

THE
CARTER CENTER



Waging Peace. Fighting Disease. Building Hope.

SUMMARY PROCEEDINGS
2nd ANNUAL MALARIA CONTROL PROGRAM REVIEW
Ethiopia and Nigeria

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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

AMFm-Affordable Medicine Facility-Malaria

ATO-Annual Treatment Objective

BCC-Behavior Change Communication

CDDs-Community Directed Distributors

CDTI-Community Directed Treatment with Ivermectin

GF-Global Fund for AIDS, Tuberculosis and Malaria

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

MACEPA-Malaria Control and Evaluation Partnership in Africa

MDA-Mass Drug Administration

MOU – Memorandum of Understanding

MOH-Ministry of Health

NTD-Neglected Tropical Disease

PATH-Program for Alternative Technology in Health

RDT-Rapid Diagnostic Test

SNNPR-Southern Nations, Nationalities and People's Region

TCC-The Carter Center

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Executive Summary of the 2nd Annual Malaria Control Program Review

The second annual review of The Carter Center Malaria Control Program was held at The Center on February 25, 2011. In addition to representatives from the Ministries of Health (MOH) and Carter Center-assisted programs in Ethiopia and Nigeria, we were joined by donors and partners from the CDC, the Bill & Melinda Gates Foundation, Emory University, the Lions Clubs of Ethiopia, Columbia University, Development Finance International, the Task Force for Global Health, Vestergaard Frandsen, and the Malaria Control and Evaluation Partnership in Africa (MACEPA).

The objective of the meeting was to receive status updates from the national ministries of health in Ethiopia and Nigeria, hear about the ways that The Carter Center is providing assistance to the national programs, identify challenges encountered in planning and implementation, and share examples of successes and best practice as a source of motivation and inspiration. Through fruitful discussion, recommendations were made for future implementation, surveillance and assessment activities.

Nigeria and Ethiopia are the focus of The Carter Center support to malaria control as they are critical nations in the global program to control and eliminate malaria. More than one out of every four Africans is from either Nigeria or Ethiopia and approximately 20-30% of all African malaria cases occur in these two countries. However, the problem of malaria takes starkly different forms in these countries. Ethiopia has unstable seasonal malaria and is prone to periodic epidemics whilst Nigeria experiences stable year-round transmission with seasonal peaks each year - and thus different approaches to malaria control and different short-term goals are appropriate for each country. Presentations from the national programs show Malaria Control Programs in different stages. In 2010, Nigeria reported a tremendous effort in scaling-up access to malaria control, whilst Ethiopia reported sustained efforts to provide widespread coverage of malarious areas with diagnostic, treatment and prevention services, following its rapid scale up in 2007.

In both countries, The Carter Center provides support to the national program for planning and implementing key malaria interventions, developing health worker capacity, mobilizing communities in the fight against malaria, and malaria monitoring and evaluations. The Carter Center support between 2004 and 2010 included assisting in the distribution of nearly eight million insecticide-treated nets to protect sleepers from potential infective mosquito bites; three million of these nets were purchased by The Carter Center.

Another key focus of The Carter Center's work is the development and demonstration of innovative strategies for malaria control, through routine programmatic activities as well as smaller operational research and pilot projects. Program review presentations highlighted progress on operational research topics such as the protective effect of universal coverage versus targeted coverage with insecticidal nets on both malaria and lymphatic filariasis; bed net durability and insecticide resistance monitoring; and the utility of different rapid diagnostic tests compared to a gold standard of microscopy. In addition, presenters shared formative research and opinion pieces on malaria surveillance and epidemic warning systems in unstable

transmission environments, behavior change communication strategies and the potential role of mass drug administration in malaria elimination.

This document aims to not only summarize the proceedings of the annual Program Review but also to present the context of the national programs and the history of the program at The Carter Center, highlight the ways that The Carter Center provides assistance to the national programs, and demonstrate the ways that The Carter Center malaria program is helping to develop new ideas and strategies for malaria control in Africa.

SUMMARY OF PROGRAM REVIEW PRESENTATIONS

Dr. Frank Richards (Director of TCC's Malaria, Onchocerciasis, Lymphatic Filariasis and Schistosomiasis Programs) and Dr. Paul Emerson (Director of TCC's Trachoma Program and Co-Director of the Malaria Program) co-chaired the meeting. Dr. Richards began the meeting with a brief overview of the priorities of TCC's Malaria Control Program, as well as an orientation to the way that TCC malaria activities have been integrated with mass drug administration for neglected tropical diseases (NTDs). He briefly introduced each of the areas where TCC Malaria Program works: Ethiopia, Nigeria and the island of Hispaniola.

Nigeria

Dr Babajide Coker, representing the Federal Ministry of Health of Nigeria, described several key elements of the country's approach to malaria control which include: scaling up all interventions for impact, shifting from a focus on vulnerable groups to universal coverage/access, integrating malaria interventions into activities at all levels of the health system, strengthening health systems, creating strong and active partnerships and enhancing community involvement and empowerment. He introduced the key intervention strategies (LLIN distribution, indoor residual spraying (IRS), effective case management and malaria prevention in pregnancy) and then proceeded to give a progress update for each strategy. As of February 2011, Nigeria had distributed 28,946,655 LLINs during mass distribution campaigns conducted in 17 states. Campaigns are planned in another 20 states (31,386,390 LLINs) in 2011. Indoor residual spraying activities in Nigeria began in 2009, when 63,088 households were sprayed in seven World Bank-assisted states, and continued in 2010 with the spraying of an additional 4,800 households in Lagos State. To date, Nigeria has achieved 14% of its target for IRS (to progressively cover 20% of all households by 2013). Where case management is concerned, the national treatment guidelines have been updated and Nigeria has joined the group of Affordable Medicine Facility-Malaria (AMFm) countries. Global Fund support has allowed for the distribution of approximately 60 million doses of artemisinin-based combination therapy (ACTs) to public and private clinics in Nigeria, while the World Bank has provided another 18 million doses for the seven states it supports. Guidelines for community case management of malaria have been revised and a total of 6,382 role model caregivers have been trained to provide malaria treatment at the community level, though this program has only been implemented in 24 states to date. Nigeria conducted a National Malaria Indicator Survey at the end of 2010, and conducted Lot Quality Assurance Sampling Surveys in 9 states. Dr. Coker also reviewed some of the main challenges facing the Malaria Control Program in Nigeria including: insufficient supply of anti-malarial drugs and supplies, weaknesses in the technical infrastructure required for managing

mass quantities of treatments and supplies, limited human resource capacity for malaria control and delays in the disbursement of Global Fund money.

Following the presentation by the Nigerian MOH, Mr. Adamu Sallau, Malaria Coordinator for TCC Nigeria, gave an update on TCC malaria control activities conducted during 2010, including a detailed discussion of The Carter Center contributions to LLIN distribution activities in Plateau State, the results and the lessons learned from this mass distribution campaign. He also presented preliminary results of two different household surveys conducted by The Carter Center Nigeria in 2010. The information provided in this presentation is described in detail in the Nigeria section of this report.

Ethiopia

Dr. Tizita Hailu of the Ethiopian Federal Ministry of Health gave a brief introduction to the demographics and malaria profile of Ethiopia, emphasizing the epidemic nature of the disease there. She also outlined the key elements of the government's approach to malaria control in Ethiopia, which places emphasis on the provision of free malaria treatments, LLINs and IRS in malarious regions, as well as a strong network of health extension workers at the community level. Dr. Tizita then described the specific strategies included in the national strategic plan for 2010-2015, providing definitions and specific targets, a brief history, and an update on the progress towards each one. She also explained that the political context for malaria control activities in Ethiopia has changed: there is no longer a designated Malaria Control Program within the Federal Ministry of Health. Malaria activities are now integrated with other activities conducted by Ministry departments such as Public Health Emergency Management and Health Information. The Regions of Ethiopia are decentralized and have autonomy to decide policy. Additionally, there is a strong partnership of stakeholders involved in malaria control in Ethiopia, whose work included the revision of Diagnosis and Treatment Guidelines, Vector Control Guidelines and Epidemic Prevention and Control Guidelines in 2010. Data presented from the 2009 Health and Health Related Indicators Report demonstrated that malaria is still the leading cause of all outpatient visits and the 4th leading cause of all inpatient admissions. Another national Malaria Indicator Survey is planned for 2011. It was cautioned that Global Fund Round 8 money will provide for the purchase of only half of the nets needed according to current net replacement need calculations.

Dr. Zerihun Tadesse, Director of Programs for TCC Ethiopia, then gave the progress report on TCC Ethiopia malaria control activities and described their integration with onchocerciasis and trachoma activities. He presented the results from the fifth MalTra Week campaign conducted in November of 2010, and a rapid assessment of the malaria situation in West Amhara which TCC Ethiopia coordinated at the request of the Federal Ministry of Health. Dr. Tadesse reported on the progress towards each of the recommendations from the previous year's program review and discussed challenges facing the malaria program. These include problems with the supply chain for MalTra Week campaigns, difficulties motivating community drug distributors for onchocerciasis (CDDs) to routinely conduct malaria education and monitor activities without additional financial incentives, limited capacity of Health Extension Workers (HEW) to correctly

use RDTs and malaria epidemic monitoring charts, and the continued need to increase net use at the community level. He proposed some key objectives for 2011: 1) improve HEW performance, 2) increase LLIN use and care, 3) enhance the role of CDDs in monitoring and behavior change communications (BCC) and 4) work with the Federal MOH to develop an appropriate and sustainable net replacement strategy.

In addition to the progress reports for each country, staff from TCC headquarters gave presentations on the following topics: 1) Behavior Change Communication for Malaria Control in Southeast Nigeria, 2) the Integrated LLIN and Mass Drug Administration Coverage survey conducted in Plateau State, Nigeria in January 2011, 3) Malaria Surveillance and 4) Mass Drug Administration for Malaria. Summaries of these talks are included in Annex 1.

INTRODUCTION AND OVERVIEW

The Disease

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 reinvade other cells. Repeated malaria infections lead to severe anemia, especially in children and pregnant women. Malaria is preventable and treatable; there is no reason that 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.

History of The Carter Center's Involvement in Malaria Control

TCC's involvement in malaria control grew from the idea of integrating control of malaria with lymphatic filariasis elimination in Nigeria¹, and from a review of malaria by the International Task Force for Disease Eradication². In Africa, the same anopheline mosquitoes that transmit lymphatic filariasis also transmit malaria. Insecticide treated bed nets are one of the most important prevention tools for malaria and should also be effective as a complement to annual mass drug administration in the filariasis elimination program. The early interest, on the part of TCC, 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 TCC was launched in Ethiopia in February 2006. The Ethiopian Minister of Health, Dr. Tedros Adhanom, requested that TCC 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 in all malarious areas by the end of 2007. TCC was also

¹ Blackburn et al., Successful integration of insecticide-treated bed net distribution with mass drug administration in Central Nigeria (2006), *Am J Trop Med Hyg*, 75(4): 650-655.

² World Health Organization, 2007. Meeting of the International Task Force for Disease Eradication — 12 May 2006. *Weekly Epidemiol Rec* 82(4): 25—30.

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 TCC programmatic networks in parts of Ethiopia while working closely with the MOH malaria control program at national, regional and local levels.

Malaria control activities have been integrated with other TCC disease control programs in Nigeria, on a pilot basis, since 2004. However, in June 2010, The Carter Center Malaria Control Program in Nigeria was formally established and began to expand its assistance to the national program in malaria control. Since the official launching of the Malaria Control Program, TCC has assisted the MOH and its other partners in the planned nation-wide scale up of malaria control activities, with a focus on the mass distribution of LLINs.

The Carter Center Focus on Malaria Control

TCC’s efforts in malaria control can be grouped into three focal areas:

- 1) Program Implementation and Interventions (treatment, net distribution and behavior change communications),
- 2) Monitoring and Evaluation, and
- 3) Operational Research.

1) PROGRAM IMPLEMENTATION

To date, implementation has focused primarily on insecticidal bed net distribution, behavior change communications (BCC) and case detection and treatment (in Ethiopia).

1.1 LLIN Provision

Between 2004 and 2010, TCC assisted with the distribution of a total of 7,961,441 LLINs in Ethiopia and Nigeria (Figure 1)³.

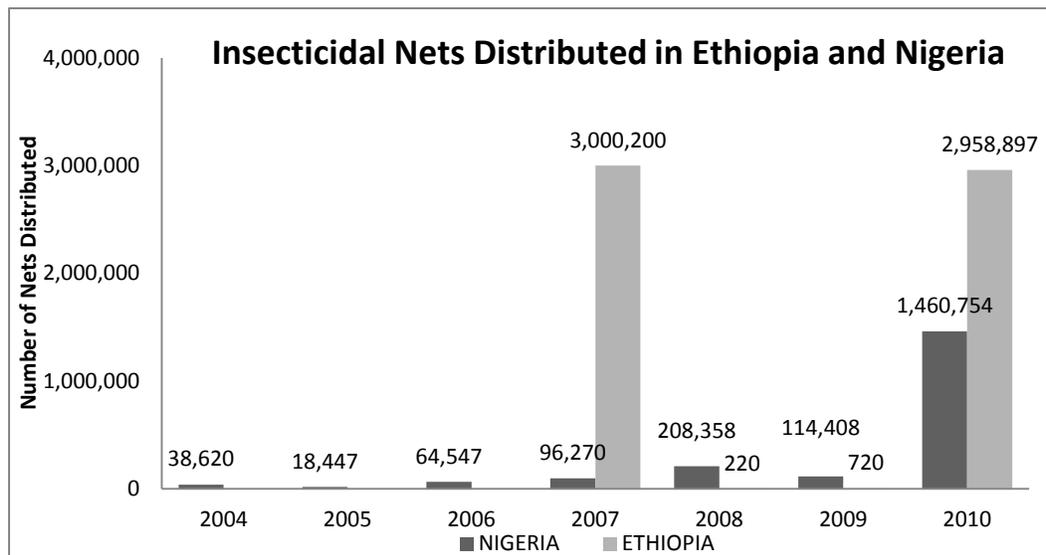


Figure 1

³ In the first few months of 2011, TCC assisted with the distribution of an additional 2,283,722 LLINs in Nigeria, bringing the total to 10,243,943 LLINs distributed with TCC assistance in Ethiopia and Nigeria combined.

