

THE
CARTER CENTER



Waging Peace. Fighting Disease. Building Hope.

SUMMARY PROCEEDINGS
1st ANNUAL MALARIA CONTROL PROGRAM REVIEW
ENHANCING IMPACT THROUGH INTEGRATED STRATEGIES

MALARIA PROGRAMS
Ethiopia and Nigeria

March 26, 2010
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The Carter Center Assisted Malaria Control Program Ethiopia & Nigeria



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List of Acronyms

ACT-Artemisinin-based Combination Therapy
ADO-Annual Distribution Objective
AMFm- Affordable Medicine Facility-Malaria
ATO-Annual Treatment Objective
BCC-Behavior Change Communication
CDC-Centers for Disease Control and Prevention
CDDs-Community Directed Distributors
CDTI-Community Directed Treatment with Ivermectin
EPHTI-Ethiopia Public Health Training Initiative
GF-Global Fund for AIDS, TB and Malaria
GFATM 2-Global Fund for AIDS, TB and Malaria Round 2
GFATM 5-Global Fund for AIDS, TB and Malaria Round 5
HE – Health Education
HEW-Health Extension Worker
IEC-Information Education and Communication
IDSR – Integrated Disease Surveillance and Response
IPTp-Intermittent Preventive Treatment in Pregnancy
IRS- Indoor Residual Spraying
ITN-Insecticide Treated Nets (this term includes both conventional nets and long lasting 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
MDG-Millennium Development Goals
mf - microfilariae
MIS-Malaria Indicator Survey
MOH-Ministry of Health
NTD – Neglected Tropical Disease
NOTF – National Onchocerciasis Task Force
PATH- Program for Alternative Technology in Health
PMI-The President’s Malaria Initiative
PSI-Population Services International
RB – River Blindness
RBM-Roll Back Malaria
RDT-Rapid Diagnostic Test
SNNPR-Southern Nations, Nationalities and People’s Region
SUFU – Scale up for Impact
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
YGC – Yakubu Gowon Centre

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SUMMARY

The Malaria Program at The Carter Center, which was launched in 2006, had its first Program Review on March 26, 2010. The meeting covered work done in partnership with Ministries of Health (MOH) in Ethiopia, Nigeria and Hispaniola (Haiti and the Dominican Republic), with the theme of the meeting being “Enhancing Impact through Integrated Strategies.” The Carter Center staff was joined by representatives from Ministries of Health (MOH) of Nigeria and Ethiopia, the Bill and Melinda Gates Foundation, Emory University, The Taskforce for Global Health, the Mectizan[®] Donation Program, Centers for Disease Control and Prevention, Clarke Mosquito Control, Vestergaard Frandsen, BASF Corporation, Sanofi -aventis, Embassy of France, Ethiopia Lions Club and University of Gainesville. Dr. Frank Richards (Director of The Carter Center’s Malaria, Onchocerciasis, Lymphatic Filariasis and Schistosomiasis Programs) and Dr. Paul Emerson (Director of The Carter Center’s Trachoma Program and Co-Director of Malaria Program) co-chaired the meeting.

Ethiopia

Dr. Asrat Genet Amnie, Head of the Amhara Regional Health Bureau, presenting on behalf of the Federal Ministry of Health of Ethiopia, described the scale up of long lasting insecticidal net (LLIN) distribution in Ethiopia that was completed in 2007 (The Carter Center assisted in the distribution of 3 million LLINs nationwide that year), and discussed current priorities regarding LLIN replacement and universal access to free treatment with artemisinin-based combination therapies (ACT). A new national malaria strategic plan for 2011-2015 has been developed, with the goal of achieving elimination in some areas by 2015. There are signs of a reduction in inpatient admissions for malaria, especially in the Amhara region, over the period from 2004 to 2009. Mr. Teshome Gebre, The Carter Center Country Representative in Ethiopia, described how Carter Center assistance to the Ethiopian national malaria program is implemented through integrated programs: the MalTra program (malaria and trachoma) and the MalOncho program (malaria and onchocerciasis). The integration involves 46 project staff and over 9,000 community based staff. Although The Carter Center helped to distribute over 3 million LLINs in Ethiopia, future net distributions will be required. Two challenges remain: lack of clear net replacement guidelines and lack of a clear definition of high risk malarious areas.

Since net utilization and appropriate care are lower than desired, the Malaria Control Program focuses on a few key malaria-related messages and delivers them through both community workers and mass mobile van campaigns prior to the MalTra week campaigns for azithromycin distribution. During MalTra weeks, those people with fever are offered malaria diagnosis and treatment. Dr. Zerihun Tadesse, Director of Programs in Ethiopia, reviewed the November 2009 MalTra campaign in West Amhara, which took place over three weeks. Dr. Tadesse also described the operational research clinical diagnostic studies performed by Dr. Tekola Endeshaw in 10 Amhara clinics, which demonstrated the accuracy and suitability of malaria rapid diagnostic tests in the clinical setting. Operational research on net durability indicates good persistence of insecticide for more than 2 years, but rapid appearance of holes in the nets: 80% of the nets have at least one hole within 18 months, and less than 1% of nets show evidence of repairs. For monitoring and evaluation activities, The Carter Center has assisted the MOH

through representative cross-sectional household surveys and review of data routinely reported to the Integrated Disease Surveillance and Response system.

Nigeria

The Carter Center's efforts against malaria in Nigeria to date have been linked to the Lymphatic Filariasis (LF) Elimination Program. The same *Anopheles* mosquitoes that transmit malaria also transmit LF parasites, so the LLIN component of the malaria program is able to 'kill two birds with one stone.' The Center has worked with the National Malaria Program in two states in central Nigeria (Plateau and Nasarawa) since 2004. Between 2004 and 2009, the Center has assisted in the distribution of over 500,000 nets. In Plateau and Nasarawa states, 300,650 nets have been distributed along with mass drug administration for LF via integrated campaigns. Although the vast majority of these nets were provided by the Federal Ministry of Health, the number includes 16,550 donated by Clarke Mosquito Control. In two southeastern states (Imo and Ebonyi), ~220,000 LLINs have been distributed through a project funded by the Bill and Melinda Gates Foundation that compares the impact of two different LLIN distribution designs for reducing malaria and LF. One design provided for universal coverage while the other limited net distribution to households with pregnant women or children under five years of age ("targeted vulnerable groups"). Preliminary analysis of household surveys in these southeastern states showed that the proportion of households with at least one LLIN increased dramatically but that there was a drop off in ownership in the second year, indicating the need for continued BCC efforts. Malaria prevalence dropped significantly between 2007 and 2008, and anemia in children under 10 improved significantly in both study groups. Dr. Emmanuel Miri, The Carter Center Country Resident Technical Advisor in Nigeria, noted that behavior change messages were developed to accompany net distribution activities but argued that, due to challenges associated with effectively delivering these messages during net distribution, more attention should be paid to post-LLIN distribution behavior change communication (BCC). Dr. Babatunde Ipaye (presenting on behalf of Dr. Folake Ademola-Majekodunmi, National Coordinator of the Nigeria National Malaria Control Program) described the Nigerian national program and the plan for a massive scale up of malaria control efforts in 2009-2010. The total number of nets needed is estimated at 63 million, of which 19 million were distributed between May 2009 and March 2010. In 2010 alone, the goal is to distribute a total of 48 million nets in 30 states, including eight of the nine states the Center assists (Only Delta state has yet to have LLINs financed).

Hispaniola

Dr. Donald Hopkins, Vice President for Health Programs at The Carter Center, gave a brief overview of the Hispaniola project that is fostering the idea of a collaborative effort between the two countries that share the island (Haiti and the Dominican Republic) in order to completely eliminate malaria and LF by 2020. If they were to do so, the entire Caribbean basin would be free of these two mosquito-transmitted diseases. The Carter Center has been promoting the idea of cross-country collaboration in the effort since September 2008, through a project in two adjacent border towns. President Carter visited the heads of state, Ministers of Health, and other partners of both countries in September 2009. The greatest burden of disease is in Haiti, which has now revised its national malaria control policies and provides free diagnosis and treatment for malaria (as does the Dominican Republic).

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 the bite of the *Anopheles* mosquito, which bites only at night. Of the species of human malaria (*Plasmodium falciparum*, *P.vivax*, *P.malariae* and *P.ovale*), the most severe disease and highest mortality are caused by *P. falciparum*. The typical intermittent fevers of malaria are caused by the repeated cycles of parasite replication inside red blood cells, which ultimately result in the rupture of the red blood cells, releasing parasites into the blood stream to invade other cells. Repeated malaria infections lead to severe anemia, especially in children and pregnant women. Malaria is preventable and treatable; there is no reason why anyone should die from malaria.

Approximately 90% of the one million deaths caused by malaria each year occur in Africa. Twenty percent of all deaths in African children less than five years of age are thought to be due to malaria. Overall, malaria constitutes 10 % of the continent's disease burden. Malaria infection in adults is not usually fatal because the patient has some acquired immunity, but fever and anemia resulting from malaria place an enormous economic burden on adults, and therefore on families, communities and countries. Pregnant women are also at great risk. Serious illness from malaria typically takes place during the late rainy season, which coincides with peak agricultural productivity and therefore leads to reduced agricultural output. Malaria is also responsible for high rates of school and work absences, which have important short- and long-term social and economic impacts. 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 bednets (ITNs) are one of the most important prevention tools for malaria and should also be effective as a complement to annual mass drug administration (MDA) in the filariasis elimination program. The early interest, on the part of The Carter Center, in insecticidal net distribution was 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, hastening elimination of lymphatic filariasis (LF).

A dedicated Malaria Program at The Carter Center was launched in Ethiopia in February 2006. The Ethiopian Minister of Health, Dr. Tedros Adhanom Ghebreyesus, requested that The Carter Center 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) in 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 effectiveness of the national control program. Since 2006, the program has built on existing Carter Center programmatic networks in parts of Ethiopia while working closely with the MOH malaria control program at national, regional and local levels.

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

Malaria control activities have been integrated with other Carter Center disease control programs in Nigeria, on a pilot basis, since 2004. However, in June 2010, with the signing of memoranda of understanding with the Yakubu Gowon Center (YGC) and agreements with the 9 states in which The Carter Center is active, The Carter Center Malaria Control Program in Nigeria was formally established and will begin to amplify its assistance to the national program in malaria control. The Carter Center will assist the MOH and its other partners in the planned nation-wide scale up of malaria control activities, including the mass distribution of LLINs, behavior change communication (BCC) and monitoring and evaluation (M&E).

The Carter Center's efforts in malaria control can be grouped into three focal areas: 1) Program Implementation, 2) Monitoring and Evaluation and 3) Operational Research.

Below is a brief overview of the activities that have been conducted in Ethiopia and/or Nigeria, categorized according to these three focal areas. These summaries reflect the cumulative activities of The Carter Center Malaria Control Program since its initiation. Activities conducted within the 2009 program year will be presented and discussed in the subsequent country-specific sections of this report.

1) PROGRAM IMPLEMENTATION:

To date, The Carter Center programmatic activities related to malaria have focused primarily on insecticidal bed net distribution and behavior change communications (BCC). These activities are embedded within the framework of integrated disease control projects, though the form and package of included activities vary between countries and regions. As a result, the program implementation sections of this report begin with an overview of the scope and nature of the integrated projects in each country with subsequent sections devoted specifically to the details of net distribution and behavior change communications associated with the integrated activities.

1.1 Integrated Projects: In Ethiopia, The Carter Center has created two innovative programs: MalTra in Amhara National Regional State (Amhara) and MalOncho in the Southern Nations, Nationalities and People's Region (SNNPR), Oromia, Beneshangul Gumuz and Gambella regions. The integrated approach in both programs uses locally identified leaders and community volunteers to assist health workers, including health extension workers (HEWs), in the delivery and collection of important information regarding disease prevention and LLIN ownership and use. In Nigeria, malaria control activities have been integrated with existing neglected tropical disease (NTD) programs in four states: Plateau, Nasarawa, Imo and Ebonyi. Volunteer community drug distributors (CDDs) assist with LLIN distribution and provide health education, in addition to their routine activities related to onchocerciasis (river blindness), lymphatic filariasis, schistosomiasis and/or trachoma.

1.2 LLIN Provision: As of December 2009, The Carter Center has helped to provide a total of 3,522,740 LLINs. Three million of these LLINs were purchased and distributed as The Carter Center's contribution to the Ethiopian national campaign to provide 20 million LLINs by August 2007. In Nigeria, we have distributed a cumulative total of 522,740 LLINs obtained through the Federal Ministry of Health or purchased by other donors such as the Bill and Melinda Gates Foundation and Clarke Mosquito Control.

1.3 Behavior Change Communication (BCC): In both Ethiopia and Nigeria, The Carter Center has helped to develop a set of key behavior change communication messages that attempt to address common misperceptions about malaria or malaria control measures, and provide clear action-oriented prompts to encourage recommended behaviors. In Ethiopia, these messages are disseminated using a number of different channels, including radio and television spots, films, posters, brochures/pamphlets, theater, t-shirts and caps, and mass education sessions. Intensive mass media campaigns, including education outreach activities conducted via a mobile van, are conducted in the Amhara Region of Ethiopia prior to azithromycin² distribution for trachoma and mass testing and treatment of malaria cases during MalTra Week, a dedicated period when all health workers within a defined geographical area focus on drug distribution and health education. Malaria messages are also highlighted during the distribution of ivermectin for onchocerciasis as part of the Ethiopia MalOncho program. In Nigeria, health education for malaria is conducted primarily in association with the distribution of insecticide treated bed nets.

2) MONITORING AND EVALUATION:

Our Monitoring and Evaluation (M&E) efforts consist of two primary types of activities: 1) monitoring and evaluation of Carter Center programs, and 2) providing assistance to the National Malaria Control Program and Ministry of Health in Ethiopia (and, in the future, in Nigeria) for their own M&E processes and the achievement of their goals. While these M&E activities are synergistic and not mutually exclusive, in this report we describe them separately.

2.1 The Carter Center-Assisted Programs. In Ethiopia, regional and national population-based surveys are a primary method of evaluating both MalTra and MalOncho programs. The Carter Center is using the integrated format of the MalOncho project to assist with measuring the penetration of the program. Community-directed distributors of ivermectin collect household LLIN net ownership information across The Carter Center's Community Directed Treatment with Ivermectin³ (CDTI) target areas in order to identify gaps in net delivery and describe net replacement needs. Additionally, ongoing MalOncho community assessments collect information on net use and malaria knowledge.

In Nigeria, we plan to conduct representative household surveys in two of the nine Carter Center-assisted states in 2010 in order to obtain baseline data before the planned scale up of malaria control activities, with which The Carter Center will also assist.

2.2 Assistance to National Programs. In Ethiopia, The Carter Center is also partnering with the MOH to help assess progress toward meeting its target malaria control goals. Since the initiation of the Malaria Control Program in Ethiopia, The Carter Center has managed two representative household surveys to estimate changes in malaria prevalence, as well as LLIN ownership and use. We have provided additional support to the MOH through training in data management and

² Azithromycin (Zithromax[®]) is donated by Pfizer, Inc.

³ Ivermectin (Mectizan[®]) is donated by Merck & Co.

epidemic recognition for regional and zonal level health staff in MalOncho areas. In 2009, The Carter Center conducted a review of the Integrated Disease Surveillance and Response data from mid-2004 to mid-2009 to assess the control programs effectiveness by zone nationwide, as well as improve stratification and targeting. In regions covered by both the MalTra and MalOncho programs in Ethiopia, The Carter Center receives information on reported malaria cases and communicates with the MOH and other partners regarding trends in malaria incidence, as well as reports of stock outages of malaria treatments and diagnostic tests.

In Nigeria, The Carter Center plans to work with the MOH to learn how the Center can best assist with monitoring and evaluation of the large nationwide scale-up of net distribution and other malaria control activities which commenced in 2009. A major element of this assistance outside of the nine states where the Center currently works could be the provision of management training through the Sustainable Management Training Center (SMTC) in Nigeria, thereby strengthening management capacity of local health workers at the state and local government area (LGA) levels. In collaboration with the U.S. Centers for Disease Control and Prevention (CDC), and Emory University, The Carter Center has maintained the SMTC in Jos, Plateau state since 1996. The training-of-trainers course develops the core skills and competencies needed to improve management and capacity building, including: leadership, team building, financial management, personnel management, supervision, communication, monitoring and evaluation, process improvement, project management, conflict management, service organization, and commodities/logistics issues. In the past 14 years, SMTC has trained 684 government and NGO program staff in the science of management. We envision the SMTC becoming a center of excellence that will increase the capacity and skills of future public health leaders, particularly in malaria work.

