America, Asia, and Africa. The world population was estimated to be 3 billion in 1960, 5 billion in 1989, and is expected to reach 6 billion in 1999 (1). This rapid growth has been attributed to the "green revolution," an associated rise in food production, high fertility rates, and public health programs that increased life expectancy and reduced infant mortality.

Sub-Saharan Africa has come to epitomize this population expansion and its social, economic, and health impacts. Since World War II, African cities have grown faster than those in any other region (2).

In 1998, an estimated 624 million people lived in sub-Saharan Africa. That figure is expected to rise to 805 million in 2010 and 1,076 million in 2025 (1). How has this population growth impacted the phenomenon of urbanization in sub-Saharan Africa? In 1950, no city in the area was ranked in the top 30 of the world's metropolitan centers. By 1990, Lagos had risen to become the 22nd most populous city in the world. It is projected that by the year 2015, Lagos will be the third most populous city in the world with more than 24 million people and that Kinshasa will rank 28th with approximately 10 million (2). To give these numbers a slightly different perspective, 250 million people lived in African cities (including North Africa) in 1995. This number is expected to rise to 804 million by 2025 (3).

These startling numbers illustrate the rate of population growth in tropical Africa and the associated trend toward urbanization. However, they do not tell the whole story of the impact of population growth on health. The numbers noted above are from the estimations provided by the Population Reference Bureau (1) and the United Nations Population Fund (2, 3), and deal primarily with changes measured in traditional urban centers. However, from the point of view of health in general and malaria transmission specifically, the impact of population growth at the periphery of established cities and in "big villages" in formerly rural areas may be of equal if not greater importance. These densely populated areas may not be truly urban in the traditional sense of the word, but may have a great impact on social and public health. This may be especially true with mosquito-borne viruses such as malaria and dengue. Peri-urban agriculture activity provides efficient and frequently augmented sites for vector breeding. As long as such breeding activity is maintained, the growing population in expanding suburban and peri-urban areas will be exposed to and associated with an increased incidence of the disease.

2.1 Urbanization and Malaria

The presence of malaria in urban environments in sub-Saharan Africa presents a number of challenges, whether locally transmitted or imported from peri-urban or rural areas. Clinical cases tax the resources of hospitals, clinics, and other diagnostic and treatment facilities. In many situations, the rate of acute disease may be higher in urban populations than in peri-urban and rural areas where the levels of transmission are low due to a relatively high level of immunity (4). For example, Watts et al. called attention to the vulnerability to malaria of populations with low resistance in Lusaka, Zambia (5).

There are many reports of clinical malaria problems in urban areas. Malaria-infected expatriates with little or no immunity challenge the resources, personnel, and facilities of most urban health systems in tropical Africa (6-11). City hospitals in sub-Saharan Africa are tremendously preoccupied with malaria in children and in pregnant women. Examples of this concern are seen in reports from Kinshasa (12), Accra (13), Brazzaville (14, 15), Dakar (16, 17), and Maputo (18). Drug distribution systems, including public and private clinics and local pharmacies, play an important role in the control of malaria in these urban areas. Self-medication (19) and associated drug misuse (20) in urban areas are considered to be major contributors to the rapid spread of drug-resistant malaria in tropical Africa.

Blood banks are another source of concern. Malaria parasites in apparently healthy donors are a constant concern (21). The use of exchange transfusions as a primary approach to treating severe clinical malaria in infants and young children

has introduced another, even more profound problem—the transmission of the human immunodeficiency virus (HIV) (22).

These are only a few examples of the health care issues related to malaria in the urban environment. However, they do provide insights into the scope of the problem malaria presents to urban health delivery systems.

It was originally thought that urban areas do not support significant levels of malaria transmission. The concentration of human populations in small areas is normally accompanied by pollution and the destruction of clean water sources required by the anopheline vectors of malaria. This process usually proceeds through a predictable sequence of changes. Initially, the local population increase is associated with a continuation of agricultural practices and breeding sites for anophelines to persist or even increase in number. As the population grows, clean water breeding sites are overwhelmed with sewage and other pollutants, and anophelines can no longer develop. In many cases, these heavily populated centers expand and as one area becomes polluted, a new one with malaria vector breeding develops a short distance away. This has proven true of the *Anopheles gambiae* complex in Africa, and is the position taken by many malaria investigators with extensive experience in tropical Africa (23-28). However, the experience in south Asia has confirmed the adaptability of *An. stephensi* breeding habitats within urban areas, and some Indian cities are now considered to be endemic for malaria (29). A disturbing report by Chinery from Accra, Ghana, tells of the adaptation of *An. gambiae* to breeding in household water containers (30). Unpublished observations that describe the adaptability of *An. gambiae* to changing environments cause considerable concern. This mosquito has also been observed to develop in relatively polluted sites, even those containing household wastes. This adaptation tended to occur if clean water areas were not available (Sexton, J.D. 1999, personal communication). If this level of biologic responsiveness and potential adaptability is found in other strains of this remarkably efficient vector of malaria, conventional thinking about malaria in urban centers in sub-Saharan Africa will have to change dramatically.

The definition of urban will also have to be addressed to understand the impact of population growth and associated expansion of cities in tropical Africa on the incidence of malaria. Areas on the periphery of all major African cities have seen unparalleled growth in the last three to four decades. These densely populated areas have emerged in what was, for the most part, a classic rural environment. Human activities have frequently remained the same as those in the rural villages from which people migrated (31). Small garden plots, irrigation, and excavations related to building continue to provide breeding sites for anophelines. Infrastructure for public health is often nonexistent in these areas. As they become better established, these areas tend to become less malarious because non-polluted surface water tends to disappear as these suburbs are occupied for longer periods.

In spite of traditional thinking, cities will have to be included as part of the broad concerns about malaria control. Malaria transmission appears to take place in some urban centers under specific environmental conditions. The concept of urban should therefore include the peripheral suburbs of established cities and newly developed "big villages" in rural areas where the concentration of people expands the population at risk for acquiring malaria. Therefore, for the purposes of this review, urban will be broadly defined as any densely populated area that has defined limits. Such a definition would, of course, include refugee camps, which will remain prominent in the demographic picture of tropical Africa for some time to come. The epidemiology and control of malaria in refugee areas will not be specifically addressed in this report, but what is characteristic of peri-urban areas undergoing uncontrolled expansion may also be true of shifting populations of refugees.