In Ethiopia, TCC purchased and assisted with the distribution of three million LLINs in 2007 as part of the Ethiopian national campaign to provide 20 million LLINs by August 2007. In 2010, Ethiopia began a series of LLIN campaigns to replace worn out nets and provide LLINs to households that had not received any during the first campaign. The Carter Center Ethiopia Program provided some technical and financial assistance for the LLIN distribution and replacement campaigns in East Amhara, where 1,156,345 LLINs were distributed, and in SNNPR, where 1,802,472 LLINs were distributed. An additional 1,220 LLINs were distributed by TCC in Ethiopia to replace those collected in the context of operational research concerning net durability. While these nets did not add to the overall number of nets in circulation, they did replace many worn out nets that had already developed large number of holes.

In Nigeria, between 2004 and 2010, 2,001,404 LLINs were distributed with TCC assistance. In Plateau and Nasarawa states, through mechanisms other than mass distribution campaigns, TCC participated in the distribution of 301,160 LLINs obtained through the Federal Ministry of Health or purchased by other donors such as Clarke Mosquito Control. An additional 255,000 LLINs have been distributed in four Local Government Areas (LGAs) of Southeast Nigeria as part of an operational research project funded by the Bill & Melinda Gates Foundation. In 2010, we assisted with the distribution of 1,445,754 nets as part of the mass distribution campaign conducted in Plateau State (The 2010 total in Figure 1 also includes 15,000 LLINs distributed in the context of operational research projects in other states.).⁴

1.2 Behavior Change Communication

In both Ethiopia and Nigeria, TCC has helped to develop a set of key behavior change communication messages that attempt to promote existing positive behavior, address common misperceptions about malaria or malaria control measures, and provide clear action-oriented prompts to encourage the adoption of recommended behaviors. In Ethiopia, these messages have been 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. Malaria health education is provided during azithromycin⁵ distribution for trachoma and mass testing and treatment of malaria cases (MalTra Weeks). Malaria messages are also highlighted during the distribution of ivermectin for onchocerciasis control. Additionally, TCC zone project coordinators in Ethiopia have worked with schools to implement a malaria curriculum, and TCC zone project coordinators provide tailored health education in the context of routine household assessments of bed net ownership and use. In Nigeria, health education for malaria to date has been provided primarily in association with the distribution of insecticide treated bed nets. However, in the future⁶, community drug distributors and other volunteers will provide malaria education and help people overcome barriers to consistent net use at the community level.

⁴ An additional 2,283,722 LLINs distributed in early 2011 as part of mass campaign activities in Ebonyi and Enugu states brings the total number of LLIN distributed with The Carter Center assistance in both countries to over 10 million.

⁵ *Azithromycin (Zithromax®) is donated by Pfizer, Inc.*

⁶ A pilot community-based behavior change intervention to encourage and monitor proper LLIN use and care was introduced in Ebonyi State, Nigeria in June 2011.

1.3 Malaria Case Detection and Treatment

Provision of malaria treatment takes place in Ethiopia in the context of Malaria and Trachoma (MalTra) Week Campaigns. All community members who present for azithromycin⁷ treatment for trachoma are asked if they have had a fever in the past few days. Those with fever are subsequently tested for malaria using a rapid diagnostic test (RDT), and offered free treatment according to the national treatment guidelines. Since 2008, 166,289 people have been tested for malaria during MalTra Weeks, and 143,228 cases have been treated.

2) MONITORING AND EVALUATION

Monitoring and Evaluation (M&E) in The Carter Center Malaria Control Program consist primarily of two types of activities:

- 1) routine monitoring and evaluation of TCC programs, and
- 2) providing assistance to National Malaria Control Programs and Ministries of Health for their own M&E processes and the achievement of their goals.

These M&E activities are synergistic since all TCC work is conducted in support of national malaria control programs.

2.1 Evaluation within The Carter Center-Assisted Areas

In Ethiopia, regional and national population-based surveys are a primary method of monitoring program delivery and evaluating program impact. Malaria indicators have been integrated with mass drug administration coverage surveys conducted by the trachoma program, and the MalTra Week reports provide estimates of malaria prevalence, at two points of time each year. In 2011, TCC Ethiopia conducted a mixed methods rapid assessment of the malaria program in the Amhara Region, and there are plans to expand routine process evaluation data collection during MalTra Weeks to better assess the quality of implementation and to understand the impacts of the malaria program. The Ethiopia office has introduced a series of routine LLIN assessments, conducted both in schools and at the household level, which are conducted by TCC zone project coordinators on a monthly basis in order to obtain routine data on net use and care. In areas served by The Carter Center River Blindness Control Program, community-directed distributors of ivermectin collect household LLIN net ownership information in order to identify gaps in net delivery and determine net replacement needs. Additionally, ongoing community assessments conducted in these areas include information on net use and malaria knowledge.

In Nigeria, a large-scale representative household survey was conducted in two of the nine TCC-assisted states (Plateau and Abia) in 2010 in order to obtain baseline data necessary to evaluate the impact of the scale-up of malaria activities in Nigeria, with which TCC is assisting.

2.2 Support to National Programs

TCC is supporting the MOH of Ethiopia to help assess progress toward meeting its target malaria control goals. Since the initiation of the Malaria Control Program in Ethiopia, TCC has managed two representative household surveys to estimate changes in malaria prevalence, as well as LLIN ownership and use. In 2010, TCC assisted the Federal Ministry of Health of Ethiopia with a series of systematic supportive supervision activities conducted at all levels of the health system in the regions we support. We have provided additional support to the MOH through trainings in

⁷ Azithromycin (Zithromax[®]) is donated by Pfizer, Inc.

data management and epidemic recognition for regional and zonal level health staff. In 2009, TCC 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 to improve stratification and targeting. In all TCC-assisted areas, TCC communicates with the MOH about reported malaria cases and trends in malaria incidence, as well as reports of stock outages of malaria treatments and diagnostic tests.

In Nigeria, TCC provided assistance for a national Malaria Indicator Survey (MIS) conducted in late 2010, and also participated in monitoring and evaluation activities associated with mass LLIN distribution campaigns in Plateau, Nasarawa, Ebonyi and Enugu states in 2010 and early 2011. TCC will work with the MOH to learn how the Center can best further assist the federal and state governments with monitoring and evaluation activities. 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, TCC 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. 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

TCC is currently engaged in three operational research projects in the two countries.

3.1 LLIN studies

In Ethiopia, we are concluding a series of multi-year LLIN durability studies, with both *Permanet*[®] (Vestergaard Frandsen) and *Duramet*[®] (Clarke Mosquito Control), to review the retention of insecticide, insecticidal activity and the physical deterioration of LLINs. In Nigeria, with the support of the Bill & Melinda Gates Foundation, TCC 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. In 2010, we began the process of converting the vulnerable groups only areas to full coverage. 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. This study will be completed at the end of 2011.

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 Ethiopia, including the fertile low-land areas that are most suitable for agriculture. More than 50 million people (68% of the population) live in areas at risk for malaria. The transmission patterns and intensity vary greatly throughout the country due to differences in altitude, rainfall and population movement. Malaria in Ethiopia is caused by *P. falciparum* malaria and *P. vivax*. 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, older children and adults are at high risk of severe disease or death in Ethiopia because they do not have protective immunity. In high transmission years, several million clinical malaria cases are reported. Therefore, the ability to detect and react to malaria epidemics is an important element of the national malaria control program.

Controlling malaria is the top priority of the Ethiopian Minister of Health, Dr. Tedros Adhanom. The MOH committed to the goal of reducing the overall burden of malaria by 50% by 2010, primarily through early diagnosis and treatment of cases, vector control using insecticide treated bed nets and indoor residual spraying, and epidemic prevention and control. However, the MOH 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 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. TCC 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. LLIN replacement campaigns began in some regions of Ethiopia in 2010. In the context of these LLIN replacement activities, TCC assisted with the distribution of 2,958,817 LLINs in East Amhara and SNNPR by providing technical and financial support for the campaigns.

In order to be able to assess the impact of the net distribution and other malaria control activities, TCC 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. Another MIS is planned for fall 2011.

1. PROGRAM IMPLEMENTATION/INTERVENTIONS

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 priorities of the Ethiopian government and the Center's commitment to integrated programs with an emphasis on community level involvement, TCC malaria program interventions in Ethiopia are integrated with the trachoma and/or onchocerciasis programs in areas where other TCC activities were already well-established.

The integrated project strategies are coordinated in partnership with the MOH, through the collaborative efforts of TCC, 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 TCC to ensure that malaria control is integrated within a multi-disease intervention package.

Integrated Malaria and Onchocerciasis Programs

Malaria and Onchocerciasis program activities are integrated in 10 geographically distinct project zones across 5 states (Figure 2): 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 objective of the integrated malaria and onchocerciasis activities is 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 of 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.

The Carter Center Assisted MalOncho Woredas in Ethiopia

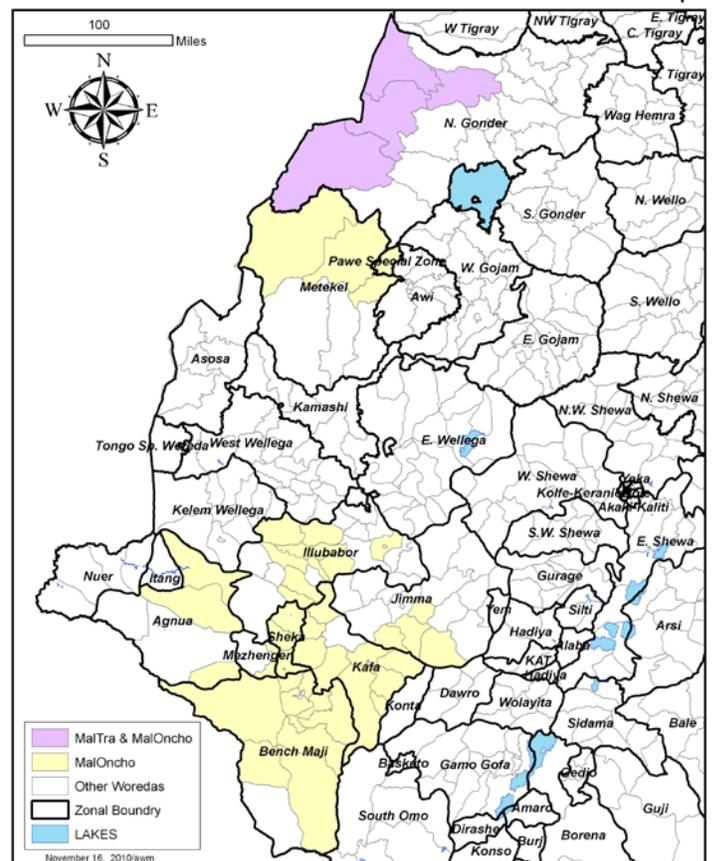


Figure 2

The integrated approach to malaria and onchocerciasis capitalizes on 2 opportunities for community mobilization and health education:

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

In 2010, Community Directed Distributors (CDDs) continued to provide health education, as well as to assess LLIN ownership, use and care in the context of routine activities. The training materials were revised to place greater emphasis on malaria-specific content. A total of 3,298,195 persons (95% of the ultimate treatment goal and 80% of the total population in the onchocerciasis program areas) received treatment with ivermectin and were targeted to receive health education about onchocerciasis and malaria.

Integrated Malaria and Trachoma Programs



Figure 3

TCC malaria and trachoma programs both are active within all ten zones of the Amhara region, which has been divided into 2 operational areas (West and East Amhara). The total population of Amhara region was estimated at 17,214,056 in the 2007 census⁸, which is 23.3% of the total country’s population.

The regional office of TCC is located in the state capital and seat of the Regional Health Bureau, Bahir Dar (red dot on map, Fig 3). There are an additional ten 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, Fig 3) coordinates activities in the 5 eastern zones of the region.

Two “MalTra Week” (Malaria-Trachoma) campaigns are conducted per year in Amhara: the first in October or November for West Amhara and the second in April or May for East Amhara. MalTra Week 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 TCC staff.

⁸ Population Census Commission, Federal Democratic Republic of Ethiopia. Summary and Statistical Report of the 2007 Population and Housing Census

During MalTra Weeks, communities receive health education pertaining to both malaria and trachoma via mass media and in schools. Health workers distribute azithromycin⁹, conduct rapid diagnostic tests (RDTs) for persons suspected to have malaria and offer free treatment to persons who test positive for malaria, according to national guidelines.

1.1 Malaria Rapid Diagnostic Testing and Treatment

In 2010, a total of 14,986,992 persons received treatment for trachoma during the MalTra Weeks. Of these, 131,545 (less than 1%) presented with fever or reported that they had had a fever in the past few days and were subsequently evaluated for malaria, either by RDT or clinical signs (Figure 4). A total of 95,697 treatments for malaria were provided during the 2 campaigns. This was the first year that sufficient RDTs and treatments were available for all zones during both of the campaigns, which facilitated the testing and treatment of a larger number of persons than in the past. During the lead up to the MalTra campaigns, a cumulative total of 2,022 supervisors and 7,849 health extension workers received training in trachoma and malaria, and 23,547 volunteer community health promoters were recruited and oriented to assist.

