

THE
CARTER CENTER



Waging Peace. Fighting Disease. Building Hope.

**2007 Summary
Malaria Program
The Carter Center
Atlanta, GA**

October 2008



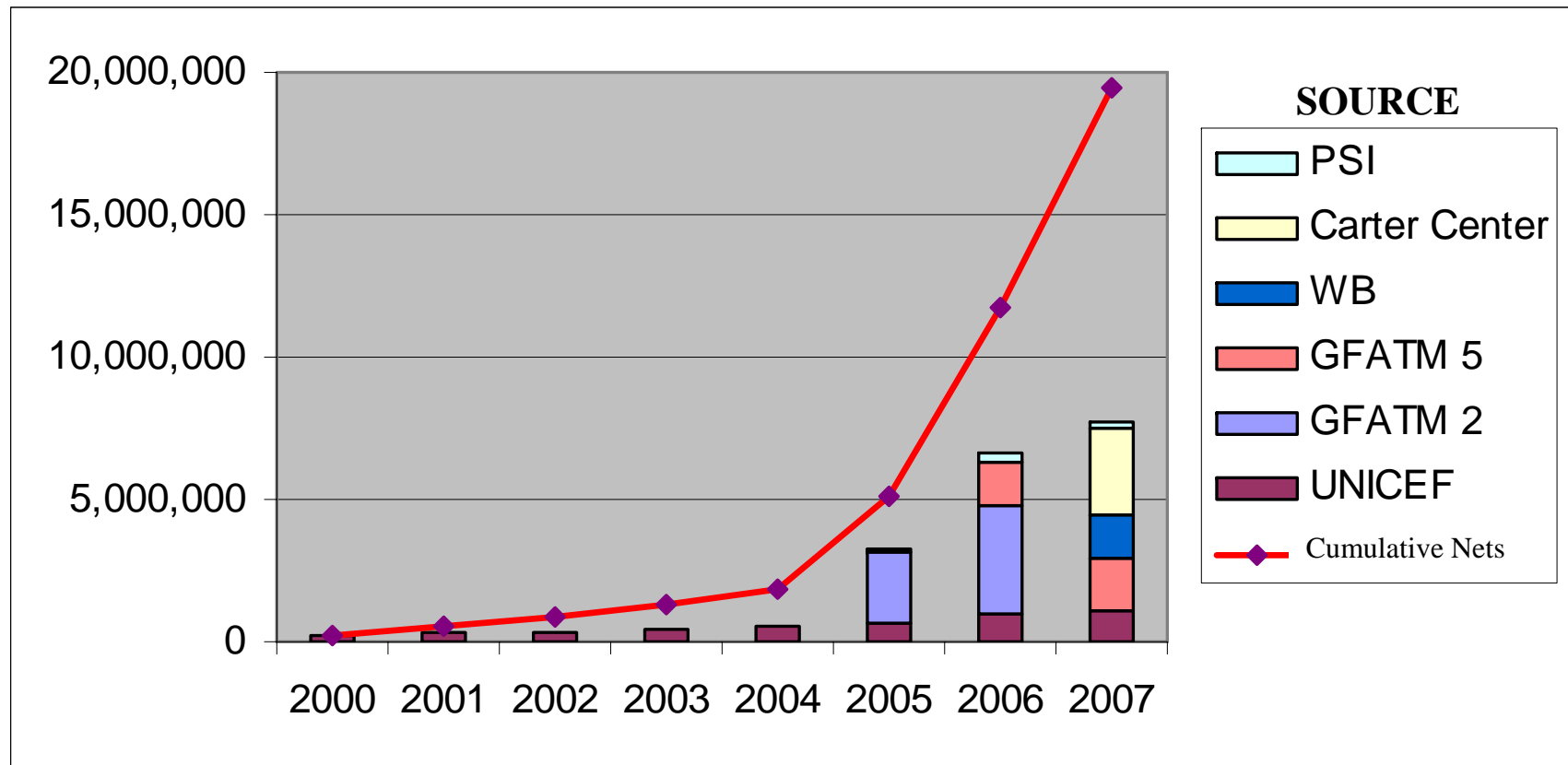
Amhara, Ethiopia: A family enjoying their new long-lasting insecticidal net. (Louise Gubb, May 2007)

The following is the first summary of the Carter Center's Malaria Control Program initiated in 2006 which includes the story of the distribution of over three million long lasting insecticidal nets, such as the one shown above, in Ethiopia in 2007.

The Carter Center Assisted Malaria Control Program Ethiopia & Nigeria



Fig. 1 Ethiopia: Cumulative Provision of Long-Lasting Insecticidal Nets by Source 2000-2007



Legend: PSI - Population Services International; WB -World Bank. GFATM 5 - Global Fund for AIDS, TB and Malaria Round 5 funding. GFATM 2 - Global Fund for AIDS, TB and Malaria Round 2 funding. *Source: UNICEF Ethiopia, with permission.*

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INTRODUCTION AND OVERVIEW

Malaria is a parasitic disease caused by the single celled organism *Plasmodium* which infects the human liver and red blood cells. It is transmitted from person to person by bite of the *Anopheles* mosquito which bites only at night. The typical intermittent fevers of malaria are caused by the repeated cycles of replication of parasites inside red blood cells, which then rupture releasing parasites into the blood stream to reinvade other cells. Repeated malaria infections lead to severe anemia, especially in children and pregnant women. There are four species of human malaria: *Plasmodium falciparum*, *P.vivax*, *P.malariae* and *P.ovale*, of which *P. falciparum* causes the most severe disease. Malaria is preventable and treatments are effective if sought early and full-courses of appropriate drugs are used. So, there is no reason why anyone should die from malaria.

Approximately 90 percent of the one million deaths from malaria each year occur in Africa. Twenty percent of all deaths in African children under-five years of age are thought to be due to malaria, and overall malaria constitutes 10 percent of the continent's disease burden. Malaria impacts individuals and, in turn, communities and countries. Malaria infection in adulthood is not usually fatal if the patient has some acquired immunity; however serious illness from malaria typically takes place during the late rainy seasons which coincide with peak agricultural productivity. Malaria infection therefore leads to reduced agricultural output. Highly malarious countries are among the very poorest in the world, and typically have very low rates of economic growth.

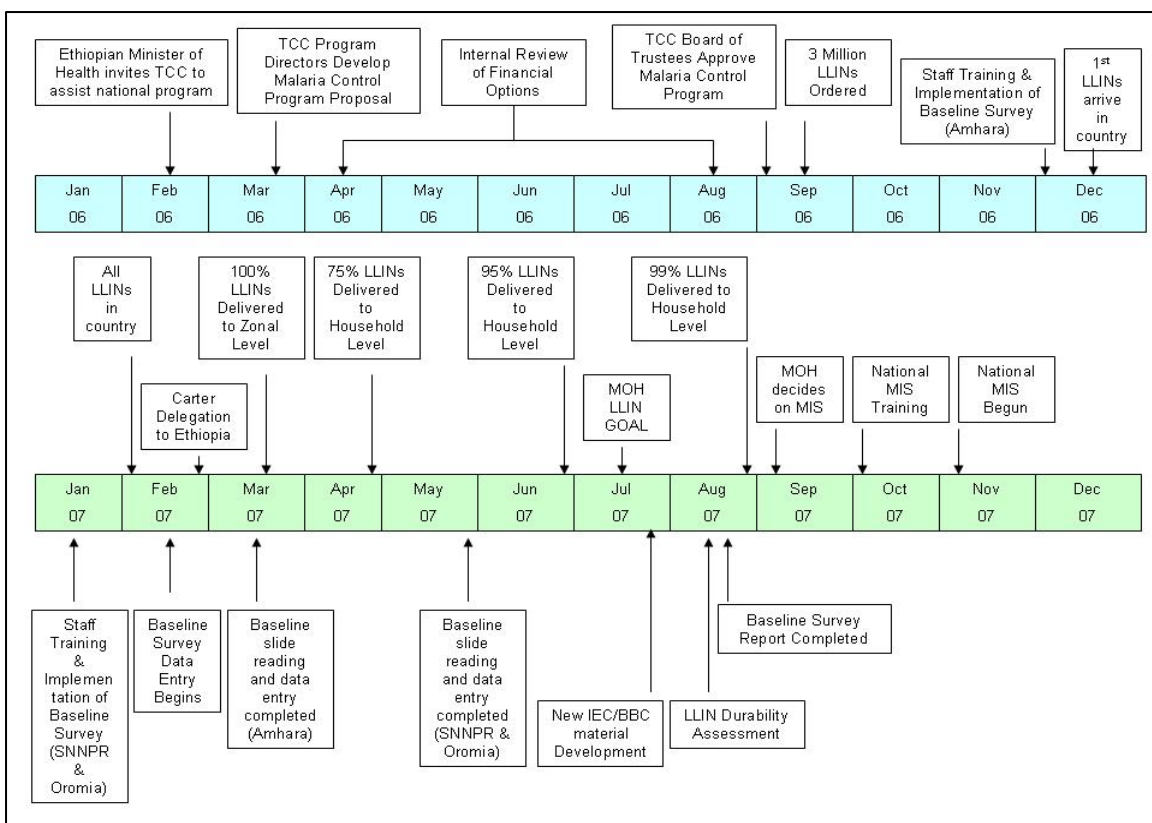
The Carter Center's involvement in malaria control grew from the idea of integrating control of malaria with lymphatic filariasis elimination in Nigeria¹. In Africa, the same anopheline mosquitoes that transmit lymphatic filariasis also transmit malaria. Insecticide treated nets are one of the most important prevention tools for malaria and should also be useful as an adjunct to annual mass drug administration (MDA) in the filariasis elimination program. With this in mind, The Carter Center partnered with the Nigerian Ministry of Health and linked net distribution with MDA programs for lymphatic filariasis (LF) on a pilot basis, based on the theory that shared resources should result in cost reductions and that protection from the mosquito vectors would reduce transmission of both diseases simultaneously.

