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CARTER CENTER

Waging Peace. Fighting Disease. Building Hope.

Summary
2014 Program Review for The Lions-Carter Center SightFirst

RIVER BLINDNESS ELIMINATION PROGRAMS

Ethiopia, Nigeria, OEPA, Sudan, and Uganda

24-26 February 2015
The Carter Center
Atlanta, GA

Lions Clubs International FOUNDATION

THE CARTER CENTER
RIVER BLINDNESS
ELIMINATION PROGRAM

October 2015

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And to many others, our sincere gratitude.

*We appreciate the support of the donors listed here, whose funding was utilized in 2014 for the activities described in these proceedings.

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ACRONYMS

APOC	African Program for Onchocerciasis Control
ARVS	at-risk villages (villages requiring community-wide active mass therapy)
ATO	Annual Treatment Objective
ATP	Annual Transmission Potential
BCC	Behavior Change Communication
CBM	Christoffel Blindenmission
CDC	Centers for Disease Control and Prevention
CDD	Community Directed Distributors
CDHS	Community-Directed Health Supervisors
CDTI	Community-Directed Treatment with Ivermectin
DDT	Dichlorodiphenyltrichloroethane
DEC	Diethylcarbamazine
DRC	Democratic Republic of Congo
earp	eligible at-risk population
EOEEAC	Ethiopia Onchocerciasis Elimination Expert Advisory Committee
ELISA	enzyme-linked immunosorbent assay
EPHI	Ethiopia Public Health Institute
FMOH	Federal Ministry of Health
GOS	Government of Sudan
GSK	GlaxoSmithKline
IACO	InterAmerican Conference on Onchocerciasis
IRB	Institutional Review Board
ITFDE	International Task Force for Disease Eradication
IVT	international verification team
KGaA	E-Merck
LCIF	Lions Clubs International Foundation
LF	Lymphatic Filariasis
LGA	local government areas
LLIN	Long Lasting Insecticidal (bed) Net
MDA	Mass Drug Administration
MDP	Mectizan® Donation Program
Mectizan®	Ivermectin (Merck & Co., Inc., product name)
MMWR	CDC's Morbidity and Mortality Weekly Report
MOH	Ministry of Health
NGDO	Non-Governmental Development Organization
NOCP	National Onchocerciasis Control Program
NOTF	National Onchocerciasis Task Force
NTDs	Neglected Tropical Diseases
OEPA	Onchocerciasis Elimination Program for the Americas
PAHO	Pan American Health Organization
PCC	Program Coordinating Committee of OEPA

PCR	Polymerase Chain Reaction
PTS	Post-Treatment Surveillance
RAPLOA	Rapid Assessment Procedures for Loiasis
RB	River Blindness
RBF	River Blindness Foundation
RBP	River Blindness Program
RBEP	River Blindness Elimination Program
REMO	Rapid Epidemiological Mapping of Onchocerciasis
RTI	Research Triangle Institute
SAE	Severe Adverse Events
STH	Soil Transmitted Helminths
TAS	Treatment Assessment Survey
TCC	The Carter Center
TDA	Triple Drug Administration
TDR	Tropical Disease Research
UOEEAC	Ugandan Onchocerciasis Elimination Expert Advisory Committee
USAID	United States Agency for International Development
USF	University of Southern Florida
UTG	Ultimate Treatment Goal
VAS	Vitamin A Supplementation
WER	Weekly Epidemiological Record
WHO	World Health Organization

Figure A1

2014 River Blindness Elimination Program Review Participants

Figure A2

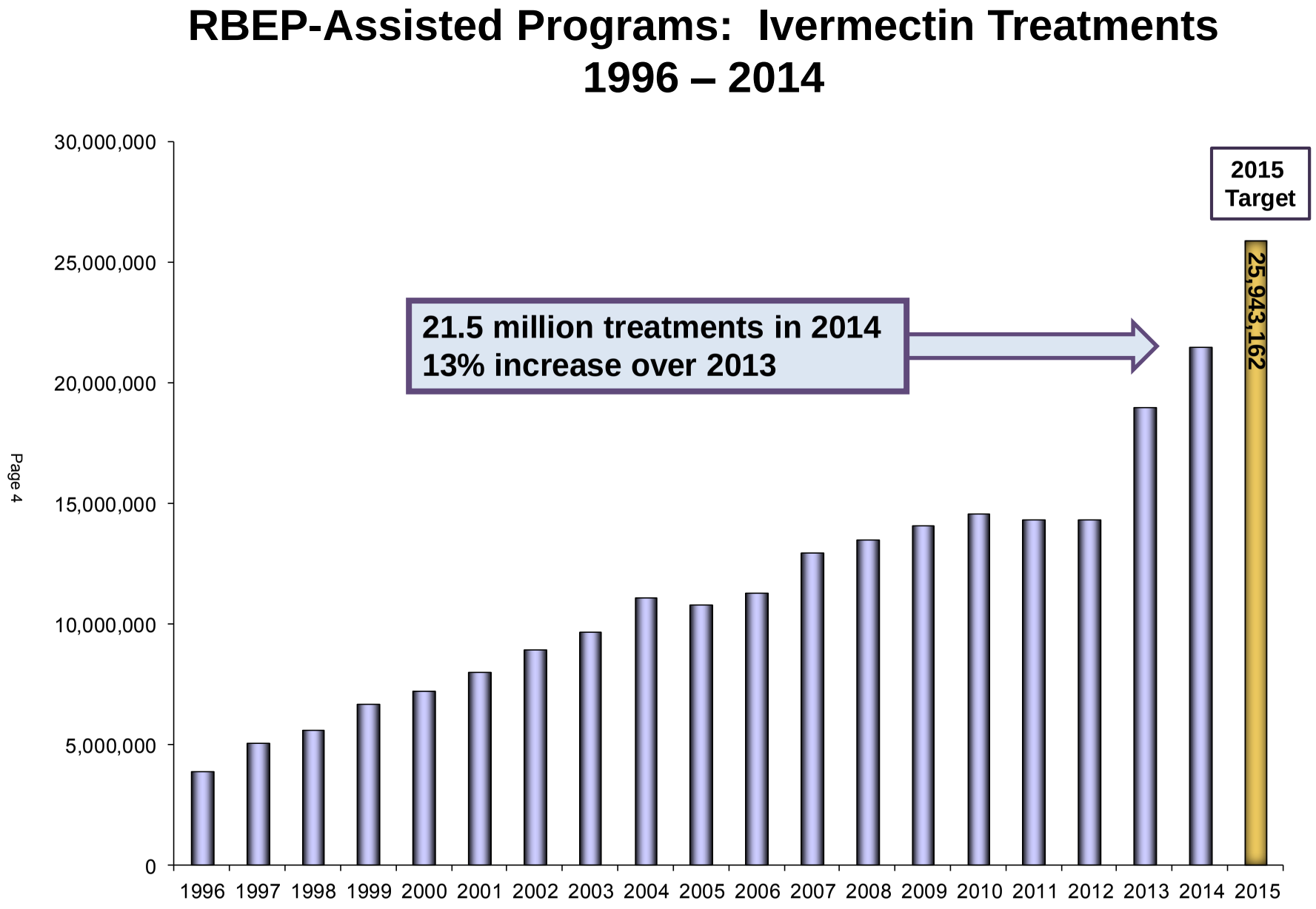
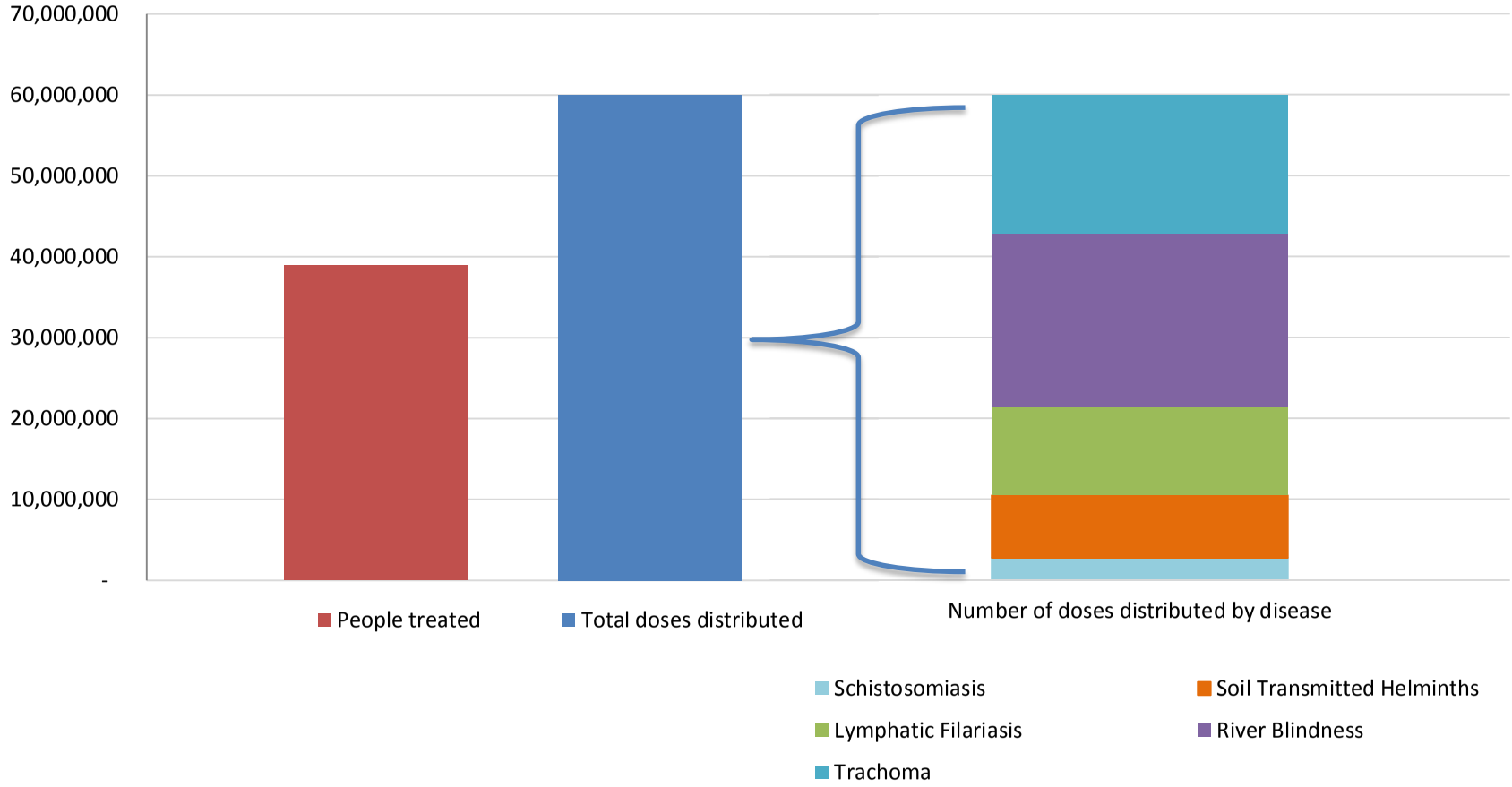

RBEP-Assisted Programs: Ivermectin Treatments
1996 – 2014
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
2015 Target
25,943,162
21.5 million treatments in 2014
13% increase over 2013
1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

Figure A3

Carter Center-supported Treatment Doses, and Persons Treated, for Neglected Tropical Diseases, 2014*



* The Carter Center is grateful for our Ministry of Health partners and the many donors and pharmaceutical companies who have made financial and in-kind contributions to make these treatments possible.