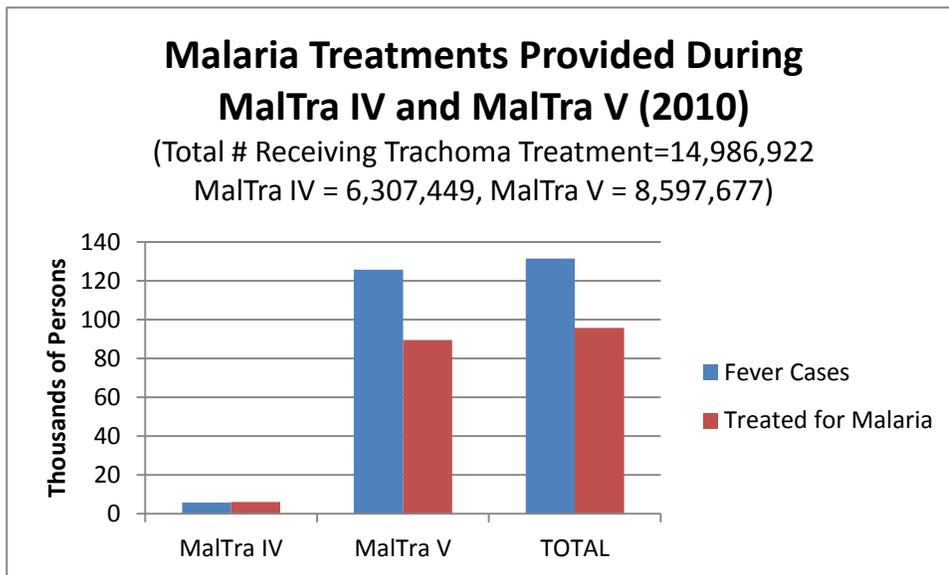


Figure 4

⁹ Azithromycin (*Zithromax*[®]) donated by Pfizer, Inc.

1.2 LLIN Provision

In 2010, TCC Ethiopia assisted with integrated malaria campaigns in 5 zones of the East Amhara and in SNNPR. The campaign included health education, malaria diagnosis and treatment, and the distribution of LLINs to replace those that were worn out. TCC contributions in East Amhara included the development of implementation guidelines, the printing of 2,402 registers for recording distribution activities, the provision of financial support for the transportation of LLINs to the woreda and kebele levels, and assistance with training, supervision and monitoring activities. A total of 1,156,345 LLINs were distributed in East Amhara, of which 694,315 were replacement nets. During the campaign in SNNPR, TCC was invited by the Regional Health Bureau to transfer knowledge and skills obtained in other regions during trainings of trainers, supervisors and health extension workers. TCC modified the training modules they had used elsewhere for the trainings in SNNPR. A total of 1,802,472 LLINs were distributed in SNNPR, bringing the total of LLINs distributed in Ethiopia with assistance from TCC in 2010 to 2,958,897, including 80 LLINs distributed in the context of operational research on net durability. During a similar campaign conducted in West Amhara, TCC was asked to develop job aids to instruct health workers how to conduct LLIN distribution activities, given that the MOH decided not to organize a formal campaign. TCC zone project coordinators also assisted with the supervision of net distribution activities conducted by health extension workers.

Since 2007, TCC has assisted with the distribution of a cumulative total of 5,960,037 LLINs in Ethiopia, including the 1,200 LLIN distributed in the context of operational research.



Two Ethiopian children protected by an LLIN received during LLIN distribution campaigns.

1.3 Behavior Change Communication

Message Development and Dissemination:

TCC 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 4 key messages are:

- 1) Sleep under an LLIN every night all year round.
- 2) Give priority for LLINs to pregnant women and children under 5 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 TCC-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.

Malaria BCC in the Context of CDTI Activities:

In the integrated malaria and onchocerciasis areas, each CDD provides ivermectin annually to a small group of households in his/her community and also provides health education and BCC related to both malaria and onchocerciasis during these drug distribution activities.



This photograph shows a community drug distributor (CDD) demonstrating his knowledge of how to use a health education flip chart, while holding a mosquito net.

In 2010, CDD training materials were revised to place greater emphasis on key malaria messages. A total of 42,887 CDDs were trained or re-trained, as were 3,284 community supervisors and 1,938 health workers. CDDs were provided with health education flip charts, including malaria messages, which were used to conduct health education activities in 14,065 communities within 8 administrative zones. During ivermectin distribution activities, CDDs provided health education and worked to mobilize communities in the fight against malaria.

Malaria BCC Activities in Amhara Region:

Health Education (HE) and Behavior Change Communication (BCC) activities in the East and West Amhara regions are centered around, but not limited to MalTra Week campaigns. 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.

During the MalTra IV kick-off ceremony, which was attended by approximately 15,000 people, malaria messages were emphasized in speeches, and there was a demonstration of appropriate net mending behaviors. In the context of the combined MalTra IV and MalTra V campaigns, 164,465 pocket calendars, 9,000 stickers, 12,364 t-shirts, 12,364 hats and 9,400 visual aids for health education sessions were produced and distributed. Posters and flyers were distributed in all villages where MalTra activities were conducted. During MalTra IV, educational films about malaria and trachoma were screened in all woredas of Oromia Zone. In addition, the ~5.6 million participants in MalTra IV and ~9.4 million participants in MalTra V were all targeted to receive health education on both malaria and trachoma during mass drug distribution activities.

2. MONITORING AND EVALUATION

2.1 Evaluation within The Carter Center Assisted Areas

Amhara Region

In 2010, TCC conducted a series of assessments of LLIN ownership, use and care at both the community and the school levels in the integrated malaria and trachoma program regions. Community net assessments were conducted in 375 households in 8 woredas (districts) of West Amhara, and in 417 households in 8 woredas of East Amhara (Figure 5). The data from the community assessments indicate that 96% of households in Amhara own at least 1 bed net, and that there is no great difference in net ownership between East and West Amhara. While 60% of respondents overall reported that they had slept

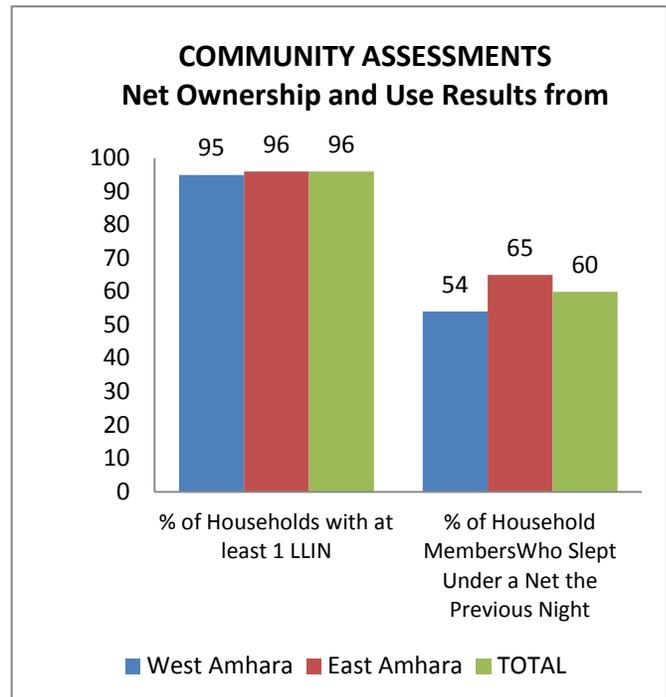


Figure 5

under a bed net the previous night, the percentage of persons sleeping under a bed net the previous night in East Amhara was higher than that in West Amhara (65% as opposed to 54%).

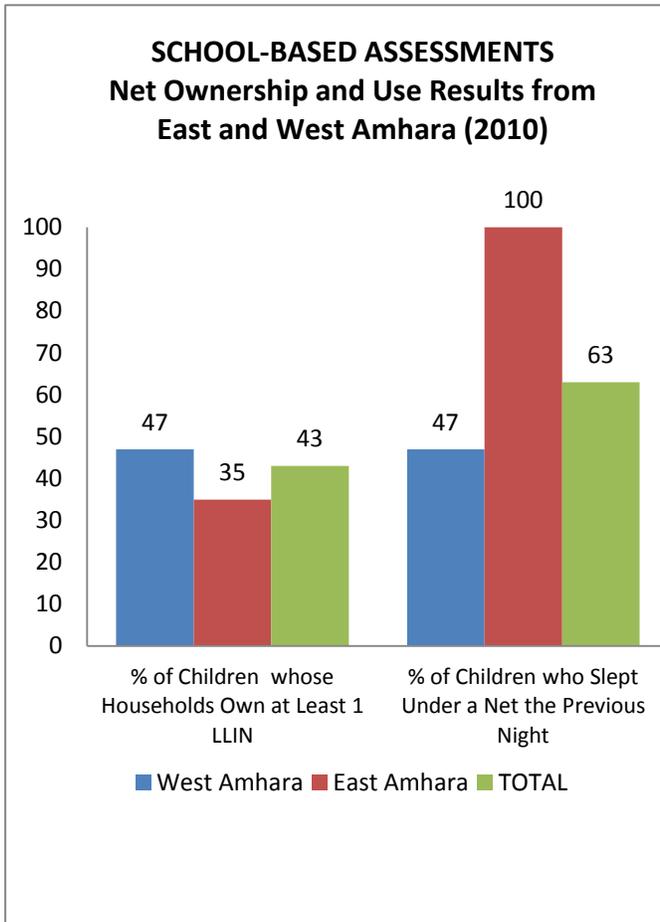


Figure 6

School-based assessments were conducted between September and December 2010. Out of the cumulative total of 3,115 children included in the assessments, 43% reported that their household possessed at least 1 net, and 63% reported that they had slept under a bed net the previous night (Figure 6). Similar to the community surveys, self-reported net use was more common in East Amhara, where 100% of children reported that they had slept under a net the night before, as opposed to 47% in West Amhara. The proportion of children who slept under nets in West Amhara was lower than the proportion of adults who had. This may mean that there is a need for better communication about the importance of prioritizing children when there are not enough nets for all members of the household. Overall net ownership was much lower as reported during school-based surveys than when assessed during community-based surveys. This is likely due to the fact that children do not necessarily know about all bed nets owned by the family and if they personally are not sleeping under a bed net, they may not realize that other members of the household are.

In both assessments, there was a great deal of variability between zones, in terms of reported net use and LLIN ownership. Further work is needed to understand the sources of this variability, as well as to identify and minimize any potential sources of bias influencing the results, and to develop systematic ways for these assessments to inform routine programmatic activities conducted by both TCC and the MOH.

Malaria Monitoring and Evaluation in Onchocerciasis Program Areas

In the regions served by TCC onchocerciasis program, CDDs collected data on bed net use and care in a total of 685 households in 5 zones. Bed nets were hanging in 84% of households visited, and had been washed at least once in the past 12 months in 62% of households. In addition, 89% of household members interviewed had slept under a bed net the previous night.

Data collected from October to December 2010 in MalOncho areas as part of an annual ongoing monitoring exercise included key malaria indicators as well as information pertaining to the strength and sustainability of the community directed treatment with ivermectin (CDTI) program. During the assessment, a convenience sample of 1,942 adult household members, 286 CDDs and 247 community supervisors were interviewed. The household survey results revealed that 31.3% of households had no LLINs and that there were, on average, 1.3 LLINs per household. Despite lower than desirable net ownership, net use was high, with 89.6% of persons interviewed having slept under a net the previous night. A total of 66% of respondents knew that sleeping under an insecticide-treated net can protect you from malaria.

2.2 Support to the Federal Ministry of Health and Regional Health Bureaus

National Malaria Indicator Surveys

TCC provided managerial and technical support for the national Malaria Indicator Survey (MIS) in 2007, which included additional households in TCC-supported regions. Like the 2006 survey conducted in TCC-supported regions, this survey provided a baseline for evaluating the impacts of subsequent interventions on malaria prevalence and insecticide-treated net ownership and use in these regions. In addition, the comparison of 2006 and 2007 data allowed for an assessment of the effects of the nationwide distribution of nearly 20 million LLINs by the end of 2007. This comparison 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 1.2¹⁰. While net use doubled overall, net use in households with access to a net actually declined from 71.7% to 48.3%. The results from these monitoring and evaluation activities offered several valuable and practically applicable insights that can help to increase the impact of future 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.

At the end of 2010, TCC, along with other members of the Ethiopia Malaria Technical Advisory Committee (TAC), began planning for another National MIS scheduled for the fall of 2011. TCC will provide financial support for the inclusion of additional households in TCC-supported regions, as well as technical support as required.

Supportive Supervision

In 2010, TCC zone project coordinators, in collaboration with MOH officials, conducted monthly supportive supervision activities at health departments, hospitals, health centers and health posts in all project regions.

¹⁰ 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. (2010). 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*. Volume 2010, Article ID 750978, 12 pages doi:10.1155/2010/750978.

The objectives of TCC supportive supervision include:

- 1) Evaluating the quality of case detection and case management at health centers and health posts;
- 2) Monitoring the distribution and use of Malaria Epidemic Monitoring Charts in health posts, health centers and woreda health offices;
- 3) Assessing the availability of RDTs and malaria treatments;
- 4) Reviewing monthly malaria case reports within TCC supported regions;
- 5) Identifying areas with case build-ups and supporting intervention in those areas; and
- 6) Providing additional training to health workers on the use of malaria epidemic monitoring charts, malaria case management and mobilizing communities to engage in environmental management and malaria prevention activities.

These activities produce information about the quality of malaria monitoring and case management and malaria case build-ups and provide additional on-the-job training for health extension workers. On several occasions, the MOH took direct action as the result of information provided by TCC supportive supervision visits. For example, 54,282 LLINs were distributed to households in SNNPR that had been missed during the mass distribution campaign. In Amhara Regional State, when unusually high numbers of malaria cases were observed during supportive supervision visits conducted in June 2010, TCC worked with the Regional Health Bureau to ensure that sufficient treatments and supplies were available where needed. They also worked to mobilize communities to engage in malaria prevention and control activities.