2.2 Urban Malaria Transmission in Sub-Saharan Africa

Published information on urban malaria in sub-Saharan Africa is uneven and reflects areas on which European investigators have focused. Many reports imply the presence of urban transmission of malaria. Studies on placental malaria in Sierra Leone (32), maternal mortality in Mozambique (18), treatment of malaria in pregnant women in Brazzaville (33), and the relationship of malaria and birthweight in Zanzibar (34) all imply urban transmission in these areas. Numerous reports look at the incidence and clinical management of malaria and/or its cerebral manifestations in Kinshasa (35) and Brazzaville (36, 37, 15, 14), but the backgrounds of the children studied are not sufficiently detailed to confirm transmission of malaria in these cities. *In vivo* sensitivity tests have been conducted with *Plasmodium falciparum* patients

in Lusaka, Zambia (38), but whether these infections were acquired in Lusaka itself or in rural areas is not clear. Antibody studies have reported specific *P. falciparum* antigens in Kinshasa (39). A report on malaria occurring in expatriates living in Kampala, Uganda (40, 41), found that travel outside the city did not increase the risk for malaria in this population. Another report examines the role played by malaria in febrile diseases in Ouagadougou, Burkina Faso (42). Further support for urban/suburban malaria transmission has been reported from Niamey, Niger (43); Cotonou, Benin (44); Bouake, Côte d'Ivoire (45); Anantanarivo, Madagascar (46); Djibouti City (47); Lusaka, Zambia (48); and Maputo, Mozambique (49). Data from these areas are important, but further confirmation is necessary before approaches to urban malaria control can be considered. These investigations are examples of many such studies that appear in malaria-related literature from sub-Saharan Africa. As can be seen, there is frequently strong but often indirect evidence of urban transmission of malaria in large cities in the region. Most of these investigations had a primary focus other than establishing urban malaria transmission, so specific local investigations would be needed to confirm that malaria is truly endemic in these cities. These investigations would have to establish the source of infection in urban malaria and also examine travel histories (48), but this information would help establish priorities for further studies.

The studies by Trape and associates on urban malaria in Brazzaville focus on the issue of urban malaria transmission and are relevant here in spite of the fact that the work was carried out more than 10 years ago (50, 51, 52). These careful studies defined a striking variation in the level of infective bites in different areas of the city and identified *An. gambiae* as the probable vector (51). The impact of urbanization on vector density and the intensity of malaria transmission were reviewed, and the existence of malaria in the urban population of Brazzaville was confirmed through parasitologic and serologic surveys (26). The investigation reported that pernicious attacks and mortality were as common in the center of the city, which had very low transmission intensity, as in a sector with as many as 100 infective bites per person per year (52). This observation should be taken into consideration when choosing areas targeted for intervention methods such as drug distribution activities and bednet programs.

Trape also carried out an equally detailed study in Dakar (53). This investigation established that the density of *An. arabiensis* was reduced on a specific gradient from a permanent marshland breeding site, extending from the center of the city to the east. Urban transmission in the area was confirmed through entomologic, serologic, and parasitologic studies carried out by Diallo and colleagues (54, 55). More recently Karch (1992) and Coene (1993) conducted entomologic studies in Kinshasa that confirm malaria transmission in this area, six and seven years after the investigations by Trape and his colleagues reported transmission in Brazzaville across the Congo River (56, 27).

Manga and his coworkers have provided both entomologic and parasitologic data suggesting malaria transmission in Yaounde, Cameroon (57, 58). These reports are further confirmed by Fondjo et al. (59) with specific information on *An. gambiae* breeding sites and biting behavior in the same area.

Unpublished investigations by Sukwa and his colleagues on urban transmission of malaria in Kitwe, Zambia (60), were carried out in the dry and rainy seasons by Tropical Diseases Research Center (TDRC) in Ndola with technical collaboration and financial support provided by the EHP. The results confirm transmission in Kitwe and provide a pattern and format for investigations to define areas of urban transmission and evaluate control efforts.

Another aspect to consider in evaluating urban transmission is evidence of anopheline breeding in sites other than fresh water. The presence of brackish water-breeding anophelines (*An. melas* in West Africa and *An. meras* in East Africa) must be considered in any examination of the epidemiology and control of malaria in coastal urban environments.

As previously indicated, sprawling suburbs or peri-urban areas are potentially an important focus for malaria problems in densely populated regions. Such rapidly developing areas are found at the edge of every major urban center in tropical Africa. These "towns" are frequently nothing more than expanded rural areas with mosquito breeding sites that have remained unchanged during the initial stages of urban development. Many of these areas are associated with swamps, rivers, and other bodies of water that provide permanent breeding sites for malaria vectors and establish a high risk for malaria transmission. Examples of studies carried out in such areas include those by Lindsay et al. (61), Adiamah et al. (62), and Koram et al. (63) in The Gambia. Reports are also available from suburban districts of Yaounde, Cameroon (57, 59); Ouagadougou, Burkina Faso (64); a suburban area of Maputo, Mozambique (49); Niamey, Niger (43); and Dakar, Senegal (53). The

Congo River appears to serve as a breeding site for anophelines in both Brazzaville in the Republic of the Congo and Kinshasa in the Democratic Republic of the Congo. Sabetinelli has emphasized the sometimes remarkable focality of malaria transmission in urban areas in studies conducted in Ouagadougou, Burkino Faso (64).

2.3 Urban Malaria Control in Tropical Africa

Several approaches and techniques used to prevent and control malaria in rural areas may also be useful in urban settings, in addition to those developed for specific application to the urban environment. The Institute of Medicine's report on malaria suggested insecticide spraying for limited or intermittent vector control in urban or semi-urban settings where many nonimmune people live in crowded conditions surrounded by a variety of larval development sites (65). Personal protection methods including the use of impregnated bednets should be strongly considered in such situations. Coene feels that bednets would be effective in the central areas of Kinshasa where levels of transmission are low and the presence of large numbers of nuisance culicines provide a stimulus for their use. However, even a marked reduction in the inoculation rate would have little effect in the populations living in the highly endemic areas at the periphery of the city (66). The use of bednets in an urban setting was studied in Kumba Town, Cameroon, by Moyou-somo et al. (67). This report indicates that bednets reduced prevalence overall but not during the rainy season when transmission was high. These results were less impressive than those obtained in rural areas. The authors suggest that people living in urban areas have more to do at night and go to bed later. Thus, they have less time under the net than do people living in rural areas. It was proposed that impregnated curtains might be of greater benefit in urban areas. Impregnated bednets have been considered effective and feasible from a cost point of view by a number of investigators, including Desfontaine et al. and Louis et al. in Yaounde (68, 69), and Zandu et al. in Kinshasa (70).