Figure A4

200,000,000 Cumulative Mectizan® Doses (Treatments) for RB Delivered by Carter Center RBEP-Assisted Programs, 1996 – 2014*

A commemorative medal, designed by Sherri Richards, celebrated the achievement.

*2014 Figure Provisional

RB = River Blindness, RBEP = River Blindness Elimination Program

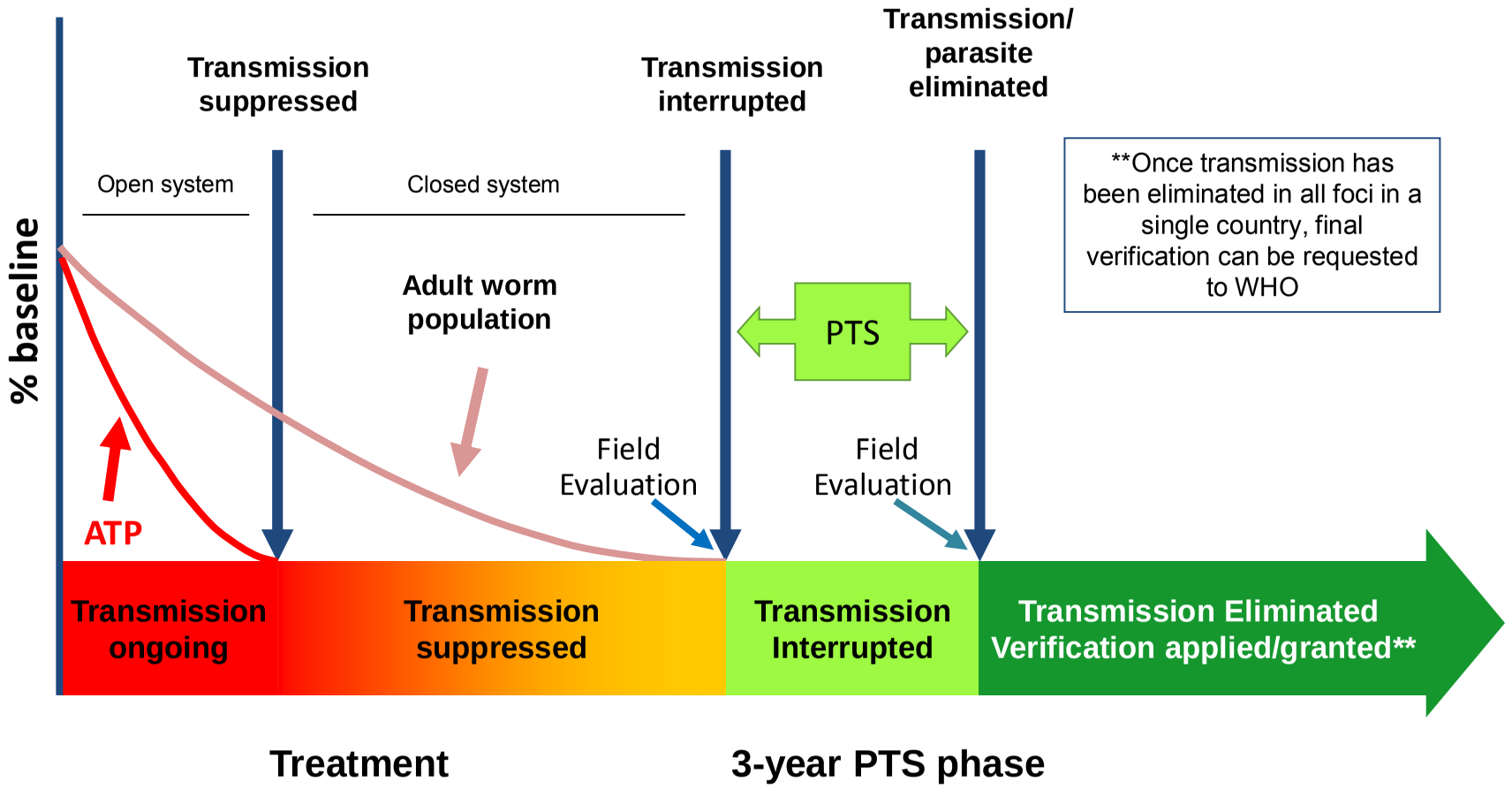
Figure A5

200,000,000 Treatment Celebration in Uganda: 200 million Cumulative Mectizan® Doses

On August 12, 2014, The Carter Center celebrated with partners its 200 millionth assisted Mectizan® treatment in the Lamwo District of northern Uganda. Lamwo's remarkable local leadership lead to a dramatic increase in mass drug administration (MDA) treatment coverage from 30% in 2013 to 90% in 2014. The treatment was administered by a community distributor in the Wigweng Community of Mura Parish to Mr. Christopher Olanya, blinded by onchocerciasis (right). Ms. Nancy Akanyo, a 14 year old girl who enthusiastically addressed the crowd about the virtues of the MDA program (top right) received the 200 million and first treatment. There were over 100 participants at the ceremony, including Ms. Peace Habomugisha (Carter Center Uganda, country representative), Ministry of Health officials Dr. Edridah Tukahebwa and Mr. Tom Lakwo; Lions PK Ndyarugahi, N. Ndyarugahi, I. Manzi, and D. Luwumu; and Dr. Ambrose Onapa (RTI ENVISION).

Figure A6

Phases of the Elimination of Onchocerciasis (Based on WHO's* certification/verification guidelines 2001)

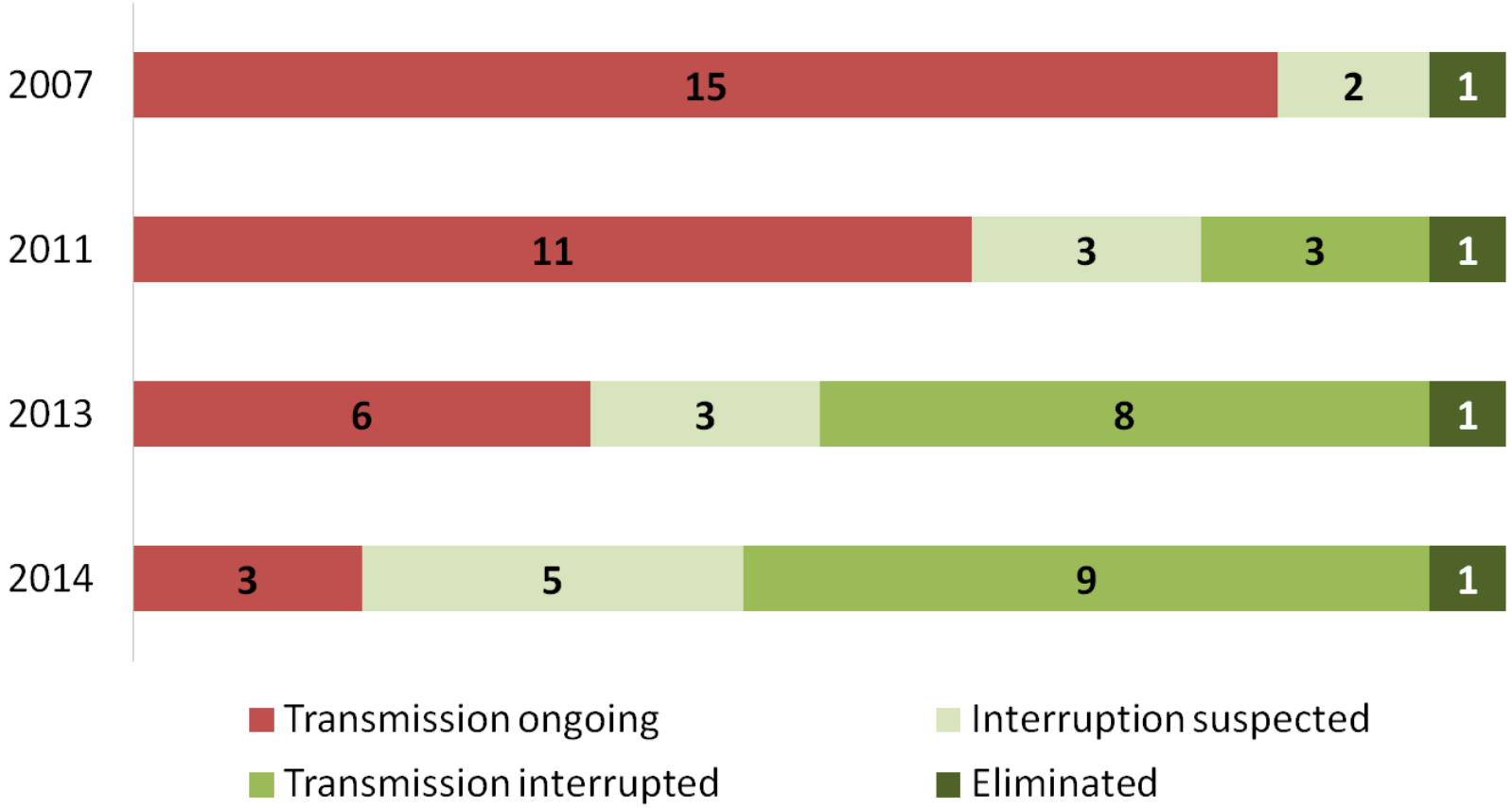


*WHO Report, (2001). *Certification of elimination of human onchocerciasis: Criteria and procedures*. Following a WHO meeting on "Criteria for Certification of interruption of transmission/elimination of human onchocerciasis" (document WHO/CDS/CPE/CEE/2001.18a). Geneva, World Health Organization.

** PTS – Post-Treatment Surveillance

Figure A7

Uganda
Change in Endemic Status in Foci (n = 18) over Time



Note: In 2014, Madi and Mid-North foci (both in “transmission ongoing”) were combined but are counted here separately.