Primary findings of these supportive supervision activities include the following:

- 1) Data recording and reporting are incomplete and inconsistent.
- 2) There are frequent stock outs of RDTs and ACTs in all regions. Some facilities had been without malaria treatments and RDTs for over a year. Of particular concern is the fact that, due to drug shortages, health departments and health facilities often do not have enough reserve stock to be fully prepared for an epidemic situation, should one arise.
- 3) Health Extension workers have trouble filling out epidemic monitoring charts and many do not use them at all.
- 4) Insufficient financial resources and supplies kept many zones from achieving their targets for indoor residual spraying.



Health Extension Workers practice using the Malaria Epidemic Monitoring Charts during supportive supervision activities.

TCC staff have worked to address these observed problems by providing constructive feedback during supportive supervision, as well as by assisting the MOH to conduct additional trainings and deliver treatments and supplies to areas in need.

In addition to the supportive supervision activities initiated by TCC, the regional and federal MOHs periodically requested TCC to assist them with their own supportive supervision activities. From September to December, TCC Ethiopia staff assisted with large-scale supportive supervision activities organized by the MOH to evaluate the quality of malaria prevention and control activities, identify any unusual case buildups and assess epidemic preparedness using tools developed by the Malaria Technical Advisory Committee. Malaria monitoring charts were also distributed in the context of these activities. The results of this assessment revealed that 37% of the 157 health posts visited had experienced stock outs of artemisinin-based combination therapies, 78% had experienced stock outs of chloroquine and 83% had experienced stock outs of RDTs. Only 50% of the health posts were using the malaria epidemic monitoring charts to track trends in malaria cases and identify unusual case build-ups. Stock-outs at health centers were much less common, with only 8 of the 35 (23%) health facilities visited reporting stock-outs of ACTs, chloroquine or lab supplies. It was the opinion of the supervision team that epidemic preparedness was severely compromised by these stockouts, as well as by a lack of financial support for supportive supervision and insufficient capacity of health extension workers to correctly and consistently use epidemic monitoring charts.

Routine Surveillance Data

Data on malaria cases and fatalities is collected from the zonal level by TCC zone project coordinators on a monthly basis. However, the zone project coordinators often have difficulty obtaining complete data from each zone, given incomplete or delayed reporting from lower levels. In order to obtain more complete data on trends in malaria cases in 2010, a team consisting of representatives from the MOH, the Amhara Regional Health Bureau and TCC visited zone health departments in Amhara in January 2011. The primary objective of this activity was to determine whether there had been an epidemic of malaria in November 2010, given the large number of cases treated during the MalTra V campaign. The routine surveillance data for 2010 suggests that the number of cases observed at that time falls within the usual range for that month, and that there was no epidemic during that period. However, it does demonstrate an unusual number of malaria cases in June 2010. The personnel of the Regional Health Bureau and TCC office in Amhara were aware of this case build-up at the time that it occurred and took action to deliver additional drugs and supplies to health facilities as well as to encourage additional environmental management activities at the community level.

Additional trends in malaria surveillance data for Amhara are described in Annex 1.

Training of Health Workers

TCC assisted regional MOHs and other partners to train health workers, at various levels, on aspects of malaria control including malaria case management, the use of RDTs, vector control methods and the use of malaria epidemic monitoring charts. In 2010, TCC assisted with training for over 500 health workers.

Additional Support to the National Malaria Control Program

TCC assisted the MOH in finalizing the Malaria Epidemic Guidelines, the national treatment guidelines, the Malaria Elimination Guidelines, the national M&E plan and the National Strategic Plan for 2011 to 2015.

At the request of the FMOH, Dr. Zerihun Tadesse served on the committee that prepared Ethiopia's application to the Global Fund for AIDS, Tuberculosis and Malaria for Round 10 funding. TCC also participates in the Malaria Technical Advisory Committee for the FMOH, and serves on the subcommittee for the Malaria Indicator Surveys.

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/m² through at least 20 washes. The lifetime of an LLIN is estimated to be between 3 and 5 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 3 to 5 years. Nets are exposed to smoke, dust, heat and embers from indoor cooking, debris that falls from roofs, animals, and rough handling by small children. In addition, they are often used with traditional sleeping mats made of natural fibers or with unfinished 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 are perceived to provide little protection when used or are discarded outright. If nets are washed more than recommended, insecticide concentration may drop below the minimal levels for insecticidal activity.

In order to assess net durability in real world conditions, taking into consideration *both* insecticide retention and the physical condition of the net, TCC is collaborating with the CDC in a multi-year operational research project in Ethiopia. Permanet™ brand LLINs were collected at 3 time points after the 2007 mass distribution campaign in 2007: 3-6 months after distribution (189 nets in 7 sites), 17-21 months after distribution (220 nets in 11 sites) and 28-32 months after distribution (200 nets in 10 sites). The characteristics of nets assessed during this study are: insecticide concentration by x-ray, number and size of holes and the effectiveness of the net at killing both susceptible and wild-caught *Anopheles* mosquitoes (bioassay).

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

- 1) Insecticide concentrations mostly remained $>10 \text{ mg/m}^2$ after 2.5 years;
- 2) In bioassays, insectary-reared mosquitoes showed high mortality when exposed to netting in the field, but there is evidence of reduced efficacy for wild-caught mosquitoes;
- 3) Physical deterioration of the nets begins as early as 3 months after net distribution, and is widespread;
- 4) Repairing damaged nets by mending is not a common practice in the villages studied, and thus should be a focus of social behavior change and communication interventions; and
- 5) There are significant differences between sites, both in number of holes and in insecticide loss.



The results of both the Permanet™ and Duranet™ studies showed that unrepaired holes in nets, such as the one on the left, were much more common than repaired holes like the one in the photo on the right.

Net durability studies involving Duranet™ brand nets began in 2009 when 500 nets were distributed to 5 sites in Amhara region. 40 nets (8 per site) were collected at each of 2 time points: after 6 months and after 1 year. At 12 months, staff members were able to locate all 40 of the nets selected for collection. 75% had holes but only 2 nets (5%) had any sign of repairs. The average mortality by bioassay was 90% with the susceptible strain but only 47% with the wild caught mosquitoes, indicating reduced efficacy.

In 2010, in addition to collecting nets for the Duranet study for net hole counts and bioassays, staff in both the Ethiopia and Atlanta offices continued work to analyze the results of these studies and to prepare manuscripts for publication. Results were also presented during the annual meeting of the American Society for Tropical Medicine and Hygiene in November 2010.

These results have several important 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. As Ethiopia prepares to begin conducting mass net replacement campaigns in 2011 and 2012, TCC should apply the findings of these studies to assist the MOH in developing efficient and appropriate net replacement strategies, as well as apply them to behavior change communication materials to be used in the context of distribution activities.

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 RDTs for malaria. Data collection was completed at the end of 2009, and 2010 activities focused on analysis and the preparation of manuscripts for publication.

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™ Pan Pf) against blood slide microscopy. 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, though microscopy performance was still better overall than RDT performance when considering both false negatives and false positives. Variability in the comparison of RDT and microscopy results from health center to health center (Figure 7) suggests that health workers need more training in using RDTs, and that careful storage and use, rather than accuracy of the tests themselves, is 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’). Differences between the number of cases that tested positive using ParaScreen tests and those that were positive by ParaCheck demonstrate the importance of vivax malaria in this area. Assuming that the cases that tested positive by ParaCheck and negative by ParaScreen are *P. vivax* cases, *P. vivax* case were found at all sites, and at several sites the number of *P. vivax* cases greatly outnumbered the cases of *P. falciparum*. 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.

Test positivity rate by health center and method (2007)

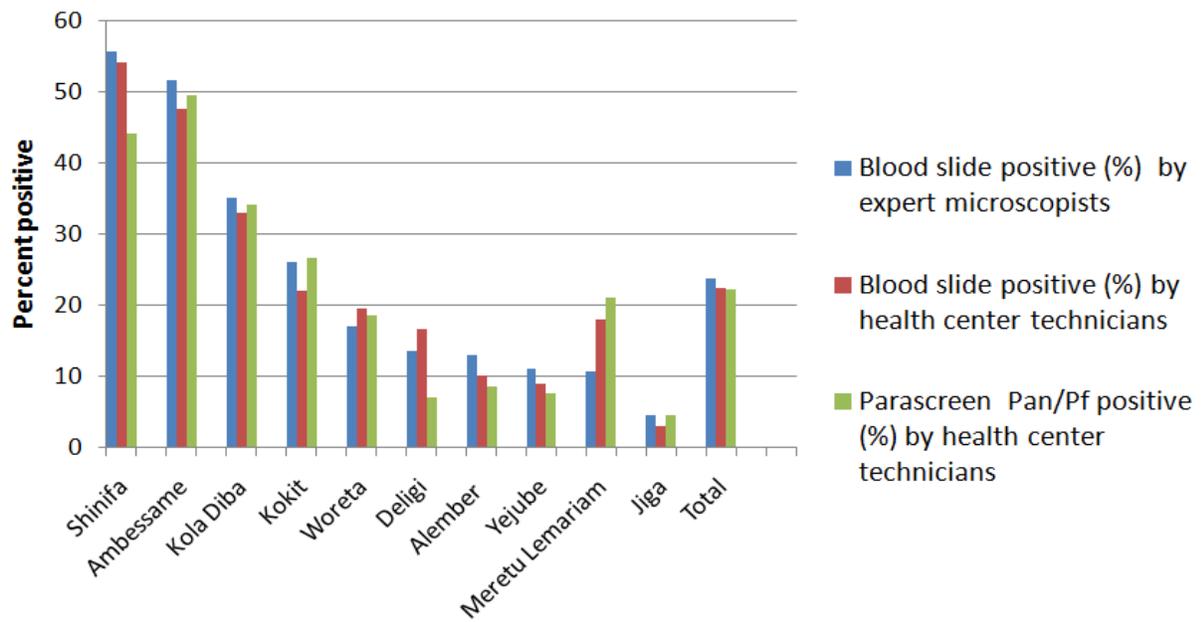


Figure 7

ETHIOPIA RECOMMENDATIONS FOR 2011

The Ethiopia Malaria Control Program should:

- 1) Participate in the national MIS 2011, as requested by the FMOH and partner organizations, as funding permits.
- 2) Implement new monthly malaria reporting system for TCC zone project coordinators, focusing first on Amhara. Complete monthly reports should be established in certain focus areas called “Enhanced Support for Surveillance” Zones (ESS zones) by June 2011. The proposed ESS zones are West Gojjam, North Gondar and Oromia. IDSR data and new TCC monthly malaria reports should be used.
- 3) Revisit the schedule of MalTra Weeks in light of trends in recent IDSR data with the aim of completing the campaign prior to the expected peak of malaria transmission.
- 4) Improve and enhance malaria program activities, with particular emphasis on appropriate use of RDTs. The Addis Ababa and Bahir Dar office should continue to assist the regional MOH in Amhara to improve RDT training and supportive supervision for HEW, both during and outside of MalTra Week campaigns. TCC Ethiopia should work with the MOH to develop and disseminate posters demonstrating the proper use of RDTs (in Amharic) for HEW to use in their daily practice.
- 5) Enhance efforts to motivate CDDs to consistently conduct monitoring and BCC activities in addition to drug distribution, using non-monetary incentives. Data on net ownership and net condition collected by CDDs should be evaluated for usefulness in developing a more tailored and cost-effective net replacement strategy.
- 6) Seek funding and LLINs for operational research to test different net replacement strategies.
- 7) Conduct training for zone health staff in data management, and seek funding to provide TCC zone project coordinators with portable internet access to facilitate the submission of reports and databases in electronic format, and thus increase the quality and consistency of the data that can be used for program management and malaria monitoring.
- 8) Publish findings from studies in Ethiopia: a) IDSR paper showing the trends and risk stratification, b) 2 remaining papers on ParaScreen/CareStart™, c) series of 4 papers on Permanet study, d) findings of final Duranet collection in Aug/Sept 2011, e) CDD net tracking paper, f) net use paper from MIS 2007 and g) an anemia paper from MIS 2007.
- 9) Conduct an evaluation of the malaria program in Amhara in order to better understand its impacts on malaria prevalence and the associated costs. The evaluation may include a retrospective comparison of the impacts of MalTra Weeks between areas where MalTra Weeks were fully implemented as planned and areas with insufficient supplies of treatments and RDTs; or, preferably, a prospective evaluation of the impact of MalTra Weeks on malaria prevalence which involves the random assignment of intervention conditions to areas matched on malaria incidence, as well as a process evaluation to assess the degree to which MalTra Weeks are implemented as designed.

NIGERIA

Country Background

Nigeria alone accounts for nearly 25% of the total malaria burden within Africa.¹¹ Malaria is endemic in this country, with year-round transmission (unlike the unstable transmission pattern observed in Ethiopia), and as much as 90% of the population is at risk of malaria. 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.¹² In addition to malaria, Nigeria suffers from many other vector-borne filarial worm diseases including lymphatic filariasis (LF), onchocerciasis (river blindness) and loiasis (*Loa loa*). Nigeria is the third most endemic country in the world for lymphatic filariasis, after India and Indonesia. Also of note is that the parasite *Loa loa* limits the use of mass drug administration (MDA) for LF in parts of the southeast due to possible severe adverse drug effects. Given this, LLIN distribution has a particularly important potential role to play in interrupting LF transmission in these areas, and not only in controlling malaria.

In the past two years, Nigeria has made dramatic progress in the scale-up for impact (SUFI) of malaria prevention and control activities. As of 2008, only 17% of households in Nigeria possessed at least 1 mosquito net and only 8% possessed an insecticide-treated net. Among children under age 5, 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 5 who had a fever in the two weeks prior to a Demographic and Health Survey in 2008, 33% took any antimalarial drug and only 2.4% of those received an ACT. In 2009, the Nigerian Ministry of Health committed to an ambitious goal of reducing the national malaria burden by 50% 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, and providing consistent delivery of intermittent preventive treatment to pregnant women.⁹ 13,653,238 LLINs were distributed in 9 states in 2009. In 2010, Nigeria distributed an additional 15,293,417 LLINs in the context of mass campaigns conducted in 10 states. 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.