A dedicated Malaria Program at The Carter Center was launched in Ethiopia in February 2006. The Ethiopian Minister of Health, Dr. Tedros Adhanom Ghebreyesus, invited The Carter Center to join his country's national effort to provide protection to all 50 million Ethiopians at-risk for malaria through an ambitious plan to distribute long lasting insecticidal nets (LLINs) throughout all malarious areas by the end of 2007. The Carter Center was also asked to help in national efforts to monitor and evaluate the progress and success of the national control program itself. In September of 2006, The Carter Center's Board of Trustees approved the Center's Malaria Program to be launched in Ethiopia. The program builds on existing Carter Center programmatic networks in parts of Ethiopia while working closely with the Ministry of Health's extensive malaria control program at national, regional and local levels.

¹ Blackburn et al, Am J Trop Med Hyg 75(4); 650-655, 2004

The program timeline for 2006-2007 (Fig 2) shows the important steps taken within the first two years to establish and launch the Center’s Malaria Program. The timeline displays the speed at which the Center accepted and acted upon the invitation from the Ethiopian Federal Minister of Health to join their national malaria control campaign. Within 7 months of the Minister’s request, the Carter Center had the initiative approved by the Board of Trustees and had identified the financial resources needed to purchase three million LLINs. After the first of these LLINs arrived in Ethiopia in December 2006, it took our country-based staff only eight months to achieve full delivery to the household level in the three largest regions of Amhara, Oromia and SNNPR, with focus on areas where we already had programs working on onchocerciasis and trachoma. (For information on these two diseases, see Annex 1.)

**Fig 2. The Carter Center Malaria assisted Control Program Timeline
January 2006-December 2007**



Our program staff also began working immediately on how to identify efficient ways to integrate malaria into our work with the onchocerciasis and trachoma programs. Within eleven months of the Malaria Program’s creation, staff were creating new materials and establishing training based upon an integrated approach. We also assessed the compatibility of the drug distribution network in onchocerciasis endemic areas with malaria prevention message dissemination needs. Other main accomplishments in Ethiopia have been the completion of two large household surveys of malaria prevalence, mosquito net coverage and net use. The first of these surveys was integrated with a trachoma survey in Amhara region. In addition, new health educational materials on malaria have been developed and produced for training community workers on key

messages, and a system to evaluate the durability of LLINs has been put in place in collaboration with the Centers for Disease Control and Prevention (CDC). The key next steps are: 1) to fully integrate the delivery of malaria prevention messages with those of other diseases delivered by community workers, 2) to determine how community workers can help the malaria program, and 3) to assist the Government of Ethiopia with overall monitoring and evaluation of the malaria program by improving malaria surveillance in Carter Center assisted areas.

In addition to the Ethiopia program, collaborations involving program integration have been extended to Nigeria. The Carter Center has partnered with the Nigerian Ministry of Health (MOH) since 2004 to distribute 207, 000 LLINs free of charge in eight Local Government Areas (LGAs) in Plateau and Nasarawa states in central Nigeria. This was achieved through the efforts of state and local MOH personnel, utilizing volunteer village health workers active in the LF, MDA, and other programs.

We have also initiated a combined filariasis/malaria LLIN intervention in four local government areas in two South-East States of Nigeria, Imo and Ebonyi. Malaria outcomes are included in a study funded by the Bill & Melinda Gates Foundation to determine whether LLIN (given either to cover all sleeping spaces, or to vulnerable groups only) can interrupt LF transmission, in areas where mass drug administration (MDA) for lymphatic filariasis cannot be given due to the presence of *Loa loa*, which can cause severe adverse affects when MDA for LF is implemented. We successfully completed a household baseline survey for malaria, anemia and net coverage in the four LGA study areas (including the filariasis sentinel sites where intensive parasitological and entomological studies are being done). The key next steps are the distribution of 200,000 LLIN in the four areas, and the completion of a follow-up household survey of net coverage and malaria prevalence in 2008.



Amhara, Ethiopia: An LLIN neatly gathered above a bed. (Dr. Steve Smith, September 2007)

ETHIOPIA

Country background

Malaria transmission in Ethiopia is seasonal and unstable. The transmission patterns and intensity vary greatly over the country due to the large diversity in altitude, rainfall and population movement. In most malaria-endemic countries, children aged < 5 years and pregnant women are most vulnerable to malaria, as others have sufficient protective immunity. However Ethiopia is prone to periodic epidemics which can have a profound impact on people of all ages. Due to the unstable transmission and lack of acquired immunity, older children and adults are also at high risk of severe disease or death. Annually, around 4-6 million clinical malaria cases are reported from health facilities. Malaria has been reported as the leading cause of morbidity and mortality, accounting for about 17% of the total out-patient visits, 15% of the total admissions and 29% of the deaths in 2005.

Controlling malaria is the Ethiopian Minister of Health's number one priority. The national program's goals are 1) vector control to reduce malaria transmission, and 2) prompt diagnosis and treatment. These will be accomplished by an aggressive comprehensive malaria control program that includes provision of long-lasting insecticidal nets (LLINs) to the estimated 50 million persons at risk of malaria in Ethiopia by July 2007, selective indoor residual spraying with DDT and other insecticides, and increased availability of diagnosis and treatment with artemisinin combination therapy through a new network of health extension workers.

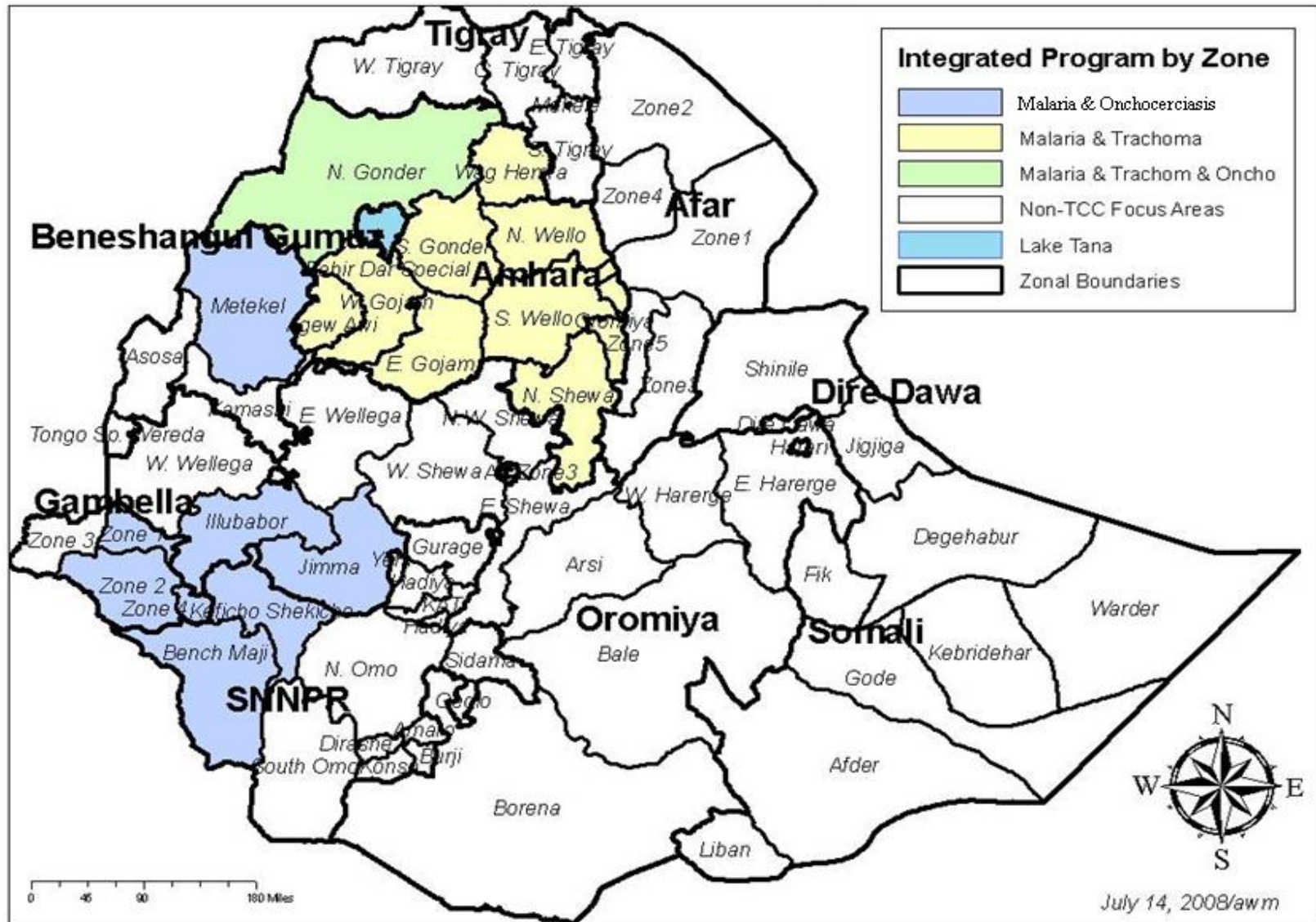
In its partnering with the Ministry of Health (MOH), the Center's Assisted Malaria Control Program established the following goals:

Goal 1: Through integrated programming, achieve a mean of 2 LLIN per household in the project areas and help the MOH achieve a 50% reduction in cases of malaria by the end of year 2010 (compared to the baseline level of 2005).