Figure A8

Uganda
Percent of Total Population by Endemic Status Over Time

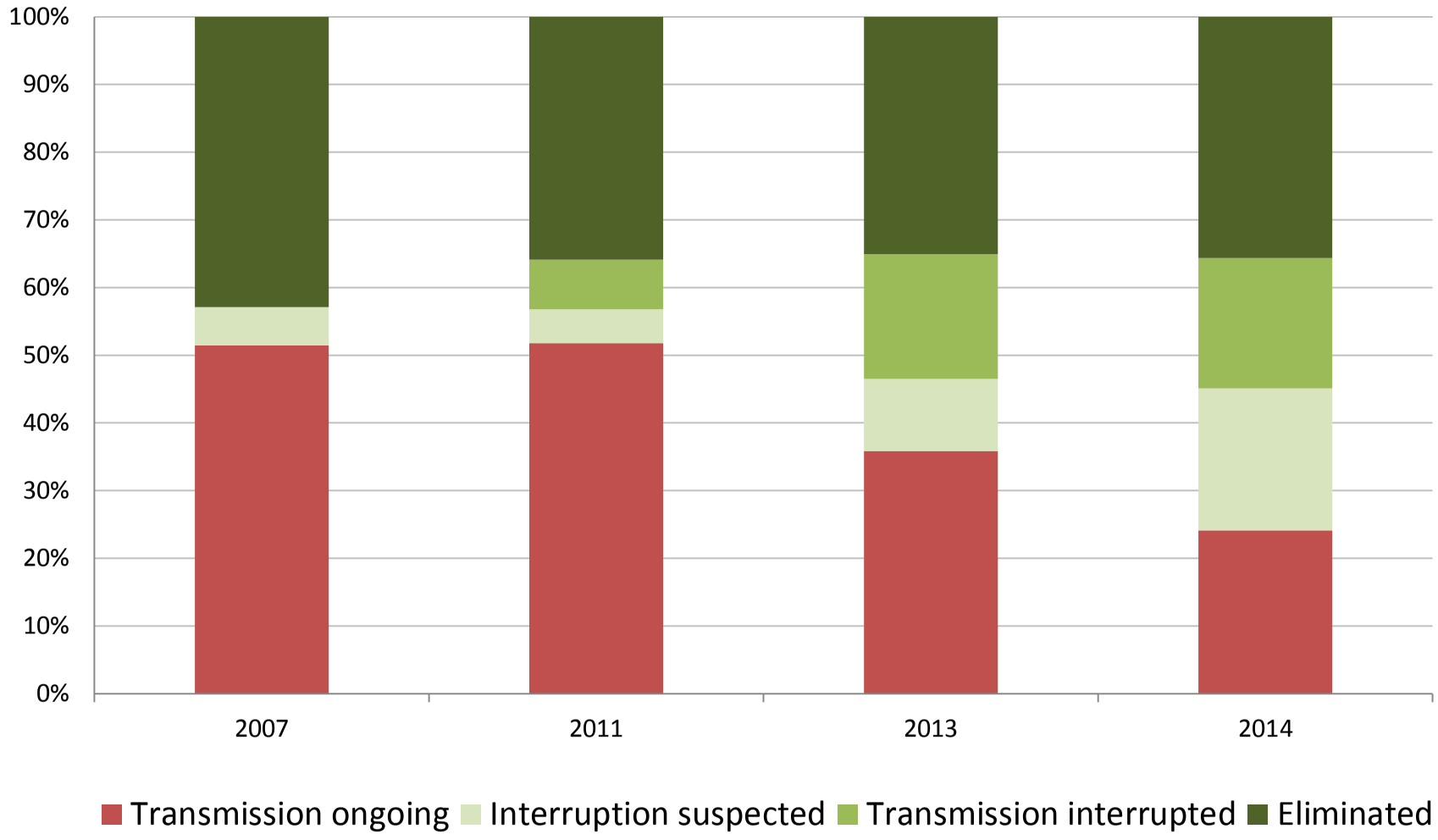
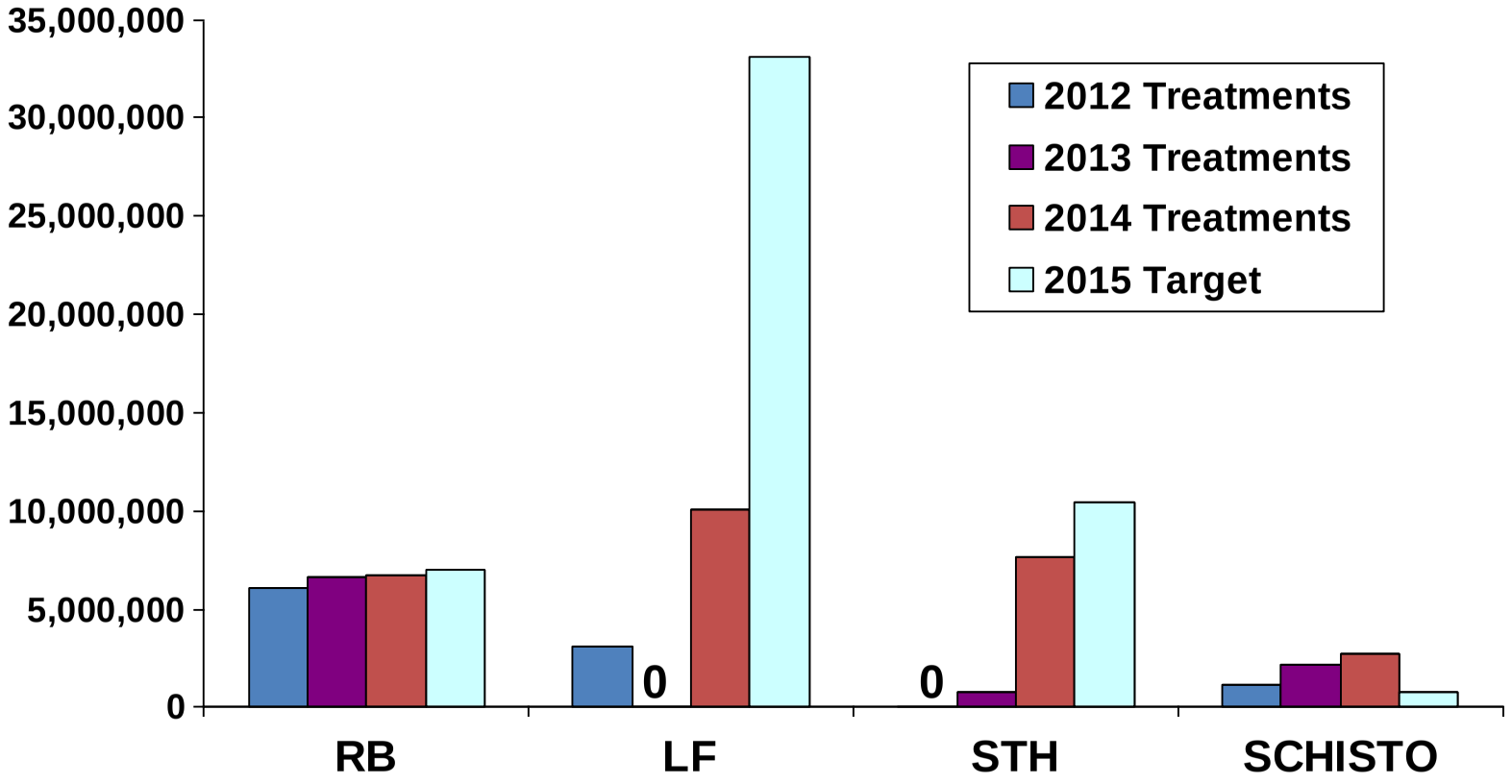


Figure A9

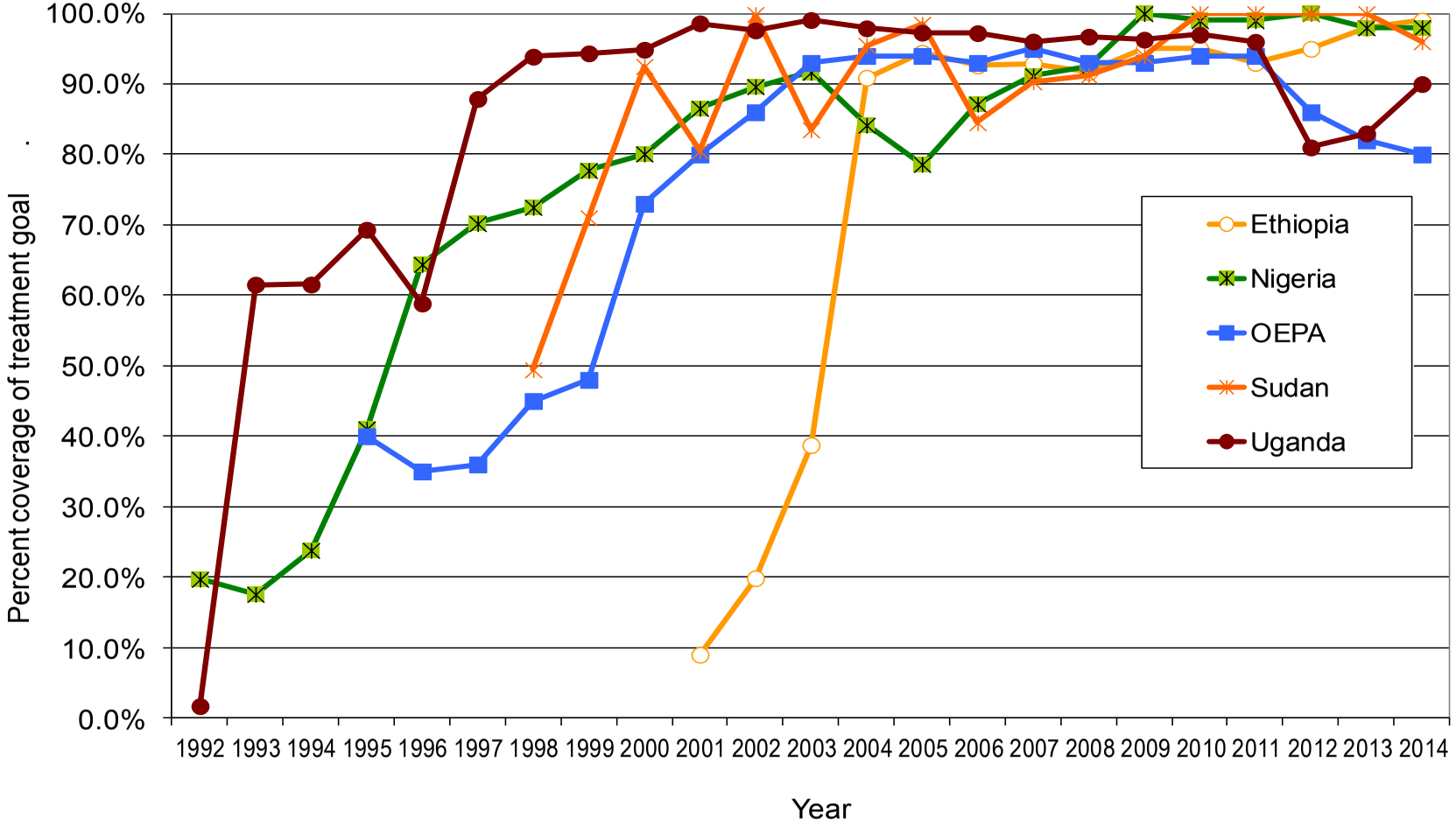
Nigeria: Carter Center Assisted River Blindness (RB), Lymphatic Filariasis (LF), Soil Transmitted Helminths (STH) and Schistosomiasis (SCH) Treatments 2012 – 2014 and 2015 Targets



2014: 27 million total treatments 2015 target: 51 million total treatments (88% increase)

Figure A10

River Blindness Program: Treatment coverage (eligible population) by project: UTG, UTG(2) or UTG(4) 1992 – 2014*



* 1992 – 1995 treatments were provided by River Blindness Foundation.