1. PROGRAM IMPLEMENTATION AND INTERVENTIONS

The Carter Center has committed to assisting the MOH of Nigeria in the achievement of its 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.

¹¹ WHO, *World Malaria Report*. 2009, World Health Organization: Geneva

¹² 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.

The Carter Center currently provides assistance to nine states of Nigeria: Abia, Anambra, Delta, Ebonyi, Edo, Enugu, Imo, Nasarawa and Plateau.

The Carter Center health programs in Nigeria were among the early pioneers of 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 for integrated treatment delivery for RB, LF and SH, that delivers combination therapy and health education 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, trachoma (2001), and Vitamin A deficiency (2007). The Carter Center began assisting with bed net distribution in 2004, as part of the LF program, but did not launch an official malaria control program until 2010. 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 4 LGAs of Imo and Ebonyi states, where *Loa loa* is endemic and risks of adverse drug reactions thus prohibit MDA for LF, The Carter Center’s integrated efforts have focused on LLIN distribution as an intervention with the potential of both preventing malaria and interrupting LF transmission, as well as on the provision of health education about both malaria and LF.

1.1 LLIN Provision

In 2010, The Carter Center distributed a total of 1,460,754 LLINs, in the contexts of a mass distribution campaign in Plateau state and operational research activities in Ebonyi state (Figure 8). This is almost 3 times the total number of nets distributed between 2004 and 2009. During mass distribution campaigns conducted in Ebonyi and Enugu states in early 2011, The Carter Center provided assistance for the distribution of an additional 2,283,212 LLINs.

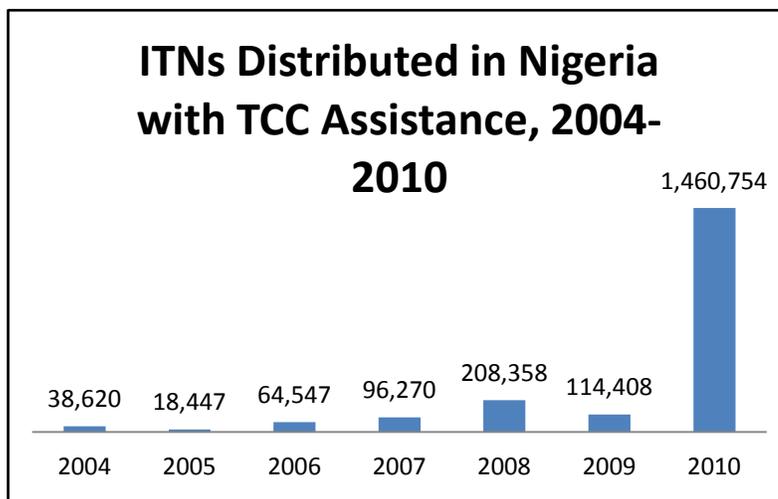


Figure 8

Plateau and Nasarawa States

Between 2004 and 2010, The Carter Center has assisted in the distribution of a total of 1,746,404 insecticide-treated nets in Plateau and Nasarawa states. Of those, 1,445,754 (56%) were distributed in 2010 alone (including some LLINs distributed through mechanisms other than mass campaigns), reflecting the major nationwide scale-up of LLIN distribution. The Carter Center provided financial and technical support for the distribution of 1,424,254 LLINs during the mass campaign conducted in Plateau state at the end of 2010. The Carter Center’s

responsibilities during this campaign included: assisting with the development of the microplan and budget, serving as secretariat for meetings, providing storage for campaign materials, and transporting 1,920 bales of nets from state stores to the local government areas, as well as providing funding for advocacy visits, the transportation of LLINs from 12 local government areas to distribution points within those LGAs, television and radio jingles, and supervision activities. The Carter Center's experience, expertise and well-established network of community volunteers were influential in the decision by the MOH of Plateau state to adopt a modified distribution strategy which emphasized a grassroots approach and employed community drug distributors and other community volunteers in the distribution of nets.



The results of the post-campaign evaluation, which The Carter Center staff also participated in, showed that 99.3% of targeted households received nets, that 99.6% of distributed nets had been retained at the time of the follow-up evaluation, that 41.2% of distributed nets were hanging, and that 51.8% of children under 5 and 48.2% of pregnant women in the sampled households slept under a net the previous night.

In addition to the nets distributed in the context of the mass campaign in Plateau state, The Carter Center has distributed a cumulative total of 322,660 insecticide-treated nets provided by the MOH and other partners in the context of other routine distribution activities in Plateau and Nasarawa since 2004. The number and type of nets distributed has varied from year to year as a function of the nets available to the MOH (see Table 1, which includes the nets distributed during the mass campaign in Plateau state). The nets distributed from 2004-2006 were insecticide treated nets, but not long-lasting insecticidal nets. All nets distributed by The Carter Center in Nigeria since 2007 have been LLINs.

Table 1 : Yearly Insecticidal Net Distribution in Plateau and Nasarawa States, 2004-2010

Year	Nets Distributed
2004	38,620
2005	18,447
2006	64,547
2007	96,270
2008	8,358
2009	74,408 ¹³
2010	1,445,754 ¹⁴
<i>Total</i>	<i>1,746,404</i>

The distribution of nets by LGA in Plateau and Nasarawa states in 2010, and since the beginning of Carter Center assistance to ITN distribution in 2004, is shown in Table 2.

¹³ Among the nets distributed by The Carter Center in 2009 were 16,500 *Duragnet*® brand nets donated by Clarke Mosquito Control, which were distributed in Kanke LGA of Plateau state.

¹⁴ This total for 2010 includes the LLINs distributed in the context of the mass distribution campaign in Plateau State.

Table 2: ITNs Distributed in Plateau and Nasarawa States of Nigeria with Assistance from The Carter Center in 2010 and since 2004, by LGA

<i>State/Local Government Area</i>	<i>ITNs Distributed with TCC Assistance in 2010</i>	<i>Cumulative ITN Distribution with TCC Assistance (since 2004)</i>
PLATEAU STATE		
Barkin Ladi	77,142	77,142
Bassa	84,584	93,036
Bokkos	78,780	78,780
Jos East	38,634	83,547
Jos North	194,862	194,862
Jos South	135,266	148,726
Kanke	75,796	107,776
Kanam	74,822	74,822
Langtang North	62,780	88,596
Langtang South	48,150	48,150
Mangu	132,822	170,319
Mikang	43,356	43,356
Pankshin	86,300	87,900
Quanpan	89,200	116,560
Riyom	57,904	70,179
Shendam	92,456	92,456
Wase	72,900	72,900
NASARAWA STATE		
Akwanga	0	26,149
Awe	0	7,858
Doma	0	0
Karu	0	0
Keana	0	8,659
Keffi	0	0
Kokona	0	0
Lafia	0	0
Nas. Eggon	0	0
Nasarawa	0	33,141
Obi	0	0
Toto	0	22,000
Wamba	0	0
TOTAL	1,460,754	1,746,404

Southeast States

In Ebonyi and Imo states, The Carter Center has collaborated with the MOH to distribute nets in 4 LGAs as part of an operational research project funded by the Bill and Melinda Gates Foundation. Since 2008, a total of 255,000 LLINs have been distributed in these LGAs, 15,000 of which were distributed in 2010.

Update on Net Distribution Status in The Carter Center-Assisted States (as of February 2011)

During the program review meeting, Dr. Babajide Coker presented an update on the status of net distribution campaign activities (Table 3), and announced the tentative dates for distribution in the remaining states where nets have not yet been distributed at the household level (Table 4).

Table 3: LLINs Distributed in Nigeria in 2010 as Part of the National Mass LLIN Distribution Campaign (The Carter Center-Assisted States in Bold)

STATE	LEAD PARTNER	CAMPAIGN DATE	LLIN TARGET	NO. OF LLIN DISTRIBUTED	% OF TARGET ACHIEVED
Bauchi (Wave 1)	World Bank	Jan 2010	1,493,986	1,471,187	99%
Akwa Ibom	World Bank	March 2010	1,733,527	1,566,974	90 %
Rivers (Wave 2)	World Bank	March 2010	1,174,821	891,168	76%
Bauchi (Wave 2)	World Bank	March 2010	573,960	532,898	93%
Jigawa (Wave 2)	World Bank	March 2010	1,221,623	1,185,140	97%
Gombe	World Bank	July 2010	1,034,864	1,013,394	98%
Kaduna	UNICEF/GF	July 2010	2,731,188	2,434,916	89%
Adamawa	UNICEF	August 2010	1,420,760	1,274,911	90%
Katsina	GF-NMCP	November/December 2010	2,682,074	2,656,251	99%
Plateau	GF- YGC	November/December 2010	1,452,658	1,424,254	98%
Nasarawa*	GF- NMCP	November/December 2010	864,019	842,324	97.49%
		2010 Total	16,383,480	15,293,417	93%
		Total to Date	31,550,152	28,946,655	91.75%

**While Nasarawa is a state assisted by The Carter Center, the nets distributed during this mass campaign are not included in the totals of LLINs distributed by The Carter Center in 2010 as The Carter Center support for this distribution was limited to attending planning meetings and participating in supervision.*

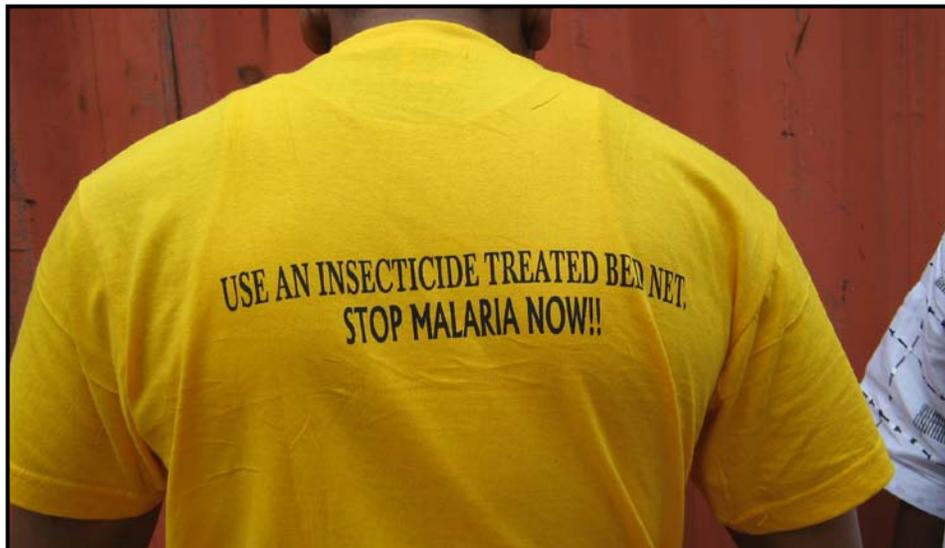
Table 4: Tentative Schedule for LLIN Distribution in Remaining States of Nigeria

MONTH	STATES SCHEDULED FOR DISTRIBUTION
February/March 2011	Lagos , Enugu, Ebonyi, FCT, Zamfara, Lagos, Borno, Yobe, Kwara
Apr/ May/June 2011	Edo, Bayelsa, Taraba, Abia, Imo, Benue
July/ August 2011	Delta, Oyo, Oyo, Osun, Ondo, Kogi
On-going	Cross Rivers

* Information received subsequent to the program review meeting indicates that net distribution is likely to be delayed again and that the states will not meet the target distribution dates listed here.

1.2 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 states in the southeast (see Tables 5 and 6). 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 states, 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 states, these messages have been emphasized during net distribution activities.



The Carter Center’s Dr. Emukah shows off a “do-able message” on the back of a t-shirt: “Use an Insecticide Treated Bed Net. Stop Malaria Now!!”

During the mass campaign in Plateau State, The Carter Center worked with other partners to adapt standard BCC messages developed at the national level as necessary and appropriate for use in Plateau State. The Center provided funding for the dissemination of these messages via radio and television broadcasts. During the process of the campaign, it became apparent that additional modifications to messages were necessary. For example, people were confused by the phrase “sleep under a bed net” while the phrase “sleep *in* a bed net” conveyed the intended message of sleeping with a bed net tucked in around you on all sides. Lessons learned about malaria education messages during this campaign will be applied during future Carter Center net distribution activities in this region.

Table 5: 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 yourself 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. ▪ Indoor Residual Spraying provides additional protection from malaria for your family.

Table 6: 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.

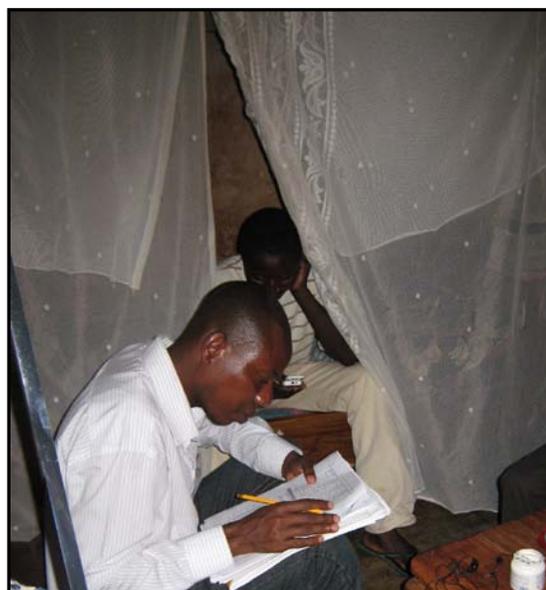
1.3 Diagnosis and Treatment of Malaria

The Carter Center activities in Nigeria currently focus primarily on LLIN distribution activities. However, in 2010, the Center provided some support for training Nigeria’s new cadre of Role Model Caregivers. This group of community health workers is responsible for providing malaria treatment, based on clinical signs, at the community level.