Goal 2: Assist the Ethiopian Federal Ministry of Health in the monitoring and evaluation (M and E) of the progress and impact of the national program.

To help accomplish these goals, The Center and the MOH conceived of two malaria integration strategies in areas assisted by the Carter Center in Ethiopia: one in river blindness areas (malaria plus onchocerciasis, known as MALONCHO) and the other in trachoma areas (malaria plus trachoma, MALTRA). Since malaria is present in all of the zones where we currently work on onchocerciasis and trachoma in Ethiopia (see map, page 5), the project builds on already existing program structures. The integrated project strategies are coordinated through the collaborative efforts of The Carter Center, Regional Health Bureaus, Zonal Health Departments and Woreda Health Offices. Both would use village-based already existing health infrastructures with Carter Center assistance, so that malaria control is integrated within a multiple disease intervention package.

The Carter Center Integrated Control Programs-Ethiopia



MALONCHO

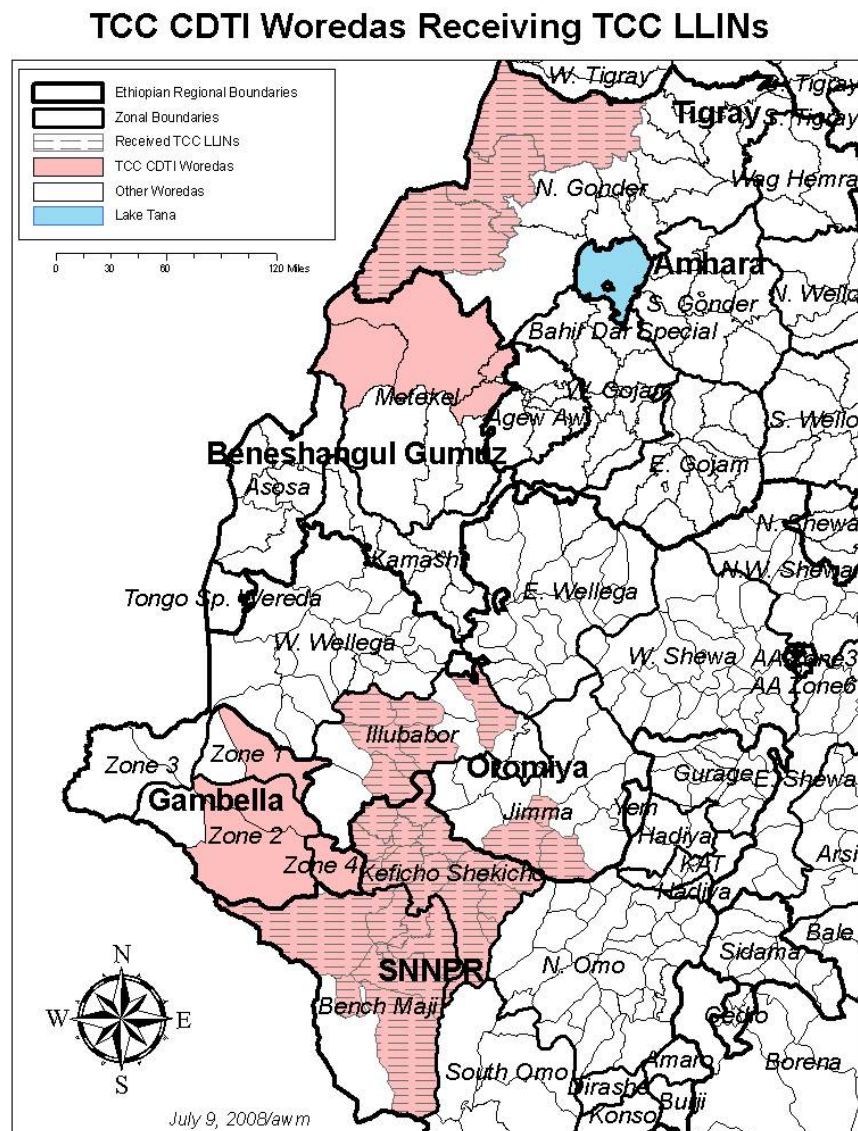
The MALONCHO program is currently operating in four zones (Illubabor, Jimma, Kaffa Sheka, and Bench Maji of Oromia and SNNPR regions) with recent expansion into three more areas (Metekel zone of Beneshangul Gumuz region, three zones in Gambella region and North Gondar zone in Amhara Region) for a total population of about 3.1 million.

The program aims to create strong supportive links between the established community directed treatment with ivermectin* (CDTI) approach of the onchocerciasis control program on the one hand, and preventive health messages and activities for reducing risk to malaria in Ethiopia on the other. The

program is organized on a district by district (woreda) basis.

The CDTI program format uses community identified distributors as the key players in assisting the importation and acceptance of health messages and activities to communities. An integrated approach to malaria and onchocerciasis can profit from the two opportunities for community interaction:

- 1) Household registration and
- 2) Drug (ivermectin*) distribution.



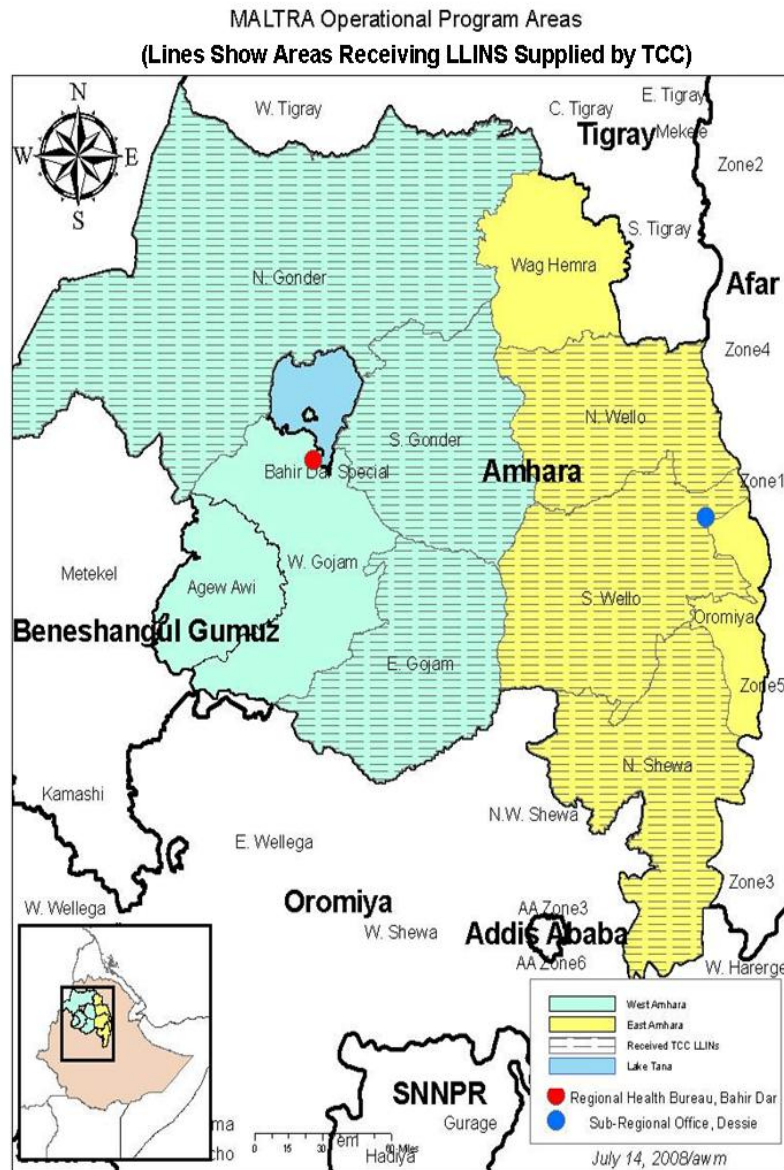
* Ivermectin (Mectizan®) is donated by Merck & Co. See Annex 1.

MALTRA

The MALTRA program is taking place within all 10 zones of the region of Amhara which have been divided into two operational areas (West and East Amhara) with a total population of around 20 million.