Figure A11

2014 Mectizan® Mass Treatment Figures for Carter Center RBEP- Assisted Areas in Latin America (OEPA) and Sudan

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL	% UTG	% ALL RBP TX
NIGERIA	***UTG=**	**6,910,345**			**UTG (villages)=**	**16,549**									
Treatments	0	0	0	0	157,529	127,209	546,587	1,858,047	1,887,495	1,197,037	615,648	379,527	**6,769,079**	98%	32%
Villages treated	0	0	0	0	81	101	480	4,145	5,761	3,738	1,265	382	**15,953**	96%	48%
UGANDA	***UTG=**	**10,182**			**UTG (villages)=**	**68**									
Treatments	0	0	0	0	9,962	0	0	0	0	0	0	0	**9,962**	98%	0%
Villages treated	0	0	0	68	0	0	0	0	0	0	0	0	**68**	100%	0%
UGANDA ELIMINA	****UTG(2)=**	**3,712,594**			**UTG (villages)=**	**3,628**									
Treatments	0	0	0	291,269	765,032	501,326	0	0	0	1,247,327	412,235	0	**3,217,189**	87%	15%
Villages treated	0	0	0	759	1,255	0	0	0	0	3,162	451	0	**2,814**	78%	9%
OEPA	****UTG(2)=**	**17,028**			**UTG (villages)=**	**143**									
Treatments	0	0	0	0	0	7,168	0	0	7,541	0	0	0	**14,709**	86%	0%
Villages treated	0	0	0	0	0	138	0	0	45	0	0	0	**92**	64%	0%
OEPA	****UTG(4)=**	**53,614**			**UTG (villages)=**	**299**									
Treatments	0	0	10,800	0	0	10,523	0	0	10,858	0	0	9,959	**42,140**	79%	0%
Villages treated	0	0	268	0	0	255	0	0	172	0	0	144	**210**	70%	1%
ETHIOPIA	***UTG=**	**1,992,961**			**UTG (villages)=**	**10,115**									
Treatments	0	0	0	0	0	0	1,058,388	152,290	0	0	0	743,943	**1,954,621**	98%	9%
Villages treated	0	0	0	0	0	0	10,115	0	0	0	0	0	**10,115**	100%	31%
ETHIOPIA ELIMIN	****UTG(2)=**	**9,176,837**			**UTG (villages)=**	**25,330**									
Treatments	0	0	0	0	0	0	4,478,126	0	0	0	0	4,635,540	**9,113,666**	99%	43%
Villages treated	0	0	0	0	0	0	24,352	0	0	0	0	25,330	**24,841**	98%	75%
SUDAN	****ATO=**	**19,723**			**UTG (villages)=**	**19**									
Treatments	0	0	0	0	0	0	0	0	0	0	0	22,782	**22,782**	116%	0%
Villages treated	0	0	0	0	0	0	0	0	0	0	0	0	**-**	0%	0%
SUDAN ELIMINATI	****UTG(2)=**	**246,180**			**UTG (villages)=**	**153**									
Treatments	0	0	0	0	0	115,877	0	0	0	0	5,628	110,659	**232,164**	94%	1%
Villages treated	0	0	0	0	0	153	0	0	0	0	0	153	**153**	100%	0%
TOTALS	***UTG=**	**22,139,464**			**UTG (villages)=**	**56,304**									
Treatments	**-**	**-**	**10,800.00**	**291,269**	**932,523**	**762,103**	**6,083,101**	**2,010,337**	**1,905,894**	**2,444,364**	**1,033,511**	**5,902,410**	**21,376,312**	**97%**	
Villages treated	**-**	**-**	**268.00**	**827**	**1,336**	**647**	**10,595**	**4,145**	**5,978**	**6,900**	**1,716**	**679.00**	**33,091**	**59%**	

Cumulative RBP-assisted treatments (1996 - 2014) = 212,751,670

2014 Mass Treatments	21,376,312
2014 Passive Treatments	127,689
2014 TOTAL TREATMENTS	**21,504,001**

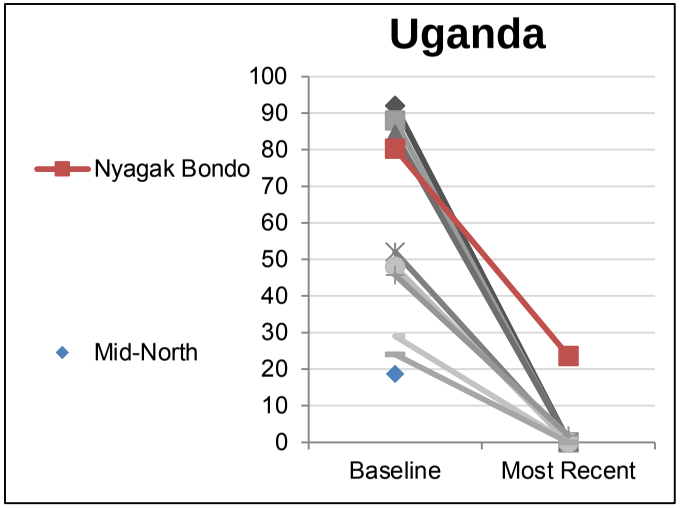
*UTG: Ultimate Treatment Goal (all the treatment-eligible population in a program area, i.e. healthy persons >5 years of age)

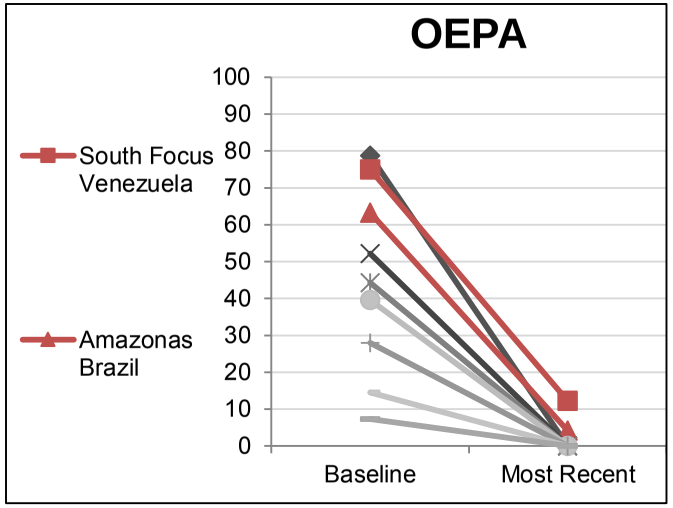
**OEPA's UTG 2 and UTG 4 are the UTG times 2 or 4. OEPA treatments are semiannual or quarterly

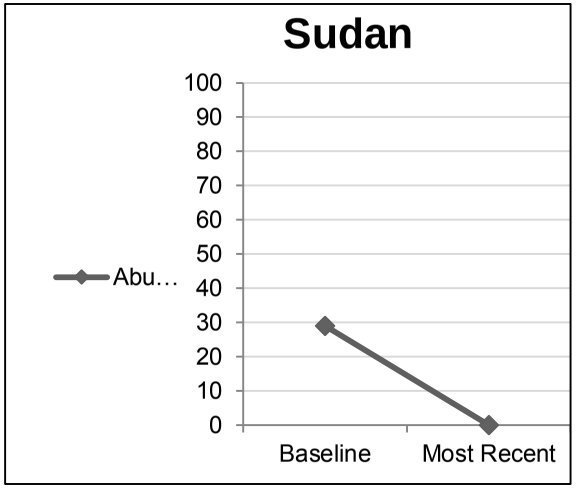
***ATO: Annual Treatment Objective – used because the population is unknown

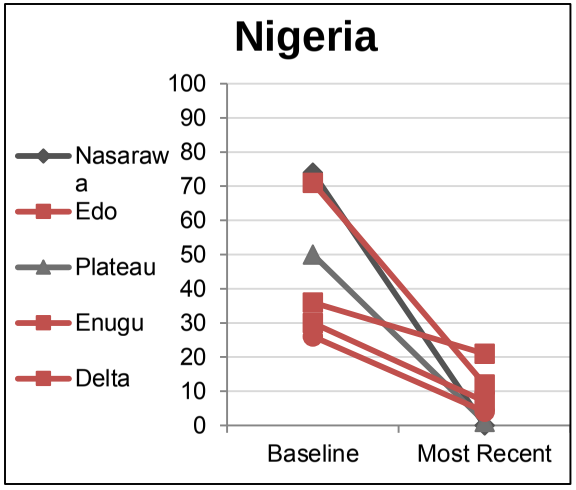
Figure A12

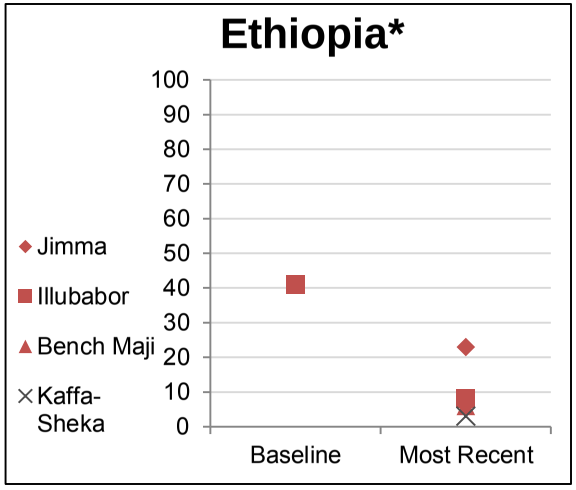
Impact of Programs: Baseline and Most Recent Prevalence of Microfilariae in Skin











Labels for Uganda and OEPA only shown for foci not reaching zero

* Consecutive data not available in Ethiopia. Only Illubabor has a baseline data point

Figure A13

Mr. Carlos Slim and President Carter, Announcing the Alliance with The Carlos Slim Foundation to Fight Onchocerciasis in the Americas, November 2014

Photo credit: G. Aguilar, Carlos Slim Foundation

Figure A14

Mr. John Moores Receives the Mectizan® Award in Mexico City

Figure A15

A Cross Border Team Working Together on the Border between Ethiopia and Sudan

(L to R): Isam Zaroug, FMOH-Sudan; Worku Mulat, North Gondar Health Department-Ethiopia, RB Focal; Carter Center driver, TCC-Ethiopi
Geremew Haileyesus, TCC- Ethiopia; the late Aseged Taye, TCC-Ethiopia, Program Officer (front); Tewodros Seid, TCC-Ethiopia, Statistician
Oumer Shafi, FMOH-Ethiopia; Sudanese community guide. (Credit: Carter Center Ethiopia)

Figure A16

Sudan: The Onchocerciasis Laboratory in Khartoum within the Federal Ministry of Health that analyzes samples from Abu Hamad and Galabat foci