2. MONITORING AND EVALUATION

2.1 Evaluation within The Carter Center Assisted Areas

In 2010, The Carter Center conducted a large representative household cluster survey in Plateau and Abia states, in order to establish a baseline for future evaluations of the impact of the scale-up of malaria control activities in these Carter Center-assisted states. From August 17-27, a total of 54 lab scientists and enumerators were trained to conduct survey activities, including administering the questionnaire, preparing blood slides for microscopy, performing rapid diagnostic tests for malaria and testing for anemia using Hemacue™ machines. Of these persons trained, 40 were ultimately selected for the survey, based on performance during the training. The



A survey enumerator interviews a young man in Plateau State during the malaria indicator survey conducted in September 2010

classroom-based training was followed by 2 days of practical experience in a field setting. The survey itself lasted 28 days, from September 2nd to September 29th.



A laboratory technician conducts a fingerprick blood draw on a young girl in the context of the September survey for malaria and anemia testing.

Data were collected from a total of 2,808 randomly selected households in 120 clusters (census enumeration areas) in the 2 states. In each household, the head of household was asked a series of questions about the household economy, and bed net ownership and use. All women between the ages of 15-49 responded to a series of questions about malaria knowledge, attitudes and practices. All children <10 were tested for malaria and anemia. In every third household, persons older than age 10 also were tested for malaria (by both RDT and microscopy).

During the survey, 45.2% of persons tested for malaria by RDT in Plateau state and 39.4% of those in Abia state were positive, and received appropriate treatment according to the national treatment guidelines (preliminary, unweighted results). The age-adjusted prevalence of malaria by RDT was 36.9% in Plateau and 29.7% in Abia. Malaria prevalence, by RDT, was higher in Plateau than in Abia, across all age groups (Figure 9), but more children in Abia than in Plateau had severe anemia (Figure 10).

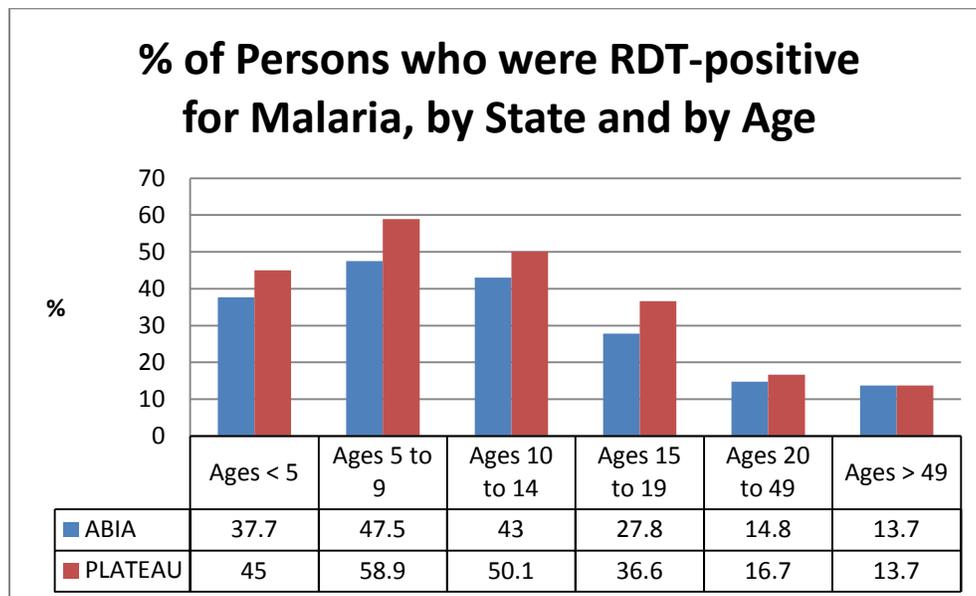


Figure 9

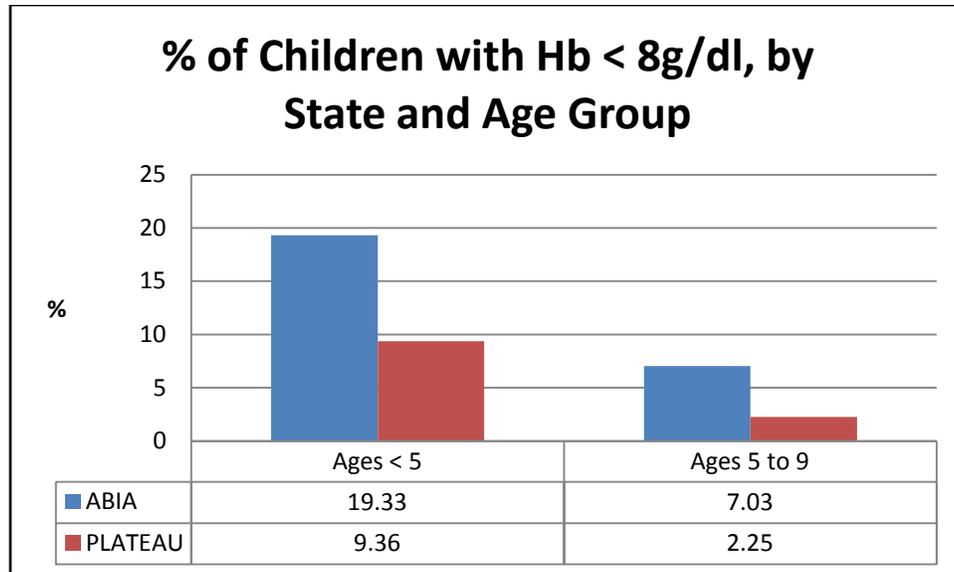


Figure 10

According to preliminary (unweighted) survey results, 35% of households in Plateau and 7.2% of households in Abia are estimated to own at least 1 bed net. The mean number of nets per household was 0.58 in Plateau, and 0.09 in Abia. Of the nets observed, over 90%, in both states, were LLINs. The higher rates of net ownership in Plateau are likely to reflect Carter Center LLIN distribution activities in that state, at least in part.

The results pertaining to net use showed that, in Plateau and Abia respectively, 15.5% and 2.9% of all persons slept under a bed net the previous night. There is evidence that campaigns stressing the importance of giving priority to vulnerable groups have had some success, given that the proportions of children under 5 and pregnant women sleeping under nets were higher than those for the general population. A total of 20.7% of children < 5 in Plateau and 5.5% in Abia were reported to have slept under a net the previous night. A total of 24.7% and 4.7% of pregnant women in Plateau and Abia states respectively slept under a net the previous night.

2.2 Support to the National Malaria Control Program

The Carter Center participated in the planning meetings for the National Malaria Indicator Survey conducted at the end of 2010, and provided financial and in-kind support for survey activities conducted in the nine states supported by The Carter Center. The results of this survey had not yet been officially released at the time the report was prepared.

3. OPERATIONAL RESEARCH

A study is being conducted in 4 LGAs in Ebonyi and Imo states, with support of the Bill & 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 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). This project has provided The Carter Center’s Nigeria program with valuable knowledge and experience, pertaining to the process and impact of stand-alone net distribution in the Nigerian context, which The Carter Center has applied and shared during the widespread national net distribution activities which began in Carter Center -assisted states in 2010.

The study currently has two arms:

Targeted Bed Net Coverage: two LGAs with LLINs provided only to vulnerable groups

Universal Bed Net Coverage: two LGAs with LLINs provided for full population coverage

In April and May 2008, the Nigerian MOH and The Carter Center provided 200,000 LLIN for four LGAs that had been randomly divided into the two study groups. The distribution was carried out within 935 villages of the targeted LGAs (Owerri 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 LLINs were distributed to maximize coverage based on subsequent improved census figures and geographic reconnaissance. In 2010, an additional 15,000 nets were distributed in Ohaukwu LGA in Ebonyi state as part of planned efforts to convert vulnerable group arms to full coverage. This conversion will be completed when mass distribution campaigns are completed in both Imo and Ebonyi states. Current information suggests that these mass distribution campaigns are unlikely to be completed before the fall of 2011.

Household Surveys to Evaluate Net Distribution:

A baseline household malaria survey was conducted in the 4 LGAs in November-December 2007 (before net distribution), and follow-up surveys were conducted in November-December 2008, 2009 and 2010.

Characteristics of the population sampled for each survey are presented in Table 7. Note that the 2010 data are provisional.

Table 7: Sample Characteristics for Imo and Ebonyi State Surveys (2007, 2008, 2009 and 2010).

	2007	2008	2009	2010
Total # of Households	968	1078	1294	1372
Mean Household Size	5.6	4.8	4.2	3.5
Mean # of Sleeping Spaces	3.1	3.0	2.4	2.5
Total # of Participants	5197	5200	5220	~6000
# of Children < 5	847	866	863	1224
Total # of Persons Eligible for Malaria Blood Test	1750	1964	1595	1713
# of Children <5 Eligible for Blood Test	334	396	364	520

The data from the 2007, 2008 and 2009 surveys were discussed at the 2009 Annual Malaria Program Review and are described in greater detail in the report for that meeting.

Data entry and analysis for the 2010 Imo and Ebonyi state cluster survey are still in process and will be presented at a later date. A subset of preliminary unweighted survey data pertaining to malaria knowledge, practices and communication is described in Annex 1.

NIGERIA RECOMMENDATIONS FOR 2011

The Nigeria malaria control program should:

- 1) Continue to provide assistance for LLIN distribution in TCC-assisted states, as funding permits. Priority focus should be on Imo and Ebonyi states, where TCC has support from the Bill & Melinda Gates Foundation to evaluate the impact of LLINs on LF and malaria. In these 2 states, full LLIN coverage is needed to convert the vulnerable group arms in that study to full-coverage.
- 2) Enhance BCC in the sentinel village areas of Imo and Ebonyi states to improve LLIN usage prior to the next rainy season as this is urgently needed. MOH and RBM staff in these states should be involved in the planning and implementation of these activities to ensure that they complement the national BCC strategy. Findings from these interventions, as well as past and future surveys and qualitative assessments, should be used to inform development of more effective BCC strategies to eventually be implemented in all TCC-assisted states.
- 3) Enhance efforts to motivate CDDs to consistently conduct monitoring and BCC activities in addition to drug distribution, using non-monetary incentives. Data on net ownership and net condition collected by CDDs should be evaluated for usefulness in developing a more tailored and cost-effective net replacement strategy.
- 4) Seek funding and LLINs for operational research to test different net replacement strategies.
- 5) Participate in national and local meetings and aid in national survey activities as funding permits.
- 6) Work to strengthen the working relationship with the Gowon Center in states where both TCC and the Gowon Center operate.
- 7) Conclude and finalize Gates-supported LF/MAL studies in SE Nigeria. Findings from these studies will include: a) LLIN impact on anemia and malaria and LF parasitemia, b) impact of enhanced BCC activities on bed net use, c) costs of standalone LLIN distribution.

GENERAL RECOMMENDATIONS FOR 2011

The malaria control program at The Carter Center headquarters, in collaboration with the Nigeria and Ethiopia country offices, should:

- 1) Seek funds for operational research to test different net replacement strategies for Ethiopia and Nigeria.
- 2) Continue to promote the idea of the benefits of malaria integration with NTDs, especially the integration of malaria with lymphatic filariasis (LF), since both infections are transmitted by anopheline mosquitoes in Nigeria and Ethiopia. Both countries should complete nationwide LF prevalence surveys as soon as possible in order to promote linkage of their LF and malaria programs.
- 3) Develop and pilot test a standard set of key indicators related to malaria behavior and communications to be used in all surveys conducted by the malaria program. These indicators should be informed by established tools used for monitoring behavior change and communications interventions in other contexts, as well as by ongoing efforts by international working groups to develop a set of standardized indicators for measuring the success of malaria control activities (including behavior change communications). Modifications to standard indicators should be made, as necessary, to reflect specific cultural context, based on information from KAP surveys and qualitative data (focus groups, interviews, participatory data collection activities). Indicators should be in line with national goals and guidelines.
- 4) Develop and pilot test a standard list of process indicators pertaining to TCC malaria activities which can be used to monitor the consistency and quality of the implementation of programmatic activities (particularly BCC) and interventions. These indicators should be informed by established process evaluation tools and guidelines developed in other contexts.
- 5) Conduct internal, in-country annual malaria program budgeting and planning sessions in Ethiopia and Nigeria. The goal of these reviews will be to develop a clear sense of the objectives and associated activities for the coming year before the beginning of the budget process. HQ staff would consider attending these meetings and plan to conduct additional in-country activities in conjunction with them, if scheduling and funding allow. Meetings should be of negligible additional cost and require no additional budget line.

ANNEX 1: SUMMARIES OF PRESENTATIONS BY INVITED GUESTS AND TCC HEADQUARTERS STAFF

Behavior Change Communications for Malaria Control in Southeast Nigeria

Amy E. Patterson

Data collected in the context of TCC's Gates Foundation-funded operational research project to assess the impact of 2 different LLIN distribution strategies on lymphatic filariasis transmission and malaria prevalence in 4 Local Government Areas (LGAs) of Imo and Ebonyi states in Southeast Nigeria demonstrates not only the common trend of net use lagging behind net ownership, but also that net use has gradually declined over time, though it is still higher than before the LLINs were distributed in 2007. These findings reinforce the growing awareness in the malaria control community that increasing access to nets and knowledge about their function and importance are not sufficient, on their own, to guarantee sustained widespread net use. Other factors, such as attitudes, skills, social norms and social support are likely to also play an important role in determining LLIN use, and must be addressed in behavior change interventions.

Now that LLINs are becoming more widely available in Nigeria, TCC is developing strategies to ensure that those nets already distributed will be used. In an effort to better understand the determinants of net use, and develop more effective, tailored approaches to behavior change communications, a series of questions pertaining to malaria knowledge, attitudes, practices, social norms and communication were added to the existing questionnaire for the study in Imo and Ebonyi states in 2010. At the time of the program review, data were available for 3 of the 4 LGAs included in this study, and thus preliminary data were presented. Results were obtained from 905 respondents in 850 different households (2 respondents in 94 households). 54% of respondents were female household members and the remaining 46% were male heads of household. Of these respondents, only 28% of the women and 25% of the men had slept under a bed net the previous night.