Crook and Baptista in Maputo, Mozambique, tried the technique of impregnated wall curtains (71). The curtains lowered the biting rates of both *An. gambiae* and *An. funestus.* The results were encouraging and indicated that broader trials of this control method would be in order.

In general, the experience gained with impregnated bednets in rural areas is applicable to the control of transmission in urban environments. However, situations with urban populations and the highly variable levels of transmission from district to district will require that detailed information on a specific area be obtained before applying this method.

Larval control methods may be effective in many urban transmission areas. In central parts of cities such breeding sites may be relatively easy to identify, but the use of biologic control approaches, source reduction, and larvicides would clearly depend on local circumstances. The use of larvicides is warranted only in urban malaria situations where larval development is in discrete and readily accessible habitats (65). The variability in levels of transmission in urban areas means that each situation must be carefully evaluated before an intervention method is adopted. The considerable information that exists on the control of *Culex sp.* in urban areas should be carefully reviewed before control procedures for anophelines are considered. For example, Barbazan et al. have found that treatments with *Bacillus sphaericus* used for *Culex quinquefasciatus* can be effective for anopheline control (28).

Drug distribution programs are important in dealing with morbidity and mortality due to malaria in urban areas. As indicated earlier, the level of severe malaria may be quite high in urban centers even though transmission intensity may be low. Self-medication has been seen as an issue in at least two urban areas, Dar Es Salaam (19) and Harare (72). Although this problem is not as extensive as in rural populations, it should be considered in the design of antimalaria programs involving drug distribution programs.

The evaluation of control techniques should include continuing surveillance activities. The transmission of malaria in densely populated areas of tropical Africa is dynamic and will change naturally or as a result of control efforts.

2.4 Conclusions

Several references provide important background in considering control of urban malaria in tropical Africa. The chapter on malaria by David Bradley in *Disease and Mortality in Sub-Saharan Africa* (73) provides an elegant and insightful review of the epidemiology of malaria in this area. Other reports that provide helpful background or confirm observations by other investigators include Kolsky's

commentary on engineers and their potential contribution to urban malaria (74). Gazin provides an interesting discussion of the nature of urban versus rural malaria in sub-Saharan Africa (75). Bruce-Chwatt's article on malaria and urbanization continues to have relevance even though it was written more than 16 years ago (76). Finally, Birley and Lock's article, "Health and Peri-urban Natural Resource Production," in *Environment and Urbanization* provides some interesting insights into the development of urban resources (77).

The reports reviewed here provide strong evidence of the urban transmission of malaria in many areas of sub-Saharan Africa. However, each situation where control activities are to be considered will have to be carefully evaluated.

Operational Guidelines for Urban Malaria Scheme, prepared by Lal et al. for the National Malaria Eradication Programme in New Delhi, provides some interesting insights into the application of larval control measures in the control of urban malaria (78). Chapter 3 of this report, which follows the references on the next few pages, provides suggestions for conducting a rapid assessment.

This review does not pretend to have fully tapped the vast reservoir of published data on malaria in sub-Saharan Africa. Literature searches focused on urban malaria, but even with this constraint, the search was less than complete. This document should be considered as background for deliberations on urban malaria in tropical Africa and approaches to its control. Specific control techniques have not been discussed in detail since such information is more effectively organized and reviewed by workers currently active in malaria control programs.

Some general conclusions concerning urban malaria control in tropical Africa follow:

- Urban malaria,whether it is locally transmitted or imported, presents serious challenges to health care delivery systems.
- Urban transmission of malaria appears to be an issue of considerable importance. Available information indicates that areas such as Kinshasa, Kampala, Brazzaville, Dakar, Maputo, Kitwe, Niamey, Ouagadougou, Lusaka, and Yaounde are prime candidates for further assessment.
- Urban transmission varies markedly from district to district within a populated area. The intensity of transmission is closely associated with nearby breeding of anophelines.
- Traditional approaches to malaria control, including drug distribution, bednet programs, and source reduction, are applicable to urban areas but must be carefully selected and evaluated because of the variable epidemiology of the disease in these environments.
- Urbanization tends to reduce areas of anopheline breeding as populated areas become more established centers.

2.5 Summary

The rapid growth of urban areas in developing countries since World War II has exacerbated existing health problems and introduced a plethora of new ones. The uncontrolled growth of peri-urban populations in tropical Africa has been of particular concern because these centers are in areas endemic for malaria. Public health workers fear that these activities will, in some situations, put an even greater population at risk for malaria than was the case previously. The phenomenal growth of urban populations in sub-Saharan Africa is expected to continue at least through the first quarter of the 21st century.

Urban malaria presents a number of problems for health workers regardless of the source of the infection. Clinical cases are taxing the resources and personnel of many urban health delivery systems to and sometimes beyond the breaking point. Severe malaria, requiring sophisticated clinical management, is frequently more common in urban environments because of the low level of resistance in these less frequently exposed people. The ready availability of drugs in cities contributes to their misuse and to a worsening of the problem of resistance to malaria so well known in Africa.

It must be known if malaria transmission is occurring in urban areas before attempting any type of disease control. Traditional thinking has considered urban environments to be inimical to anopheline breeding because of the paucity of unpolluted breeding sites. Malaria transmission has been considered to be a rural rather than an urban problem. However, rapid growth in peri-urban areas has tended to superimpose a relatively dense concentration of people over an essentially rural environment. Agricultural practices which continue in peri-urban areas create breeding sites which may be responsible for production of mosquitoes in urban settings.

Because of their special geographic features, many urban centers in tropical Africa have active malaria transmission in or close to city centers for

at least part of the year. Cities built adjacent to marshy areas or along the banks of rivers continually have to deal with the problems of endemic malaria. Dakar, Yaounde, Brazzaville, Kinshasa, and Ouagadougou are only a few of such areas where local malaria transmission has been confirmed or the evidence of such activity is too strong to ignore.

The situation has grown more complicated by increasing evidence of the biologic adaptivity of members of the *Anopheles gambiae* complex to the urban environment, such as the finding of anopheline breeding in household water containers in Accra. More recently unpublished observations by experienced entomologists have indicated much broader adaptations by this mosquito species, including the capacity for larval development in relatively polluted surface water.