The regional MALTRA coordination office is located in the state capital, and seat of the Regional Health Bureau, Bahir Dar. There are an additional 10 zonal project coordinators assigned to provide technical and logistic support to the respective zonal health departments. A sub-regional office in Dessie coordinates activities in the five eastern zones of the region.

MALTRA training for community volunteers and teachers, woreda health offices and health extension workers is conducted via a cascade approach with the training of trainers co-ordinated by Carter Center staff. It is anticipated that starting in October 2008 there will be two “MALTRA weeks” in Amhara per year: one in October for West Amhara and the second in April for East Amhara. During these “MALTRA weeks” there will be saturation coverage with health education messages via mass media, schools, and health workers with a massive mobilization of azithromycin* distribution and health promotion messaging.



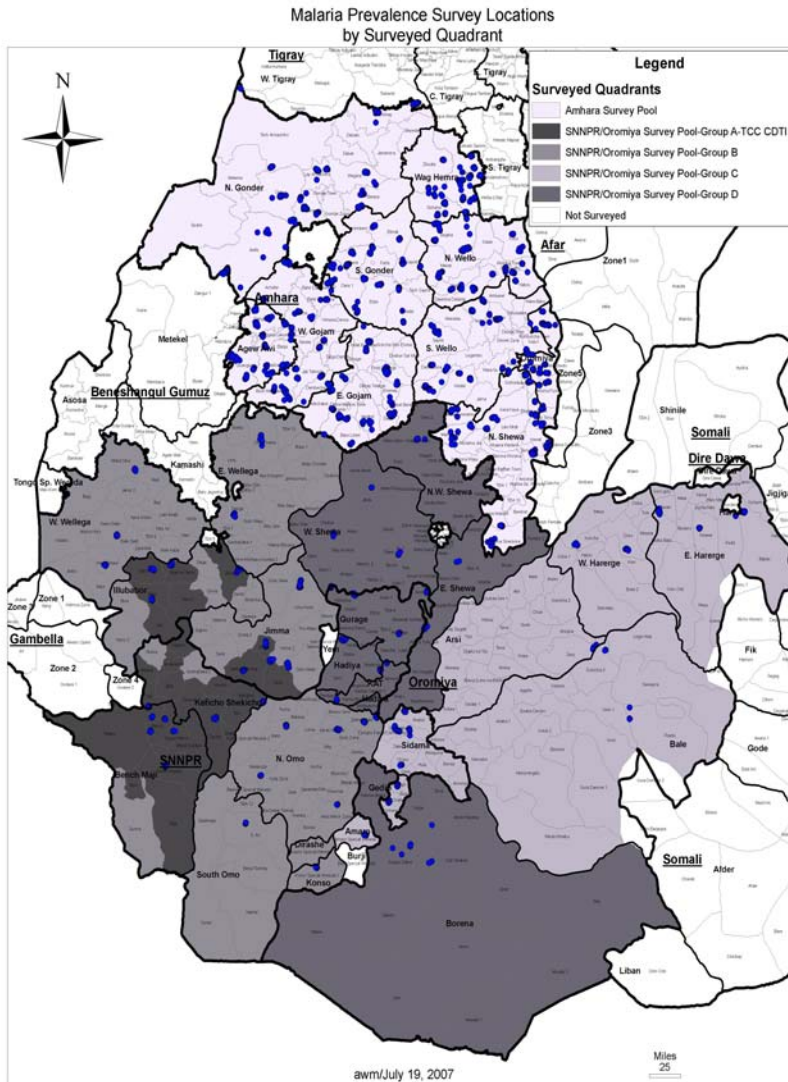
* *Azithromycin (Zithromax®)* is donated by Pfizer. See Annex 1.

Goal One Activities:

Baseline household survey: A survey of 5,708 households (28,994 individuals) was conducted between November 2006 and January 2007 to establish baseline data on 1) coverage of LLINs, untreated mosquito nets and indoor residual spraying, 2) prevalence of malaria parasitaemia in all age groups, 3) (in Amhara) prevalence of trachoma in all age groups, and 4) socio-economic indicators.

Blood slides from 11,601 people estimated the overall prevalence of malaria infection to be 4.1%. The highest prevalence of 5.4% was in SNNPR, followed by Amhara at 4.6%, with lowest prevalence of 0.9% in Oromia. Overall, 37% of households possessed at least one mosquito net and 20% owned at least one LLIN. The mean number of nets of any type and LLINs was 0.6 and 0.3 per household respectively. Overall, 28% of people of all ages slept under a net on the night before the survey and 15% slept under an LLIN. The proportions were slightly higher for under-five-year-olds (32% net and 17% LLIN) and pregnant women (36% net; 19% LLIN).

Five peer-reviewed scientific papers have been published or submitted for publication from this survey and the abstracts can be found in the Annex 2 of this document. A full summary of this report can be reviewed at: www.cartercenter.org/news/publications/health/malaria_publications/malaria_program_reports.html



LLIN Distribution: Working in partnership with the FMOH of Ethiopia, the Center purchased and distributed three million LLINs in three regions (Amhara, Oromia and SNNPR) in 2007. Of these, 2,011,000 LLINs went to households within areas where we have primary programmatic interest. Amhara region received 1.26 million LLINs in the zones of E. Gojam (315,775), S. Gondar (220,454), N. Gondar (110,551), S. Wollo (367,944), N. Wollo (132,309) and N. Shoa (112,967). Oromia region received 990,000, of which 467,607 were in CDTI zones of Jimma and Illubabor. SNNPR received 750,000, of which 284,000 were in CDTI zones of Kaffa, Sheka and Bench Maji. Additionally, the Center provided approximately 989,000 LLINs and funding for their distribution to the MOH for distribution in other parts of Oromia and SNNPR regions.

In all these areas, staff and MOH colleagues at local administrative levels distributed the LLINs from various locations (health centers, community halls, schools, market places) to previously registered heads of households. Whereas the guidelines for interpreting “average of 2 LLINs per household” was left to local governments, in most cases, a house hold with fewer than five persons received one LLIN and households with five or more received two. The rapid scale up of net distribution and the extent of The Carter Center’s contribution to filling the net gap in Ethiopia can be seen in the figure on Page iv of this summary.



Community Mobilization, LLIN Distribution, Jimma, Ethiopia, Aryc Mosher, April 2007

Behavior Change Communication (BCC): Before the delivery of the LLINs, the Center understood the need to develop behavior change communication messages that educated malaria at-risk populations regarding the care and use of LLINs. First we assessed past knowledge, attitudes and practice surveys in Ethiopia, which showed that although the malaria control program has been on-going for many years, there still exist many misconceptions regarding the transmission of malaria and how one can avoid becoming infected. Some of these misunderstandings were that malaria results from poor eating, getting wet or too much sun; that nets only need to be used for part of the year; or that nets do not prevent malaria because mosquitoes bite during the day as well.

The Center used the information to develop ‘do-able messages’ on malaria prevention for householders, with additional background information for community workers. Four messages were chosen for implementation in the first year. Since the specific target population will be the households receiving the LLINS, the messages needed to be actions that could be carried out by the heads of households.

They are as follows:

- 1) Sleep under an LLIN every night.
- 2) Give priority for LLINs to pregnant women and children <5 years.
- 3) Properly hang and care (wash and mend) for your LLIN.
- 4) Seek prompt medical attention for all febrile illness.

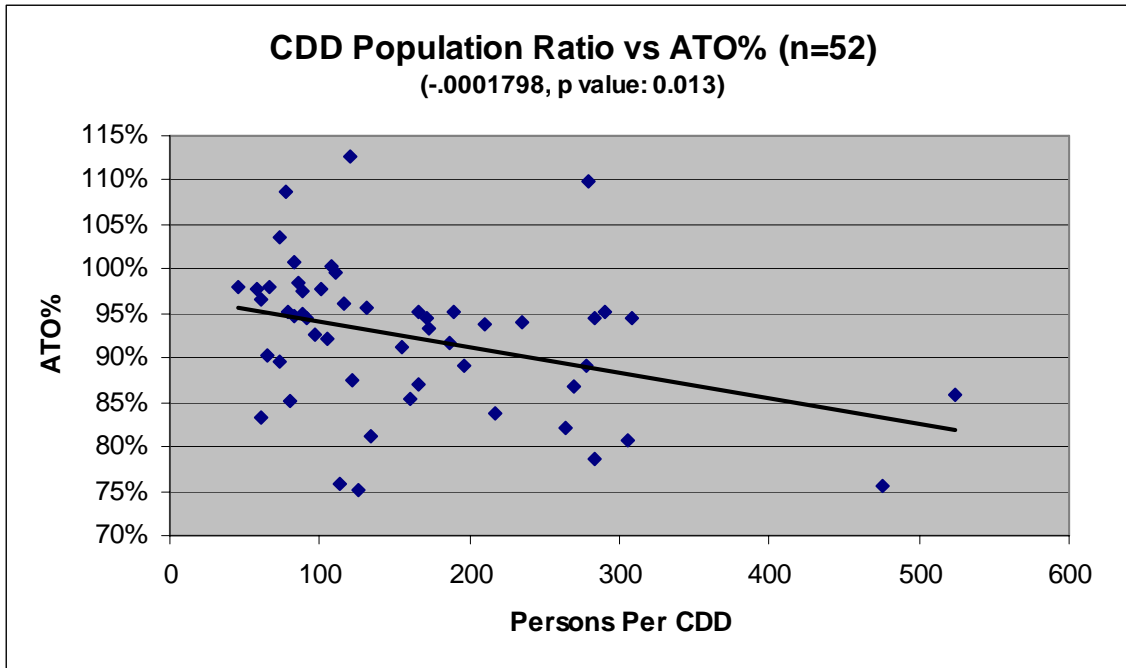


“Sleep under an LLIN every night.” The image above shows corn hanging from the ceiling in the right hand corner suggestive of the harvest season. Even during this time when most people feel that mosquitoes are biting less, they should still sleep under an LLIN every night.