Key findings, as well as their implications for malaria behavior change communications are described below:

- **Knowledge that malaria is transmitted by mosquitoes was high (84%). However, a large number of people also hold concurrent false beliefs about malaria, some of which could have a negative impact on LLIN use at certain times of the year.** 83.5% of respondents incorrectly believe that people are only at risk of malaria infection during the rainy season, and 74.6% believe that you can get malaria from eating certain foods.
- **While knowledge about the importance of LLIN use was widespread and attitudes towards LLINs were generally positive, there is a need for much better education about how to use and care for an LLIN.** 77% of respondents spontaneously mentioned that bed nets protect you from mosquito bites when asked about the advantages of nets and 12% mentioned malaria prevention. However, 13% also spontaneously listed "use as

a window screen” as a primary advantage of LLINs. 44% reported that bed nets have no disadvantages. 85% agreed with the statement that LLINs can be hung any place where people sleep, and 91% agreed that LLINs are safe to sleep under. While most people (85%) understood the importance of prioritizing young children when there are a limited number of bed nets in a household, there was poor awareness of the importance of prioritizing pregnant women (only 5%). Importantly, less than 5% of respondents were aware that LLINs contain long-lasting insecticide and thus do not have to be re-treated regularly.

- **The fact that expected barriers to LLIN use such as lack of knowledge, and perceived disadvantages of LLINs (hot and uncomfortable to sleep under, fear of adverse reactions to insecticide) were rarely reported, but net use remains low suggests that barriers to net use may not involve intrinsic characteristics of nets so much as cultural norms and stereotypes, rumors, lack of established habit and situational factors.** For example, bed nets seem to have some negative associations in this context: 42% agreed with the statement that bed nets are mostly for poor, rural farmers and 49% feel that bed nets were “old fashioned.” Almost 37% of respondents believe that bed nets are part of a plot developed by Western nations to reduce African populations. Questions will be added to future surveys to explore the role of social norms, social support, habit and situational factors such as traveling or arriving home late after a long day of work on LLIN use.
- **For future malaria communication efforts in this area, it will be important to identify the appropriate local language terms to use for malaria (as well as LLINs and malaria treatments) in behavior change communications. Interpersonal communications (conducted in Igbo) are likely to be much more effective in this region than are print materials.** Most malaria communications in Nigeria are conducted in either English or Pidgin, and both use the English term “malaria.” Many malaria messages are conveyed through the channels of billboards and printed leaflets. While school attendance is relatively high (70% attended school), only 51% of respondents could read at all, and the percentages who could understand English and Pidgin were only 22% and 14% respectively. Only 49% reported familiarity with the English word “malaria.”
- **Overall, exposure to information about malaria was reported to be very low in these LGAs, suggesting that the channels commonly used for malaria communications (radio, television, leaflets, posters, etc.) are not reaching this audience.** Fewer than 20% of respondents had been exposed to any information about malaria in the past few weeks, though close to 50% said they had heard something about malaria control during a mass LLIN distribution campaign at some point in the past few years. Fewer than 5% had received information about malaria during a home visit conducted by a health worker or community health promoter, though studies demonstrate that this can be a very effective strategy for encouraging sustained LLIN use, provided adequate supervision and motivation for community volunteers.

- **When asked how much they trust different potential sources of health information (including radio, television, billboards, flyers, print media, educators, musicians, traditional healers, health workers, religious leaders and friends), for each source at least 60% of respondents indicated that they didn't trust the source at all.** This provides further evidence that using trusted community members, who have been selected by the community, to provide malaria education in the context of community activities and home visits may be the most appropriate and effective strategy in this area, given that such people are more likely to be considered reliable sources of information.
- **When asked about a number of specific billboards and television broadcasts pertaining to malaria, few people (<10% for all but 2 of the 10 communications included) reported having seen any of them.** The most commonly recalled television spot was a commercial produced by a drug company, rather than an educational broadcast produced by the MOH or its partners. When those who remembered seeing specific billboards or television announcements were asked about the specific message it conveyed, they reported messages intended to increase knowledge about the causes and severity of malaria. These communications did not seem to have increased knowledge about appropriate use of LLINs or the specific skills required to properly use and care for an LLIN, demonstrating a gap that should be addressed by TCC behavior change communication activities.

Integrated antibiotic and mosquito net coverage survey in Plateau state, Nigeria 2011

Jonathan D. King, TCC Trachoma Control Program

In 2010, the Federal Ministry of Health received its first shipment of Pfizer-donated azithromycin for the elimination of blinding trachoma. Residents in 7, trachoma endemic local government areas (LGAs) in Plateau and Nasarawa states were among the first recipients of the drug during an inaugural mass distribution. Simultaneously, LLINs were distributed to registered households through central distribution points in Plateau state as part of a national malaria control initiative. Both activities were supported by TCC Nigeria.

Just over a month after both distributions, a cluster randomized survey was implemented to estimate the true coverage of antibiotics and household net ownership as a monitor of the distribution strategies. Three LGAs in Plateau state with both antibiotic and net distribution were surveyed as 1 domain. Within the domain, all census enumeration areas were listed geographically and 24 were selected by random, systematic sampling. Within each selected enumeration area, households were divided into segments of approximately 16 households and the village leader selected 1 segment randomly via lottery. All households within a selected segment were visited by a survey team and all household residents were enumerated. Household residents present reported taking or not taking antibiotics for trachoma and sleeping or not sleeping under a bed net the previous night. Household interviews and observations were conducted to determine knowledge of trachoma and the antibiotic distribution; presence of a household latrine; net ownership and use; and knowledge about using nets.

An adult household resident was present to give consent for the survey in 365 of 392 visited households. From the surveyed households, responses were recorded for 1,858 out of 2,185 registered persons (85.0%). Overall, antibiotic was reported as taken by 59.9% (95%CI 48.0-71.8%) of surveyed individuals.

The average number of nets owned per household was 2.15 (95%CI 1.84-2.46). 82.2% of households owned at least 1 net and 79.7% owned 2 or more. Reported nets were observed in 88.6% of households. The average age of the newest net received was 1.5 months old, corresponding to the distribution timeframe. Among households with nets, 98.3% reported that their newest net was received from a mass distribution campaign. The newest net was being used in 52.0% (39.5-64.5%) of households with nets. The principle reasons reported for the new net not being used were the perception that there were no mosquitoes and that the net was being saved for use at a later time. For households with nets, 98.3% received information about nets when nets were received. The information recalled most frequently by household respondents about using nets was the following: Hang up nets to air out; Nets protect from malaria; sleep under nets every night. The information recalled most frequently by household interview respondents about taking care of nets was the following: wash the net using mild soap; hang net to dry in the shade; wash only when dirty and mend holes immediately.

Individual net use assessed by reporting sleeping under a net the previous night was 44.0% (29.7-58.2%) among households with at least 1 net observed and 44.3% (29.7-58.9%) among households reporting 3 or more nets. The reason most frequently reported for not sleeping under a net was the perception of there being no mosquitoes. In households with nets, the proportion

of household residents reporting to have slept under a net the previous night is presented by age group in Figure A-1. There was no indication that children or women of reproductive age were more likely to have slept under a net than the general population.

This coverage survey highlights the importance of monitoring mass distribution campaigns through household surveys. These results indicate that the LLIN distribution strategies utilized in Plateau state were successful. However, additional enhanced behavior change communication is required to promote sleeping under the nets. Further investigation into residents’ perceptions about mosquito seasonality is warranted.

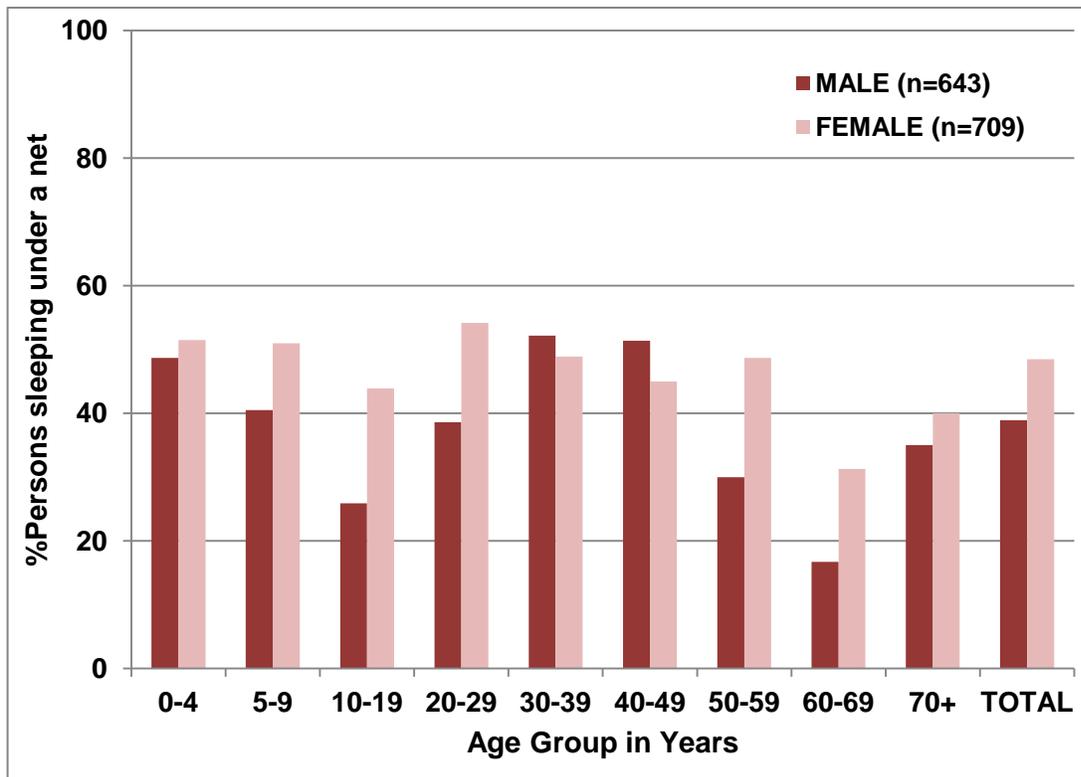


Figure A-1: Reported net use among residents of households with at least 1 LLIN by age group and gender.

Malaria Surveillance (with reference to Ethiopia)

Patricia M. Graves

This presentation discussed the need for routinely reported surveillance data on malaria cases, inpatients and deaths. This data can be used to assess the trends in disease incidence over space and time and whether control methods are working. Routine data over a number of years is needed, particularly in areas like Ethiopia with unstable malaria, to provide baseline information on the 'normal situation' for malaria epidemiology and to identify epidemics quickly so that their effects can be averted. Cross sectional surveys provide only snapshots with some spatial variation but not seasonal or interannual variation. Various schemes for malaria stratification in Ethiopia have been proposed, but they are all based on predictions from climate and other sources, rather than population-based disease incidence which would be preferable.

There are 3 potential data sources in Ethiopia: 1) the malaria specific reporting systems maintained to a greater or lesser extent in the regions since the eradication era; 2) the newly revised National Health Management Information System; and 3) the Integrated Disease Surveillance and Response System (IDSR). All of them need to have consistent reporting units with known populations, clearly defined and useful indicators, and reasonable (not necessarily perfect) completeness. The quality of each of these varies over time but, where consistent patterns are shown, there can be more confidence that the observed trends are real. Sources can be combined over long time stretches as in Figure A-2, which shows the strong interannual variation pattern for Ethiopia between 1983 and 2008, though there is a consistent incidence level at each peak.

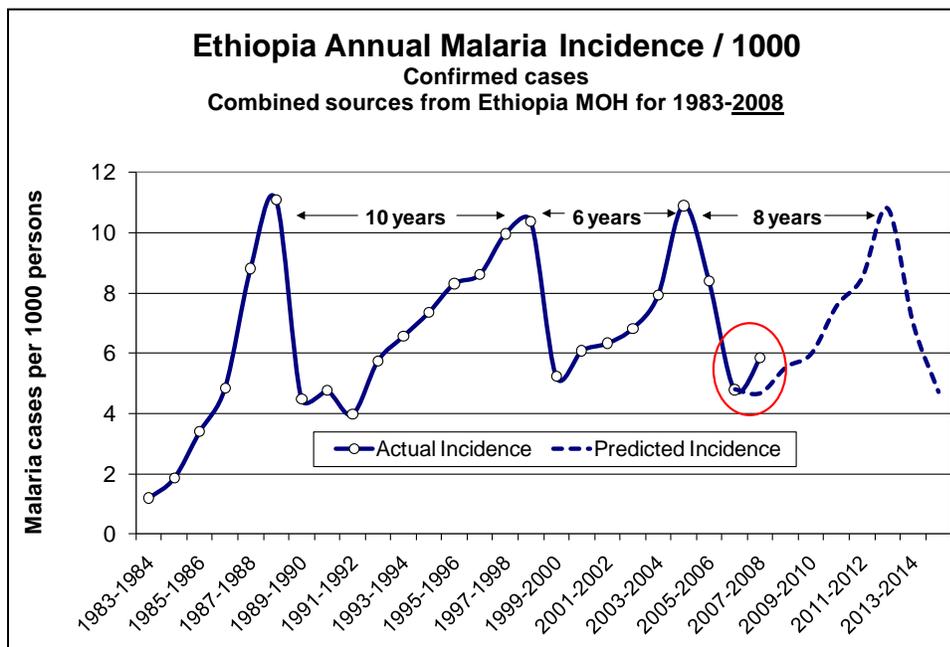


Figure A-2

Examples were presented for each data source. For the malaria information systems, the Oromia Regional Health Bureau has good data by health facility and demonstrated the peak in that region in 2003 with variation in zonal incidence. The National HMIS was a good source of data by region until mid-2008 after which indicators changed. The IDSR functioned well (80% reporting completeness) for zone level monthly data up from mid-2004 until mid-2009 when it changed to weekly under the Public Health Emergency Management. The change involved a much-needed reduction in the number of indicators, and a harmonization with the HMIS indicators, but did lead to a disruption of reporting during the transition. The IDSR data indicated greater reduction in inpatients and deaths than in outpatients between 2004 and 2009.