Figure A17

Carter Center-Assisted Programs: 1996 – 2014 Mectizan® Treatments by Program

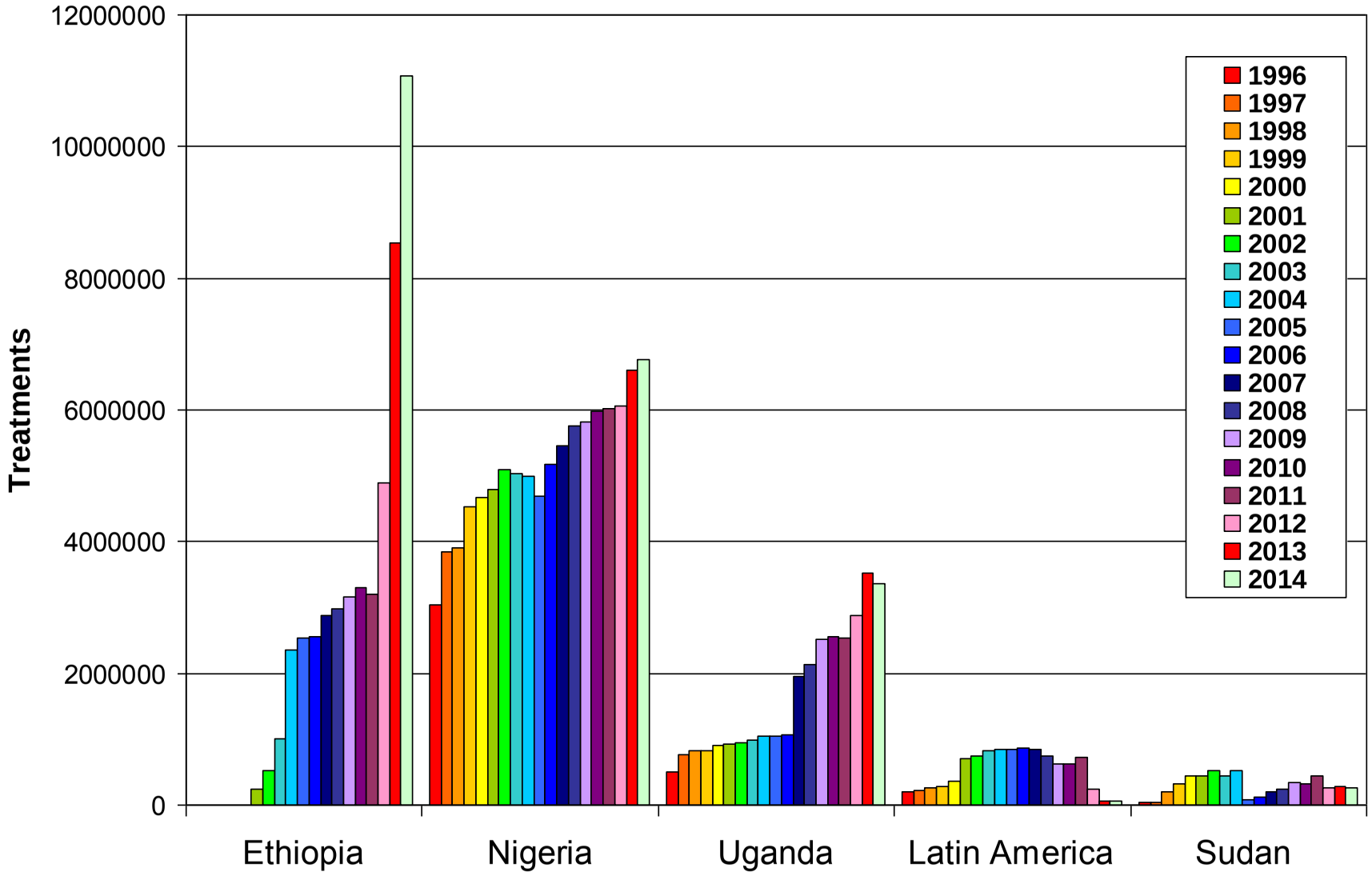
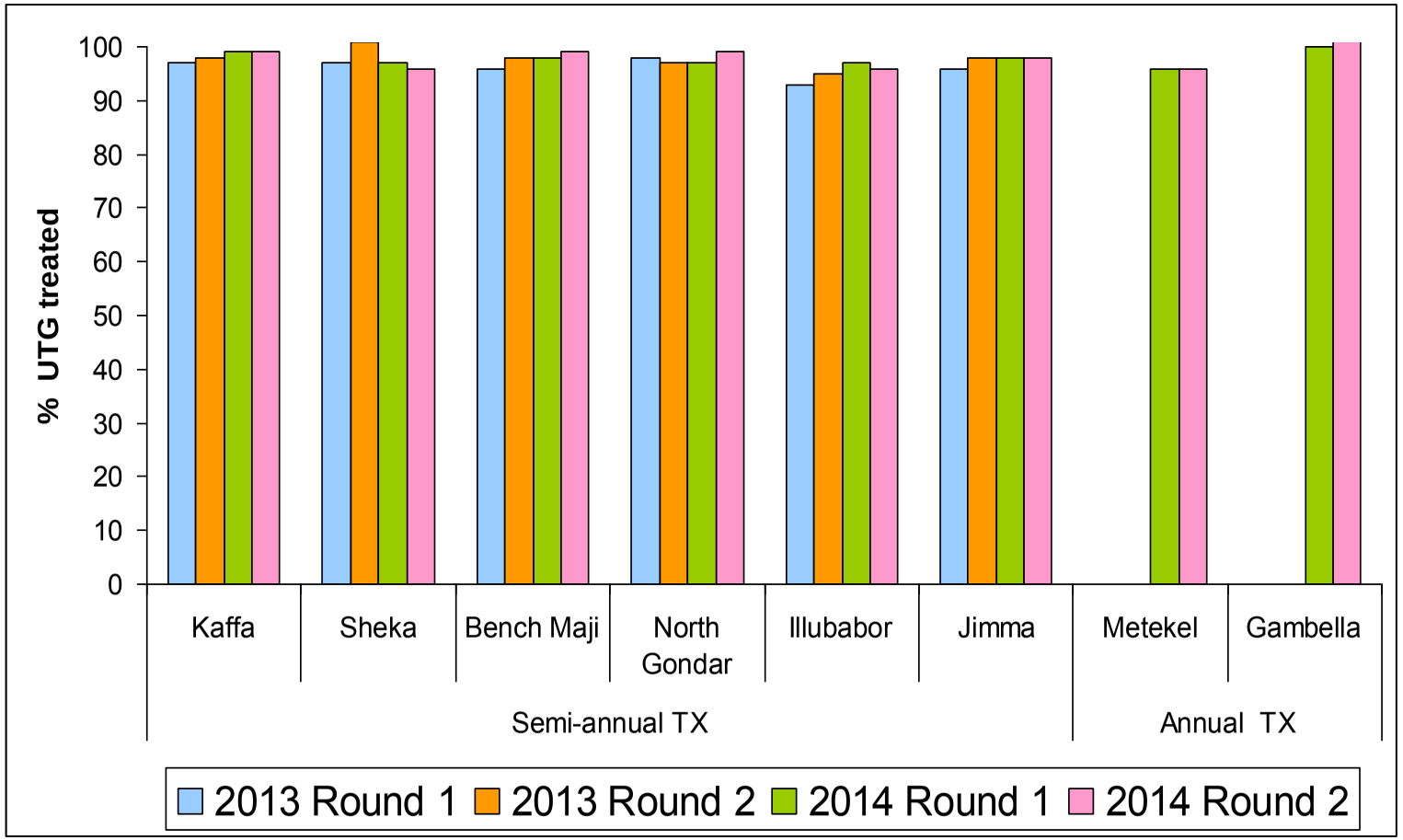


Figure A18

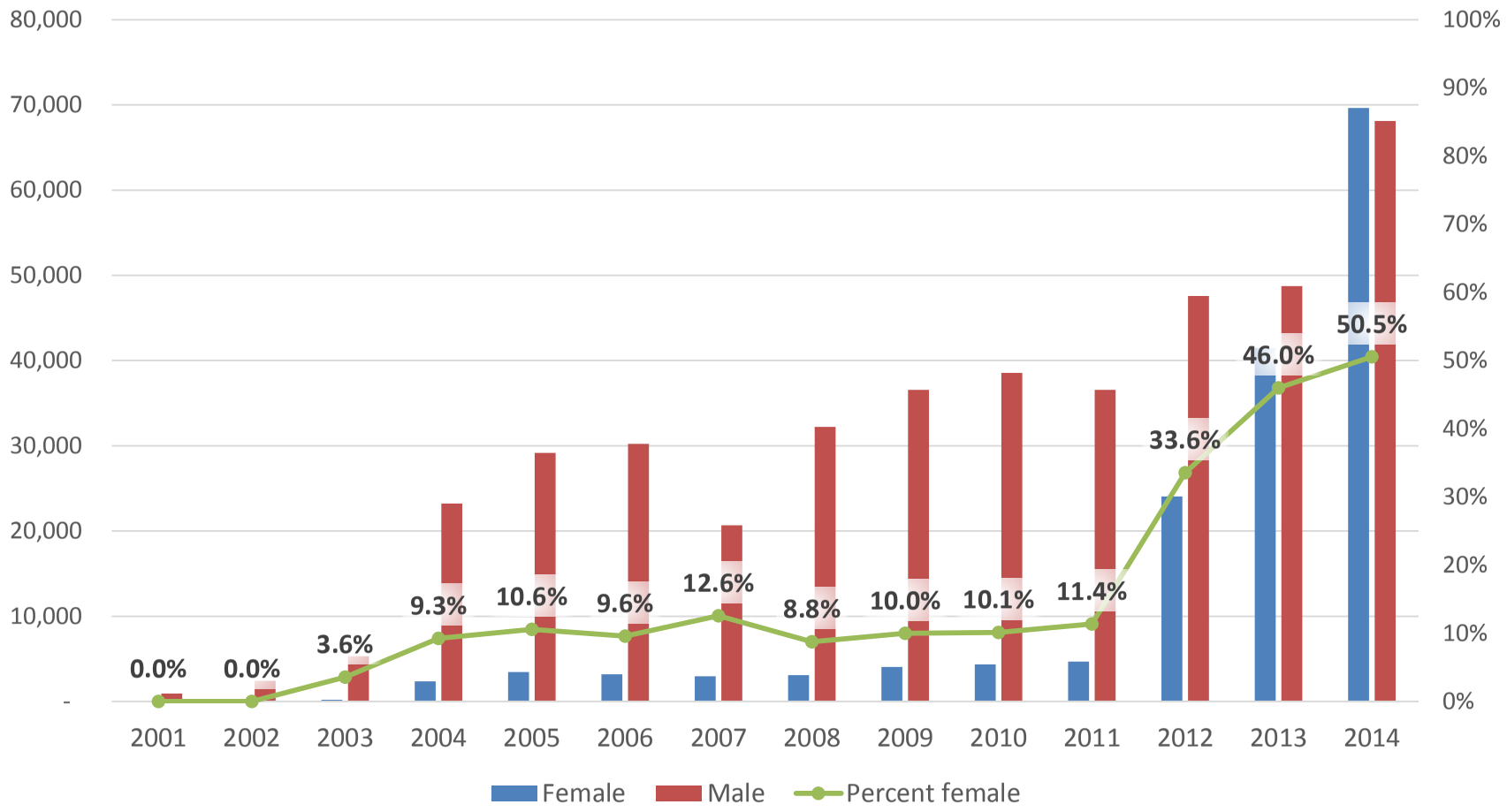
Ethiopia: 2013 and 2014 Treatment Coverage of Carter Center-assisted River Blindness Programs providing Twice per Treatment, by Treatment Round



Metekel and Gambella provided annual treatment in 2013

Figure A19

Ethiopia: Training of Community Directed Drug Distributors: 2001-2014 and Percentage Female



HIGHLIGHTS OF THE PROGRAM REVIEW

The 19th Review of the River Blindness Elimination Program (RBEP) of The Carter Center (TCC) was held from 24-26, February 2015 (meeting photo, Figure A1).

Through programs and technical assistance, the goals of which are to eliminate river blindness (RB) transmission, the RBEP assists the ministries of health (MOHs) of 10 countries[1] to either distribute Mectizan® (ivermectin, donated by Merck) or to conduct post-treatment activities (when the country has interrupted or eliminated disease transmission). Much of our work is undertaken in collaborative initiatives with Lions Clubs International Foundation (LCIF) and with the United States Agency for International Development (USAID) ENVISION project, led by RTI International and funded by USAID. The RBEP also helps countries integrate RB efforts with activities against lymphatic filariasis (LF), malaria, schistosomiasis, soil transmitted helminthiasis (STH), and trachoma when feasible. In 2014, the RBEP and its partners provided nearly 21.5 million Mectizan® treatments for RB (Figure A2), representing about 35% of the 60 million mass drug administration treatments assisted by Carter Center (TCC) for neglected tropical diseases (NTDs) (Figure A3). From 1996 to 2014, TCC's RBEP cumulatively has assisted over 212 million Mectizan® treatments (Figures A4 and A5).