Message Delivery: If the programs are to succeed, all essential messages and clear instructions regarding necessary activities need to be placed before the targeted population. A range of persons including community volunteers, teachers, woreda health officers and health extension workers are being empowered to deliver these messages. Within the MALONCHO project, messages and activities are brought to the targeted communities via the Community Directed Distributors (CDDs). Each CDD provides ivermectin annually to a small group of households in his/her community.

A sufficient number of CDDs is needed to ensure that each community member can receive the information in a manner that is understandable. An assessment was done of the current numbers of CDDs, as reported by each district, to assess their workload and whether all communities were

being adequately served. A measure of their performance in the onchocerciasis program is how well they are reaching targeted coverage represented by the annual treatment objective (ATO%: percent of eligible persons treated). The results are shown in the graph below.



The assessment demonstrated that reducing the number of persons for whom each CDDs is responsible increased treatment coverage. A target ratio of 1 CDD to 100 persons is likely to result in annual contact with over 90% of community members, providing openings for discussion and BCC about net use. While some zones appeared well covered at this target ratio, assessment at district level showed that some districts were oversupplied while others were lacking. Current numbers suggest that the program needs an additional 9,241 CDDs. In addition, the program needs to improve population estimates to provide more precise instructions to zonal and woreda level staff regarding the number of CDDs needed to achieve the desired ratio.

Goal Two Activities:

Baseline Survey: The results from the baseline survey established a vital source of information on the malaria situation and will be extensively used in refining malaria control target areas as well as assessing the progress and impact of the national malaria program in Ethiopia.

Malaria Indicator Survey: In November-December 2007 we managed the Ethiopia National Malaria Indicator Survey (MIS-2007) on behalf of the MOH in collaboration with the Central Statistics Agency, Malaria Control and Evaluation Partnership in Africa (MACEPA) at Program for Alternative Technology in Health (PATH), The President's Malaria Initiative (PMI at CDC/USAID), WHO, UNICEF, the Centre for National Health Development in Ethiopia, and the Malaria Consortium. The MIS was a large nationally representative survey of coverage of key malaria interventions, treatment-seeking behavior, anemia prevalence in children less than 6 years, malaria prevalence in all age groups, malaria knowledge among women, and indicators of socioeconomic status. It included 7,621 households surveyed in 319 census enumeration areas randomly selected in three strata from all regions and urban areas of the country. To meet The Carter Center needs and those of other partner organizations, over-sampling was done in two regions (Amhara and Oromia). The Center will be using the data from this national survey to assist us in determining the degree of progress and impact of the first year of the MALTRA and MALONCHO program areas. Preliminary results of this survey can be found at:

http://www.cartercenter.org/news/publications/health/malaria_publications/malaria_program_reports.html

Routine surveillance data: We have assembled all available routinely-reported malaria data by region and zone for the last 8 years and are assisting the regions in the interpretation and use of this data for targeting and assessing interventions. Reported numbers of cases by region were assessed for their comparability with the baseline survey data and are included in one of the published papers for the MALONCHO area (see Annex 2, paper # 2).

LLIN Durability: The useful life of LLINs is still poorly understood. The correlation between laboratory experience and actual use is not yet clear, and the effects of cultural, demographic, and climatic factors on the longevity of LLINs are unknown. An accurate appraisal of the useful life for LLINs is vital in order to optimally time their replacement, estimate future program costs, and guide manufacturers' efforts to improve their products. In collaboration with Dr. Steve Smith and Aprielle Brackery of CDC, we developed an assessment protocol to annually examine the distributed LLINs for a minimum of three years, to document insecticide loss (assessed by chemical methods and bioassay for mosquito killing effect) and physical deterioration (size, type and location of holes). The photo to the right shows holes/tears (surrounded by black circles) which may compromise the usefulness of the net.



LLIN with holes, Amhara, Dr. Steve Smith, September 2007

In August 2007, Dr. Steve Smith collected the first year's sample of 200 LLINs from the field. Fifty from each of the following zones: East Gojjam (Amhara Region, woreda Enarge Enawga, and kebeles Titar and Dejamma), South Gondar (Amhara Region, woreda Farta and kebeles Medeb Gubida and Teraroch), Jimma (Oromiya Region, woreda Mana and kebeles Haro and Gudata Bula) and Kaffa (SNNPR, woreda Gimbo and kebeles Argoba and Gojeb).

The bednet assessment revealed that out of the 200 nets collected, 31 nets could not be identified as distributed by the Carter Center and one net had a missing label. Therefore, these nets were excluded from analysis, as the length of time in the field may have exceeded the 3-6 month focus of the study. Preliminary analysis of the findings revealed that 94.1% of the 169 nets had a mean insecticide concentration that met or exceeded the PermaNet[®] target range of 55 mg/m² ± 25%. Of the 24 nets randomly selected for bioassays, 91.7% of these samples were effective at "knocking down" mosquitoes and all (100%) were effective in killing mosquitoes that came into contact with them. Over half (57.4%) of the 169 nets had at least one hole, and many showed significant damage: 13.6% had 10 or more holes, and the sum of the area of the holes exceeded 21cm² in 18.3% of nets. Most of the damage had occurred in the bottom 30 cm of the nets, consistent with them snagging on rough wooden bed frames. We will continue to monitor net durability on an annual basis.

ETHIOPIA RECOMMENDATIONS

MALONCHO Areas:

- 1) CDD Training Objective for 2008: 41,220 (with 9,240 new CDDs) and 2,198 Community supervisors.
- 2) Focus on SNNPR as the area with greatest shortfall of CDDs and so the greatest integrated training need.
- 3) Ensure that the CDDs have malaria messages and knowledge to deliver when they distribute ivermectin (integrated health education for malaria and onchocerciasis).
- 4) Develop plans for full scale up of MALONCHO program in Metekel zone and Gambella region.
- 5) Train CDDs to record the number of nets per household in the household registers when they deliver ivermectin and use the information to assess net gaps in CDTI areas or plan replacements.
- 6) Revise the ONCHO annual assessments (which include questionnaires to CDDs, CDD supervisors and households) to capture information on malaria knowledge and net use.

MALTRA Areas:

- 1) Ensure that trachoma volunteers have malaria messages and knowledge to deliver when they are working on trachoma (integrated health education for malaria and trachoma).
- 2) Use specific information from the Amhara MIS women's knowledge, attitudes and practices questionnaire to develop a targeted health education/behavior change communication strategy.
- 3) Kick-start behavior change communication in Amhara with a multi-media campaign to improve net usage particularly among children aged 1-5 years and pregnant women.
- 4) Implement combined malaria and trachoma health education in conjunction with azithromycin distribution in a massive campaign approach under the title "MALTRA weeks." Two such weeks should be held annually, one in East and one in West Amhara.
- 5) Conduct integrated training on malaria and trachoma in a cascaded fashion for 25-30,000 health and administrative staff.

Ethiopia General:

- 1) Complete the sub-analysis of the MIS 2007 results for TCC-assisted areas and participate in policy meetings with the Ethiopia MOH and other partners, related to the findings.
- 2) Develop and initiate a plan to capture the reducing trend in malaria morbidity and mortality associated with the FMOH malaria control program.
- 3) Monitor for signs of malaria elimination in zones at the edge of the transmission range.
- 4) Conduct training for TCC and region/zone level malaria staff for collation and use of woreda level malaria surveillance data for M&E and planning purposes.
- 5) Investigate areas of unexpectedly low coverage of LLIN in TCC areas (as shown by MIS 2007 results) to determine the reasons for the shortfall.
- 6) Identify remaining gaps in net coverage and develop mechanisms to fill them.
- 7) Engage the MOH in discussions regarding the provision of LLINs to growing and/or new families.
- 8) Engage the MOH in discussions regarding replacement of lost and deteriorated LLINs and new families with no LLIN.
- 9) Develop plans for the distribution of the remaining planned Carter Center contribution of one million LLINs for 2009-10.
- 10) Encourage MOH to reach out to coffee and tea farm worker and other migrants, along with institutions housing individuals not based in a household (military, health clinic staff, boarding schools) with LLINs and include them in M&E processes.
- 11) Determine reasons why some people have nets but do not use them. Use this knowledge to develop BCC materials.
- 12) Assess, improve and refine the malaria BCC messages and include new ones to provide variety.
- 13) Assess and revise current school curricula on malaria in collaboration with the Dept of Education.
- 14) Develop stronger links with EPHTI regarding the health extension worker materials.
- 15) Develop specific plan for North Gondar, where malaria, onchocerciasis and trachoma activities are all under way, to ensure full integration.
- 16) Establish a database of climate information by woreda and month for Ethiopia.