3) OPERATIONAL RESEARCH:

The Carter Center is currently engaged in three operational research projects in the two countries.

3.1 LLIN studies. In Ethiopia, we are conducting LLIN durability studies annually, with both *Permanet*[®] (Vestergaard Frandsen) and *Duramet*[®] (Clarke Mosquito Control), to review the rate of insecticide loss and the physical deterioration of LLINs.

In Nigeria, with the support of the Bill and Melinda Gates Foundation, The Carter Center is conducting a study designed to compare the effectiveness of two different net distribution strategies on both malaria and LF indicators. The two strategies are 1) universal distribution and 2) the provision of nets to vulnerable groups only. We have been monitoring net ownership and use, as well as evaluating the resulting impact on prevalence of malaria, anemia, and filariasis, through annual household surveys in two southeast states, Imo and Ebonyi.

3.2 Diagnostic studies. We have been evaluating different rapid tests for the diagnosis of malaria in Ethiopia by comparing them with the results of microscopy conducted in health facilities as well as the results obtained by expert microscopists.

ETHIOPIA

Country background

In Ethiopia, malaria is one of the leading causes of morbidity and mortality for both outpatients and hospital admissions: in 2007-2008, it accounted for about 12 % of the total out-patient visits and 10 % of the total admissions. Malaria transmission occurs in over 75 % of the country's land mass, including the fertile low-land areas that are most suitable for agriculture. More than 50 million people (68 % of the population) live in these regions and are therefore at risk for malaria. The transmission patterns and intensity vary greatly throughout the country due to differences in altitude, rainfall and population movement. The two major forms of malaria in Ethiopia are falciparum ('malignant') malaria and vivax ('relapsing') malaria. Malaria transmission in Ethiopia is seasonal and unstable. This means that the country is prone to periodic epidemics that can have a profound impact on people of all ages. In contrast to many other African countries with malaria, where children under five years of age and pregnant women are most vulnerable to malaria (as others have sufficient protective immunity), in Ethiopia older children and adults are also at high risk of severe disease or death. In high transmission years, several million clinical malaria cases are reported from health facilities. Therefore, the ability to detect and react to malaria epidemics is an important element of the national malaria control program.

Controlling malaria is the number one priority of the Ethiopian Minister of Health, Dr. Tedros Adhanom Ghebreyesus. The MOH has committed to the goal of reducing the overall burden of malaria by 50 % by the year 2010, primarily through early diagnosis and treatment of cases, vector control using insecticide treated bed nets and indoor residual spraying (IRS), and epidemic prevention and control. However, the ministry also recognizes the importance of cross-cutting strategies such as human resource development, and program monitoring and evaluation for the success of malaria control. The national program's specific aims for 2011-2015 are:

- 1) to further scale up diagnosis and treatment activities by ensuring a continuous supply of diagnostic materials and drugs to the lowest levels of the health sector;
- 2) to ensure 100% coverage with insecticide-treated nets (ITN);
- 3) to ensure the replacement of ITNs to maintain >80 % coverage and utilization rates in malaria-prone areas;
- 4) to scale up indoor residual spraying activities (IRS) to achieve 60 % coverage in malaria prone areas;
- 5) to strengthen epidemic prevention and control systems; and
- 6) to strengthen monitoring and evaluation systems.

Ethiopia has made great progress in malaria control in the past few years. Since 2005, when LLINs were first introduced, 18.2 million LLINs have been distributed. The Carter Center helped provide and distribute some of these nets, supplying 3 million LLINs (Vestergaard *Permanets*®) in 2007 to help the country achieve its goal of full coverage. In order to be able to assess the impact of the net distribution and other malaria control activities, The Carter Center conducted a baseline malaria survey in 2006, and also managed a nation-wide malaria indicator survey (MIS) in 2007 in collaboration with the Ethiopian MOH and other partners.

1. PROGRAM IMPLEMENTATION

Given that malaria is present in all of the zones where we currently work on onchocerciasis and trachoma in Ethiopia, and in keeping with the Center's commitment to integrated programs with an emphasis on community level involvement and the priorities of the Ethiopian government, The Carter Center has helped introduce and maintain two integrated programs in areas where other Carter Center activities were already well-established:

1. MalOncho-integrated malaria and onchocerciasis
2. MalTra-integrated malaria and trachoma

The integrated project strategies are coordinated in partnership with the MOH, through the collaborative efforts of The Carter Center, Regional Health Bureaus, Zonal Health Departments and Woredas. The latter represent the approximate administrative level of a district Health Office. Both programs use existing village-based health infrastructures, with assistance from The Carter Center to ensure that malaria control is integrated within a multi-disease intervention package.

The Lions Clubs of Ethiopia and the Lions Clubs International Foundation are major supporters of both trachoma and river blindness activities in Ethiopia. The Lions Club of Ethiopia (District 411A) supports the National Onchocerciasis Task Force of Ethiopia (NOTF). Mr. Teshome Gebre (head of The Carter Center's Ethiopia office) is a Lion and represents Lions on both the NOTF (which oversees the onchocerciasis program implementation and integration with other NTDs and malaria) and the National Committee for the Prevention of Blindness. The Lions-Carter Center Sight First Initiative has supported the Amhara trachoma program from its first activities in four districts in 2000 and has been vital in the expansion (and integration since 2007 with malaria) to cover all 151 districts in Amhara region by 2009.

1. Integrated Projects

MalOncho

The MalOncho program is currently operating in 10 project zones across the regions of Amhara (parts of North Gondar), Beneshangul Gumuz (part of Metekel), Gambella (Itang and parts of Agnua and Mezhenger), Oromia (parts of Illubabor and Jimma) and SNNPR (Kaffa, Sheka and part of Bench Maji). The Carter Center supported Community Drug Treatment with Ivermectin (CDTI) areas have a total population of close to 4 million inhabitants.

The program aims to create strong supportive links between the established CDTI approach of the onchocerciasis control program, and preventive health education and behavior change communication activities for reducing risk to malaria in Ethiopia. The program is organized on a woreda-by-woreda basis.

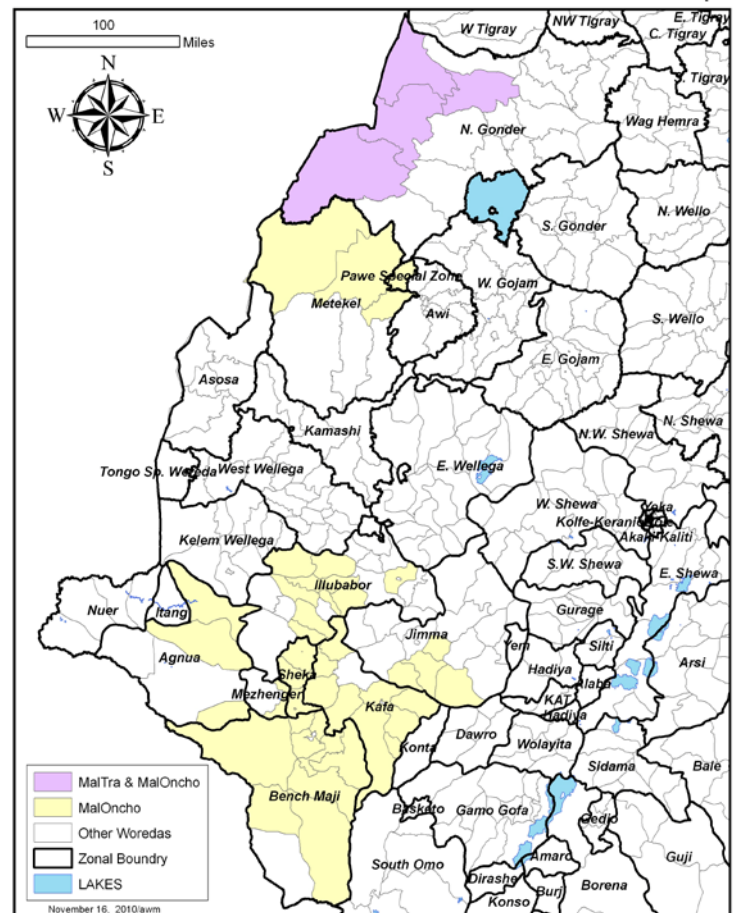
The CDTI program format uses community-identified distributors as the key players in encouraging the acceptance and implementation of health messages and activities by communities.

An integrated approach to malaria and onchocerciasis capitalizes on two potential opportunities for community mobilization and health education:

- 1) Household registration and
- 2) Drug (ivermectin) distribution, which is often done house-to-house.

In 2009, the MalOncho training materials were revised to include malaria-specific content. 3,163,181 persons (95% of the ultimate treatment goal and 79% of the total population in the target areas) received treatment with ivermectin and were provided with health education about onchocerciasis and malaria.

The Carter Center Assisted MalOncho Woredas in Ethiopia



MalTra

The MalTra program is active within all ten zones of the Amhara region, which has been divided into two operational areas (West and East Amhara). The total population of Amhara region was estimated at 17,214,056 in the 2007 census⁴, which is 23.3% of the total country's population.

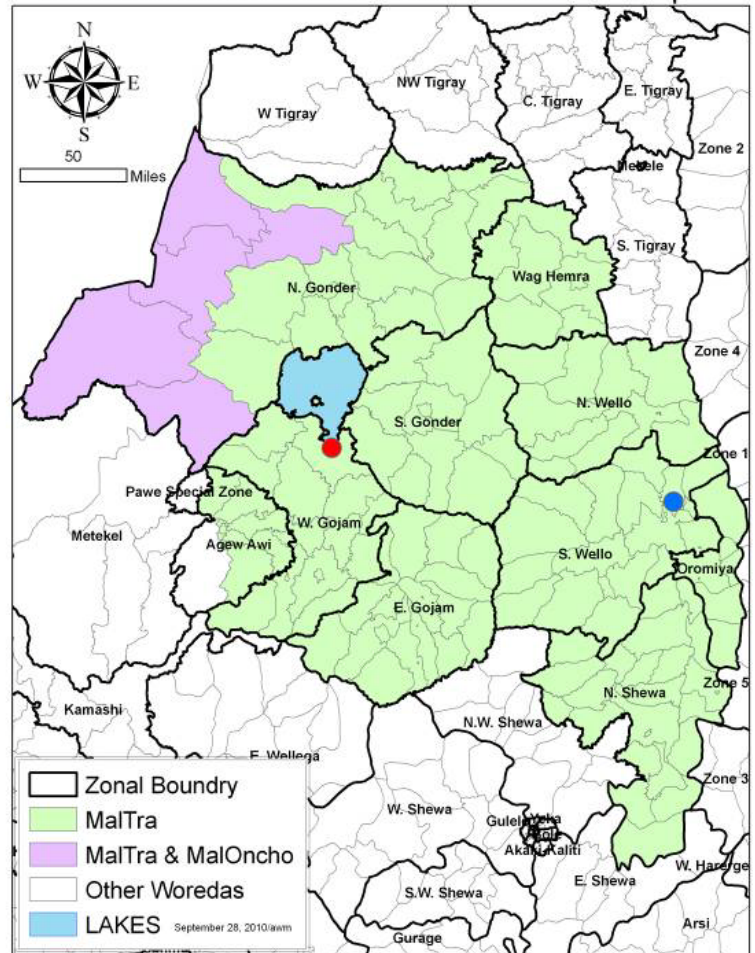
The regional MalTra coordination office is located in the state capital and seat of the Regional Health Bureau, Bahir Dar (red dot on map). There are an additional 10 zonal project coordinators assigned to provide technical and logistic support to the respective zonal health departments. A sub-regional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

MalTra training for community volunteers, teachers, woreda health officers and health extension workers is conducted via a cascade approach with the training of trainers co-coordinated by Carter Center staff. Two "MalTra Weeks" are conducted per year in Amhara: one in October or November for West Amhara and the second in April for East Amhara.

During these MalTra Weeks, communities receive health education pertaining to both malaria and trachoma via mass media and in schools. Health workers distribute azithromycin⁵, conduct rapid diagnostic tests (RDTs) for persons suspected to have malaria and treat persons who test positive for malaria.

In 2009, a cumulative total of 416 health workers participated in trainings of trainers. Prior to the MalTra Weeks, 251 Zone- and Woreda-level supervisors, 1,589 field supervisors/health officers and 6,756 health extension workers received training in trachoma and malaria, and 20,270 volunteer community health promoters participated in a half-day orientation. Approximately 13,289,000 persons received treatment with azithromycin during MalTra campaigns, and nearly 38,000 persons were treated for malaria.

Carter Center Assisted MalTra Woredas in Ethiopia



⁴ Population Census Commission, Federal Democratic Republic of Ethiopia. Summary and Statistical Report of the 2007 Population and Housing Census

⁵ Azithromycin (*Zithromax*[®]) donated by Pfizer

1.2 LLIN Provision

In 2007, The Carter Center supplied three million long lasting insecticidal nets (LLINs) which were distributed in the Amhara (1.26 million nets), Oromia (990,000 nets) and SNNPR (750,000 nets) regions of Ethiopia. The Carter Center did not purchase any additional nets for Ethiopia in 2008 and 2009. However, a small number of *Permanets*[®] (~220) and *Duranets*[®] (~500) nets were distributed in 2009 for operational research to assess net durability. (see below, “Operational Research”).

1.3 Behavior Change Communication

Message Development and Dissemination: The Carter Center and Ethiopian staff have developed a list of ‘do-able messages’ on malaria prevention for use in community malaria education activities, as well as related training materials for health workers and community volunteers. The focus is on actions that can be done by householders themselves to prevent malaria as well as to properly handle and care for LLINs.

The four key messages are:

- 1) Sleep under an LLIN every night all year round.
- 2) Give priority for LLINs to pregnant women and children under five years of age.
- 3) Hang and care for (wash and mend) your LLIN properly.
- 4) Seek prompt medical attention for all febrile illnesses.

Additional messages used in The Carter Center-assisted health education and BCC activities follow those recommended by the national malaria control program.

These messages have been translated to Amharic and are disseminated using a variety of different media, including: posters, leaflets, banners, t-shirts, dramas, role play activities, radio and television broadcasts, films, songs and a mobile health education van.

MalOncho

Within the MalOncho project, messages and activities are brought to the targeted communities via the CDDs. Each CDD provides ivermectin annually to a small group of households in his/her community, and provides health education and BCC related to both malaria and onchocerciasis during these drug distribution activities. In 2009, trainings of health workers and supervisors conducted in February, March, June and July included content on malaria and malaria-specific BCC messages. During ivermectin distribution activities, CDDs provided health education and worked to mobilize communities in the fight against malaria.



The above pictorial health education banner from the MalOncho program is used to train people in the process of mass drug administration (MDA) with ivermectin, including educational demonstrations and messages pertaining to proper LLIN use (See top right picture of net).

MalTra

Health Education (HE) and Behavior Change Communication (BCC) activities in the East and West Amhara regions are centered around, but not limited to MalTra weeks. Health Education and BCC activities and materials focus on both trachoma and malaria, and utilize a variety of different media in order to maximize both the exposure to and impact of health messages. In 2009, a number of materials were developed or revised to increase the emphasis on malaria, including teaching materials for use with mobile van social mobilization campaigns and training materials for health extension workers.

World Malaria Day and the Launching of MalTra II in April 2009

In collaboration with the Amhara Regional Health Bureau, the Federal Ministry of Health consortium and other governmental and non-governmental organizations, The Carter Center was actively involved in organizing a World Malaria Day celebration on April 25 in Kombolcha town of the South Wollo Administrative zone. In order to highlight the importance of malaria in MalTra week activities, the official launching of MalTra II was scheduled to coincide with World Malaria Day (April 24th). In attendance at the World Malaria Day celebration were: Dr. Kebede Worku (State Minister of Health), Dr. Asrat Genet (Head of Amhara Regional Health

Bureau), Dr. Tibebe Yemane-Birhane (World Laureate, Ethiopian Lions) and Dr. Paul Emerson (TCC). Opening remarks were made by the State Minister of Health, and keynote addresses were made by representatives of various partner organizations (TCC, WHO, UNICEF, CARE) and the Mayor of Kombolcha. The theme of World Malaria Day 2009 was “Counting Malaria Out!” Specific messages emphasized the proper care for, and use of, LLINs, community mobilization to improve environmental control and improving care seeking behavior for febrile patients. Activities associated with World Malaria Day included regional review meetings, field visits, a review of the health service extension program, technical updates, a special session on MalTra, preparation for the next major malaria transmission season and a launching ceremony including dramas and athletic events.