The conclusions are clear. Malaria constitutes a significant problem in urban areas of tropical Africa. The issues confronted in approaches to control and management require special attention. It is more than the simple transfer of a rural phenomenon to an urban environment. Many conventional control techniques are applicable to city populations. However, such an application will require new thinking, especially in terms of the effort's location, the length of the program, and the methods of evaluation. Urban malaria transmission is frequently highly focal. Control programs for such areas need extensive epidemiologic and sociologic input in planning and maintenance. Evaluation of control efforts will be critical. An approach that is found to be unproductive must be stopped quickly without further waste of valuable resources.

In conclusion, malaria undoubtedly poses a problem in urban environments in tropical Africa. These population centers are not only those identified as traditional cities but include peri-urban sprawls, the developing "big village" in previously rural areas, and the refugee camps that so frequently dominate the political landscape of sub-Saharan Africa.

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3 AN APPROACH FOR RAPID ASSESSMENT OF URBAN MALARIA

3.1 Background

3.1.1 Rapid assessment objectives

The primary objective of a rapid assessment for malaria in an urban environment is to answer sequentially three questions: (1) Is malaria present? (2) If so, is it likely of local origin? and (3) What are the local transmission factors? If the answers to Questions 1 and 2 reveal, for example, that most fevers are a result of other diseases or conditions or that actual malaria cases are not of local origin, then resources would not need to be spent investigating Question 3. If malaria is a problem, answering all three questions will provide the key information needed to begin developing effective malaria prevention and control interventions.

A secondary objective is to conduct the rapid assessment in a manner that begins to build a coalition of stakeholders that will likely be involved in developing interventions.

3.1.2 Rapid assessment techniques

Rapid assessment refers to a focused collection of epidemiological, environmental, and anthropological data and information to provide an accurate overview quickly, at low cost, and in a simple format. Information that can be useful for both assessment and planning is emphasized. By "rapid" is meant two to three months from start to finish, including 25 to 30 days in the field. Work takes place in two phases. The first phase, which is designed to assess the presence of malaria and the likelihood of local transmission, is *very* rapid—two to three weeks; the second phase, in which transmission factors are identified, takes an additional two months on average. This compares with more conventional assessments that may take a year or even more. Used appropriately, and carefully carried out, rapid assessments can result in accurate appraisals in a relatively short time.

3.1.3 EHP experience

EHP has conducted rapid assessments in two locations: Kitwe, Zambia, and Lagos, Nigeria. The Zambia assessment was intended to determine whether community-based strategies could be effective for the prevention and control of malaria in the city of Kitwe. Based on the results of the assessment, a pilot program of community efforts to reduce mosquito breeding sites is underway in selected neighborhoods.

The Nigeria assessment was conducted in Lagos in 1998 in collaboration with a program sponsored by BASICS (a USAID-funded Child Survival project) aimed at facilitating the activities of Community Partnerships for Health (CPHs), coalitions of religious, social, and occupational organizations. Several CPHs had initiated community activities for malaria prevention, but they were not based on the scientific verification of the presence of malaria or an adequate understanding of malaria in the community. The groups put a great deal of effort into cleaning up areas that they *presumed* to be breeding sites for mosquitoes, which they *presumed* were transmitting "malaria," a term used locally to describe any illness characterized by fever. The rapid assessment was used to examine these presumptions and, in fact, found that malaria was not a problem in Lagos during the dry season examination. The findings of the assessment will guide further CPH activities, including further evaluation of malaria after the rainy season. (See EHP Activity Report No. 55, "Design and Implementation of a Rapid Assessment for Malaria Control Initiative, Community Partners for Health, Lagos, Nigeria" and No. 59, "Summary of EHP Activities in Kitwe, Zambia, 1997-1999, Kitwe Urban Health Programs.")

3.1.4 Audience for the assessment overview

This brief overview of rapid assessment is intended to give persons responsible for designing malaria control programs in urban or peri-urban settings a broad understanding of assessment techniques that

can be used to gather information on which to base programming decisions. The guide is based on EHP's field experience, the experience of others, and input from international experts at an urban malaria meeting convened by USAID/EHP on February 11-12, 1999, in Arlington, Virginia. It is not a step-by-step manual for conducting an assessment. Rather, it provides a review of the process, the rationale behind it, and resources and time necessary, so that a program officer can decide if a rapid assessment would be appropriate, identify the right persons and organizations to implement it, and oversee its implementation. While most aspects of a rapid assessment, including planning considerations, are discussed, any assessment will still have to be tailored to the context of the local situation.

3.2 Assessment Overview

This overview describes in general terms the steps in the two-phase rapid assessment process. The first phase, assessing the presence of malaria and the likelihood of local transmission, involves a parasitological assessment to determine the presence of malaria along with collection of a travel history for each person sampled to assess the potential for local transmission. Concurrently, a preliminary assessment of potential anopheline breeding sites is carried out, including identification of larvae. Recommendations are made about the next steps to be taken when urban malaria is confirmed and when it is not. Phase Two activities, which lead to the design of preventive interventions, include techniques of entomological assessment, sociological/ anthropological assessment, and area mapping. Appendix B contains examples of survey instruments used in two separate rapid assessments, one in Kitwe, Zambia, and the other in Lagos, Nigeria.

3.2.1 Phase One activities: assessing the presence of malaria

Goals of Phase One activities. The goal of this phase of the assessment is to answer two questions: Is malaria present? and Is it likely of local origin? These questions are answered through a very rapid, weight-of-evidence assessment of parasitemia, associated travel histories, and the presence of anopheline breeding sites.

Site assessment and planning. After the decision to conduct a rapid assessment is made, a clinical malaria specialist and a malaria entomology specialist visit the site to gather information and make preliminary observations. Meetings with local health officials are needed to discuss the purpose and, depending upon who initiated the assessment (central agency, donor program, etc.), their potential role in implementing the assessment. At a minimum, agreements are needed with local hospitals or clinics to acquire blood samples and travel histories from potential malaria cases. In addition, information on local protocols for diagnosis and treatment of malaria, laboratory capabilities for reading blood smears, and perceptions of the magnitude of malaria are needed.

The entomology specialist meets with local entomologists, assesses seasonal considerations, identifies potential breeding sites and, if conditions are appropriate, checks for the presence of larvae. At this point, information collected may be manually displayed on the best map of the area available locally. Further mapping takes place in Phase Two, if needed, based on the start made here.