- 17) Finalize report on LLIN durability studies from 2007.
- 18) Continue studies on net durability by collection of second annual sample from the field and production of standardized data entry tools and damage assessment procedures for nets. Establish the bioassay procedure in Ethiopia for locally collected mosquitoes.
- 19) Engage further with the Global Fund Country Coordinating Mechanism by becoming a full member.

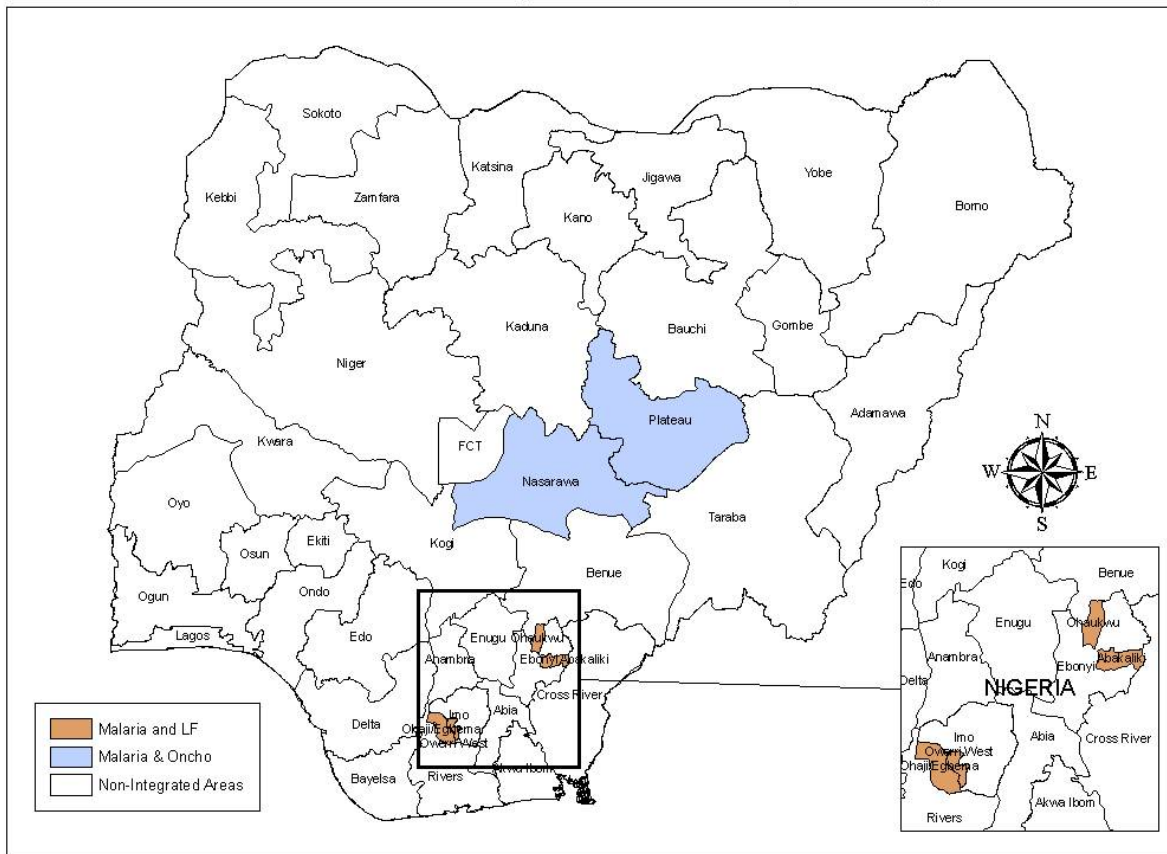
NIGERIA

Country Background

Nigeria, as many other African countries, has a double threat from the anopheline mosquitoes which can transmit both lymphatic filariasis (LF) and malaria. Insecticide treated bed nets* (ITNs), which are the principal prevention tools for malaria, should also be useful in providing additional protection in LF elimination programs that rely upon mass drug administration (MDA). Moreover, in LF endemic areas where MDA cannot be used due to the additional concern of *Loa loa*, ITNs can be provided as the primary tool for LF elimination. With this in mind, The Carter Center partnered with the Nigerian Ministry of Health (MOH) to link ITN distribution for both malaria and LF on a pilot basis. Sharing resources should result in cost reductions, and protection from the mosquito vectors will reduce transmission of both diseases simultaneously.

**Most nets distributed to date in Nigeria have been ITNs which are conventionally impregnated, not long-lasting insecticidal nets (LLIN).*

The Carter Center Integrated Control Programs-Nigeria



AWM/The Carter Center/July 21, 2008

Goals, objectives and activities:

Goal 1: Establish “proof of concept” that integrated interventions against onchocerciasis, lymphatic filariasis, urinary schistosomiasis, trachoma, and malaria, are feasible, effective, cost-effective, and sustainable in Plateau and Nasarawa States, Nigeria.

Goal 2: Demonstrate the effects of LLINs on LF elimination and malaria control in parts of two states in southeastern Nigeria.

Goal One Activities:

The Carter Center has helped to distribute bed nets in Plateau and Nasarawa States since we began our integrated collaboration in malaria and lymphatic filariasis with the MOH's in 2004. From 2004 to 2007, a total of 207,000 ITNs (provided by the Nigeria MOH) have been distributed during MDA in eight LGAs in Plateau and Nasarawa states. The ITNs were distributed free of charge through the efforts of state and local MOH personnel, utilizing volunteer village health workers active in the onchocerciasis and lymphatic filariasis (LF) programs. The distribution program is supported in part by a grant from the Gates Foundation. (The Gates Foundation does not support the purchase of ITNs.)

Most distributed nets in Nigeria have been ITNs which are conventionally impregnated, not long-lasting insecticidal nets (LLIN). A major challenge with ITNs is the need to annually re-treat with insecticide those that have already been distributed. We have adopted a policy to re-treat the nets (using retreatment sachets) upon distribution, but this slows the distribution process, and, further, annual retreatment has been largely unsuccessful due to expense. In the future, we plan to seek more than two million LLINs, which will not require retreatment, for Plateau and Nasarawa states.

Goal Two Activities:

In 2006, The Gates Foundation awarded The Carter Center funding for two states in southeast Nigeria in 2006 (Ebonyi and Imo States) to assess whether LLINs can overcome the stagnation of LF programs in *Loa loa* endemic areas in addition to assisting with malaria control. The goal is integration in a field demonstration that will test whether LLINs alone, without adjunctive mass drug administration, can interrupt LF transmission while improving the control of malaria.

The resulting study has two arms:

- 1) two LGAs provided with LLINs only to vulnerable groups (under fives and pregnant women)
- 2) two LGAs provided with LLINs for full population coverage.

(Unlike in Plateau and Nasarawa states, the Gates Foundation is providing support for the purchase of LLINs for this study.)

A household malaria survey was conducted in November-December 2007 with 3 objectives:

- 1) to obtain baseline data on malaria, anemia and net coverage in each LGA;
- 2) to assist in matching LGAs for the two study arms;
- 3) to assist planning of net distribution policy by assessing numbers of sleeping spaces.

Overall, 968 households and 4,227 people were surveyed, and blood tests were administered to 1,384 people including 589 children under five. The mean number of persons per household was 4.4 and the median was 3. The average number of sleeping spaces per house was 3.1 and number of vulnerable sleeping spaces (occupied by a pregnant woman and/or a child under 5) was 1.1. Net coverage was extremely low, with only 5% of households having one or more net (most were LLIN) (Fig 1). One LGA (Ohaji Egbema) had no nets in the sampled households.

Overall 31% of people were positive for malaria by blood slide, and the prevalence was not much greater in under fives than in >10 year olds (Fig 3). There was more malaria and anemia in Ebonyi than in Imo state, but within each state malaria and anemia prevalence was comparable between LGAs.