Dr. Tibebe Yemane-Birhane with the Ethiopia Lions Club speaks at the World Malaria Day in Kombolcha, South Wollo, Ethiopia.

Mass Media Campaigns

In the months leading up to, and during, each MalTra week (MalTra II in April-May in East Amhara and MalTra III in November in West Amhara), intensive multi-media campaigns were conducted in East and West Amhara respectively.

For several months prior to the launch of the first MalTra week of 2009 (MalTra II), health education and mobilization was conducted using radio broadcasts, mobile van activities (films with facilitated discussions, question and answer sessions, etc.), and the distribution of 500 audio cassettes to schools and health facilities in East Amhara. Over 60,000 HE and BCC materials were produced and disseminated, mobile van activities were conducted in 75 woredas and 90 different towns, and messages were broadcast on Amhara radio stations for one month. Mobile van social mobilization activities that concentrated on malaria were conducted in 20 woredas over the course of 30 days, while trachoma was discussed in 55 woredas over 60 days. It is estimated that over 700,000 people attended sessions on malaria (close to 1.7 million for trachoma).

Two months before the MalTra III campaign, which began in November 2009, messages to encourage community mobilization were prepared and began to air. The month before the start of MalTra III was marked by a series of health education and community mobilization activities. Additionally, health extension workers and volunteers received new communication materials. In November, leaflets, teaching guides, four radio spots (broadcast 2 minutes a day for 13 days), a mini-drama and a song were disseminated in West Amhara in the context of MalTra III. Mobile van social mobilization emphasizing both malaria and trachoma was conducted in a total of 26

woredas of West Amhara, over a period of 30 days, and it is estimated that over 1 million people attended. Concurrently, a mass media campaign was launched in East Amhara to increase awareness of epidemics and ways to prevent them. In total, 36 thousand leaflets, 16 thousand posters, 8 thousand treatment guides, 10 thousand hats and t-shirts were distributed in 2009 during the two campaigns, reaching nearly 5 million people.



Social mobilization effort being conducted in North Gondar, Amhara Region via a mobile van which broadcasts health education messages regarding malaria and trachoma. During the evening video and interactive activities take place.

Other Health Education and BCC activities

While most of the mass media communications in the MalTra zones were conducted during the months immediately prior to and during the MalTra campaigns, IEC and BCC activities took place throughout 2009, including additional radio announcements, school education sessions and mobile van activities. In December of 2009, 49 primary school supervisors were trained to facilitate “MalTra Mondays” in schools. On “MalTra Mondays,” students learned about how to avoid contracting malaria and trachoma.



Women and children are the most vulnerable to both malaria and trachoma. Providing health education messages that target these groups is a key component of the MalTra Program.

2. MONITORING AND EVALUATION

2.1 Evaluation within The Carter Center Assisted Areas

Large representative household surveys were conducted in 2006 in the Amhara, Oromia and SNNPR regions and in 2007 with management and support to the nationwide Malaria Indicator Survey. These surveys were designed to evaluate changes in insecticide treated net ownership and use, and evaluate malaria prevalence after the distribution of nearly 20 million LLINs nationwide by the end of 2007. In 2008 and 2009, efforts focused on data analysis and the preparation and submission of manuscripts for publication. The comparisons of baseline and follow-up data demonstrated that large scale-ups of net ownership are possible within a short time period, but that increases in net ownership do not necessarily result in parallel increases in net use. Household net ownership more than tripled from 2006 to 2007 (19.6% to 68.4%), while the mean number of LLINs per household increased from 0.3 to 1.2⁶. While net use overall doubled, net use actually declined from 71.7% to 48.3% when the analysis was limited to households owning an LLIN. The results from these monitoring and evaluation activities offered several valuable and practically applicable insights that can help to increase the impact of future

⁶ Shargie EB, Ngondi J, Graves PM, Getachew A, Hwang J, Gebre T, Mosher AW, Ceccato P, Endeshaw T, Jima D, Tadesse Z, Tenaw E, Reithinger R, Emerson PM, Richards FO and Ghebreyesus TA. (in press). Rapid increase in ownership and use of long-lasting insecticidal nets and decrease in prevalence of malaria in three regional states of Ethiopia, 2006-2007, *Journal of Tropical Medicine*.

net distribution campaigns: nets need to be more carefully targeted to areas with a high risk of malaria, and sustained BCC efforts are necessary to ensure that distributed nets are used and cared for properly and consistently by the recipients.

2.2 Support to the National Malaria Control Program

In 2009, Carter Center staff assisted the newly created Public Health Emergency Management section based at the Ethiopia Health and Nutrition Research Institute (a department of the MOH) to collate, assess, clean and review all available routinely collected data from the Integrated Disease Surveillance and Response System (IDSR) for the period July 2004 to June 2009 in order to track trends in malaria cases.

Between 2004 and 2009, each health center and hospital produced a monthly report summarizing data from all health facilities in its catchment area. The report contains information pertaining to the following indicators:

- 1) Malaria morbidity (outpatient and inpatient cases) among children < 5 years of age (by clinical and confirmed cases, and for the latter by species)
- 2) Malaria morbidity (outpatient and inpatient cases) among persons 5 years of age and older (by clinical and confirmed cases, and for the latter by species)
- 3) Malaria inpatient deaths in children < 5 years of age and in persons > 5 years of age
- 4) Numbers of inpatient cases of severe anemia with malaria in children <5years of age.

These data were computerized at the zonal level in the Ministry of Health using a dedicated EpiInfo database and were available in Access. The data were cleaned, reporting rates were summarized, and incidences were estimated by region, zone and month using zone populations from the 2007 census. The results showed that reporting rates, while variable by region, were reasonably consistent over time. There has been a decline in the rate of inpatient malaria cases between 2004 and 2009 (Fig 1), which was greater in Amhara than the other two regions of interest to The Carter Center. A report on the IDSR data was produced and shared with the MOH in November 2009.

Annual incidence per 1000 by Ethiopia reporting year by region, MALARIA INPATIENTS

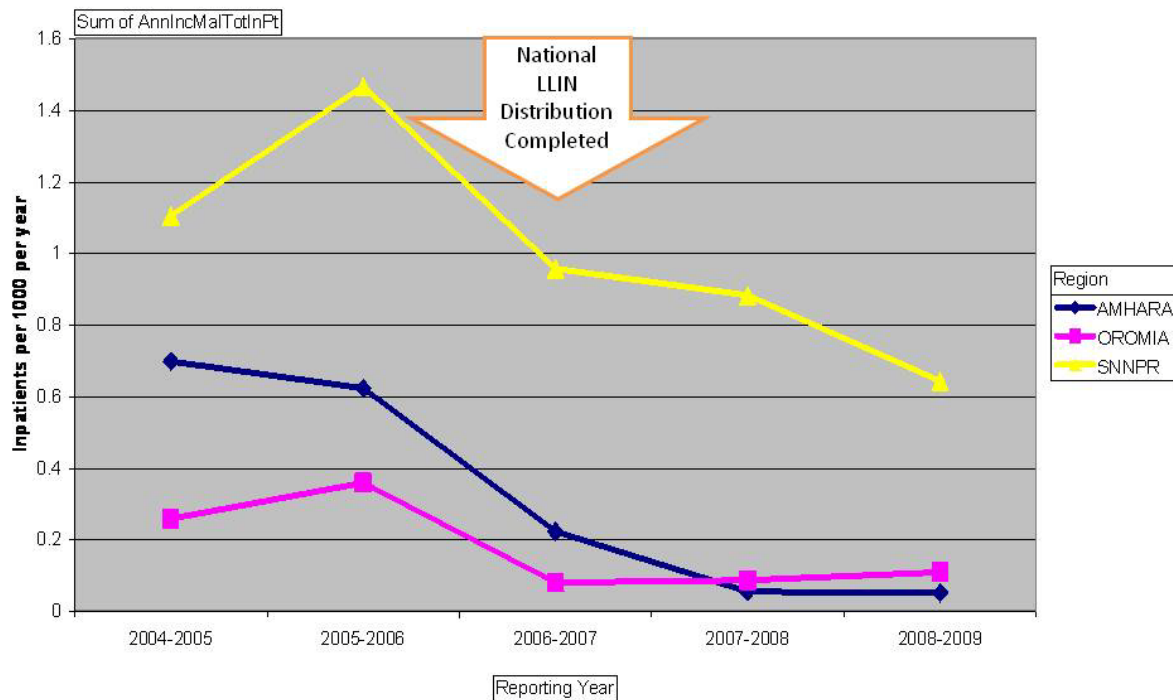


Figure 1. Annual incidence per 1000 by Ethiopian reporting year by region

The monthly data by zone on incidence of malaria cases (clinical and confirmed) were used to develop a stratification map of the country showing the average annual incidence for the past 5 years (Fig 2). This map shows both the magnitude of estimated incidence level by zone (useful for assessing how close certain areas are to potential malaria elimination) and the zones that require extra control efforts.

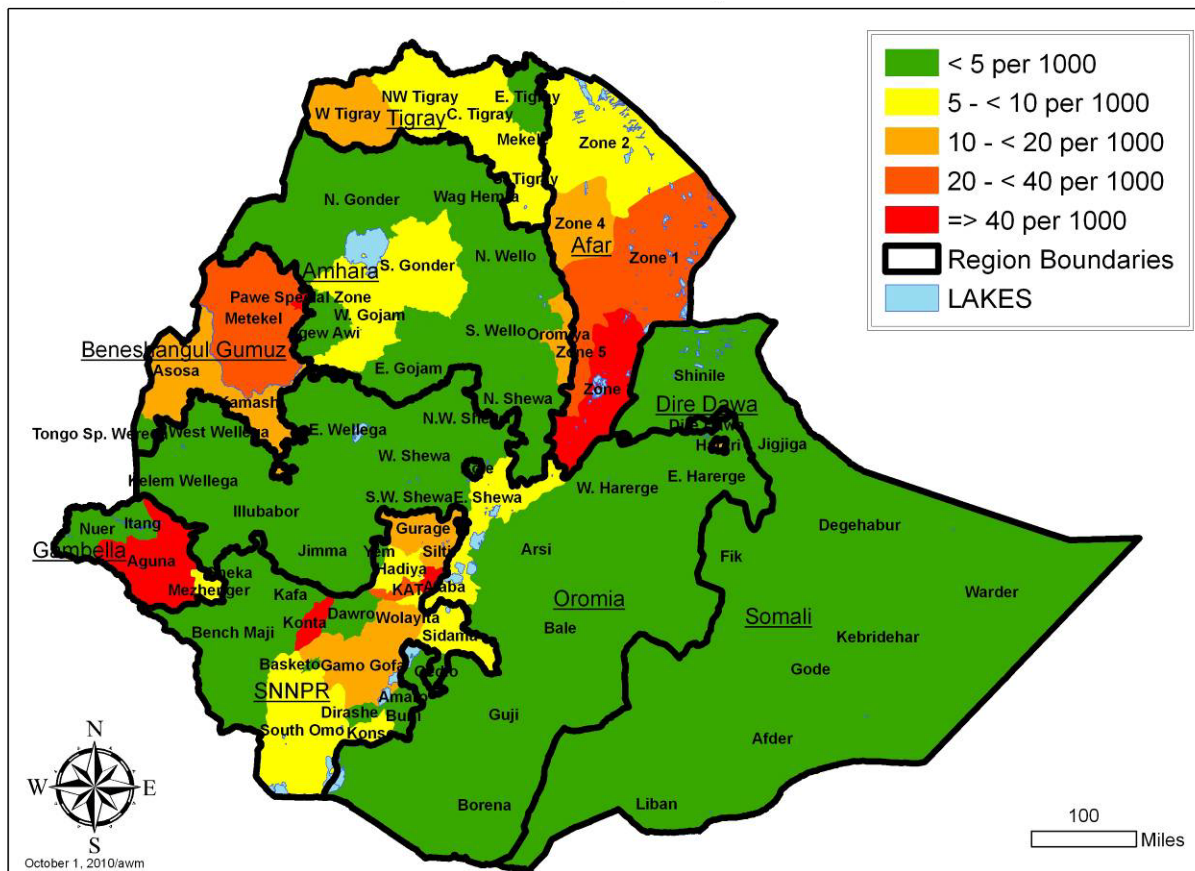


Figure 2. IDSR average annual incidence of confirmed malaria cases from health centers and hospitals by zone, 2004 to 2009

In mid-2009, the IDSR system changed from monthly reporting to a weekly reporting system using a revised form. However, since most regions and zones continue to report monthly on malaria cases, The Carter Center is working with the MOH and other partners to maintain continuity of reported malaria over time so that key trends needed to detect epidemics can continue to be monitored as new data become available.

In addition to the review and analysis of IDSR data, The Carter Center assisted the MOH in reviewing the Malaria Epidemic Guidelines, the Malaria Elimination Guidelines, the national M&E plan and the National Strategic Plan for 2011 to 2015. In view of the change in reporting (from monthly to weekly) at health facilities, The Carter Center proposed major revisions to the Malaria Monitoring Chart being used at the health facility level to detect and mitigate epidemics. These revisions, which are still being studied by the Ministry of Health, promote consistent definitions of epidemics in time and space to allow better monitoring of the numbers of epidemics that occur in the country each year.

3. OPERATIONAL RESEARCH:

3.1 LLIN studies

LLIN Durability:

When manufacturers classify a net as ‘long-lasting,’ this refers primarily to the time during which it is expected to retain at least the minimum effective concentration of insecticide (10 mg/sq m for deltamethrin). New nets are expected to have between 41 and 69 mg (55+/-25%) of deltamethrin insecticide per square meter, and they are expected to retain above 10 mg/sq m through at least 20 washes. The lifetime of an LLIN is estimated to be between three and five years.

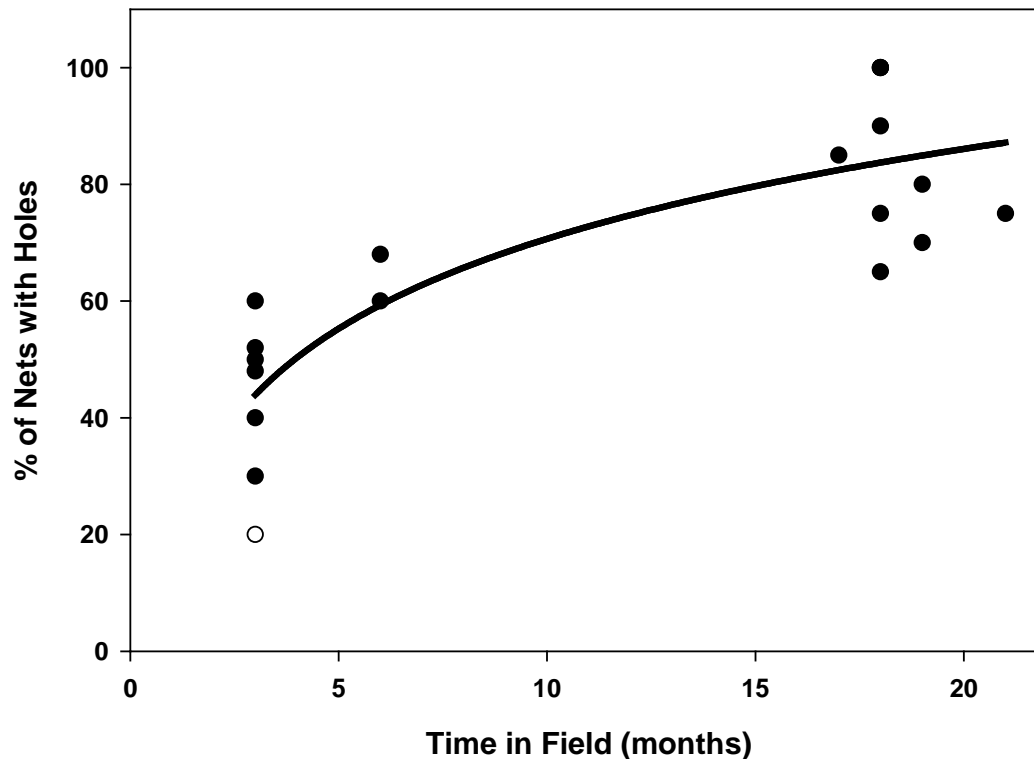
Few studies have examined the *physical* durability of nets in real world settings. If the material that the insecticide is applied to does not last as long as the insecticide itself, the actual lifetime of a net could be significantly less than the predicted three to five years. In actuality, nets are exposed to smoke, dust, heat and embers from indoor cooking, debris that falls from roofs, animals, and small children. In addition, they are often used with traditional sleeping mats made of natural fibers or with rough bed frames that snag and tear the nets when they are tucked in for nighttime use. In these conditions, nets may become so full of holes that they provide little protection when used or are discarded outright. If soiling results in >20 washings, insecticide concentration may drop below the minimal levels for activity.