The approach to RB elimination is defined by four phases (Figure A6): 1) Transmission ongoing ('open system'); 2) Transmission suppressed ('closed system'); 3) Transmission interrupted; 4) Transmission eliminated.

The Onchocerciasis Elimination Program for the Americas (OEPA) has stopped MDA in 11 of 13 endemic transmission zones (foci) in six countries in the Americas. In 2014, Ecuador followed in the footsteps of Colombia and received verification of elimination from the World Health Organization (WHO).

Uganda has stopped MDA in 9 of 17 endemic transmission zones. This year, the Ugandan Onchocerciasis Elimination Expert Advisory Committee (UOEEAC) recommended treatments be halted in the Obongi focus. Imaramagambo and Mount Elgon foci will complete post-treatment surveillance (PTS) activities in 2015. Scale up of twice-per-year treatment (semiannual) and vector elimination/control have been the main strategies in Uganda since the country launched its elimination effort in 2007. Figure A7 depicts the changing elimination status of each focus by year between 2007 and 2014, while Figure A8 shows the proportion of the population in these foci (more than 6 million people) affected by the changing status.

The Federal Ministry of Health of Sudan declared the interruption of onchocerciasis from the Abu Hamad focus in May 2012 and stopped treatment there. TCC will continue to assist in the post-treatment surveillance (PTS) required prior to declaration of transmission elimination. PTS activities end in 2015 with epidemiological and entomological surveys before onchocerciasis is declared eliminated.

[1] Brazil, Colombia, Ecuador, Ethiopia, Guatemala, Mexico, Nigeria, Sudan, Uganda and Venezuela

In Nigeria, in addition to RB treatment, TCC was able to increase sevenfold its assisted treatments to three other NTDs (lymphatic filariasis, schistosomiasis, and soil-transmitted helminths) in 2014 (Figure A9). This remarkable expansion was primarily attributable to great leaps in lymphatic filariasis and soil-transmitted helminth treatments generously funded by USAID.

Ethiopia continued its strong performance in its second year of conducting primarily twice-per-year treatments for river blindness, aggressively pursuing the national policy of onchocerciasis elimination by 2020. In 2014, Ethiopia met its goal of 11 million treatments. The Carter Center, with technical assistance from the University of South Florida, established a new molecular laboratory that uses more sophisticated and sensitive techniques to support national RB elimination activities.

Background:

Human onchocerciasis, an infection caused by the parasitic worm *Onchocerca volvulus,* causes chronic skin disease and severe itching, as well as eye lesions that can progress to visual loss or complete blindness. The worms live in fibrous 'nodules' that often can be felt just under the skin. Onchocerciasis is transmitted by small black flies that breed in rapidly flowing rivers and streams, thus leading to the common name for the disease, "river blindness." The WHO estimates that approximately 37.2 million people are infected and 770,000 are blinded or severely visually impaired in 36 endemic countries. Approximately 123 million people live in endemic areas worldwide and are therefore at risk of infection; more than 99% of those at risk reside in Africa. Periodic mass treatment with the oral tablet Mectizan® (ivermectin, donated by Merck) prevents eye and skin disease caused by *O. volvulus* and may also be used to reduce or even interrupt transmission of the disease depending on the duration and frequency of treatment, the efficiency of the vector, and the geographic extent of the distribution programs. (See Annex 1 and 2 for further details.)

TCC's RBEP is dedicated to safe and sustainable mass distribution of Mectizan® with health education to eliminate onchocerciasis. The distinction between control and elimination is important. In the control approach, Mectizan® distribution in a substantial number of endemic areas will likely need to continue indefinitely because onchocerciasis transmission persists and people continue to get new infections ('open system,' Figure A6); sustainability of control programs is vital. In the elimination approach, Mectizan® treatment is used more intensively to 'close the system' so that transmission can eventually be broken. At a point when the residual parasites in the human population are unable to recover, the MDA can be stopped because there is no animal reservoir of this infection. In 2012 and prior, the elimination of onchocerciasis was the program goal in the Americas, Uganda and the Abu Hamad focus in Sudan. In 2013, RBEP set a new goal to stop transmission in all its supported areas. Of note, onchocerciasis elimination is now the stated goal of all the governments where RBEP assists. We also advocate for our programs to cooperate and integrate when possible with the national LF programs of these countries.

Local Lions Clubs and the Lions Clubs International Foundation (LCIF) are special partners of TCC in the battle against RB under the Lions-Carter Center, TCC SightFirst Initiative. When TCC assumed the functions of the River Blindness Foundation (RBF) in 1996, TCC also adopted RBF's collaboration with local Lions Clubs in Cameroon, Nigeria, and Uganda. Since 1997, LCIF has generously provided grants to TCC to help control or eliminate RB through their SightFirst I and SightFirst II Initiatives. In the first phase (Lions SightFirst I Initiative) the LCIF and TCC partnership encompassed controlling RB in five countries in Africa (Cameroon, Ethiopia, Nigeria, Sudan, and Uganda) and efforts toward eliminating RB altogether in the six endemic countries of the Americas. The second phase (SightFirst II Initiative) currently provides support for RB elimination work in Ethiopia and Uganda.

In 2003, TCC's RBEP received its first support from the Bill & Melinda Gates Foundation for OEPA through a matching grant that drew additional funding from LCIF, Merck, and more than 70 other donors. The Gates Foundation provided a supplemental grant of $2 million to OEPA in 2011; that grant was completed in 2015. Between 2006 and 2011, the Gates Foundation also provided support to TCC's integrated programs (which included RB) in Nigeria.

In 2012, USAID pledged significant financial support to TCC for OEPA, in partnership with the CDC. In 2013, USAID began providing substantial support for the Uganda and Nigeria river blindness elimination programs through the ENVISION program, which is led by RTI International. In 2013, the ENVISION program in Nigeria supported MDA for RB in the southeastern states as well as MDA for RB, schistosomiasis and STH in Plateau and Nasarawa. This support has also facilitated interventions against schistosomiasis, lymphatic filariasis, trachoma, and soil-transmitted helminths. The ENVISION program supported major surveys for trachoma, STH and schistosomiasis in all un-assessed local government areas (LGA's) in Carter Center-assisted states of Nigeria. Based on these results, limited STH treatments began in 2013 in Plateau and Nasarawa states, and in 2014, the program began expanding MDA with praziquantel, albendazole or mebendazole treatments for STH, LF and SCH where applicable; this expansion continues in 2015.

Other external RBEP partners include the WHO, the African Program for Onchocerciasis Control (APOC)[2], and the World Bank, as well as other foundations, corporations, governments, and nongovernmental development organizations (NGDOs). Of course, the RBEP would not be possible without Merck's donation of Mectizan®.

A major focus of TCC in order to achieve impact on RB is reaching the best possible treatment coverage, monitored through routine monthly reports by assisted programs and periodic coverage surveys and on achieving impact on RB itself. Annex 2 is a discussion of this reporting process and treatment indices used by the program and in this report. Important coverage terms include the **Ultimate Treatment Goal** (**UTG**),

[2] TCC RB projects no longer receive substantial APOC support; they are beyond the 5-7 year APOC project horizon, and APOC is set to close in 2015. (See Annex 8.)

which is the number of treatment-eligible people living in a program area (persons >5 years of age); the **UTG(2) and UTG(4)**, used by elimination programs in areas where semiannual or quarterly treatments are required to break transmission; the **Annual Treatment Objective** (**ATO**), which is an interim target population in programs that are not operating at full scale due to initial operational limitations or financial resource constraints; and **full coverage**, which is defined as >90% achievement of the UTG, UTG(2), or UTG(4) (85% for OEPA). **Passive treatments** are Mectizan® treatments for onchocerciasis provided through health care units located in hypoendemic communities (where estimated onchocerciasis nodule prevalence is under 20%) in the control program strategy. In elimination programs, hypoendemic villages receive mass treatment (not passive). As TCC-assisted programs are transitioning to the elimination mode, passive treatments are being phased out of TCC strategy. Refer to Figure A10, coverage of treatment goals over time; this figure demonstrates the impressive progress each program has made toward the high coverage we are now seeing.

Mectizan® tablets are distributed in Africa at the community level by grassroots community volunteers known as Community Directed Distributors (CDDs) through a process known as Community Directed Treatment with Ivermectin (CDTI); CDTI was perfected by the Tropical Disease Research (TDR) program of WHO and was broadly introduced into APOC-supported project areas throughout Africa in the late 1990's. In some areas, TCC's RBEP focuses on "kinship-enhanced CDTI," an approach that seeks to train more CDDs than is done in classic CDTI, and which TCC developed and pioneered in Uganda. In kinship-enhanced CDTI, CDDs serve within their own kinships or neighborhoods within every community where decisions and activities about treatments are handled. This strategy seeks to increase the active participation of members of affected communities by: 1) training as many inhabitants of endemic villages as possible to serve as distributors; 2) encouraging the involvement of women; 3) reducing the demand for financial or other "incentives"; and 4) allowing community members to choose their own health workers and the time and location of treatments. Monitoring indices of the kinship approach include 1) community selection of CDDs in every kinship/neighborhood zone in the community; 2) sustained treatment coverage of at least 90% of treatment-eligible persons; 3) increasing involvement of women as CDDs; and 4) the presence of at least two community selected supervisors in every community. The ratio of CDD per population set by APOC is at least 1 CDD per 100 persons to be treated in all communities. The Ethiopia government policy uses members of its Health Development Army to support a ratio of 1 CDD per 30 persons.

The CDDs and community supervisors are often also highly engaged in other community- based health interventions, such as water provision and sanitation, malaria control, immunization, and integrated NTD control efforts.

SUMMARY OF THE MEETING

The 19th Program Review focused on the 2014 achievements, challenges, and research of TCC-assisted onchocerciasis elimination programs. The Review also addressed other diseases and public health initiatives in which TCC helps countries integrate RB programs with LF, malaria, schistosomiasis, soil-transmitted helminths, trachoma, and Vitamin A supplementation programs. A major goal was to provide recommendations for each program.

Dr. Frank Richards, director of TCC's LF, Malaria, RB, and Schistosomiasis Programs, co-chaired the meeting with the field office heads of the TCC RBEP: Dr. Nabil Aziz (Country Representative, Sudan), Ms. Peace Habomugisha (Country Representative, Uganda), Dr. Emmanuel Miri (Country Representative, Nigeria), Dr. Mauricio Sauerbrey (Director, OEPA), and Dr. Zerihun Tadesse (Country Representative, Ethiopia). Attendees included representatives from the ministries of health of Ethiopia, Nigeria, Sudan, and Uganda; the Bill & Melinda Gates Foundation; U.S. Centers for Disease Control and Prevention; Department for International Development U.K.; Izumi Foundation; Lions Clubs International Foundation; Mectizan Donation Program; PATH; Rabin Martin; RTI International; Sightsavers; Sir Emeka Offor Foundation; Task Force for Global Health; University of Notre Dame; University of South Florida; U.S. Agency for International Development; and the World Health Organization (See Figure A1 for the group photo of participants and Annexes 3, 4 and 5 for a complete participant list, contact list, and agenda).

In 2014, TCC delivered a record-breaking 21,504,001 Mectizan® treatments in 54,245 villages in six countries, 96% of its treatment target. Overall, 212,751,670 cumulative treatments have been provided since the RBEP was launched in 1996 (Figure A11). The 200 millionth treatment was administered in Uganda in 2014. A goal of more than 25 million treatments has been set for 2015. The impact of Mectizan® treatments on microfilaria in the skin, by country or project area where available, is shown in Figure A12. No follow up data are yet available for Madi-Mid North focus (Uganda) and Illubabor Zone (Ethiopia), and we do not have baseline data for most areas in Ethiopia.