Fig 3: Household net coverage

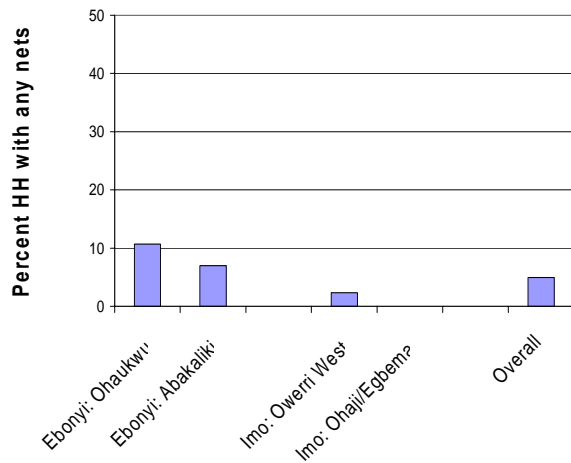
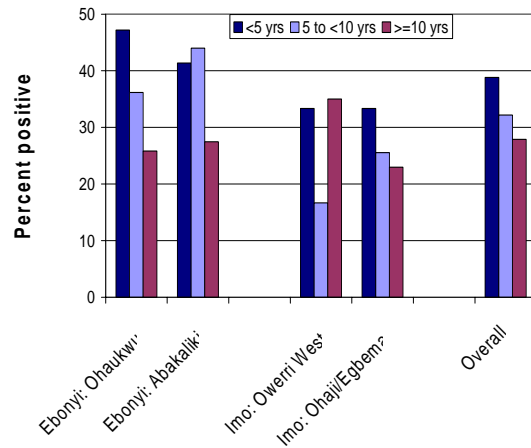


Fig 4: Percent positive for malaria



Average numbers of sleeping spaces observed were used to develop a scheme for net distribution that will result in the desired average number of nets per household. For vulnerable groups this involves giving one net to each child under five and one to each pregnant woman. For full coverage it is proposed to give 1 net for the first person in a household, then another net for each additional 1-2 people up to a maximum of 10 nets per household.

NIGERIA RECOMMENDATIONS

Plateau and Nasarawa states:

1) Seek as many LLINs as possible. (Two million are needed for full coverage.)

Southeastern States:

1) Deliver 200,000 LLIN to the four target LGAs (two LGAs targeting vulnerable groups, two full coverage) using a campaign strategy and fixed distribution points.

2) Establish a system for resupply of nets to future pregnant women in the ‘vulnerable populations’ (group A) LGAs.

3) Closely monitor the number of nets delivered using a tracking and reporting system.

4) Complete the analysis of the household malaria/net survey completed in Nov/Dec 2007.

5) Conduct a follow-up household survey in late 2008 to assess the success of the net distribution.

6) Assess the costs of distributing to vulnerable groups versus full coverage.

Nigeria General:

1) Strengthen collaborative relationship with the General Gowon Center on malaria control issues.

2) Request a position on the Global Fund Country Coordinating Mechanism.

List of Acronyms

ATO-Annual Treatment Objective
BCC-Behavior Change Communication
CDC-Centers for Disease Control and Prevention
CDD-Community Directed Distributors
CDTI-Community Directed Treatment with Ivermectin
EPHTI-Ethiopia Public Health Training Initiative
GFATM 2-Global Fund for AIDS, TB and Malaria Round 2
GFATM 5-Global Fund for AIDS, TB and Malaria Round 5
HEW-Health Extension Worker
IEC-Information Education and Communication
ITN-Insecticide Treated Nets
LF-Lymphatic Filariasis
LGA-Local Government Area
LLIN-Long-Lasting Insecticidal Nets
M and E (M & E)-Monitoring and Evaluation
MACEPA-Malaria Control and Evaluation Partnership in Africa
MALONCHO-Malaria and Onchocerciasis (Carter Center integrated program)
MALTRA-Malaria and Trachoma (Carter Center integrated program)
MDA-Mass Drug Administration
MIS-Malaria Indicator Survey
MOH-Ministry of Health
PATH- Program for Alternative Technology in Health
PMI-The President's Malaria Initiative
PSI-Population Services International
SNNPR-Southern Nations, Nationalities and People's Region
TCC-The Carter Center
UNICEF-United Nations International Children's Emergency Fund
USAID-United States Agency for International Development
WB-World Bank
WHO-World Health Organization

ANNEX 1: THE NEGLECTED TROPICAL DISEASES (Trachoma and Onchocerciasis)

TRACHOMA and its control

Trachoma is the world's leading cause of preventable blindness. The World Health Organization estimates that 6 million people are blind due to trachoma, most of whom are women, and another 540 million are at risk of blindness or severe visual impairment. Trachoma is caused by repeated infections of the conjunctiva (lining of the eye and eyelid) by the bacterium *Chlamydia trachomatis*.

Trachoma is transmitted from person to person through discharge from the eyes and nose of infected individuals, which may be passed to others on hands, towels or clothing, or by flies which are attracted to ocular and nasal discharge. Repeated infections lead to scarring of the conjunctiva which deforms the eyelid margin, causing eyelashes to turn inward and rub against the cornea. This condition, called *trichiasis*, causes severe pain and abrades the cornea leading to other infections, opacity and ultimately blindness.

Effective control of trachoma can be achieved by the SAFE strategy, where SAFE stands for the four components of the strategy. They are:

- 1) Surgery on eyelids to correct advanced stages of the disease
- 2) Antibiotics to treat active eye infection (predominantly oral azithromycin (Zithromax) donated by Pfizer and given once per year)
- 3) Facial cleanliness, achieved through face washing, to prevent disease transmission
- 4) Environmental improvements to increase access to clean water and improved sanitation (building latrines to reduce fly breeding on faeces).

ONCHOCERCIASIS and its control

Human onchocerciasis is an infection caused by the worm parasite *Onchocerca volvulus* that causes chronic skin and eye lesions. The worms live under the skin in nodules. Onchocerciasis is transmitted by *Simulium* blackflies that breed in fast flowing rivers and streams – hence the common name "river blindness". The World Health Organization estimates that approximately 37.2 million people are infected and 770,000 are blinded or severely physically visually impaired in the endemic countries, where 123 million (99% in Africa) live at risk of the disease.

The disease is chronic and non-fatal, but causes a wide spectrum of skin lesions, from intense itching to gross changes in skin elasticity. This results in hanging groins, lizard-like skin appearance and color changes such as patchy depigmentation ("leopard skin"). The most severe manifestations are those associated with damaged eye tissues, leading to serious visual impairment and ultimate blindness.

Periodic mass treatment with ivermectin (Mectizan, donated by Merck) prevents eye and skin disease caused by *O. volvulus* and may also be used to reduce or interrupt transmission of the disease. Delivery of Mectizan is through Community Directed Treatment with Ivermectin (CDTI). In this process, volunteer Community Drug Distributors (CDDs) serve their own communities and kinship networks once per year. Applying this strategy enables the affected communities to have shared responsibility in the planning, execution, monitoring, evaluation, and reporting process of the control activities.

ANNEX 2: PAPER ABSTRACTS

1) Integrating an NTD with One of "The Big Three": Combined Malaria and Trachoma Survey in Amhara Region of Ethiopia.

Authors: Emerson PM, Ngondi J, Biru E, Graves PM, Ejigsemahu Y, Gebre T, Endeshaw T, Genet A, Mosher AW, Zerihun M, Messele A, Richards FO.

PLoS Negl Trop Dis. 2008 Mar 19;2(3):e197

Abstract:

BACKGROUND: Amhara Regional State of Ethiopia has a population of approximately 19.6 million, is prone to unstable and epidemic malaria, and is severely affected by trachoma. An integrated malaria and trachoma control program is being implemented by the Regional Health Bureau. To provide baseline data, a survey was conducted during December 2006 to estimate malaria parasite prevalence, malaria indicators, prevalence of



A fly approaching and child's eye. Louise Gubb, May 2007

trachoma, and trachoma risk factors in households and people of all ages in each of the ten zones of the state, excluding three urban centers (0.4% of the population).

METHODOLOGY/PRINCIPAL FINDINGS: The study was designed to provide prevalence estimates at zone and state levels. Using multi-stage cluster random sampling, 16 clusters of 25 households were randomly selected in each of the ten zones. Household heads were interviewed for malaria indicators and trachoma risk factors (N = 4,101). All people were examined for trachoma signs (N = 17,242), and those in even-numbered households provided blood films for malaria parasite detection (N = 7,745); both thick and thin blood films were read. Zonal malaria parasite prevalence ranged from 2.4% to 6.1%, with the overall state-wide prevalence being 4.6% (95% confidence interval (CI): 3.8%-5.6%). The *Plasmodium falciparum*: *Plasmodium vivax* ratio ranged from 0.9-2.1 with an overall regional ratio of 1.2. A total of 14.8% of households reported indoor residual spraying in the past year, 34.7% had at least one mosquito net, and 16.1% had one or more long-lasting insecticidal net. Zonal trachoma prevalence (trachomatous inflammation follicular [WHO grade TF] in children aged 1-9 years) ranged from 12.6% to 60.1%, with the overall state-wide prevalence being 32.7% (95% CI: 29.2%-36.5%). State-wide prevalence of trachomatous trichiasis (TT) in persons aged over fifteen was 6.2% (95% CI: 5.3-7.4), and 0.3% (95% CI: 0.2-0.5) in children aged 0-14 years. Overall, an estimated 643,904 persons (lower bound 419,274, upper bound 975,635) have TT and require immediate corrective surgery.

CONCLUSIONS/SIGNIFICANCE: The results provide extensive baseline data to guide planning, implementation, and evaluation of the integrated malaria and trachoma control program in Amhara. The success of the integrated survey is the first step towards demonstration that control of priority neglected tropical diseases can be integrated with one of the "big three" killer diseases.

2) Malaria Prevalence and Mosquito Net Coverage in Oromia and SNNPR Regions of Ethiopia.