In order to assess net durability in real world conditions, taking into consideration *both* insecticide retention and the physical condition of the net, The Carter Center is collaborating with Dr. Stephen Smith of the US Centers for Disease Control and Prevention (CDC) in a multi-year operational research project in Ethiopia (See Annex I.2).

The key findings of this study, to date, are summarized below:

- 1) Insecticide concentrations mostly remained >10 mg/sq m after 2.5 years
- 2) In bioassays, insectary-reared mosquitoes showed high mortality when exposed to netting in the field, but wild-caught mosquitoes have begun developing some resistance to the insecticide on the nets.
- 3) Physical deterioration of the nets begins as early as three months after net distribution, and is widespread. (Fig 3)
- 4) Repairing damaged nets by mending is not common practice in the villages studied.
- 5) There are significant differences between sites, both in number of holes and in insecticide loss.

Fig 3 Percentage of LLIN with holes, by time in the field



These results have several potentially significant programmatic implications. They indicate that policy makers and planners at the national level may need to adopt more conservative estimates of net durability when calculating net replacement needs, but they also suggest that intensive mass media and BCC campaigns to encourage net mending may be an effective way to extend the life of nets. Data from this study show that LLINs distributed in 2007 will need to be replaced soon. The Carter Center should assist the MOH to develop and test strategies for the best approach to LLIN replacement.

3.2 Diagnostic studies

Comparison of Different Rapid Diagnostic Tests for the Diagnosis of Malaria at Health Facilities

Since 2006, the operational research team in Ethiopia has been engaged in an assessment of the sensitivity and specificity of a number of rapid diagnostic tests (RDTs) for malaria. The aim of these studies is to determine which RDT is best able to correctly identify cases of malaria and should be used in contexts where microscopy is not available. The studies also give vital information on the proportion of presumptive malaria cases that are actually infected with malaria parasites. The studies were conducted in 10 health facilities in the Amhara region of

Ethiopia and evaluated several RDTs (ParaScreen Pan/Pf, ParaCheck Pf and Carestart) against blood slide microscopy. The detailed results are beyond the scope of this report, and will be published elsewhere. Overall, the results suggest that the RDTs are sufficiently accurate when compared to microscopy, and should be considered for use in health facilities where diagnosis by microscopy is not available. Variability in the comparison of RDT and microscopy results from health center to health center suggests that health workers need more training in using RDTs, and that careful storage and use, rather than accuracy of the tests themselves, are likely to be the more important limiting factors when it comes to the accuracy of RDT results. This highlights the importance of quality training and supervision associated with the introduction of RDTs in new contexts.

One RDT trial of particular interest was a comparison of the ParaCheck Pf RDT with the ParaScreen Pan/Pf RDT. ParaCheck only detects the most dangerous kind of malaria, caused by *Plasmodium falciparum*. The ParaScreen test allows diagnosis of both forms of malaria in Ethiopia (*Plasmodium falciparum* and *P. vivax*), with *P. vivax* causing ‘relapsing’ that requires an extended treatment period if relapse is to be prevented (‘radical cure’). Note in Fig 4 the different occurrences of each form of malaria in the different clinics that participated in the study. If it is assumed that the difference between the red and green bars reflects the occurrence of *P. vivax*, the importance of vivax malaria in this part of Ethiopia becomes readily apparent. Establishing a program that can provide full treatment of the relapsing forms of malaria is important if malaria elimination is a future goal of the Ethiopia Malaria Program.

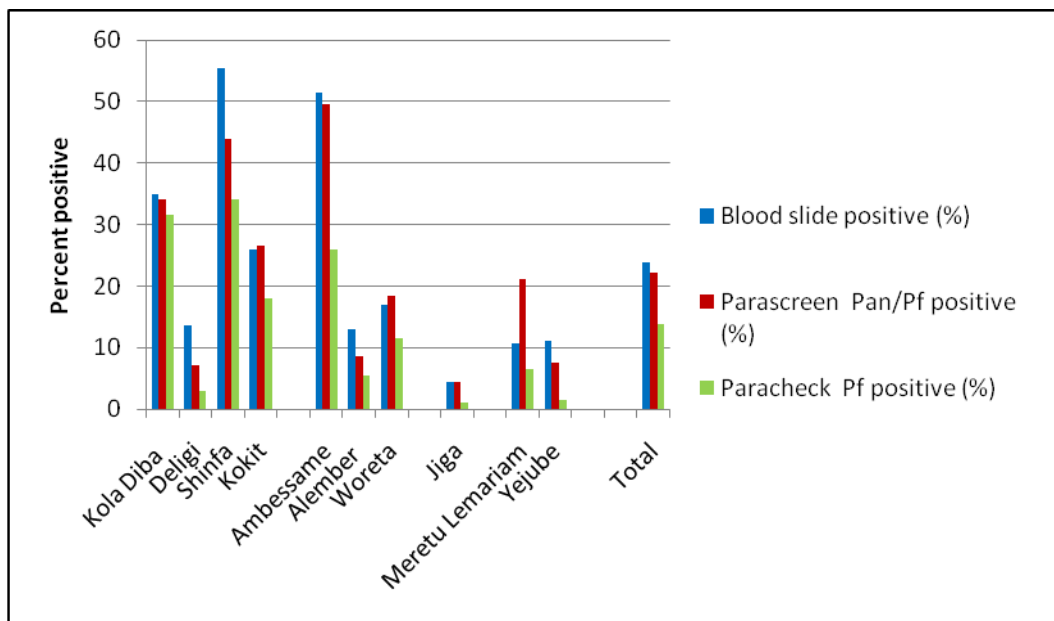


Fig 4: A comparison of ParaScreen (which diagnoses both forms of malaria in Ethiopia (*Plasmodium falciparum* and *P. vivax*)) with ParaCheck (detecting only *Plasmodium falciparum*) among persons with fever in ten health centers in the Western Amhara Region.

2010 ETHIOPIA RECOMMENDATIONS

1. The Federal Ministry of Health (FMOH) national estimate is that 50 million nets are needed between 2008 and 2015 for gap filling and replacement. The Carter Center should assist the FMOH in refining this national level estimate.
2. The Carter Center should work with the targeted regional states (Amhara, SNNPR, Oromia, Gambella, and Benishangul Gumuz) to assist in the microplanning processes for refining LLIN gap estimates and prioritizing replacement need.
3. The Carter Center should assist the FMOH in developing and testing strategies for LLIN replacement.
4. The Carter Center should continue LLIN durability studies.
5. The Carter Center should help the FMOH investigate reasons why nets are not used and devise/test effective behavior change communication/health education (BCC) strategies to overcome this.
6. Net mending should be a key actionable message, and changes in mending practices should be monitored.
7. There should be increased BCC focus on rapid treatment seeking behavior, especially for (mothers of) febrile children and changes in this behavior should be monitored.
8. The Carter Center should continue to help evaluate the River Blindness (RB) program CDDs in an expanded role involving net use monitoring, replacement, and BCC.
9. The roles of the health workers (including health extension workers) and partners in LLIN pre- & post-distribution campaigns (including community mobilization before distribution and follow up on LLIN use and care after distribution campaign) should be clarified and supported.
10. Planning for MalTra weeks should include adequate supplies of RDTs and ACTS (supplied by government or donors) and use of available surveillance data as well as previous MalTra week information to guide the distribution of malaria commodities to the most malarious areas.
11. Methods to assess the impact of MalTra weeks on incidence of malaria should be developed and tested by Carter Center staff and the MOH.
12. The Carter Center should promote a standard definition of epidemics (in terms of time and space) and consistent monitoring of the numbers of epidemics
13. The FMOH and partners should evaluate how radical cures (complete elimination of parasite) for *P.vivax* infections can be achieved in the context of malaria elimination.

NIGERIA

Country Background

Nigeria alone accounts for nearly 25% of the total malaria burden within Africa.⁷ Malaria is endemic in this country, with year-round transmission (unlike the unstable transmission pattern discussed in the previous section on Ethiopia), and as much as 90% of the population is at risk of contracting this disease. In Nigeria, malaria accounts for approximately 60% of outpatient visits, 30% of all hospitalizations, and up to 11% of all maternal mortality, 25% of all infant mortality and 30% of under-five mortality.⁸

While there has been some improvement in malaria indicators since 2003, Nigeria still falls far short of all targets established by the Roll Back Malaria partnership. As of 2008, only 17% of households possessed at least one mosquito net and only 8% possessed an insecticide-treated net. Among children under age five, only 12% slept under a mosquito net the previous night and only 5.5% slept under an insecticide-treated net. Of the 15.9% of children under age five who had a fever in the two weeks prior to a Demographic and Health Survey (DHS) in 2008, only 33% took any antimalarial drug and only 2.4% received an ACT.

However, in 2009, the Nigerian Ministry of Health (MOH) committed to an ambitious goal of reducing the national malaria burden by 50% in the next few years by using a combination of proven malaria control and prevention strategies: increasing the availability and appropriate use of accurate diagnostic technologies, improving the quality of malaria case management with ACTs, distributing long-lasting insecticide-treated bed nets (LLIN), and providing consistent delivery of intermittent preventive treatment (IPT) to pregnant women.⁹ The Carter Center aims to contribute to the achievement of these goals primarily by providing technical expertise, participating in the mass distribution of insecticide-treated bed nets, developing and disseminating behavior change communication and conducting monitoring and evaluation activities as Nigeria continues to scale up its malaria control program.

The Carter Center approach in Nigeria reflects the Center's commitment to developing integrated disease control programs and mobilizing community members to engage in health promotion and disease prevention activities. In Nigeria, as throughout Africa, the same anopheline mosquitoes that transmit lymphatic filariasis (LF) also transmit malaria. Insecticide treated bed nets (ITNs) are one of the most important prevention tools for malaria and should also be useful as an adjunct to mass drug treatment in the LF elimination program. With this in mind, The Carter Center has partnered with the Nigerian MOH and linked ITN distribution with mass drug administration (MDA) programs for LF on a pilot basis beginning in 2004. Sharing resources will result in cost reductions, and protection from the mosquito vectors will reduce transmission of both diseases simultaneously. Distributing ITNs, particularly LLINs, free of charge and at scale (full population coverage) is likely to be an effective way to protect from the possible

⁷ WHO, *World Malaria Report*. 2009, World Health Organization: Geneva

⁸ DHS, *Nigeria Demographic and Health Survey 2008*. 2008, National Population Commission (NPC) and ICF Macro: Abuja, Nigeria.

⁹ Nigeria Federal Ministry of Health, NMCP, *Strategic Plan for Malaria Control in Nigeria, 2009-2013*. 2008: Abuja, Nigeria.

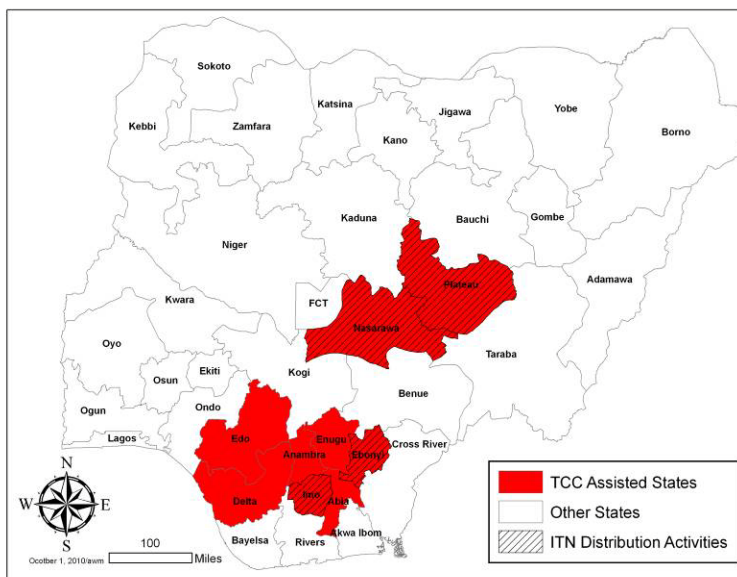
resurgence of LF after MDA with ivermectin/albendazole is halted. Logistical systems have been developed to enable the distribution of insecticidal nets during MDA for LF/onchocerciasis.

As the national malaria control program in Nigeria is preparing to scale up for impact (SUFI), ample opportunities exist for The Carter Center to play an important role in the fight against malaria. The current malaria control effort in Nigeria will be the largest public health intervention ever to be launched by a country against a single disease. The national malaria control program in Nigeria has recognized The Carter Center as having valuable technical expertise and human resources, as well as a strong existing infrastructure at the village level, which can all be mobilized in the national response to this important public health problem in Nigeria.

1. PROGRAM IMPLEMENTATION

1.1. Integrated Projects

The Carter Center program in Nigeria has pioneered the concept of integrated mass treatment in which the logistics of an MDA program are shared across several programs, including malaria. The program in Plateau and Nasarawa states is built on an infrastructure and logistics system that delivers annual combination ivermectin/albendazole treatments with health education for LF to the entire population. Plateau and Nasarawa's partners include Nigeria's FMOH, state governments and health staff, and The Carter Center. The program began in 1999 with integrated river blindness (RB) and urinary schistosomiasis interventions, expanding into LF in 2000. Interventions now also include trachoma (since 2001), Vitamin A deficiency (since 2007), and malaria (since 2004). Malaria activities include the distribution of insecticide-treated bed nets during mass drug administration, as well as educational messages about malaria and the correct use of bed nets. Bed net distribution activities vary by local government area (LGA), depending on net availability. In Imo and Ebonyi states, the integrated effort is between malaria and LF, and was restricted in 2009 to four LGAs.



Nigeria: States assisted by Carter Center ITN distribution activities in 2009.

1.2 LLIN Provision

Plateau and Nasarawa States

Since 2004, a total of 300,650 ITNs have been distributed in Plateau and Nasarawa states, many during mass drug administration (MDA). For the first three years, these ITNs were conventionally impregnated, which meant that the insecticide lasted less than one year before the net needed to be re-treated. Since 2007, The Carter Center has distributed only LLINs (long-lasting insecticidal nets) which have already been impregnated with an insecticide predicted to remain active for up to five years. For the most part, The Carter Center is involved in the distribution of nets provided by the MOH and other partners, and therefore does not make the decisions pertaining to the type or brand of nets distributed. The number of nets distributed each year fluctuates considerably, being dependent upon the number of nets provided by the MOH (Table 1).

Table 1. Yearly net distribution in Plateau & Nasarawa states, 2004-2009.

Year	Nets Distributed
2004	38,620
2005	18,447
2006	64,547
2007	96,270
2008	8,358
2009	74,408
<i>Total</i>	<i>300,650</i>

In 2009, a ninefold increase in LLIN distributed (compared to 2008) took place due to increased supplies from the MOH and a donation of 16,500 *Duranets*[®] by Clarke Mosquito Control. These nets were distributed in Kanke LGA (Plateau State), an LGA with high rates of LF despite many years of MDA.



Participants gathering for the launch of the distribution of the LLIN *Duranet*[®] in Kanke, Nigeria.

The distribution of nets by LGA in Plateau and Nasarawa states in 2009, and since the beginning of Carter Center assistance to ITN distribution in 2004, is shown in Table 2.

Table 2. Nigeria: ITN distribution in Plateau & Nasarawa states, by LGA.