Malaria and parasitological investigations. The purpose of this component is to determine the prevalence of *Plasmodium* parasitemia and to assess the accuracy of local clinical diagnosis and laboratory practices. The basic procedure is to draw blood from a representative sample of persons with fever symptoms, most likely at a health post, clinic, or hospital, and screen the blood samples for parasite species, parasite density, and gametocytaemia through microscopy (and the possible use of a rapid dipstick method such as Parasight F). Depending on the local situation, it may be advisable to stratify the sample by age, sex, neighborhood, or other variables. The information obtained on the prevalence of parasitemia by laboratory technicians retained for the assessment is compared with the clinical and laboratory diagnosis records from local health facilities. In addition, those carrying out the parasitological assessment may visit clinics and laboratories to observe their equipment and procedures first hand. Information on clinical diagnostic and treatment practices would have been collected during the preliminary assessment. For an urban area, if 10% or more of the children under five with fever have malaria confirmed by microscopy, malaria is considered to be present in the area and further investigations regarding the locus of transmission are warranted.

Assessing the likelihood of local transmission. An assessment of the likelihood of local transmission is made based upon the brief travel histories of each person whose blood is sampled and by observing selected breeding sites to see if anopheline breeding is taking place. Travel histories are acquired by asking each person, or, in the case of children, their mothers or caretakers, the following questions:

- During the last three weeks, have you (and your child) spent the night out of town? If so, where did you go? (Clear guidance is needed for interviewers regarding what locations or boundaries separate "in town" [urban and peri-urban] from "out of town" [rural].)
- How long have you been living here in town?

The technicians drawing blood for the parasitological studies should be trained to conduct the interviews. The information about travel and mobility is used to assess likely transmission patterns: Does the malaria originate in urban or peri-urban areas or is it imported from rural areas?

Breeding sites selected for observation and larval sampling should be close to the area from which the sample for the parasitological tests was drawn.

Interpreting the results of Phase One. Using the information gathered about parasitemia, anopheline vector breeding within the confines of the urban area, and travel histories of confirmed cases, a weight-of-evidence assessment can be made as to whether or not the problem is malaria and whether or not transmission is local.

Next steps. If it is determined that malaria exists in the urban area and that transmission is likely to be taking place locally, the next step is to design a second phase of assessment activities to identify the local transmission factors so that preventive activities can be designed. On the other hand, if it turns out that urban malaria is not the problem, those conducting the assessment have a responsibility to consult with local health officials and the funding agency about the findings. It may be that further investigations must be conducted to find out what is causing the fevers that are being diagnosed and treated as malaria. Also, if there is a significant discrepancy between the results of clinical diagnosis and the microscopy conducted for the assessment, it may be that clinical practices should be reviewed. Likewise, if local microscopy results differ from those of the assessment, it may be that local laboratory procedures and equipment should be evaluated. To sum up, it is important to recommend some follow-up activities even if most local fevers are not a result of malaria.

3.2.2 Phase Two activities: identifying local transmission factors

Planning Phase Two activities. Phase Two activities focus on tools and techniques for assessing malaria epidemiology in urban areas from the point of view of:

- The disease (parasitology, clinical diagnosis, and treatment)
- The vector (entomology and environmental conditions)
- Human activities, behaviors, and knowledge (socioeconomic and behavioral)

After urban malaria has been deemed likely through Phase One activities, the shape of further assessment activities depends on the local situation: available resources, type of program anticipated, extent of the malaria problem, existence of other related activities, and so on. There is no one "right" design for Phase Two; it is up to planners to select the elements and sequence appropriate for their location.

Other aspects of planning for this phase are similar to those for planning Phase One: team planning, involvement of stakeholders and partners, ascertaining personnel and material needs, and preparation of a workplan. Throughout Phase Two, data and information collected can be added to the map begun in Phase One. This may be done manually or with the aid of computerized mapping systems (see section on mapping below).

Possible follow-up to Phase One activities. It may be advisable to carry out more extensive studies of parasitemia or travel patterns to obtain more detailed results. For example, if the parasitological assessment was carried out in the rainy season, it may be advisable to carry out another assessment in the dry season or vice versa. Or, based on Phase One results, it may be desirable to stratify future sampling or increase the sample to identify locations with the greatest number of cases or to assess the severity of the disease. Whether or not follow-up to Phase One activities is needed depends upon the questions Phase Two seeks to answer.

Entomological assessment. An entomological assessment collects information about anopheline breeding sites, the presence of anopheline mosquitoes in homes, and mosquito-human contacts. Specific techniques are used for each type of information.

Information about breeding sites is developed by taking larval samples in (1) areas identified as potential breeding sites and (2) in a sample of houses and their immediate environments. Many breeding areas in urban settings are created by human activities. Potential breeding sites include surface water, swampy areas, agricultural fields and irrigation channels, burrow pits, wells, drainage channels, water storage containers, solid waste dumps, brackish water, etc. The entomological assessment team visits areas with a high potential as breeding sites and notes their characteristics. General information about potential breeding sites and the presence of anopheline vectors will have been collected under Phase One.

Techniques used to gather the information about the location of breeding sites include review of published maps, reports, and government documents (many of which may be obtained from agencies and organizations outside the health sector), interviews with knowledgeable persons or officials, and direct observation.

An accurate identification of the species is necessary. In some areas, the mosquitoes that are a nuisance in the community may not be malaria vectors. Samples are taken of adult mosquitoes through landing catches, light-trap catches, and knock-down spray catches following carefully outlined procedures. The purpose of taking these samples is to estimate the prevalence of potential malaria vector mosquitoes and to study their indoor/outdoor behaviors and biting patterns. In homes where knock-down catches and light-trap catches are conducted, investigators may check the housing structure for the level of protection rendered by the walls, windows, and roofs.

The ecology of all identified breeding areas is described along with their amenability to various environmental control methods, including tree planting, filling, water-course shaping, draining, and general clean-up.

Sociological/anthropological assessment. The sociological/anthropological team uses both qualitative and quantitative techniques to collect information about local beliefs, perceptions, and behaviors that can form the basis of designing and implementing appropriate health education and community action against malaria. Such information includes community knowledge, attitudes, practices, beliefs, and behaviors about:

- Malaria and other fevers

- Mosquitoes and their breeding and biting
- Human activities that influence malaria transmission
- Prevention and treatment of malaria

This part of the assessment may also include information on the current costs to the household for preventing and treating malaria.

Qualitative information is obtained from those who are in the best position to provide it. For programs focusing on maternal and child health, pregnant women and mothers whose children have had malaria in the last two weeks would be a key component of the target population. In addition, health workers, neighborhood health committees, traditional healers, opinion leaders (church and political parties), and local government officials can also provide important information. Qualitative techniques include interviews and focus group discussions, examples of which are given in Appendix B. Both of these techniques offer opportunities to involve community members. For example, in Lagos, members of health coalitions played a major role in data collection by recording, collating, and summarizing data collected in focus groups.