Authors: Estifanos Biru Shargie, Teshome Gebre, Jeremiah Ngondi, Patricia M Graves, Aryc W Mosher, Paul Emerson, Yeshewamebrat Ejigsemahu, Tekola Endeshaw, Dereje Olana, Asrat WeldeMeskel, Admas Teferra, Zerihun Tadesse, Abate Tilahun, Gedeon Yohannes, Donald R Hopkins, Frank O Richards.

BMC Public Health, vol. 8, page 321, 2008.

Abstract: Background: Malaria transmission in Ethiopia is unstable and seasonal, with the majority of the country's population living in malaria-prone areas. Results from DHS 2005 indicate that the coverage of key malaria interventions was low. The government of Ethiopia has set the national goal of full population coverage with a mean of 2 long-lasting insecticidal nets (LLINs) per household through distribution of about 20 million LLIN by the end of 2007. The aim of this study was to generate baseline information on malaria parasite prevalence and coverage of key malaria control interventions in Oromia and SNNPR and to relate the prevalence survey findings to routine surveillance data just before further mass distribution of LLINs.

Methods: A 64 cluster malaria survey was conducted in January 2007 using a multi-stage cluster random sampling design. Using Malaria Indicator Survey Household Questionnaire modified for the local conditions as well as peripheral blood microscopy and rapid diagnostic testes, the survey assessed net ownership and use and malaria parasite prevalence in Oromia and SNNPR regions of Ethiopia. Routine surveillance data on malaria for the survey time period was obtained for comparison with prevalence survey results.

Results: Overall, 47.5% (95% confidence interval (CI) 33.5--61.9%) of households had at least one net, and 35.1% (95% CI 23.1--49.4%) had at least one LLIN. There was no difference in net ownership or net utilization between the regions. Malaria parasite prevalence was 2.4% (95% CI 1.6--3.5%) overall, but differed markedly between regions: Oromia, 0.9% (95% CI 0.5--1.6); SNNPR, 5.4% (95% CI 3.4--8.5), $p < 0.001$. This difference between regions was also reflected in the routine surveillance data.

Conclusions: Household net ownership exhibited nearly ten-fold increase compared to the results of Demographic and Health Survey 2005 when fewer than 5% of households in these two regions owned any nets. The results of the survey as well as the routine surveillance data demonstrated that malaria continues to be a significant public health challenge in these regions—and more prevalent in SNNPR than in Oromia.



A girl in Ethiopia underneath her new LLIN.
Aryc Mosher, April 2007

3) Risk factors for active trachoma in children and trichiasis in adults; a household survey in Amhara Regional State, Ethiopia

Authors: Ngondi J, Gebre T, Shargie EB, Graves PM, Ejigsemahu Y, Teferi T, Genet A, Mosher AW, Endeshaw T, Zerihun M, Messele A, Richards FO Jr, Emerson PM.

Transactions of the Royal Society of Tropical Medicine and Hygiene, 2008 May; 102(5):432-8.

Abstract: Identification of risk factors is essential for planning and implementing effective trachoma control programmes. We aimed to investigate risk factors for active trachoma and trichiasis in Amhara Regional State, Ethiopia. A survey was undertaken and eligible participants (children aged 1-9 years and adults aged 15 years and above) examined for trachoma. Risk factors were assessed through interviews and observations. Using ordinal logistic regression, associations between signs of active trachoma in children and potential risk factors were explored. Associations between trichiasis in adults and potential risk factors were investigated using conventional logistic regression. A total of 5427 children from 2845 households and 9098 adults from 4039 households were included in the analysis. Ocular discharge [odds ratio (OR)=5.9; 95% CI 4.8-7.2], nasal discharge (OR=1.6; 95% CI 1.3-1.9), thatch roof in household (OR=1.3; 95% CI 1.0-1.5), no electricity in household (OR=2.4; 95% CI 1.3-4.3) and increasing altitude ($P(\text{trend}) < 0.001$) were independently associated with severity of active trachoma. Trichiasis was associated with increasing age (OR(per 5 year increase)=1.5; 95% CI 1.4-1.7), female gender (OR=4.5; 95% CI 3.5-5.8), increasing prevalence of active trachoma in children ($P(\text{trend}) = 0.003$) and increasing altitude ($P(\text{trend}) = 0.015$).



Checking eye lids for active trachoma in Ethiopia.
Aryc Mosher, April 2007

4) Individual, household, and environmental risk factors for malaria infection in Amhara, Oromia and SNNP regions of Ethiopia.

Authors: Patricia M Graves, Frank O Richards, Jeremiah Ngondi, Paul M Emerson, Estifanos Biru Shargie, Tekola Endeshaw, Pietro Ceccato, Yeshewamebrat Ejigsemahu, Aryc W Mosher, Afework Hailemariam, Mulat Zerihun, Tesfaye Teferi, Berhan Ayele, Ayenew Mesele, Gideon Yohannes, Abate Tilahun, Teshome Gebre.

Trans Roy Soc Trop Med Hyg, in press 2008.



Child under 5 years old giving blood sample to check for presence of malaria. Aryc Mosher, April 2007

Abstract: We assessed malaria infection in relation to age, altitude, rainfall, socioeconomic factors and coverage of control measures in a representative sample of 11 437 persons in Amhara, Oromia and SNNP regions of Ethiopia in Dec 2006-Jan 2007. Surveys were conducted in 224 randomly selected clusters of 25 households (overall sample of 27 884 people in 5 708 households). In 11 538 blood slides examined from alternate households (83% of those eligible), malaria prevalence in persons of all ages was 4.1% (95% CI 3.4 to 4.9%), with 56.5% of infections being *Plasmodium falciparum*. At least one mosquito net or one long-lasting insecticidal net (LLIN) was present in 37.0% (95% confidence interval [CI] 31.1 to 43.3%) and 19.6% (95% CI 15.5 to 24.5%) of households, respectively. In multivariate analysis (N=11 437; 82% of those eligible), significant protective factors were: number of LLINs per household (odds ratio [OR] $=0.60$; 95% CI 0.40 to 0.89), living at higher altitude (OR $=0.95$; 95% CI 0.90 to 1.00), and household wealth (OR $=0.79$; 95% CI 0.66 to 0.94). Malaria prevalence was positively associated with the peak monthly rainfall in the year before the survey (OR $=1.10$; 95% CI 1.03 to 1.18). Persons living above 2 000m and persons of all ages are still at significant risk of malaria infection.

per additional net
per 100m
per unit increase in asset index
per additional 10mm rain

5) Evaluation of microscopy and ParaScreen rapid diagnostic test for the detection of malaria under operational field conditions: a household survey in Amhara, Oromia and Southern Nations, Nationalities and Peoples' Regions of Ethiopia

Authors: Tekola Endeshaw, Teshome Gebre, Jeremiah Ngondi, Patricia M Graves, Estifanos Biru Shargie, Yeshewamebrat Ejigsemahu, Berhan Ayele, Gedeon Yohannes, Tesfaye Teferi, Ayenew Messele, Mulat Zerihun, Asrat Genet, Aryc W Mosher, Paul M Emerson, Frank O Richards. *Malaria Journal*, vol. 7, page 118, 2008.

Abstract: Background: In most resource-poor settings, malaria is usually diagnosed based on clinical signs and symptoms and not by detection of parasites in the blood using microscopy or rapid diagnostic test (RDT). In population-based malaria surveys, accurate diagnosis is

important: Microscopy provides the gold standard whilst RDTs allow immediate findings and treatment. The concordance between RDTs and microscopy in low or unstable transmission areas has not been evaluated. **Objectives:** We aimed to estimate the prevalence of malaria parasites in randomly selected malarious areas of Amhara, Oromia, and Southern Nations, Nationalities and Peoples' (SNNP) regions of Ethiopia using microscopy and RDT, and to investigate the agreement



Samples of blood smears and RDTs that were used to determine the presence of malaria. Aryc Mosher, April 2007

between microscopy and RDT under field conditions. **Methods:** A population based survey was conducted in 224 randomly selected clusters of 25 households each in Amhara, Oromia and SNNP regions between December 2006 and February 2007. Fingertip blood samples from all persons living in even-numbered households were tested using two methods: light microscopy of Giemsa-stained blood slides; and RDT (ParaScreen device for Pan/Pf). **Results:** A total of 13,960 people were eligible for malaria parasite testing of whom 11,504 (82%) were included in the analysis. Overall slide positivity rate was 4.1% (95% confidence interval [CI] 3.4-5.0%) while ParaScreen RDT was positive in 3.3% (95% CI 2.6-4.1%) of those tested. Considering microscopy as the gold standard, ParaScreen RDT exhibited high specificity (98.5%, 95% CI 98.3-98.7) and moderate sensitivity (47.5%, 95% CI 42.8-52.2) with a positive predictive value of 56.8% (95% CI 51.7-61.9) and negative predictive value of 97.6%, (95% CI 97.6-98.1%) under field conditions. **Conclusion:** Blood slide microscopy remains the preferred option for population-based prevalence surveys of malaria parasitaemia. The level of agreement between microscopy and RDT warrants further investigation in different transmission settings and in the clinical situation.