<i>Local Government Area</i>	<i>ITNs Distributed in 2009</i>	<i>Cumulative ITN Distribution (since 2004)</i>
PLATEAU STATE	-	-
Barkin Ladi	-	-
Bassa	-	8,452
Bokkos	-	-
Jos East	34,308	44,913
Jos North	-	-
Jos South	-	12,950
Kanke	16,500	31,980
Kanam	-	-
Langtang North	-	25,816
Langtang South	-	-
Mangu	-	37,497
Mikang	-	-
Pankshin	1,600	1,600
Quanpan	-	27,360
Riyom	-	12,275
Shendam	-	-
Wase	-	-
NASARAWA STATE	-	-
Akwanga	-	26,149
Awe	-	7,858
Keana	-	8,659
Doma	-	-
Karu	-	-
Kokona	-	-
Keffi	-	-
Lafia	-	-
Nawarawa	-	33,141
Nas. Eggon	-	-
Obi	-	-
Toto	22,000	22,000
Wamba	-	-
TOTAL	74,408	300,650

Southeast States

In Ebonyi and Imo states, in contrast to ‘integrated’ distribution in Plateau and Nasarawa, LLIN distribution was conducted in a vertical (‘stand alone’) manner that is the current strategy of the Nigeria National Malaria Program. In 2009, a total of 40,000 *Permanet*[®] (Vestergaard) brand LLINs were purchased, in addition to the ~180,000 nets that had already been delivered in 2008.

Permanet[®] LLIN hanging in a home in Ohaji-Egbema LGA in Imo State.



Nationwide Scale up of Net Distribution

Following a decision taken together with funding partners in late 2008, Nigeria committed in 2009 to full net coverage nationwide. This is achievable through a successful large proposal (~\$600 million) granted under Global Fund Round 8 in 2009. Other donors, such as the World Bank, DFID, and USAID are providing LLINs as well. In Carter Center-assisted states, Anambra State was already supplied with LLIN financed by the World Bank (in 2008), and all other net needs should be fully covered in 2010 with the exception of Delta State (see Table 3). The Carter Center will assist with the distribution of nets in these states as its funding allows, in partnership with the MOH, the State Ministries of Health, and, in some states (Plateau, Edo, Ebonyi, Imo and Abia) with the Yakubu Gowon Centre.

Table 3. LLIN Supply for Carter Center-Assisted States in Nigeria.

State	Target LLIN for Distribution	FINANCED BY Global Fund or other donor	PERCENT FINANCED
Anambra*	1,784,523	1,784,523	100%
Ebonyi	998,126	998,126	100%
Enugu	1,510,440	1,510,440	100%
Nasarawa	864,019	864,019	100%
Plateau	1,452,658	1,452,658	100%
Abia	1,295,126	1,295,126	100%
Edo	1,470,764	1,470,764	100%
Imo	1,842,435	1,842,435	100%
Delta	1,918,989	0	0%
TOTAL	11,352,557	9,433,568	83%

* *Distributed in 2009*

1.3 Behavior Change Communication

The Carter Center Nigeria staff has promoted a series of malaria-specific behavior change messages to accompany specific phases of net distribution campaigns it has conducted so far, especially those in Ebonyi and Imo in the southeast (See Tables 4 and 5). Each key actionable or “do-able” message has been linked to a body of critical knowledge assumed to be a prerequisite for action. Health education focuses on increasing this critical knowledge and encouraging specific associated behaviors. In Ebonyi and Imo, these messages have been used in the development of radio public service announcements and pamphlets and have been included in the training of volunteers involved in net distribution. In Plateau and Nasarawa, these messages recently have been emphasized during net distribution activities.

Table 4. Malaria BCC Messages Used in Nigeria

When to Give Messages	Behavior Change Messages
Before Distribution	<ul style="list-style-type: none"> ▪ Help every family get its share of nets by taking only your own share. ▪ Mosquitoes kill. Kill the Mosquitoes by getting an LLIN from your CDD. ▪ Only mosquitoes that bite at night cause malaria and filariasis. ▪ LLINs are safe for everyone, including children and pregnant women.
During Distribution	<ul style="list-style-type: none"> ▪ Sleep under your LLIN every night, all night long, all year long. ▪ Give priority to pregnant women and children less than 5 years old. ▪ Hang your LLIN so it can be tucked in. ▪ Take all febrile cases to be treated at a clinic within 24 hours.
After Distribution	<ul style="list-style-type: none"> ▪ Protect you and your unborn child with a visit to a clinic for free malaria prevention. ▪ Sell your net and buy malaria. ▪ Mend your LLIN if it tears or gets holes. ▪ Take all febrile cases to be treated at a clinic within 24 hours. ▪ Don't let malaria take you. Completely take all treatments given to make you healthy and happy. ▪ Clear bushes and stagnant water from your own home. ▪ In-Door Residual Spraying provides additional protection from malaria for your family.

Table 5. Actionable Messages for Malaria Control and Associated Critical Knowledge.

Do-Able Message	Critical Knowledge
To protect children and pregnant women from malaria and other diseases like filariasis, make sure they sleep under a LLIN all night, every night.	<ul style="list-style-type: none"> ▪ Malaria and filariasis are diseases carried from one person to another by mosquitoes. ▪ Malaria causes fever, anemia and sometimes death, especially in young children and pregnant women. ▪ Filariasis causes fever, swollen limbs or testicles, and elephantiasis. ▪ Mosquitoes which cause malaria and filariasis bite at all times of the year. ▪ Mosquitoes transmitting these diseases bite only at night.
Hang the net over the sleeping area as soon as you get it and start using it immediately.	<ul style="list-style-type: none"> ▪ LLINs are nets treated with a safe insecticide which can repel or kill mosquitoes. ▪ Nets can be folded or tied up during the day. ▪ Nets must be tucked in to work properly. ▪ A hanging net can repel mosquitoes from the house.
Care for your net by repairing it and washing it carefully when necessary.	<ul style="list-style-type: none"> ▪ A net without holes is the best protection. ▪ Repair holes or breaks in the seams by stitching or patching. ▪ Wash gently with mild soap when needed – up to 6 times per year. ▪ Do not use bleach. ▪ Dry the net in the shade.

Important issues that came up during the Program Review discussions included the dangers of use of artemisinin monotherapies (as opposed to artemisinin combination therapy -ACT) and concerns about the flood of counterfeit antimalarials in Nigeria. BCC messages should be developed that provide information on the dangers of artemisinin monotherapies and warnings about counterfeit drugs.

In addition to the development of messages, The Carter Center Nigeria staff has developed some general guidelines and recommendations to guide future malaria BCC activities based on their experiences to date. These include:

- 1) BCC messages must be broadcast repeatedly over an extended period of time.
- 2) The most intensive BCC activities related to net distribution campaigns must be conducted before and after net distribution. It is logistically difficult for volunteers to provide adequate health education and BCC during the campaign itself when their energies are focused on making sure every household receives the appropriate number of nets.
- 3) Health education should be provided during house-to-house follow-up visits conducted after a net distribution campaign. During these visits, village volunteers should ensure that nets are being used, and being used properly. If they are not, volunteers should provide education to encourage proper use.

2. MONITORING AND EVALUATION

In 2009, the Center engaged in evaluations similar to malaria indicator surveys, on a limited scale, in the context of operational research in southeast Nigeria in Ebonyi and Imo states (see below). In 2010, The Carter Center will conduct the first of a series of surveys intended to evaluate the effects of the intensive scale up of malaria control activities in two states (Plateau and Abia).

3. OPERATIONAL RESEARCH

A study is being conducted in four LGAs in Ebonyi and Imo, with support of the Bill and Melinda Gates Foundation, to assess whether LLINs alone can interrupt transmission of LF in areas where a co-endemic parasite called *Loa loa* makes the usual LF strategy of MDA impossible. This is due to the possibility of severe adverse reactions to the LF MDA drugs in *Loa loa*-infected individuals. The inability to conduct MDA in *Loa loa* endemic areas has completely arrested the LF program in parts of Nigeria. The goal of the research is to determine whether LLINs alone can interrupt LF transmission and control malaria and what level of coverage with nets is required to achieve this (universal coverage versus coverage of only the 'vulnerable groups' [pregnant women and children under five years of age]). A discussion of the impact of LLINs in LF transmission is beyond the scope of this report. However, this project has provided The Carter Center Nigeria program with valuable knowledge and experience, pertaining to the process and impact of stand-alone net distribution in the Nigerian context, that will aid The Carter Center in perfecting strategies for the upcoming widespread national net distribution activities.

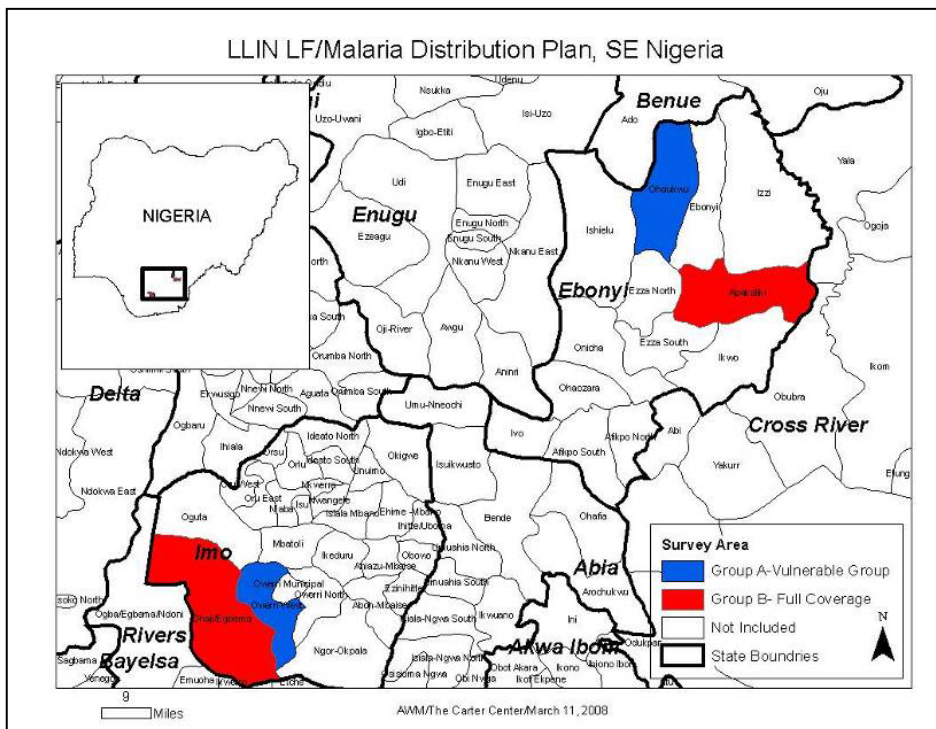
The study currently has two arms:

Targeted: two LGAs provided with LLINs only to vulnerable groups

Full Coverage: two LGAs provided with LLINs for full population coverage

The arm targeting vulnerable groups only will end in 2010 with the national distribution of LLINs in accordance with the full coverage strategy.

In April and May 2008, the Nigerian MOH and The Carter Center distributed 200,000 LLIN in four LGAs that had been randomly divided into the two study groups. The distribution was carried out within 935 villages of the targeted LGAs (Oweri West and Ohaji/ Egbema of Imo State and Abakaliki and Ohaukwu of Ebonyi State). Of the 200,000 LLINs provided, 180,390 (90.2%) are documented as having been delivered to more than 96,240 households. In 2009, an additional 40,000 LLIN were distributed to maximize coverage based on subsequent improved census figures and geographic reconnaissance.



Household Surveys to Evaluate Net Distribution:

A baseline household malaria survey was conducted in the four LGAs in November-December 2007 (before nets), and follow-up surveys were conducted in November-December 2008 and 2009. Characteristics of the population sampled for each survey are presented in Table 6.

Table 6: Sample Characteristics for Imo and Ebonyi State Surveys (2007, 2008 and 2009).

	2007	2008	2009
Total # of Households	968	1078	1294
Mean Household Size	5.6	4.8	4.2
Mean # of Sleeping Spaces	3.1	3.0	2.4
Total # of Participants	5197	5200	5220
# of Children < 5	847	866	863
Total # of Persons Eligible for Malaria Blood Test	1750	1964	1595
# of Children <5 Eligible for Blood Test	334	396	364

Analyses of the survey data suggest that the differences in the outcomes reported below between years is not due to a decline in the condition of nets or to differences between the population of households included in the study from year to year. The preliminary results reveal the following trends:

Bed Net Ownership and Use

- **Household net ownership has increased dramatically compared to baseline, but the level of net ownership immediately following the distribution campaign has not been fully sustained over time** (Fig. 5). In 2008, following net distribution activities, the percentage of households owning at least one net in the full coverage areas was 92%, compared to the baseline of 3.3%. In the areas where net distribution was limited to vulnerable (‘targeted’) groups, the proportion of households owning one or more net rose to 42.4% in 2008. However, in 2009, these percentages fell to 65.3% and 24.5% in the full-coverage and vulnerable-groups-only distribution areas respectively, even given the distribution of an additional 40,000 nets that year.

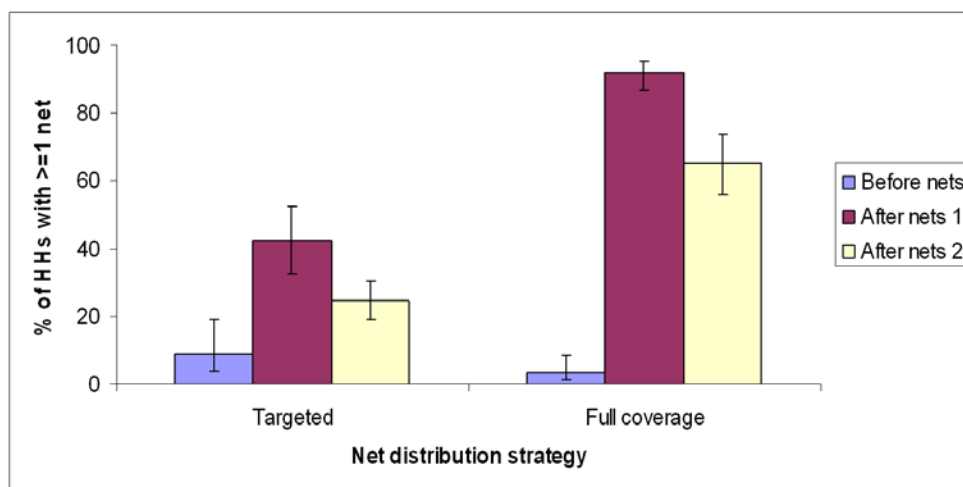


Figure 5. Trends in the percentage of households owning at least one net, before and after net distribution (‘targeted’ means vulnerable group distribution strategy).

While net ownership is still much higher than it was at baseline in both groups, we need to identify the reasons that net ownership has not been sustained, particularly as net need estimates are generally calculated on the assumption that the same net will be used by a household for several years. Possible explanations for the decline in net ownership include: net deterioration, sales of nets, or redistribution of nets to other households.

- **Bed net usage in both groups has increased since the start of the study. However similar to the case of bed net ownership, usage rates declined from 2008 to 2009** (Fig. 6 and 7). While at baseline the percentage of persons who slept under a bed net the previous night was only 2.5% in vulnerable-groups-only LGAs, net usage increased to 13.6% in 2008, but then dropped to 9.8% in 2009. These trends were even more exaggerated in the full-coverage LGAs, where a more dramatic initial increase was seen (1.4% in 2007 to 61.6% in 2008), but a more dramatic decline also in usage was observed from 2008 to 2009 (61.6% to 33%).

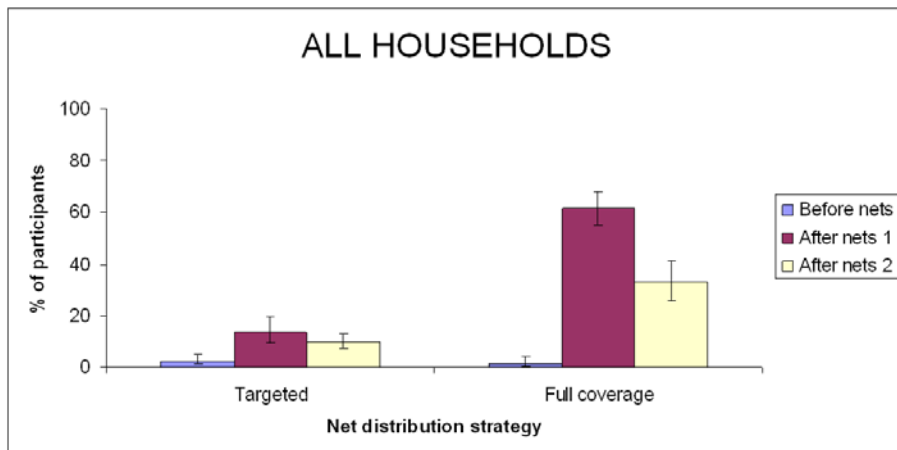


Figure 6. Net use trends within all households and limited to only those households with at least one net ('targeted' means vulnerable group distribution strategy).