Quantitative techniques include household surveys for malaria prevalence and knowledge, attitudes, practices, and behaviors (KAPB) regarding malaria, as well as direct observation of environmental conditions conducive to mosquito breeding. They require sampling designs that assure representativeness.

Area mapping. As mentioned, study area mapping begins during the pre-assessment visit. Its purpose is to map major features in the study area that could influence malaria occurrence and transmission patterns. Types of information collected may include:

- Natural water courses and wetlands
- Location of infrastructure with a potential impact on malaria prevention and control: markets, health facilities, laboratories, road networks, bus routes, etc.
- Water supply and drainage systems
- Solid waste dumps
- Urban agriculture or gardens

This early base map also provides an opportunity for coordinating and displaying data and information collected during the assessment and, most important, can be an informative and useful tool for identifying and planning interventions with stakeholders.

Mapping can be accomplished with a range of simple to sophisticated technologies. Recent applications of geographic information system (GIS) and global positioning system (GPS) technologies, combined with reductions in cost, have made it more practical and feasible to take advantage of the potential of mapping for health programming in developing countries. In fact, most environment and agriculture ministries in developing countries make extensive use of GIS systems for analyzing and displaying information, but the health sector is just discovering their potential.

EHP has successfully introduced computer-assisted mapping in developing country settings. Both GIS and GPS can be used to provide detailed maps of the malaria situation in the study area. The process takes place in three stages: (1) preparation of base maps, (2) incorporation of basic information collected in the preliminary assessment, (3) addition of information from the malaria, parasitological, and entomological assessments. Training local personnel in GIS to create in-country capability may be part of the mapping effort.

A GIS map can overlay information from the various parts of a rapid assessment. For example, the results of the parasitological tests to confirm malaria or clinic records of malaria prevalence can be entered on the map by highlighting households where cases of malaria are reported. This will help prioritize breeding areas targeted for destruction or identify other preventive activities. GIS can produce maps that provide a high level of detail on individual neighborhoods or other areas of concern.

Designing interventions. The information obtained through the assessment is applied to develop feasible, effective preventive interventions. The process includes:

- Recording, collating, and summarizing data
- Identifying and prioritizing risk factors for malaria
- Developing potential clinical and case management strategies
- Designing potential community actions to address risk factors

APPENDIX A: EHP Urban Malaria Meeting: February 11-12, 1999

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Agenda

Day 1 - Thursday, February 11

9:00-9:45 **Opening Remarks -** *Dennis Carroll/USAID*
Introductions
Meeting Objectives
- Information sharing between organizations
- Development of research and programmatic agendas
- Evaluating the need for and defining the characteristics of an urban malaria assessment tool
- Input for finalizing background paper
- Next steps

Agenda

9:45-10:30 **Discussion of Background Paper**
- Objectives - *Patricia Billig/EHP*
- Summary and highlights - *McWilson Warren/EHP*
- Small group discussions/reactions, issues

10:30-10:45 **Break**

10:45-12:00 **Malaria in Urban Environments: Rapidly Assessing the Situation**
(15-minute framing, followed by small group discussions)
- Vector-related issues
- Illness-related issues (e.g., urban fevers and case management)
- Social/behavioral factors

12:00 **Small Group Report Out**

12:30-1:30 **Lunch (provided)**

1:30-2:45 **Urban Malaria: Potential Implications for Prevention/Control Strategies**
(15-minute framing, followed by small group discussion)
- Health facility
- Household and community
- Ecological and environmental

2:45 **Break**

3:00 **Small Group Report Out**

3:45 **Summary of Research and Program Agenda Items**

4:00 **Identifying Resources Across Organizations**
Charting what each organization has to offer or how it could benefit from others
(current experience, approaches, and techniques in assessing and controlling urban malaria in Africa and India, and programmatic needs)
- WHO
- UNICEF
- LSTMH/Malaria Consortium
- World Bank
- CDC
- USAID

- EHP/*Pandu Wijeyaratne*
  Draft Urban Malaria Rapid Assessment Tool
  Applications in Kitwe, Zambia; and Lagos, Nigeria

5:00 Agenda for Day 2
Adjourn

6:00 Dinner at Local Restaurant

****

Day 2 - Friday, February 12

8:30-9:00 Follow-up on Cross-Organization Potential Collaboration

9:00-10:30 Small Group Discussions
- Rapid Assessment Guide
- Research Agenda
- Programmatic Agenda

10:30-10:45 Break

10:45-12:00 Small Group Report Out
- Rapid Assessment Guide
- Research Agenda
- Programmatic Agenda

12:00-12:30 Input for Finalizing Background Paper
Next Steps
Closing Remarks - *Dennis Carroll/USAID*
Meeting Evaluation

Expected Meeting Products
- Input for finalizing background paper
- Research and programmatic agenda
- Input for rapid assessment guide
- Coordinated plan for next steps

Flipchart Notes

Below are flipchart notes from full group and break-out group discussions at the meeting. The notes are divided into three topics:

Research Agenda
Programmatic Agenda
Rapid Assessment for Malaria in Urban Areas

Although these notes do not give a detailed account of all of the ideas and opinions expressed, they represent the issues that arose and topics discussed.

RESEARCH AGENDA

1. Inquiry Areas/Sectors

- Epidemiological/clinical
  - -Confirmation of urban transmission
  - -Assessing facility-based management of fevers
  - -Monitoring of resistance of parasite
- Vector biology and control
  - -Adaptation of vector to new breeding environments
  - -Resistance
  - -Assessment of different interventions and their cost-effectiveness
- Social/behavioral
  - -Household recognition and management of febrile illness
  - -Household use of treatment and preventative services
  - -Human behaviors contributing to resistance
  - -Human behaviors/contributions to transmission and spread of vectors
  - -Provider practices
- Institutional analysis
  - - Cost effectiveness
  - - Institutional capabilities

2. Specific Research Ideas

- Short-term study of confirmed malaria cases and transmission
- Resistance
  - - Parasite
  - - Molecular information
  - - Vector
  - - Assessment levels (PCR, bioassays)
  - - Contribution of human behavior (parasite and vector)
- Fever
  - - Facility-based management and diagnosis
  - - Household based recognition and management
- Cost and institutional implications of urban malaria strategy (and intermediate steps)
- Vector bionomics in the urban setting
  - -Ecology, breeding, etc.
  - -Review available information in environmental studies and assessments