In addition to river blindness, the Review also highlighted Carter Center-assisted mass drug administration activities in several other NTD efforts in 2014, including treatments for lymphatic filariasis (10,925,183), schistosomiasis (2,756,257), and soil-transmitted helminthes (7,700,653). Most of these treatments occurred in Nigeria.

The program would not be possible without a grassroots network of community-directed drug distributors. Over 208,000 distributors were trained in 2014, supervised by 45,700 community supervisors and ministry of health district personnel.

***Americas*:**

RBEP's Onchocerciasis Program for the Americas (OEPA) supports a coalition that includes the ministries of health of the six endemic countries in the region (Brazil, Colombia, Ecuador, Guatemala, Mexico and Venezuela), Pan American Health Organization/World Health Organization (PAHO/WHO), Merck and the Mectizan Donation Program (MDP), the United States Agency for International Development (USAID), the U.S. Centers for Disease Control and Prevention (CDC), the Lions Clubs International Foundation (LCIF) and local Lions Clubs, the Bill & Melinda Gates Foundation, the Carlos Slim Foundation and several U.S. and Latin American universities, local Lions clubs and LCIF, the Bill & Melinda Gates Foundation, the Pan American Health Organization (PAHO)/ WHO and USAID.

In 2014, the OEPA program celebrated several achievements which it reported at the RBEP Program Review. First, Ecuador joined Colombia as the second country to be verified by the World Health Organization (WHO) as onchocerciasis-free. Second, Mexican businessman Mr. Carlos Slim announced a partnership with his foundation and $6.9 million grant in financial support to the program to support the final mile of onchocerciasis elimination in the Americas (Figure A13). And third, longtime supporter of RB programs in the Americas and founder of the RBEP predecessor the River Blindness Foundation (RBF), Mr. John J. Moores Sr. received the 2014 Merck Mectizan® Award during the 2014 InterAmerican Conference for Onchocerciasis, held in November in Mexico City (Figure A14). Mr. Moores is a longtime supporter of RB programs in the Americas and founded the River Blindness Foundation, the predecessor the Carter Center's River Blindness Elimination Program, The Merck Mectizan Award is given to individuals who have demonstrated an extraordinary level of commitment to fighting river blindness and/or lymphatic filariasis.

Guatemala and Mexico stopped MDA and completed their third year of PTS activities in 2014; Mexico submitted its dossier for verification of disease elimination from WHO in 2014. Once Although river blindness once threatened some half a million people in six countries, only five percent of the originally at-risk populations, deep in the Amazon rainforest, currently experience transmission of onchocerciasis in the Americas. OEPA's priority continues to be this last area with ongoing disease transmission, spanning the border of Brazil and Venezuela. For years OEPA used a twice-per-year treatment strategy, but it is increasingly adopting a four-times-per-year approach in its end game strategy to accelerate the breaking of transmission among the indigenous Yanomami population in this region.

***Uganda*:**

The Uganda program administered 3.2 million Mectizan® treatments in 2014. Of the 2014 treatments, 9,962 were annual treatments in control areas and 3,217,189 were twice- per- year treatments in elimination areas. In 2015, all Uganda districts with mass drug administration programs for onchocerciasis will be treating twice per year, with a target of 3.8 million treatments. Uganda continues to make progress toward elimination

by 2020, and in 2014 the seventh meeting of the Ugandan Onchocerciasis Elimination Expert Advisory Committee (UOEEAC) recommended treatments be halted in the Obongi transmission zone (focus). Imaramagambo and Mount Elgon foci will complete post-treatment surveillance activities in 2015. The major challenge to halting transmission in West Nile and Bwindi foci (where transmission interruption is suspected) is the possibility that these foci cross the border into the Democratic Republic of Congo (DRC). Other foci, Bwindi, Lhubiriha, Nyagak-Bondo and West Nile representing nine districts also may share their transmission zones with the DRC. In such cases, cross-border collaboration is needed. In 2014, the UOEEAC recommended that the Uganda Ministry of Health work with the DRC to conduct joint cross-border assessments, and to provide a report of their findings at the 2015 UOEEAC meeting. The Carter Center's work in Uganda is based on a partnership with the Ministry of Health, Lions Clubs, the Lions Clubs SightFirst Program International Foundation, and the USAID-funded ENVISION project led by RTI.

***Sudan*:**

In 2014, Sudan's Ministry of Health delivered 254,974 treatments, the majority of which were twice per year in the Gadarif focus, which is another transmission zone that may be shared with Ethiopia. Ethiopia and Sudan have demonstrated excellent coordination in their cross-border endemic zone, an area that encompasses Metema woreda in Ethiopia and Gadarif in Sudan (Figure A15). In 2015, The Carter Center will continue to assist in post-treatment surveillance activities in the Abu Hamad focus, where treatments were stopped in 2012. See Figure A16 for a photo of the laboratory, based in the Ministry of Health, where impact assessments are completed.

***Nigeria*:**

The program assisted in 6,769,079 Mectizan® treatments for river blindness in Nigeria in 2014. The Nigerian Ministry of Health has not yet agreed to a twice-per-year distribution strategy, although the country is aiming to eliminate onchocerciasis by 2020. The Carter Center is continuing to advocate twice-per-year treatments for onchocerciasis in many parts of its assisted areas in Nigeria to improve the country's chances of meeting this ambitious target.

The strong collaboration with the USAID's ENVISION project enabled The Carter Center to increase *sevenfold* its assisted treatments for other NTDs in Nigeria in 2014. This remarkable expansion was primarily attributable to great leaps in lymphatic filariasis and soil-transmitted helminth treatments (Figure A9).

The Carter Center's Lymphatic Filariasis Elimination Program and the two Plateau and Nasarawa state ministries of health successfully interrupted transmission of the disease in Plateau and Nasarawa in 2012. Thus, there were no treatments in 2013, but in 2014 the program launched MDA for LF in seven other Nigerian states by assisting the state ministries of health in providing 10,042,479 treatments. The program plans to triple lymphatic filariasis treatments to 33 million in 2015 by expanding into previously

untreated areas in the seven states. In contrast to onchocerciasis, many of these treatments will be provided twice per year. The albendazole used in LF MDA is donated by GlaxoSmithKline. Significant collateral impact on LF has likely occurred thanks to mass distribution of long-lasting insecticidal bed nets (LLIN) in Nigeria (as well as Ethiopia).

Treatments for soil-transmitted helminths also expanded greatly in 2014, with 7,700,653 treatments given in areas assisted by The Carter Center in Nigeria, nearly 10 times the amount given in 2013. The 2015 target is 10.4 million treatments. The medicines used against soil-transmitted helminthiasis are donated by GlaxoSmithKline (albendazole) and Johnson & Johnson (mebendazole).

The Carter Center assisted in 2,756,257 praziquantel treatments for schistosomiasis in Delta, Ebonyi, Enugu, Edo, Nasarawa, and Plateau states in 2014. The majority of the praziquantel used was donated to The Carter Center through the World Health Organization by Merck KGaA (E-Merck) of Germany. Complementing USAID funding, the Izumi Foundation supports this program in four of the six states. The treatment target in 2015 is 831,430; this is lower than 2014 due to WHO guidelines, which call for treatment every other year in some areas.

***Ethiopia*:**

Ethiopia continued its strong performance in its second year of conducting primarily twice-per-year treatments for river blindness, aggressively pursuing the national policy of onchocerciasis elimination by 2020. In 2013, Ethiopia surpassed Nigeria as the Carter Center's largest RBEP treatment program, and this trend continued into 2014 (Figure A17) A total of 11,068,287 treatments were provided with 9 million of these in the twice-per-year strategy. Coverage in Ethiopia has been excellent even as it ambitiously expanded to this strategy in 2013 and 2014 (Figure A18). Over 167,000 community drug distributors were trained—, approximately 77,000 more than in 2013—, and Ethiopia also has also shown incredible progress in incorporating women into its cadre of health workers (Figure A19). The Carter Center's river blindness work in Ethiopia is based on a longstanding partnership with the Federal Ministry of Health, the Lions Clubs of Ethiopia, and the Lions Clubs International Foundation.

2015 GENERAL RECOMMENDATIONS FOR THE CARTER CENTER RIVER BLINDNESS ELIMINATION PROGRAM

In collaboration with the host governments, RBEP helps interrupt onchocerciasis transmission in Carter Center-assisted River Blindness Elimination Program (TCC/RBEP) assisted areas in Africa by 2020. This includes:

- Helping to empower national onchocerciasis committees to review their data and make decisions related to enhancing interventions, expanding treatment, stopping interventions, and entering into post treatment surveillance, guided by (but not restricted to) WHO guidelines.
- New assessments to help delimit the precise borders of African onchocerciasis transmission zones ('*foci*') that are targeted for elimination in TCC/RBEP assisted areas.
- Defining areas of active onchocerciasis transmission, including within the so-called 'hypoendemic' onchocerciasis areas that have traditionally not been targeted for ivermectin treatment under previous WHO/APOC disease control policy.
- Enhanced interventions (two or four-times-per-year ivermectin treatment, vector control, etc.) where transmission persists or in new foci where treatments have never been given.
- Monitoring the impact of interventions using sensitive tools.

Encourage WHO and the concerned Ministries of Health to evaluate and treat cross-border foci in a coordinated manner.

Encourage partners to revise complex village rollup forms that must be completed by CDDs and health workers that require recording treatment data by gender and age groups.

Programs should collect more information, to share at the next review, on communities with low coverage (as shown on the Likert scale).

Programs should conduct treatment coverage surveys, in consultation with HQ.

Submit drug applications to WHO and MDP as early as possible, and no later than August of the year before the drug is needed, so that drugs arrive by December. This is especially important as programs move to twice- per- year treatments in many areas. Work with national agencies to facilitate appropriate documentation and clearance for all medications. Because drug requests are made well before treatment activities are done, treatment denominators will require adjustment during the treatment year. Keep TCC/RBEP headquarters copied on all related correspondence.

In African programs, seek to increase training, supervision, involvement of kinship groups, and gender balance among CDDs and community supervisors. Work toward a target ratio of at least 1 CDD:100 people and 1 community supervisor:5 CDDs.

Maintain laboratory support by TCC/RBEP for serology, entomology, and parasitology (including PCR testing in vectors and skin snips) led by University of Southern South Florida (Dr. Thomas Unnasch). In consultation with USF, field laboratories should send samples and/or data to USF for quality control purposes.

Through national mechanisms, monitor government and partner financial contributions for elimination efforts in RBEP-assisted areas.

Seek more Lions participation at the local level to help maintain program visibility and support wherever possible.

Carter Center program staff must complete or renew the Emory IRB certification if they are to be involved with research programs.