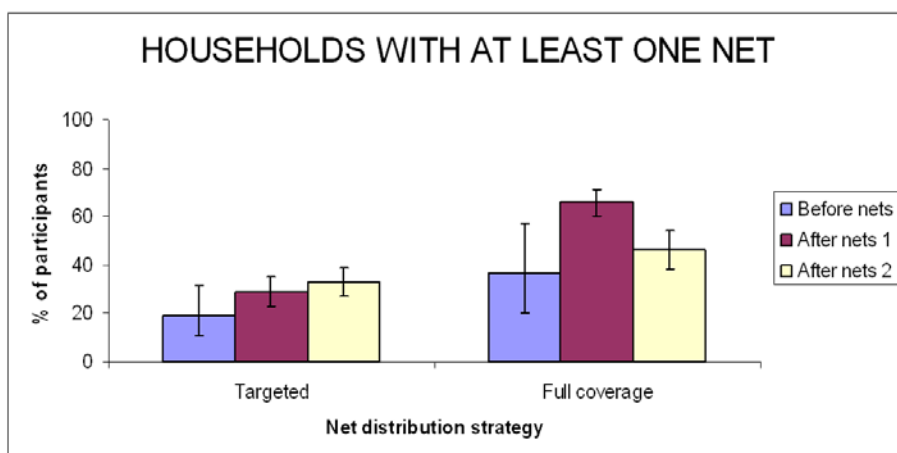


Figure 7. Net use trends in those households with at least one net ('targeted' means vulnerable group distribution strategy).

- As nets have become more available (particularly in the full-coverage areas), the proportion of children under five who sleep protected by nets has increased.** In 2007, only 4.5% and 1.8% of children under 5 slept under a net the previous night in the vulnerable-groups-only and full-coverage areas respectively. However, by 2008, those rates increased to 24.8% in the vulnerable-groups-only areas and to a full 61% in the full-coverage areas. *This suggests that, in order to best protect vulnerable groups, distributing nets to the full population seems to be more effective than distributing to vulnerable groups only.* When nets are in short supply, targeted vulnerable groups (young children and pregnant women) may not be given priority in household decision-making about who will be permitted to sleep under a net. As is the case with the other indicators discussed thus far, the dramatic gains of 2008 were not fully sustained in 2009. Net use among under-5s declined to 19.3% in the vulnerable-groups-only areas and to 39.6% in the full-coverage areas. However, these declines were less pronounced when the analysis was limited to households owning at least one net.

These observed trends suggest that access to mosquito nets is not the only important barrier to sustained net ownership and use. In order to address the declines in these behaviors over time, more BCC and health education are needed. Carter Center BCC messages will continue to emphasize ways to properly repair/care for and use nets as well as the fact that the value of a net when used properly is greater than the cash amount that can be gained by selling the net. In addition, there is a need to explore alternative methods of long-lasting mosquito protection as there seems to be some continued resistance to sustained bed net use, even when nets are provided free of charge to every household.

Malaria Prevalence

- **Blood slide results suggest a significant positive impact of the LLIN distribution on malaria prevalence.** Malaria prevalence was as high as 54.5% in the vulnerable-groups-only regions at the start of the study. In 2008, it had dropped to 14.9%. In the full-coverage LGAs, malaria prevalence declined from 22.3% to 10.1% between 2007 and 2008. Blood slide results for 2009 are not yet available.

Anemia Prevalence

- **The introduction of LLINs in these LGAs was associated with declines in rates of anemia in children less than 10 years of age, as well as with corresponding increases in normal hemoglobin levels.** In the vulnerable-groups-only areas, the percentage of children with moderate-to-severe anemia (Hb<8g/dl) was 19.3% in 2007, 3.3% in 2008 and 9.6% in 2009. For the full coverage areas, these rates were 11.6%, 1.3% and 6.5% for 2007, 2008 and 2009 respectively. The percentage of children with normal hemoglobin (Hb>11 g/dl) in the vulnerable-groups-only LGAs increased from 10.1% in 2007 to 23.5% in 2009, while the proportion of children with normal hemoglobin in the full-coverage areas increased from 22.8% to 40% between 2007 and 2009.



The real-life conditions to which LLINs are subjected may impact their longevity.

NIGERIA 2010 RECOMMENDATIONS

1. The goal of the Federal Ministry of Health (FMOH) of Nigeria is to reach 80% of households with LLIN (2 LLIN/HH). The total needed is 63 million nets, of which the FMOH distributed 19 million between May 2009 and March 2010. Funding has been provided and planning is underway to provide a total of 48 million in 2010 alone (including nets already distributed in the first three months of 2010). Another 9 million nets remain to be financed for distribution in Delta, Kogi, Ondo, Osun, and Oyo states (1.9 million for Delta, a Carter Center-supported state). The Federal government is to support the purchase of those nets, and states will need to provide financing to support transport of these nets to states. The Carter Center should assist in LLIN distribution and other malaria control activities in the nine states it currently assists.
2. The Carter Center (TCC) Nigeria should engage at national and state levels in malaria governance committees, including the Partner's Forum and the Coordination Framework. The Center should also engage in malaria technical committees (especially those related to community-based activities and NTDs). Dr. Miri's direct participation in these committees is encouraged. Dr. Anibueze, Director of Public Health at the FMOH offered to help the Center to engage at federal levels.
3. TCC Nigeria should obtain baseline data prior to 'scaling up for impact' (SUFI) in the Center-assisted areas so that the impact of LLIN distribution in particular can be measured toward RBM targets. In 2010, TCC will conduct the first of a series of surveys intended to evaluate the effects of the scale up of malaria control activities in two states (Plateau and Abia). The 2010 survey should provide baseline estimates, in these states, to help the MOH to evaluate the impacts of the national LLIN distribution campaign. The surveys will also help The Carter Center program to develop effective programmatic activities tailored for the specific needs of each state. Funding should be sought to expand these surveys into additional The Carter Center-assisted states in the future.
4. Behavior change communication (BCC): Mechanisms for delivering health education and BCC messages outside of the actual LLIN distribution exercises should be developed. BCC messages should provide information on dangers associated with the use of artemisinin monotherapies and warnings about counterfeit drugs.
5. Surveillance: In selected states assisted by The Carter Center, TCC Nigeria should evaluate hospital admission data as a malaria surveillance tool.
6. NTDs: TCC should further evaluate the benefits of malaria integration with NTDs, especially the integration of malaria with lymphatic filariasis (LF), since both infections are transmitted by anopheline mosquitoes. The FMOH should complete nationwide LF prevalence surveys as soon as possible in order to promote linkage of LF and malaria programs. Further evaluate the onchocerciasis and LF program community distributors in an expanded role for BCC, net use monitoring and net replacement.

7. The Carter Center requests that the FMOH provide 500,000 LLIN as soon as possible for Plateau and Nasarawa states to allow distribution in LGAs where mass drug administration (MDA) for LF could be stopped if LLIN are first provided.
8. In the study in Imo and Ebonyi states, convert the vulnerable group arm to full-coverage.

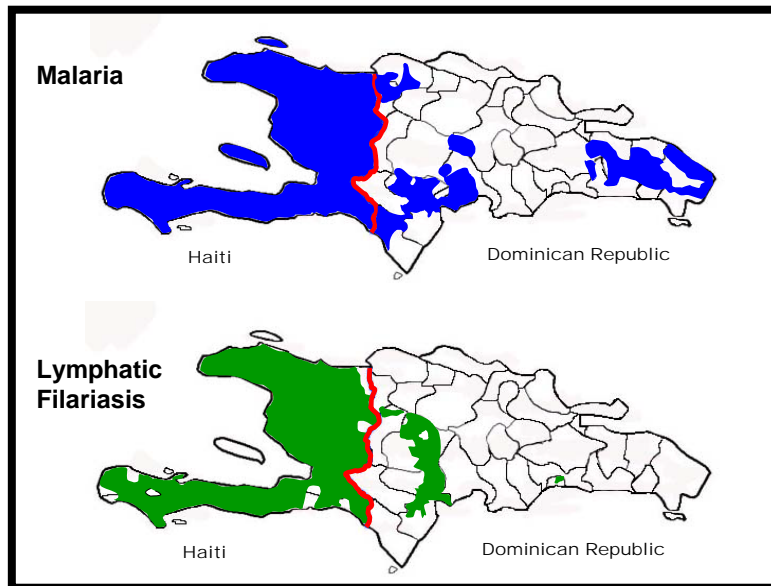
HISPANIOLA

The island of Hispaniola (comprising Haiti and Dominican Republic) is the last island endemic for malaria and lymphatic filariasis in the Caribbean. The filariasis cases in Hispaniola represent 92% of lymphatic filariasis cases in the Americas. Aside from the effects of these diseases of poverty on the island, there are regular exportations of malaria from Hispaniola to other islands, including the Bahamas and Jamaica, causing epidemics. The economic burden, particularly on the tourism industry, is significant.



Therefore, there is a huge potential benefit of eliminating these two diseases from the island of Hispaniola. Globally, lymphatic filariasis elimination is well advanced; malaria elimination in some areas is also being seriously discussed in international circles.

Haiti is much more highly endemic for both diseases compared with the Dominican Republic, as shown in the following map from 2006:



The International Task Force for Disease Elimination, which is housed at The Carter Center and funded by a grant from the Bill and Melinda Gates Foundation, has advocated since 2006 for Haiti and the Dominican Republic to work together to eliminate malaria and lymphatic filariasis from the island. That position was reiterated in 2009 in the *WHO Weekly Epidemiological Record* 11/12:93-4: "The Task Force urges Haiti and the Dominican Republic to prepare a plan

to intensify and expand bi-national collaboration, and emphasizes the need for development partners to help these 2 countries eliminate malaria and lymphatic filariasis from Hispaniola soon.”

In 2008, The Carter Center began funding an 18-month-long demonstration project in two adjacent communities on the border between Haiti and the Dominican Republic. The initiative focused on the border town of Dajabon/Ouananminthe, with the former being the highest malaria endemic district in the Dominican Republic. As a result of this effort, data systems have been synchronized and shared in routine meetings between the two ministries of health, cases have been mapped, LLINs distributed, and the malaria treatment policies of the two countries have been aligned. Haiti has altered its national policies to provide free malaria diagnosis and treatment and has added primaquine to chloroquine treatment to reduce circulating gametocytes (and possibly also reduce transmission).

In October 2009, President Carter visited the border communities, met with both presidents (photographs below), ministers of health and their donor partners and held press conferences in Santo Domingo and Port-au-Prince.



Left: President Carter meets with Dominican President Dr. Leonel Fernandez.
Right: President Carter presents Haitian President René Préval with a signed copy of his book while Dr. Alex Larson looks on.

Both governments announced a \$194 million bi-national plan to eliminate malaria by 2020. Haiti announced a \$49.4 million plan to eliminate lymphatic filariasis by 2020, while the Dominican Republic expects to eliminate LF by 2010. Of this budget, about \$10 million would be used to support coordinated efforts by the two countries that share the office. That support is proposed to be provided via the Pan American Health Organization (PAHO).

While the Carters’ trip to Hispaniola in October 2009 drew international attention to the common elimination goals of the two countries, the subsequent earthquake in Haiti impacted the plans for elimination. However, in the current plans for reconstruction, there is yet an opportunity to restructure for an even better future; one free of malaria and LF.

HISPANIOLA 2010 RECOMMENDATIONS

The Carter Center's direct support to the Haiti project will end in April 2010.

Use the influence of The Carter Center to advocate among key donors for US \$10 million over 10 years to support coordinated efforts by the two countries to eliminate malaria and LF. That support is proposed to be provided via the Pan American Health Organization (PAHO).

ANNEX 1: SUMMARIES OF PRESENTATIONS BY INVITED GUESTS

Ethiopia

- 1) Dr. Asrat Genet
- 2) Dr. Stephen Smith

Nigeria

- 3) Dr. Babatunde Ipaye (on behalf of Dr. Folake Ademola-Majekodunmi)
- 4) Dr. Remi Sogunro (presented by Dr. Babatunde Ipaye)

1) Malaria in Ethiopia

Dr. Asrat Genet Amnie, Head, Bureau of Health, Amhara Regional State

The history of the malaria control program in Ethiopia was described, starting with the establishment of the malaria eradication service in 1959. This was converted to a vertical malaria control program in 1971, and then integrated into the general health system and decentralized in 1993.

Malaria is a leading public health problem in Ethiopia, affecting two thirds of the population. Malaria was the leading cause of death in 2006.

Recent achievements include the cumulative distribution of more than 22 million nets since 2001 (Fig. 1). In ranking of African countries on household net ownership, Ethiopia has moved from almost last in 2005 to fifth place in 2007. There is evidence that the incidence of in-patient malaria has declined significantly since 2004 in the three largest regions.

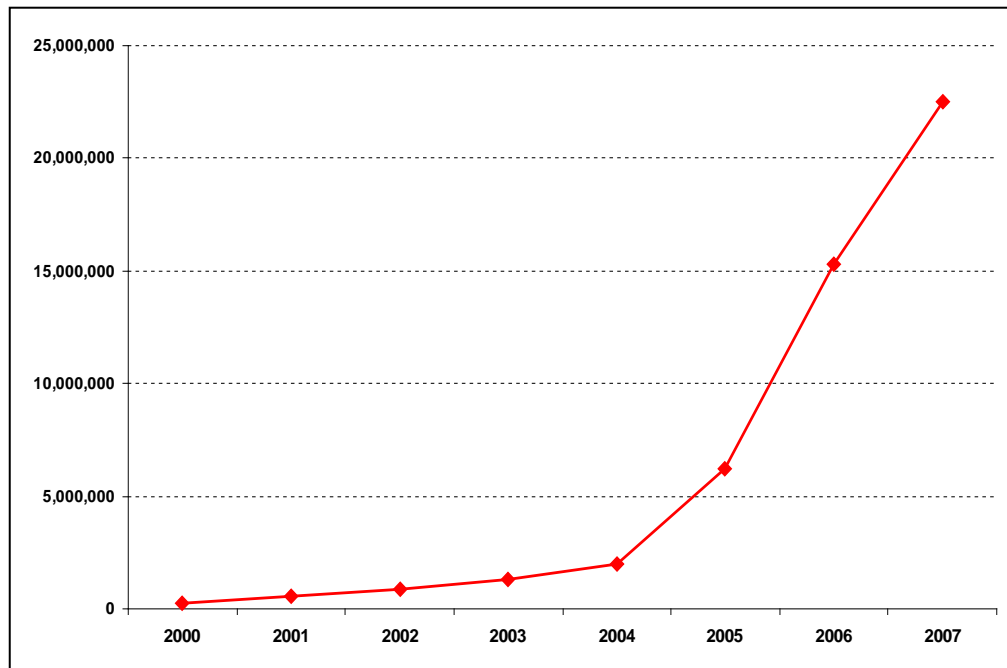


Figure 1. Cumulative number of nets distributed by year.

A new malaria control strategic plan has been recently developed for the period 2010-2015. The components are:

1. Community empowerment and mobilisation
2. Diagnosis and case management
3. Prevention
 - IRS, LLIN and environmental management
4. Active surveillance and epidemic control
 - Early warning, preparedness, response and recovery

In order to ensure 100% net ownership and ensure net replacement, from 2008 onwards (to MDG date of 2015) an extra 50 million ITNs are needed to replace old nets. The target dates for elimination stages are shown in Fig. 2 below.