PROGRAMMATIC AGENDA

1. Principles

- Urban malaria should be included in overall malaria prevention and control
- Urban malaria should be included in other urban health issues
- Urban malaria is not a health issue only, but has an important economic dimension
- Urban malaria is not the purview of the health sector alone

2. Opportunities for Collaboration

- Ranking of interventions in terms of effectiveness in different setting (e.g. bednets, drugs, IRS, larvaciding)
- Malaria control versus pest control (function of health dept. verses municipality)
- Private/public partnerships (e.g., pharmaceutical companies and private providers working on anti-malarial rational use)
- Communities need to be linked to municipalities and private sector efforts
- Convene relevant authorities for policy collaboration

3. Potential Sites

- Blantryre
- Dakar
- Bouake
- Accra
- Dar es Salaam
- Ouagadougou

4. Characteristics

- Uniform approach to allow comparison
- Include entomological, environmental, epidemiological, and social/behavioral dimensions
- Systematically include monitoring and evaluation component to build a body of knowledge

RAPID ASSESSMENT OF MALARIA IN URBAN AREAS

Organization: 1) Pre-Assessment Planning/Information Gathering
2) Very Rapid Assessment (complete within 2-3 weeks)
3) Rapid Assessment (complete within 2-3 months)

Very Rapid Assessment

1. Malaria or not?

- Stratified random blood smear sampling to achieve representativeness
- Sample symptomatic only, all ages
- Ask about travel history (how long have you lived here?, have you spent a night outside of town in the last three weeks? [based on two week incubation period])
- Is there a need to modify diagnostics? (Dipsticks may be more cost effective in urban areas if many fevers have an origin other than malaria)
- How much malaria and how severe?
- Drug treatment appropriate?

2. Locally acquired or not?

- Presence of vector breeding sites? (# of potential sites vs. sites with larvae)
- Active biting?

3. Weight of evidence analysis regarding transmission/potential control

- Travel history information?
- Presence of vectors, active biting?
- Implications for case management and diagnostics?
- Any other apparent risk factors?
- Potential control options?

4. Potential Scenarios

- Most malaria acquired outside of urban area **ö** case management is the priority
- Urban area built on breeding areas/perhaps clustered in certain locations **ö** combination of case management, personal protection and environmental management may be most effective

APPENDIX B: Sample Questionnaires and Survey Documents

MALARIA RAPID ASSESSMENT
FOCUS GROUP GUIDE

Greetings. Thank you for sparing your time to be with us. Today we would like to discuss some of your common experiences with illness. Please feel free to share your thoughts. We hope everyone will give his/her ideas. There are no right or wrong answers.

A. RECOGNITION OF MALARIA

1. What are some of the most common illnesses that people suffer from in this community?
2. What illnesses are associated with hot body/high body temperature?
3. What illnesses are associated with body pain/joint pain?
4. How can you know if someone has malaria/*iba*/fever - the common signs and symptoms?
5. Normally, how long do these different signs and symptoms usually last?
   How long before a person feels well again?
6. What different types of malaria/*iba*/fever do you know?
   For each type, please give the signs and symptoms.
   Which of these are the most common types?
   How often in a year do people get malaria?
   What time(s) of the year is malaria/*iba*/fever most common?
7. How serious an illness is malaria/*iba*/fever? Please explain your answers.
   Of the different types we have mentioned, are some types of malaria more serious than others?
   Explain which ones and why.
8. Is there any difference between malaria in children and malaria in adults? Please explain your answers. (Ask about types, seriousness, duration)
9. From our discussion so far, what group(s) of people would you say are most affected by malaria and why?

B. CAUSE/MOSQUITOES

1. What do you think causes malaria?
2. For the different types of malaria we have discussed, what are the causes of each type? (Use names of types mentioned above. Ask about each, one by one.)
3. What causes malaria to be more severe/serious?
4. What causes malaria to last longer?
5. Are you aware of any insects that can carry diseases?
   If yes, which insects?
6. Generally in this community, what do people think about mosquitoes?
7. Are there different types of mosquitoes?
   If yes, what types - names, descriptions and other characteristics of note?
8. Are there any illnesses/diseases associated with mosquitoes?
   If yes, list these.
9. Where do mosquitoes usually come from?
   (Or - Where do we usually find mosquitoes in this community?)
10. What times of day do we usually find that mosquitoes are active and biting people?.
11. What do people in this community usually do to prevent mosquito bites and control their spread?

12. Among the different ways of controlling mosquitoes (what do people use), ...
    Which do people like best and why?
    Which do they like least and why?
    Which methods are most commonly used?
13. What do people know about *tanwiji/tanwili* (mosquito larvae)?
    Where are they found?
    What do they do?
    Can they cause any harm?
    What do they become?

C. PREVENTION

1. Generally, what can be done to reduce the level of malaria in this community?
   What has actually been done?
2. Specifically, what can you do to be sure that you and your family members do not get malaria?
   What have you actually done?
3. (For each method mentioned - ask)
   What is good about the method and what are the problems?
4. Are bed nets available for sale in this community?
   If yes, where have you seen them sold?
   About how much do they cost?
5. What do you think about sleeping under a bed net?
   What have been your own experiences?
   Would you recommend bed nets to others?
   Why/why not?

D. TREATMENT

1. What are the different treatments that people in this community use for malaria?
   (ask specifically for the treatments used for **each** type of malaria mentioned in Section A.)
2. Is the treatment for malaria different for children and adults?
   If yes, please explain.
3. Apart from drugs (tablets, *agbo*, local, oyinbo, etc.), what other forms of malaria care/treatment (*itoju*) do people use?
4. Among all the different types of malaria care/treatment that you have seen and tried, which are most effective and which are least effective?
   Please explain you answers.
5. Among the different herbal medicines that people try, which are the most effective? Why?
   (Consider the different types of malaria mentioned.)
   What do they actually do to help the people?
   How do they work?
6. Among all the different tablets and *oyinbo* medicines that people try for malaria, which are most effective?
   Why? (consider the different types of malaria)
   What do they actually do to help people?
   How do they work?
7. There are different places that people find treatment for malaria including treatment right at home, treatment from an herbalist, treatment from a drug shop/chemist, treatment from a government hospital/clinic and treatment from a private hospital/clinic. Are you aware of any other places that people go?
   a. Among the different places that people can find malaria treatment in this community, which is usually their first choice?
      Please explain why.
   b. Among the different places, which do they like least?
      Please explain your answer.