The recommended population-based core malaria indicators are:

- Incidence of total malaria cases (clinical plus confirmed)
- Incidence of confirmed malaria (RDT or slide) cases, by species
- Incidence of malaria admissions
- Mortality.

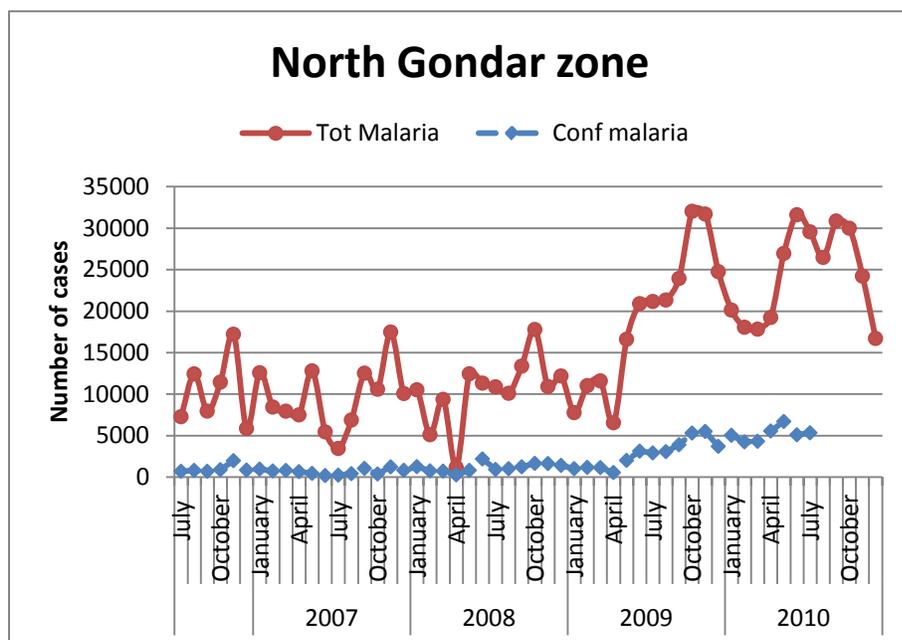


Figure A-3

A very high test positivity rate among those participants presenting with fever during the fifth MalTra Week (Nov 2010) suggested an increase in cases in some zones of Amhara, which was investigated using routine data from the malaria reporting system. There was an increase around this time in some zones compared to previous years (for example N. Gondar zone, Figure A-3), but also a peak earlier in 2010 in many districts.

Routine monthly data by district, collated to zone is an essential tool for understanding the disease trends, for stratifying areas for increased targeting of interventions, and for evaluating the impact of malaria control efforts.

Mass Drug Administration for Malaria Control: The MalTra Example

Dr. Paul Emerson

Dr. Paul Emerson, the co-director of TCC malaria program, described the malaria control program in the Amhara Region of Ethiopia in some detail both to highlight the ways that MalTra Weeks differ from mass drug administration strategies for malaria, and to provide program review participants with a better understanding of the massive scale of MalTra Week campaign activities. The MalTra Week campaigns employ a “mass fever test and treat” strategy, meaning that all persons who present with a fever are tested for malaria. This differs from mass drug administration activities, during which all members of a population are treated, regardless of whether or not they are infected, and from “mass test and treat” strategies in which all members of a population are tested, regardless of symptoms, and all persons with positive test results are treated. It also differs, however, from “mass fever treatment” in that persons with a fever are tested using a rapid diagnostic test (RDT) before receiving treatment according to national treatment guidelines, rather than simply receiving treatment based upon clinical diagnosis.

During the most recent MalTra Week campaign (MalTra V, November 2010), 4,633 4-person teams and 1,400 supervisors were trained and deployed to conduct mass drug administration of azithromycin for trachoma control, as well as to provide mass fever test and treat services to a population of 10.1 million people in 76 districts of West Amhara. One million RDTs, 700,000 doses of Coartem and 300,000 doses of chloroquine were procured for these activities. Of 127,029 persons presenting with a fever, 117,838 were classified as “suspected malaria” by team leaders and were subsequently provided diagnostic services (RDT or clinical diagnosis in the absence of RDTs). Of 109,811 persons tested by RDT, 70,656 (64%) were positive. A total of 77,825 persons were treated for malaria and an additional 23,119 individuals were referred for additional care. Though the population estimate of fever cases was low (12/1000 persons in the population) and the population estimate of persons who tested positive for malaria was even lower (8/1000 persons), the test positivity rate by RDT was higher than expected (64%). This may have been due to localized malaria case build-ups, incorrect reading of RDTs by health extension workers, or incorrect recording of test results due to social pressure to provide treatment regardless of test result, or distrust of RDT results based upon familiarity with symptomatic diagnosis and treatment of malaria.

In light of these results, and with consideration of the unique opportunities presented by the MalTra program, Dr. Emerson encouraged the audience to consider a number of important questions. Program review participants engaged in lively discussion and debate about each one. These questions, as well as some pertinent information related to each one, are presented below:

1) Is TCC taking full advantage of the opportunities presented by MalTra Week campaigns to control malaria in the Amhara region?

- The current strategy does not allow for the identification and treatment of sub-clinical malaria infections, and likely fails to identify a number of clinical infections as well. These untreated cases contribute to the continued transmission of malaria in this region, even if they are not currently experiencing symptoms. *Is there a way for us to treat subclinical cases and thus have a greater impact on malaria transmission?*

- Given the risk of adverse events for persons with G6PD enzyme deficiency, it is not possible to use 8-aminoquinolines (primaquine) for a radical cure of the *P. vivax* malaria parasite (the removal of gametocytes and even dormant liver states of the parasite) in the context of MalTra Weeks because we are not able to identify individuals with this genetic condition.

2) Is mass-drug administration, or targeted mass-drug administration worth pursuing, instead of the current strategy of testing and treating only those individuals who present with a fever?

- Should we consider treating all MalTra Week participants for malaria?
- Should we consider a targeted strategy resembling intermittent preventive treatment of infants or pregnant women (IPTi and IPTp)?
- If IPT were to contribute to elimination, treatment selection would have to take into consideration the requirements for blocking transmission.

3) Is the MalTra Week strategy contributing to the control or elimination of malaria in the Amhara region of Ethiopia? How can we best measure the effects of MalTra?

- The Regional Health Bureau in Amhara believes that the MalTra Weeks have been responsible for preventing epidemics in the region.
- MalTra Weeks certainly benefit the large number of individuals who receive treatment for malaria in the context of the campaign, who may not have otherwise been treated given frequent, sustained stockouts at health facilities.
- Health facilities in the region are better able to treat malaria patients in the months following one of the MalTra Weeks because they receive the leftover stock of antimalarial treatments and RDTs. For many, this may be the only time of year that they can count on having these supplies.
- However, given weak surveillance systems in the region, and the great variability in malaria transmission in Ethiopia, not only within a one year period but also between years, it has been difficult to assess whether MalTra Weeks are truly having an impact on malaria prevalence.

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. Blinding 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 using the SAFE strategy, where SAFE stands for the 4 components of the strategy:

- 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.) and albendazole (donated by GlaxoSmithKline); or diethylcarbamazine (DEC) and albendazole. Annual treatment is not possible in areas co-infected with the worm *Loa loa* since severe adverse events may take place if the *Loa loa* worms are killed and unmasked to the immune system. 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 2010

Ethiopia Activities										Nigeria Activities	
Jan 06	Feb 06	Mar 06	Apr 06	May 06	Jun 06	Jul 06	Aug 06	Sep 06	Oct 06	Nov 06	Dec 06
										Baseline Survey	
Baseline Survey				Ivermectin Drug Distribution			LLIN Durability Study Round I	On-Going Community Assessment		Malaria Indicator Survey	
Delivery of 3 Million LLINs (Permanets)										SE Household Survey I	
										LLIN Durability Study Round II	LLIN Durability Study Round II
										SE Household Survey II	
										MALTRA WEEK I	
										SE Household Survey II	
										MALTRA WEEK III	
										SE Household Survey III	
										MALTRA WEEK IV	
										SE Household Survey III	
										MALTRA WEEK V	
										SE Household Survey III	
										SE Household Survey III	

ANNEX 4: PUBLICATIONS AND ABSTRACTS SINCE 2007

- 1) 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. (2010). 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*. Volume 2010, Article ID 750978, 12 pages doi:10.1155/2010/750978.
- 2) Endeshaw T, Graves PM, Shargie EB, Gebre T, Ayele B, Yohannes G, Zerihun M, Genet A, Melak B, Kebede A, Jima D, Tadesse Z, Ngondi J, Mosher AW, Richards FO, Emerson PM (2010). Comparison of Parascreeen Pan/Pf, Paracheck Pf and light microscopy for detection of malaria among febrile patients, Northwest Ethiopia. *Trans Roy Soc Trop Med Hyg*. 104: 467-474.
- 3) Jima D, Getachew A, Bilak H, Steketee RW, Emerson PM, Graves PM, Gebre T, Reithinger R, Hwang J, and the Ethiopia Malaria Indicator Survey Working Group (2010). Malaria Indicator Survey 2007, Ethiopia: coverage and use of major malaria prevention and control interventions. *Malaria J*. 9: 58.
- 4) Hwang J, Graves PM, Jima D, Reithinger R, Kachur SP and the Ethiopia MIS working group. (2010). Knowledge of malaria and its association with malaria-related behaviors — Results from the Malaria Indicator Survey, Ethiopia, 2007. *PLoS One* 5(7): e11692.
- 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, 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.
- 7) 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.
- 8) 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.

Abstracts presented at ASTMH 2010

Patricia M. Graves, Emmanuel Emukah, Aryc W. Mosher, Jeremiah Ngondi, Emmanuel Miri, Obiezu Josephine, Okpala T. Njideka, Njoku Chidi, Nwordu Kenrick, Obasi Andrew, Frank O. Richards. *Reduction in anemia in children under ten years of age after distribution of long-lasting insecticidal Nets (LLIN) for control of malaria and lymphatic filariasis in four local government areas (LGAs) in Southeast Nigeria.*

Stephen C. Smith, Aprielle Brackery, Gedeon Yohannes, Patricia M. Graves, Tekola Endeshaw, Estifanos B. Shargie, Aryc W. Mosher, Paul M. Emerson, Teshome Gebre. *Monitoring the durability of long-lasting Insecticidal bednets in rural Ethiopia.*

Gedeon Yohannes Anshebo, Stephen C. Smith, Aprielle Brackery, Damtew Yadeta, Patricia M. Graves, Tekola Endeshaw, Teshome Gebre, Paul M. Emerson. Bioassay testing with permanet-2 long lasting insecticidal net samples collected after 3 to 32 months of use in Ethiopia demonstrates persistence of insecticide on nets but reduced killing effect in wild type *Anopheles arabiensis*.

Abstract presented at APHA 2010

Tamica Moon, Julie Gutman, Emmanuel Emukah, Patricia Graves, Nkwocha Omeni, Nwankwo Lawrence, Gift Opara, Adaku Echebima, Rita Otozi, Mgbodichi Onyia, Frank O. Richards. *Exploring factors that Influence the use of bednets in southeastern Nigeria.*

Abstract presented at ASTMH 2009

Jimee 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.*

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 Katarbarwa, 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.*

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.*

ANNEX 5: LIST OF PARTICIPANTS

Bill and Melinda Gates Foundation

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Dr. Julie Gutman

Mr. Marc Cunningham

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Mrs. Nicole Kruse

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Mr. Kent Nelson

Ms. Stephanie Palmer

Mr. Jay Papisan

Ms. Lindsay Rakers

Dr. Frank Richards

Mr. Randy Slaven

Mr. Craig Withers

ANNEX 6: PROGRAM REVIEW AGENDA

Friday, February 25, 2011		
8:00	Shuttle pickup at hotel	
8:30 – 9:00	Continental breakfast	
	Morning session	Dr. Paul Emerson (chair)
9:00 – 9:10	Welcome and introductions	Dr. Donald Hopkins
9:05 – 9:15	Overview	Dr. Frank Richards
9:15-9:45	Nigeria National Malaria Control Program	Dr Babajide Coker MOH Nigeria
9:45-10:00	<i>Discussion</i>	
10:00– 10:30	TCC Nigeria Malaria Program Progress Report	Mr. Adamu Sallau
10:30-10:45	<i>Discussion</i>	
10:45-11:00	Coffee Break	
11:00-11:25	Behavior Change Communications for Malaria Control in Southeast Nigeria	Ms. Amy Patterson
11:25-11:40	<i>Discussion</i>	
11:40-11:55	Rapid assessment of LLIN coverage and use in an integrated survey in Plateau state, Nigeria	Mr. Jonathan King
11:55-12:10	<i>Discussion</i>	
12:10 – 1:30	Lunch	
	Afternoon session	Dr. Frank Richards (chair)
1:30-2:00	Ethiopia National Malaria Control Program	Dr. Tizita Hailu Gudeta MOH Ethiopia
2:00 -2:15	<i>Discussion</i>	
2:15-2:45	TCC Ethiopia Malaria Program Progress Report	Mr. Zerihun Tadesse
2:45-3:00	<i>Discussion</i>	
3:00-3:15	Group Photo	
3:15-3:30	Coffee Break	
3:30-3:55	Malaria Surveillance	Dr. Patricia Graves
3:50-4:05	<i>Discussion</i>	
4:05 – 4:20	MDA for malaria control: The MalTra Example	Dr. Paul Emerson
4:20-4:35	<i>Discussion</i>	
4:35-5:15	<i>General discussion and recommendations</i>	Dr Frank Richards (chair)
5:15-5:30	Summary and Closure	Dr. Donald Hopkins
5:30	Session Adjourned Shuttle departs for hotel	