The 9 outcome indicators in the strategic plan were described:

- Proportion of households with ≥ 1 ITN in target districts
- Proportion of children <5 years old and adults who slept under an ITN the previous night in malarious areas
- Proportion of pregnant women who slept under an ITN the previous night in malarious areas
- Proportion of children under 5 years old with fever in last 2 weeks who received diagnosis within 24 hours from onset of fever
- Proportion of children under 5 years old with fever in last 2 weeks who received a heel or finger stick (for diagnosis)
- Proportion of severe malaria cases in children <5 presenting at health facility receiving appropriate case management as per national guidelines
- Proportion of households in IRS-targeted areas that were sprayed in the last 12 months
- Proportion of malaria epidemics detected that are addressed as per national guidelines within two weeks from onset
- Proportion of women who recognize ITNs and IRS as a malaria prevention method

With elimination in mind, there are also 4 'sustained impact' indicators:

- Proportion of previously malarious kebeles reporting no monthly malaria cases for 24 months
- Prevalence of parasite infection in children < 5 years old and adults
- Lab-confirmed (RDT or microscopy) malaria incidence per year, among children <5 years old and adults
- Lab-confirmed (RDT or microscopy) malaria case fatality ratio among children <5 years old and adults

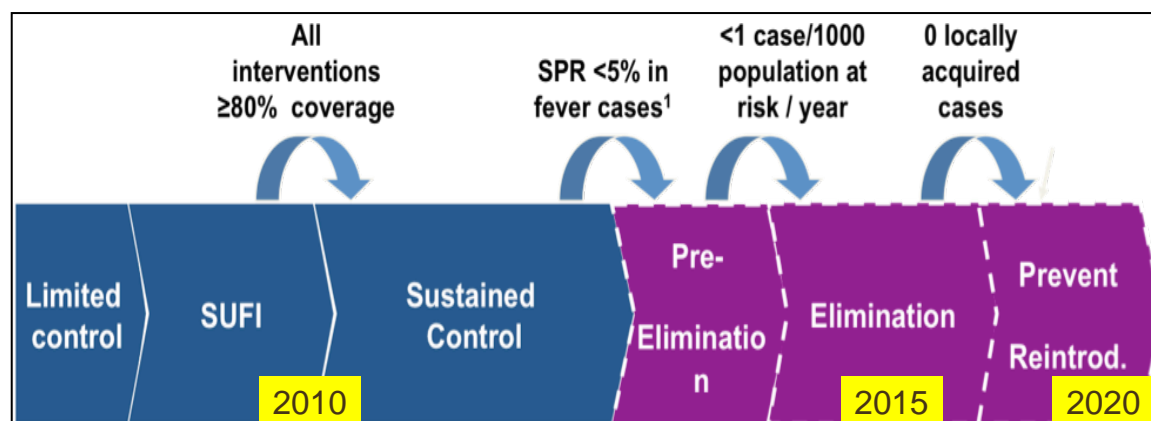


Figure 2. Timeline for elimination in Ethiopia.

2) Monitoring the durability of LLINs in rural Ethiopia **Dr. Stephen C Smith, CDC Entomology Branch Atlanta**

Background

Millions of LLINs have been distributed worldwide, but little attention has been paid to post-distribution monitoring, and that which has been done has mainly focused on insecticide retention. There is no consensus methodology or consolidation of results for post-distribution monitoring. The claims by net manufacturers for their products have not been well verified.

The Carter Center purchased and supported distribution of 3 million *Permanet*[®] 2.0 LLINs in three regions of Ethiopia in early 2007. These nets were 75 denier fiber, rectangular dimensions of 190L x 180W x 150H cm, and blue in color. The batch numbers were recorded.

Objectives of the Study

- Assess rate of deterioration of *Permanet*[®] LLINs distributed by The Carter Center in Ethiopia.
 - Both physical condition and insecticide retention.
 - Guide timing for future replacement campaigns.
- Assess variance in deterioration rates.
 - Inform future sampling strategies.
 - Inform future replacement strategies.
- Develop methods to quantify LLIN deterioration.
 - Especially to guide development of rapid assessment techniques.

Methods

Samples of nets identified by the label were collected in 2007 (169 nets used for 3-6 months from 8 sites), 2008 (220 nets used for 3-21 months from 11 sites) and 2009 (220 nets used for 12-32 months from same 11 sites). Site locations are shown in Fig. 1 at right.

Nets were placed over a frame (see Fig. 2) and the size and location of holes and repairs measured and recorded.

Insecticide (deltamethrin) concentration on the nets was measured by x-ray fluorescence (Fig. 3). Bioassays were performed with a sample of nets using susceptible and resistant *Anopheles* mosquitoes.

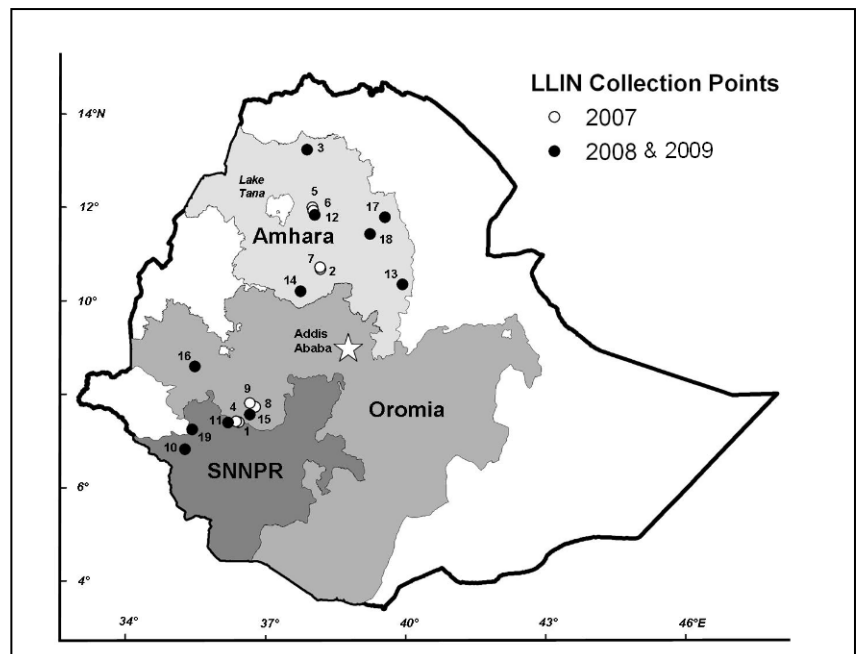


Figure 1. Site locations of collected LLINs.



Figure 2. Assessing holes in a net.



Figure 3. X-ray fluorescence to measure deltamethrin.

Results and Conclusions:

Out of a total of 389 nets collected, only 3 showed evidence of repairs. Hole formation started early, with a mean of 4.3 holes after 3-6 months of use. The number of holes and the percentage of nets with damage increased significantly by 17-21 months, but the mean hole size (2.2-2.5 cm in length) and distribution of sizes (ratio of large to small holes) stayed the same over time.

Deltamethrin concentrations fell significantly between the 3-6 months and 17-21 months of use time points but then remained stable up to 32 months. However, even after 2.5 years, most recovered nets have insecticide levels above the manufacturer-recommended level. The bioassay results supported the finding that most nets retain sufficient insecticide to kill susceptible mosquitoes, but data are available (not included here) that suggest local wild-caught mosquitoes in Ethiopia are developing resistance to deltamethrin.

Significant differences between collection sites were observed in the number of holes and the insecticide loss. These results will be useful in devising standard monitoring methods for future net purchasing and replacement decisions.

3) Nigeria National Malaria Control Program

Dr. Babatunde Ipaye, Nigeria National Malaria Control Program

Dr. Babatunde Ipaye presented a review of the Nigeria National Malaria Control Program (NMCP) on behalf of Dr. Folake Ademola-Majekodunmi, National Coordinator for the NMCP. His major points for The Carter Center were:

- 1) The Carter Center has enormous technical, human and infrastructural capacities that should be important in supporting the call to action against malaria in 2010.
- 2) Malaria, as the biggest public health problem in Nigeria, should attract attention of The Carter Center Board for significant funding that is needed to support the operational cost for service delivery at the sub-national levels (funds at this level are not provided in the Global Fund grant to Nigeria).

The NMCP Goal is to reduce by 50% malaria-related morbidity and mortality in Nigeria by 2010 and to minimize the socio-economic impact of the disease. The targets for the period 2009-2013 are:

1. By 2010 at least 80% of households have two or more ITNs/LLINs and level of coverage is sustained until 2013
2. By 2010 at least 80% of children <5 and pregnant women sleep under an ITN and coverage is sustained until 2013
3. By 2011 at least 80% of fever/malaria patients receive appropriate and timely treatment and coverage level is sustained until 2013
4. By 2011 all (100%) of pregnant women attending antenatal care receive at least two doses of intermittent preventive treatment and coverage level is sustained until 2013
5. By 2010 malaria related morbidity and mortality is reduced by 50% and level of coverage is sustained to 2013

Since a decision was taken in November 2008 that Nigeria would go for full Scale Up for Impact (SUFI), and since the approval of the Global Fund Round 8 grant, it was determined that the total number of LLINs required to achieve SUFI in Nigeria is 63 million. The number of LLINs distributed between May 2009 and March 2010 was 19,367,023. In 2010, over 47.9 Million LLINs will be distributed in 30 states (including 8 of the 9 Carter Center-assisted states according to a monthly schedule. There is a remaining 9.3 million gap in 5 states, including Delta.

Beyond 2010, the plan is to institute net replacement strategies, increase the availability of ACTs and do more indoor spraying in the context of integrated vector management. The Affordable Medicine Facility-Malaria (AMFm) is a cost-saving mechanism created by GF to make ACT cheap and available. AMFm will deliver 53 million doses of ACTs in the GF-R8 grant to Nigeria in the next 2 years. The ACTs will be delivered at a cost of about \$0.20 (N30), equal or less than cost of chloroquine and Sulphadoxine-pyrimethamine. They will be free through the public sector (NMCP and Yakubu Gowon Centre). Scale-up of IPTp and the use of larvicide will also receive attention.

The key challenges identified are:

1. Operational cost for service delivery at the sub-national levels (not provided in the GF grant)
2. Gaps still exist in anti-malaria medicines and commodities required
3. Technical and infrastructural requirements for managing massive quantities of anti-malaria commodities and medicines
4. Human resource capacity in terms of skills, numbers and mix
5. Program management structures and capacity at state and LGA levels are weak
6. Gaps in funding for coordination mechanisms, system strengthening, etc.



Nigerian boy receiving an LLIN to protect himself from malaria. Photo courtesy of the National Malaria Control Program, Nigeria.

4) The Ekiti State Net Distribution Project

**Dr. Remi Sogunro, Director, Malaria Program, Yakubu Gowon Center
(Presented by Dr. Babatunde Ipaye)**

Background

The Yakubu Gowon Centre for National Unity and International Cooperation (YGC) has a focus on long-term reduction of malaria through universal coverage of key interventions with a special focus on pregnant women, children under five and the rural poor. As a principal recipient of Global Fund grants to Nigeria, the YGC has been assisting with LLIN distribution in Nigeria in several states. The presentation described an LLIN scale up campaign in Ekiti state that occurred in November and December 2009. This is an example of how LLIN distribution may potentially occur in 2010 in other YGC supported states.

The Ekiti campaign

With a population of 2.6 million, Ekiti state received an allocation of 1,028,155 LLINs for 16 LGAs. The goals of the campaign were to distribute LLIN to all households, with each household having at least 2 LLIN, and to ensure at least 80% of those at risk sleep under ITN.

The phases of the LLIN campaign were:

1. Pre-implementation: *Formation of local coordinating committees (LCCN), advocacy, micro-planning (including assessing preparedness, sharing lessons from previous campaigns, setting timelines, set up supervision framework), and adaptation of IEC materials*
2. Implementation: *Training, household mobilization and distribution*
3. Post-implementation: *End process, retention survey and debriefing*

During the implementation phase, 210 state-level trainers were trained and training was subsequently cascaded down to 7,890 LGA personnel. The campaign team comprised the YGC together with the Federal Ministry and National Malaria Control Program, together with state agencies. The distribution process was managed through 'Net cards' distributed through the LGA malaria focal persons during the household mobilization in advance of the nets. Each card entitles a household to 2 nets. A total of 443,374 net cards were distributed in 5,987 settlements covering over 2.1 million persons. Fig. 1 shows the number of cards distributed and nets redeemed by LGA. At distribution points, there were on average 7 personnel managing the process and doing health education; crowd control was an issue at some distribution points. Overall 889,762 LLIN were distributed.

An end process evaluation was done in 2,560 households. These were selected by a multistage process in clusters of 10 households in 4 settlements in 4 wards in each LGA. The evaluation showed that 96.1% of households in Ekiti state had been reached during the mobilization and received cards, 87.3% of households had received nets and 52.1% of them had hung their nets. Net use was 88.6% among pregnant women, 69.6% among children under 5 and 50% among non-pregnant adults. Household net ownership increased from 23% to 95% through the campaign. More than 95% of households had received information about the campaign from at least one source (Fig. 2). Electronic media were the most effective means of communication, followed closely by town criers and religious houses.

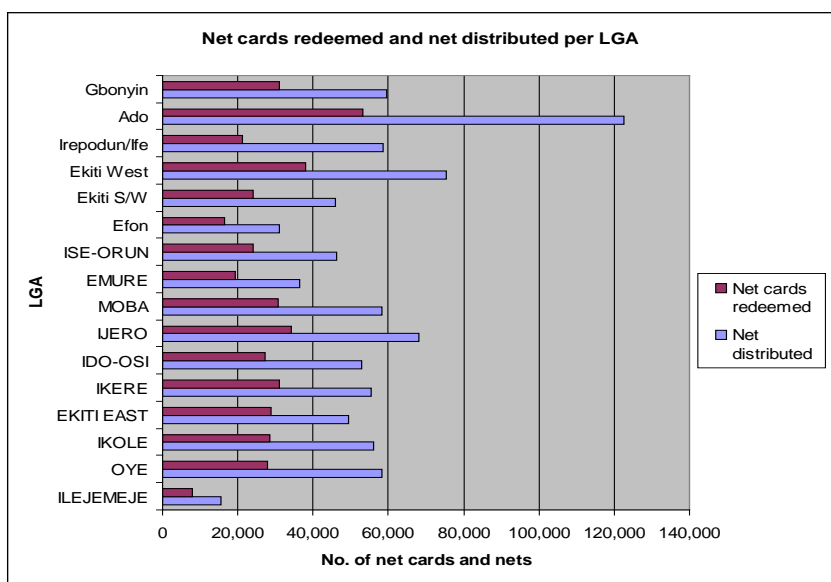


Figure 1. Number of cards distributed and nets redeemed, by LGA.

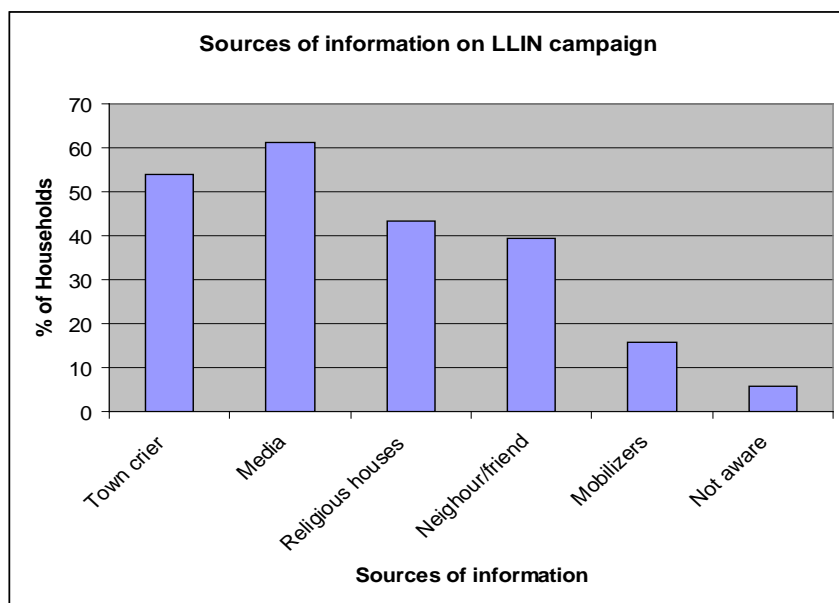


Figure 2. Sources of information on LLIN campaign.

Lessons learned:

1. Resources must be allocated to LGA according to population size, with special consideration to densely populated urban areas.
2. Personnel to distribute LLINs must also be allocated based on number of nets per LGA.
3. Daily tracking of net cards and nets distributed is a useful way to estimate population more accurately as well as detect problematic LGAs likely to have low coverage.
4. Funding from state and LGA must be agreed upon in advance with clear deadlines.