TROPICAL DISEASES RESEARCH CENTRE NDOLA
KITWE URBAN HEALTH PROJECT

November 1997

Area _____ Clinic Name _____

Date _____

Time arrived at facility _____ Time departed facility _____

Time starting interview _____

Interviewer Code , ,

Supervisor's Signature _____

Result Code
1 Completed
2 Partially completeed
(Specify reason _____)

SECTION 1. FAMILY DEMOGRAPHIC DATA

1. Respondent's name _____

2. Home address _____

3. Identification number , , ,

4. Sex ,
1 Male
2 Female

5. Age (Code in years) ,

6. Marital Status ,
1 Single
2 Married
3 Divorced
4 Widowed
5 Separated

7. Level of education ,
   1 Never been to school
   2 Primary not completed
   3 Primary
   4 Junior Secondary
   5 Senior Secondary
   6 College/University

8. Occupation ,
   1 Trader/sales
   2 Clerical/General worker
   3 Professional/Administrative
   4 Knitting/Sewing
   5 Self employed/Unemployed
   6 Housewife
   7 Other (Specify _____)

9. What is your religion? ,
   1 Protestant
   2 Catholic
   3 Muslim
   4 Traditional
   5 Other (Specify _____)

10. What is the total number of children in the home? , ,

11. Total number of children under five years in the home? , ,

12. What is the relationship with the child? ,
   1 Own child
   2 Niece/Nephew
   3 Grandchild
   4 Other (Specify _____)

13. How long have you lived with child? ,
   1 Since birth
   2 Less that one month
   3 Over 1 year
   4 Other (Specify _____)

SECTION 2. MIGRATION

14. How old is the child?
(Code only one of the age-measurement)

Days , ,

Weeks , ,

Months , ,

15. Where was this child born? ,
1 Same city
2 Other urban
3 Rural area
4 Other country

16. How long has this child lived in this city? ,
1 Since birth
2 Less than one month
3 More than one month
4 Other (Specify _____)

17. Where was this child before? ,
1 Within Copperbelt - urban
2 Within Copperbelt - rural
3 Other provinces - urban
4 Other provinces - rural
5 Outside Zambia
9 N/A

18. Why is this child in this city? ,
1 Lives here
2 Visiting - Skip to Question 32
3 Family moved
4 Other (Specify _____)

19. Has this child ever made a trip outside this city the last 21 days? ,
1 Yes
2 No - *Skip to Question 32*
9 N/A

20. If yes, how many days was the child away from this city in the last 21 days? , ,
99 N/A

21. Where did the child go? ,
    1 Within the Coperbelt province - urban
    2 Within the Coperbelt province - rural
    3 Other provinces - urban
    4 Other provinces - rural
    5 Outside Zambia
    9 N/A

22. On the trip(s) this child made outside this city in the last 21 days, did he/she spend nights at some point before getting to the destination? ,
    1 Yes
    2 No - *Skip to Question 26*
    9 N/A

23. If yes, where was it? ,
    1 Within the Coperbelt province - urban
    2 Within the Coperbelt province - rural
    3 Other provinces - urban
    4 Other provinces - rural
    5 Outside Zambia
    9 N/A

24. What was the reason for the stop over? ,
    1 Child had malaria
    2 Visiting friends/relatives
    3 Business
    4 Other (Specify _____)
    9 N/A

25. How long did the child stay at the final destination? , , days
    99 N/A

26. Where did the child stay at the final destination? Specify _____ ,
    1 Urban low-density areas
    2 Urban medium-density areas
    3 Urban high-density areas
    4 Boma/rural
    5 Village
    9 N/A

27. Did the child suffer from malaria at the destination point? ,
    1 Yes
    2 No
    9 N/A

28. Were the following facilities available at the final destination? ,
(Read out and circle the easily accessible facility - one response only.)
1 Clinic/Hospital
2 Traditional Healer
3 Herbalist
4 Medical personnel
9 N/A

29. On the child's way back from _____did he/she make any stops? ,
1 Yes
2 No - *Skip to Question 32*
9 N/A

30. If yes, was it? ,
1 Within the Coperbelt province - urban
2 Within the Coperbelt province - rural
3 Other provinces - urban
4 Other provinces - rural
5 Outside Zambia
9 N/A

31. Is there a reason why the child made a stop on the way back? ,
1 Child had malaria
2 Visiting friends/relatives
3 Business
4 Other
9 N/A

32. Have you ever received a visitor from outside this city who had malaria? ,
1 Yes
2 No - *Skip to Section 3*

33. If yes, how long ago? ,
1 3 weeks ago
2 1-6 months ago
3 Over 6 months ago
4 Other (Specify _____)
9 N/A

34. Where did he/she come from? ,
1 Within the Coperbelt province - urban
2 Within the Coperbelt province - rural
3 Other provinces - urban
4 Other provinces - rural
5 Outside Zambia
9 N/A

SECTION 3. KNOWLEDGE ABOUT MALARIA

35. What symptoms are associated with malaria? ,
(Write exactly as respondent states.)

_____

_____

_____

36. What causes malaria? ,

_____

_____

_____

37. Has this child ever suffered from malaria before? ,
1 Yes
2 No
3 First episode - *Skip to Question 39*
4 Don't know

38. If yes, how long ago? ,
1 2 weeks
2 2-4 weeks
3 1-6 months
4 Other (Specify _____)
9 N/A

39. What was the first action that you took when you suspected that the child had malaria? ,
1 Went to the Hospital/Clinic
2 Went to the Traditional Healer
3 Bought medicine/used medicine at home
4 Other (Specify _____)

40. What was the reason for the action in Question 39? ,

_____

_____

_____

41. Are there any other treatment measures that you have seen or heard of for treatment of malaria in the home? ,
    1 Yes
    2 No - *Skip to Question 43*

42. If yes, specify ,

    _____

    _____

    _____

43. After how long can a person with malaria not receiving malaria treatment die of malaria? ,
    1 Days
    2 Weeks
    3 Months
    4 Hours
    5 Years
    6 Don't know
    7 Other (Specify _____)

44. What do you do when malaria treatment fails in children? ,
    1 Take the child back to the Hospital/Clinic
    2 Go to traditional healer/Herbalist
    3 Sit at home
    4 Buy medicine
    5 Other (Specify _____)

END OF INTERVIEW

TIME END OF INTERVIEW _____