ANNEX 2: THE NEGLECTED TROPICAL DISEASES (Trachoma, Onchocerciasis and Lymphatic Filariasis)

TRACHOMA and its control

Trachoma is the world's leading infectious 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 Inc 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 feces).

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. The female adult worms release microfilariae (mf), which are tiny embryonic worms that exit the nodules and swim under the skin, where they cause inflammation. The mf can also enter the eye and cause visual damage or even blindness. Onchocerciasis is transmitted by *Simulium* black flies that breed in fast-flowing rivers and streams, hence its common name, "river blindness". The black flies ingest the mf, which then develop over several days into infectious larvae and are then able to be transmitted to another person when the fly bites again. 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, ultimately, blindness.

Periodic mass treatment with ivermectin (Mectizan[®], donated by Merck and Co., Inc.) kills the mf and prevents eye and skin disease caused by *O. volvulus* and may also be used to reduce or interrupt transmission of the disease. Delivery of ivermectin in Africa is done by community volunteers called Community Drug Distributors (CDDs). CDDs serve their own communities and kinship networks once per year by providing the ivermectin tablets. Applying this strategy enables the affected communities to have shared responsibility in the planning, execution, monitoring, evaluation, and reporting process of the disease control activities.

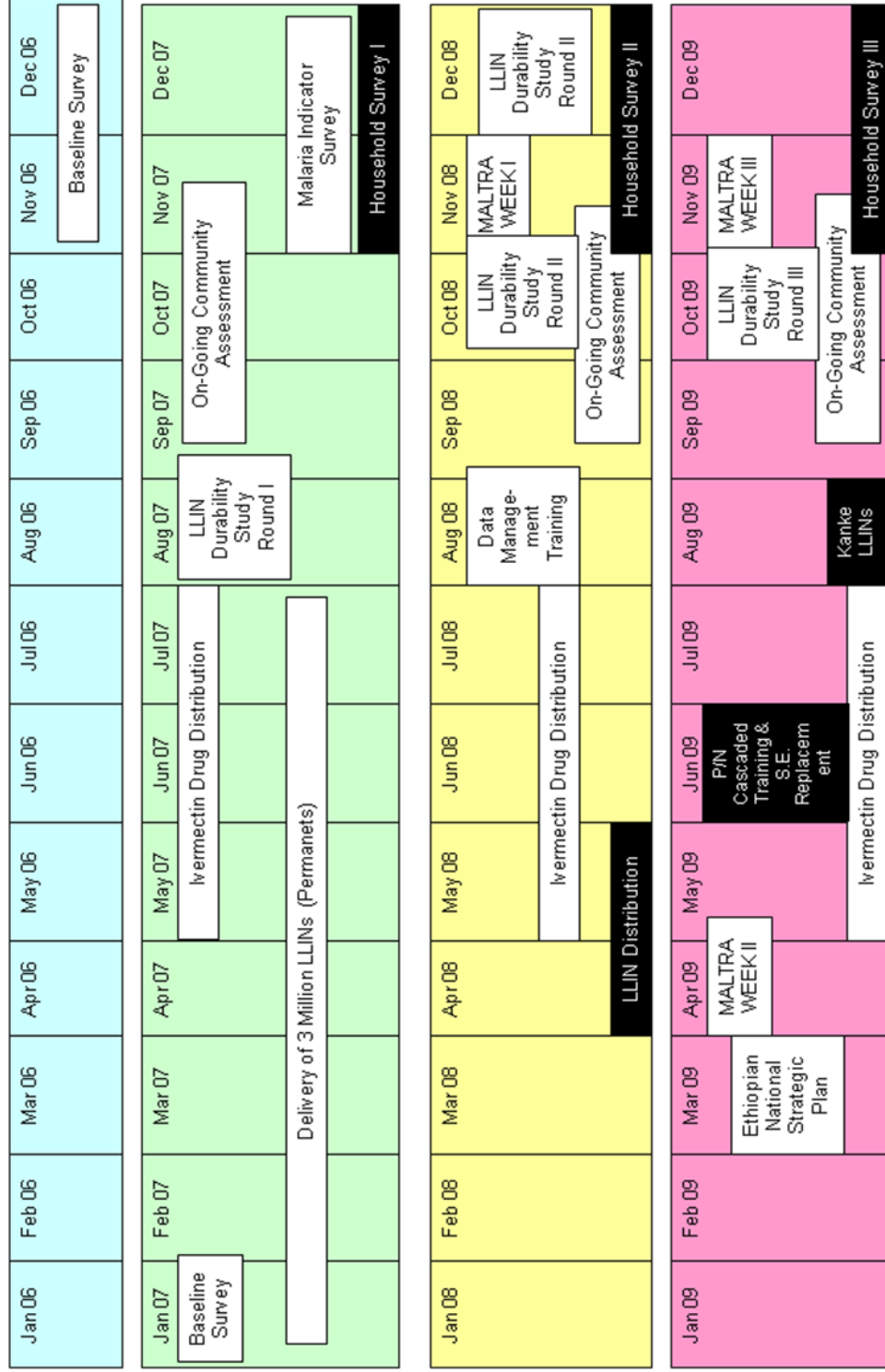
LYMPHATIC FILARIASIS and its control

Lymphatic filariasis (LF) in Africa is caused by *Wuchereria bancrofti*, a filarial worm that is transmitted in rural and urban areas by *Anopheles* and *Culex sp.* mosquitoes respectively. The adult worms live in the lymphatic vessels and cause dysfunction, often leading to poor lymphatic drainage. Clinical consequences include swelling of limbs and genital organs (lymphedema and “elephantiasis”) and painful recurrent attacks of acute adenolymphangitis.

Transmission occurs when the female adult worms release microfilariae (mf), which are tiny embryonic worms that circulate in blood at night, when the vector mosquitoes bite. The mf are picked up by mosquitoes, develop over several days into infectious larvae and are then able to be transmitted to another person when the mosquitoes bite again.

The mf are killed by annual single-dose combination therapy, with either Mectizan[®] (donated by Merck & Co., Inc.), albendazole (donated by GlaxoSmithKline), or diethylcarbamazine (DEC) and albendazole (in areas where there is no onchocerciasis and/or *Loa loa* infection). Annual mass drug administration (MDA) prevents mosquitoes from being infected and, when given for a period of time (estimated to be five to six years), can interrupt transmission of *W. bancrofti* (which has no animal reservoir, so the transmission cycle is dependent on infecting humans).

ANNEX 3: MALARIA CONTROL PROGRAM TIMELINE



The Carter Center
Malaria Control Program
Timeline

January 2006-December 2009



ANNEX 4: PUBLICATIONS AND ABSTRACTS SINCE 2007

- 1) Emerson PE, Ngondi J, Shargie EB, Graves PM, Ejigsemahu Y, Gebre T, Endeshaw T, Genet A, Mosher AW, Zerihun M, Messele A and Richards FO (2008). *Integrating an NTD with one of “The Big Three”: combined malaria and trachoma survey in Amhara Region of Ethiopia*. PLOS Neglected Tropical Diseases 2(3): e197.
- 2) Endeshaw T, Gebre T, Ngondi J, Graves PM, Shargie EB, Ejigsemahu Y, Ayele B , Yohannes G, Teferi T, Messele A, Zerihun M, Genet A, Mosher AW, Emerson PM and Richards FO (2008). *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*. Malaria J 7:118.
- 3) 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 and Emerson PM (2008). *Risk factors for active trachoma in children and trichiasis in adults: a household survey in Amhara Regional State, Ethiopia*. Trans Roy Soc Trop Med Hyg 102(5):432-8.
- 4) Shargie EB, Gebre T, Ngondi J, Graves PM, Mosher AW, Emerson P, Ejigsemahu Y, Endeshaw T, Olana D, WeldeMeskel A, Teferra A, Tadesse Z, Tilahun A, Yohannes G, Hopkins DR and Richards FO. (2008). *Malaria prevalence and mosquito net coverage in Oromia and SNNPR regions of Ethiopia*. BMC Public Health 8: 321.
- 5) Graves PM, Richards FO, Ngondi J, Emerson PM, Shargie EB, Endeshaw T, Ceccato P, Ejigsemahu Y, Mosher AW, Hailemariam A, Zerihun M, Teferi T, Ayele B, Mesele A, Yohannes G, Tilahun A and Gebre T (2009). *Individual, household, and environmental risk factors for malaria infection in Amhara, Oromia and SNNP regions of Ethiopia*. Trans Roy Soc Trop Med Hyg. 103(12):1211-20.
- 6) Shargie EB, Ngondi J, Graves PM, Getachew A, Hwang J, Gebre T, Mosher AW, Ceccato P, Endeshaw T, Jima D, Tadesse Z, Tenaw E, Reithinger R, Emerson PM, Richards FO and Ghebreyesus TA. (in press). *Rapid increase in ownership and use of long-lasting insecticidal nets and decrease in prevalence of malaria in three regional states of Ethiopia, 2006-2007*, Journal of Tropical Medicine.

Abstracts presented at ASTMH 2007

- 1) Paul Emerson, Yeshewamebrat Ejigsemahu, Estifanos Biru, Patricia Graves, Jeremiah Ngondi, Asrat Genet, Teshome Gebre, Tekola Endeshaw, Aryc Mosher, Frank Richards. *Integrating one of the NTDs with one of the big three. An integrated malaria indicator, parasite prevalence, trachoma indicator and trachoma prevalence survey in Amhara national regional state, Ethiopia*.
- 2) Patricia M Graves, Yeshewamebrat Ejigsemahu, Estifanos Biru, Aryc W Mosher, Jeremiah Ngondi, Teshome Gebre, Tekola Endeshaw, Paul Emerson , Afework Hailemariam, Frank O Richards. *Can river blindness village workers improve the quality of LLIN distribution? A mosquito net coverage and malaria prevalence survey in Oromiya and SNNP regions of Ethiopia, 2006-2007*.

Abstracts presented at ASTMH 2008

- 1) 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 , Daddi Jima, Tedros Adhanom Ghebreyesus. *Individual, household, and environmental risk factors for malaria infection in Amhara, Oromia and SNNP regions of Ethiopia*.

2) Daddi Jima, Jimée Hwang, Asefaw Getachew, Hana Bilak, Estifanos Biru Shargie, Teshome Gebre, Gashu Fentie, Adam Wolkon, Scott Filler, Richard Reithinger, Paul M Emerson, Tekola Endeshaw, Aryc W Mosher, Frank O Richards, Eskindir Tenaw, Ambachew Medhin, Khoti Gausi, John Miller, Judith Robb-McCord, Richard Steketee, Patricia M Graves, Zerihun Tadesse, Tedros Adhanom Ghebreyesus. *Achievements in Malaria Control in Ethiopia— Results from Malaria Indicator Survey, 2007.*

3) Aryc W Mosher, Moses Katarwa, Teshome Gebre, Estifanos Biru Shargie, Abate Tilahun, Patricia M Graves, Frank O Richards. *Impact of increased numbers of Community Directed Distributors on successful distribution of ivermectin in Ethiopia, 2007.*

4) Estifanos Biru Shargie, Patricia M Graves, Asefaw Getachew, Jimée Hwang, Frank O Richards, Paul M Emerson, Teshome Gebre, Aryc W Mosher, Tekola Endeshaw, Yeshewamebrat Ejigsemahu, Afework Hailemariam, Eskindir Tenaw, John Miller, Ambachew Medhin, Jeremiah Ngondi, Daddi Jima, Zerihun Tadesse, Tedros Adhanom Ghebreyesus. *Rapid increase in coverage with long-lasting insecticidal nets in Amhara, Oromia and SNNP regions of Ethiopia.*

Abstract presented at ASTMH 2009

Jimée Hwang, Patricia M Graves, Richard Reithinger, Asefaw Getachew, Hana Bilak, Estifanos Biru Shargie, Jeremiah Ngondi, Aryc Mosher, Adam Wolkon, Eskindir Tenaw, S. Patrick Kachur, Daddi Jima. *Mother's Knowledge of Malaria Predicts Child's ITN Use and Fever Treatment— Malaria Indicator Survey, Ethiopia, 2007*

Abstract presented at MIM 2009 Nairobi.

Stephen C. Smith, Aprielle Brackery, Paul Emerson, Tekola Endeshaw, Patricia Graves, Estifanos Biru, Gedeon Yohannes, Teshome Gebre. *Physical and insecticidal deterioration of bednets after 3 - 6 months household use in rural Ethiopia.*

ANNEX 5: LIST OF PARTICIPANTS

BASF Corporation

Dr. Egon Weinmuller

Bill and Melinda Gates Foundation

Dr. Jan Agosti

Emory University

Dr. Deborah McFarland

Dr. Julie Gutman

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Dr. Teshome Gebre (TCC)

Mr. Asrat Genet (Amhara Region)

Dr. Zerihun Tadesse (TCC)

Mr. Tesfaye Teferri (TCC)

Mr. Abate Tilahun (TCC)

Centers for Disease Control and Prevention (CDC)

Dr. Stephen Smith

Clarke Mosquito Control

Mr. William Jany

Development Finance International

Ms. Jessica Rockwood

Lions Ethiopia

Dr. Tebebe Berhan

Nigeria

Mr. Kal Alphonsus (TCC)

Dr. Michael Anibueze (MOH)

Dr. Abel Eigege (TCC)

Dr. Emmanuel Emukah (TCC)

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Dr. Patricia Graves

Dr. John Hardman

Ms. Madelle Hatch

Dr. Donald Hopkins

Ms. Lauri Hudson-Davis

Dr. Moses Katarbarwa

Mrs. Nicole Kruse

Mr. Aryc Mosher

Mr. Kent Nelson

Ms. Lindsay Rakers

Dr. Frank Richards

Mr. Randy Slaven

Mr. Craig Withers

Mr. Phil Wise

French Consulate Atlanta

Ms. Claire Collobert

ANNEX 6: PROGRAM REVIEW AGENDA

Friday, March 26, 2010

8:00	Shuttle pickup at hotel	
8:30 – 9:00	Continental breakfast	
9:00 – 9:05	Welcome	Dr. Donald Hopkins
9:05 – 9:15	Overview and Introduction	Dr. Frank Richards (chair)
9:15 – 9:45	Ethiopia: Malaria situation and control program progress	Dr. Asrat Genet
9:45 – 10:00	<i>Discussion</i>	
10:00 – 10:30	Ethiopia: Country Progress - 4 Key Program Areas	Mr. Teshome Gebre
10:30 – 10:45	<i>Discussion</i>	
10:45 – 11:00	Coffee Break	
11:00 – 11:30	Nigeria: Malaria situation and control program progress	Dr. Babatunde Ipaye
11:30 – 11:45	<i>Discussion</i>	
11:45 – 12:15	Nigeria: Country Progress - 4 Key Program Areas	Dr. Emmanuel Miri
12:15 – 12:30	<i>Discussion</i>	
12:30 – 2:00	Lunch	
2:00	Ethiopia: Operational Research & Other Discussions	Dr. Paul Emerson (chair)
2:00 – 2:25	Malaria Diagnosis and Treatment in MalTra week	Dr. Zerihun Tadesse
	<i>Discussion</i>	
2:25 – 2:50	Assessing impact to date	Dr. Patricia Graves
	<i>Discussion</i>	
2:50 – 3:15	LLIN Durability	Dr. Stephen Smith
	<i>Discussion</i>	
3:15 - 3:30	Group Photograph	
3:30 – 3:45	Coffee Break	
3:45	Nigeria: Operational Research & Other Discussions	Dr. Paul Emerson (chair)
3:45 – 4:05	LLIN impact on malaria/anemia in SE	Dr. Emmanuel Emukah
	<i>Discussion</i>	
4:05 – 4:25	Review of malaria in Plateau/Nasarawa	Dr. Abel Eigege
	<i>Discussion</i>	
4:25 – 4:45	Survey and evaluation plans in 2010 (Dr. P. Graves)	Dr. Patricia Graves
	<i>Discussion</i>	
4:45 – 5:00	Yakubu Gowon Center activities	Dr. Babatunde Ipaye <i>on behalf of Dr. Remi Sogunro</i>
	<i>Discussion</i>	
5:00 – 5:30	<i>Hispaniola Presentation</i>	Dr. Donald Hopkins
5:30 – 6:00	<i>General discussion and recommendations</i>	Dr. Frank Richards (chair)
6:00 – 6:15	Summary and Closure	Dr. Donald Hopkins
6:15	Session Adjourned Shuttle departs for hotel	