Overall Treatment Objective for onchocerciasis for 2015: 25,943,162

UTG = Ultimate Treatment Goal
UTG(2) = Twice-per-year Ultimate Treatment Goal
UTG(4) = Four-times-per-year Ultimate Treatment Goal

River Blindness	
Quarterly UTG(4)	**57,608**
Semiannual UTG(2)	**18,256,802**
Annual UTG	**7,628,752**
CDDs	**235,150**
Community Supervisors	**73,956**

Schistosomiasis/STHs	
Annual UTG SCH	**6,433,917**
Annual UTG STH	**10,423,809**
CDDs	**15,088**
Community Supervisors	**10,303**

Lymphatic Filariasis	
Annual UTG	**34,176,260**
CDDs	**41,236**
Community Supervisors	**8,458**

ONCHOCERCIASIS ELIMINATION PROGRAM FOR THE AMERICAS (OEPA)

Summary

The primary strategy for eliminating onchocerciasis from the Americas is Mectizan® (ivermectin) MDA every 3-6 months, with health education and community mobilization, in all affected communities of the 13 endemic foci in the six affected countries. MDA aims to achieve at least 85% coverage of the population at risk and eligible for treatment. MDA has decreased by over 95% in the Americas since its peak in 2005 under this elimination strategy, as transmission in the region has been broken focus by focus. As of 2014, *O. volvulus* transmission was interrupted or eliminated in 11 of the 13 foci in the Americas, and in 4 of the 6 endemic countries. Ecuador became the second country verified by WHO (after Colombia in 2013) as having eliminated onchocerciasis. A total of 56,849 Mectizan® treatments were given in 2014, all in the 'Yanomami Area' shared by Brazil and Venezuela (foci 10 and 11 in Figure O1), which is the very last active transmission zone for onchocerciasis in the Americas and the only area that will be under treatment in 2015.

Background: The Onchocerciasis Elimination Program for the Americas (OEPA) is a Carter Center-led program that serves as the vanguard of the regional initiative working to eliminate both morbidity and transmission of onchocerciasis from the Americas through distribution of Mectizan® every 6 months, and in some areas every 3 months, in all affected communities of the 13 endemic areas of the Americas region. Mass Drug Administration (MDA) aims at reaching ≥85% coverage of the population eligible for treatment. In addition to The Carter Center, the OEPA coalition includes ministries of health (MOHs) of the 6 countries with onchocerciasis in the Americas (Brazil, Colombia, Ecuador, Guatemala, Mexico, and Venezuela), the Lions Clubs International Foundation (LCIF) and local Lions Clubs, the Bill & Melinda Gates Foundation, Pan American Health Organization/World Health Organization (PAHO/WHO), Merck and the Mectizan® Donation Program (MDP), the United States Agency for International Development (USAID), the U.S. Centers for Disease Control and Prevention (CDC), the Lions Clubs International Foundation (LCIF) and local Lions Clubs, the Bill & Melinda Gates Foundation, and several U.S. and Latin American universities. A new member in 2014 of the OEPA initiative is the Carlos Slim Foundation. A Program Coordinating Committee (PCC) serves as the steering committee for OEPA staff, which are based in Guatemala City, Guatemala. Technical and financial assistance to the 6 countries flows through the OEPA office.

The OEPA initiative was launched by the River Blindness Foundation in 1993 in response to the 1991 Resolution XIV of the 35th PAHO Assembly that called for the elimination of onchocerciasis morbidity from the Americas by the year 2007. The Carter Center assumed administrative responsibilities for OEPA in 1996. In 2008, PAHO renewed the call to eliminate onchocerciasis (Resolution CD48.R12) throughout the region. A subsequent 2009 PAHO Resolution (CD49.R19), calling for the elimination or drastic reduction of 12 neglected infectious diseases of poverty in the Americas by 2015, includes onchocerciasis as an elimination target.

In 2001, the WHO established a set of guidelines to assist onchocerciasis programs to determine whether interruption of transmission had occurred and MDA with Mectizan® could be stopped. The process (shown diagrammatically in Figure A6) involves three key points depicted by the three vertical arrows: 1) Suppression of transmission, when infective stage larvae are no longer introduced into the human population by the vectors (Annual Transmission Potential [ATP] is at or near zero), but the parasite population maintains the ability to recover if interventions are withdrawn; 2) Interruption of transmission, when the parasite population is thought to be unable to recover and ivermectin treatment can be halted; and 3) Elimination of transmission and the parasite, after a post-treatment surveillance (PTS) period of at least 3 years, confirms no return of transmission in the absence of treatment or other interventions. Once all country foci reach the elimination stage, final country verification can be considered by an independent international verification team (IVT) meeting under the auspices of the WHO. IVT activities involve a country visit.

Figure O1 shows the situation in the Americas in 2014. The transmission has been eliminated from 78.4% of the population, interrupted in 16.9%, and is ongoing in 4.7%. 442,950 persons are no longer at risk, and 122,282 remain at risk although the majority of these are under post treatment surveillance (Figure O2). Figure O3 shows the dramatic scale up and scale down of treatments as the WHO 'roadmap' to elimination has been followed.

ECUADOR: THE SECOND COUNTRY IN THE WORLD TO BE VERIFIED BY WHO FREE OF RIVER BLINDNESS

The single focus of onchocerciasis in Ecuador included 119 communities (42 hyperendemic, 23 mesoendemic, and 54 hypoendemic) distributed among three river valleys in the Province of Esmeraldas. Although Ecuador's population at risk for onchocerciasis was relatively small (25,863), this focus had the highest prevalence of microfilariae in the skin at baseline and included the most efficient vector of the 13 American foci. Ecuador's Ministry of Health had distributed ivermectin (Mectizan®, donated by Merck) in Ecuador since 1990, using the regionally recommended strategy of twice yearly community-wide mass drug administration (MDA) and health education programs to all people in the afflicted areas. Ecuador completed 23 semiannual MDA rounds of at least 85% coverage with dramatic impact on *O. volvulus* mf prevalence in skin and eyes of the afflicted population. In 2010, MDA was halted after transmission of onchocerciasis in the country was successfully interrupted. An evaluation conducted in 2012 at the end of the three-year post-treatment surveillance period showed no infected black fly vectors. Based upon these results, Ecuador applied for formal verification of elimination of the disease from WHO in July 2013. An IVT visited Ecuador in May 2014, and on September 22, 2014, WHO Director-General Dr. Margaret Chan provided Ecuador with official notification that WHO had verified elimination of the disease.

At the inception of the OEPA program in 1993, the Esmeraldas Focus of Ecuador was considered to be one of the greatest challenges in the region to the proof that transmission of onchocerciasis could be interrupted using a strategy of twice-per-year ivermectin MDA. The 23rd annual InterAmerican Conference on Onchocerciasis (IACO 2013) was held in Quito, Ecuador in November, 2013 to celebrate the occasion of Ecuador's filing its formal request to the World Health Organization (WHO) for verification of elimination. Ecuador is only the second in the world to be verified by WHO as having eliminated onchocerciasis. (In 2013, Colombia became the first country officially verified by the WHO as free of onchocerciasis.)

Dr. Carina Vance, Minister of Health of Ecuador, announced the achievement during the opening session of the 53rd Pan American Health Organization (PAHO) Directing Council in Washington D.C. on September 29, 2014. "The elimination of onchocerciasis is another step toward reducing poverty in Ecuador, and is a significant improvement in Ecuadorians' quality of life," said Minister of Health Vance. "Ecuador will continue its fight to eliminate so-called diseases of poverty to achieve a good life for all."

OTHER COUNTRY UPDATES

Mexico:

In Mexico, the first cases of onchocerciasis were documented in 1923, in southern Chiapas State (Figure O1, focus 3). The Mexican Onchocerciasis Program was launched in 1930, making it the longest continuously operative onchocerciasis program in the Americas (85 years). It is also the only American onchocerciasis program having a cadre of health workers devoted exclusively to onchocerciasis control/elimination.

There were three Mexican onchocerciasis transmission foci: Oaxaca, North Chiapas and South Chiapas (Figure O1, foci 1-3). Residing in these foci was the second largest population (nearly 170,000 individuals in 1,131 communities) at risk for onchocerciasis in the Americas (after Guatemala). During the first 60 years the program strategy focused on surgical removal of nodules, treatment of cases with diethylcarbamazine (DEC), and sporadic vector control. Ivermectin MDA began in 1990. The North Chiapas focus completed 26 rounds of ivermectin MDA from 1995-2007, with 17 (65%) of those rounds with coverage >85%. North Chiapas was the first to halt MDA, and successfully completed its PTS phase in 2010. The Oaxaca Focus completed 28 rounds of treatment with ivermectin from 1995-2008, with 18 (65%) of those rounds having coverage >85%. Oaxaca successfully completed PTS in 2011. South Chiapas was the largest Mexican focus with the most intense onchocerciasis transmission, and took the longest to eliminate. It required 34 rounds of MDA from 1995-2011 with 25 (74%) of those rounds with coverage >85%. The South Chiapas Focus was a pioneer in the implementation of four-times per year (quarterly) treatment in selected communities where twice per- year treatment appeared to be insufficient to break transmission. Four-times per- year treatment started in 2003 in 50 communities (5,824 at risk) and eventually expanded to 163 communities (33,269 at risk) by 2011.

On November 18, 2014, Mexico filed a formal application to WHO for verification of elimination after the Ministry of Health of Mexico and the OEPA technical steering committee (The Program Coordinating Committee-PCC) concluded that the country had eliminated onchocerciasis. The application included a comprehensive country dossier describing the history and achievements of the national program. [Editor's note: In response to Mexico's request, an IVT visited the country from June 1-10, 2015 to extensively review the program and data supportive of elimination with respect to the WHO 2001 guidelines. The decision from WHO on the IVT's report is pending as of the publication date of the Proceedings.]

Guatemala:

Guatemala is closely following Mexico's steps in the process of verification of elimination of the disease. On August 13, 2014, the Guatemalan ministry of health received a recommendation from the OEPA technical steering committee (The Program Coordinating Committee – PCC) to file for verification of elimination of the disease, after the committee evaluated the results from the PTS Entomological Evaluation conducted in the focus which showed that transmission of the parasite remained interrupted in the Central Focus. The other three foci of the country had, in previous years, reached the end of their PTS phases and transmission had likewise been found interrupted in those areas: Santa Rosa and Escuintla in 2010, and Huehuetenango in 2011. Guatemala submitted its dossier in March 2015. With the largest Latin American endemic populations (the country accounted for 41% of the regional population at risk), a Guatemala free of onchocerciasis will largely contribute to the goal of elimination in the Americas.

Venezuela/Brazil:

In 2015, the regional population in onchocerciasis endemic and formerly endemic communities is calculated to be 566,142. Of these, 442,950 (78.2%) reside in areas where PTS has been successfully completed and are therefore no longer at risk of infection; 95,567 (16.9%) reside in the Northeast focus of Venezuela, not being offered MDA but still under the three-year PTS period 2013 – 2015.

The remaining population of 27,625 (4.7%), targeted by active MDA programs, are indigenous Yanomami people who live deep in the Amazon rainforest in a transmission zone (known as the 'Yanomami Area') that straddles the border of the Bolivarian Republic of Venezuela and Brazil. Two national foci, the Venezuelan South Focus and the only Brazilian focus (the Amazonas Focus), comprise the Yanomami Area.

Figure O4 shows the treatments given in 2014. In 2014, 8,514 persons, resident in communities with lower endemicity, were eligible to receive the standard twice-per-year treatment approach in the Yanomami Area, of which 84% were treated during the first round, and 89% during the second. Venezuela accomplished the >85% goal on its side of the border in the twice- per- year scheme (87% and 100%), while Brazil did not (82% and 81%). In 2015, 8,820 individuals should be treated twice per year. Selected communities having the highest infection prevalence (of microfilariae in skin) have been targeted to receive four-times-per-year (quarterly) treatment in an effort to hasten the

elimination of the disease. A total of 13,532 persons were eligible for four-times-per-year treatment approach in 2014, of which no rounds exceeded 85% overall (80% was treated during the first round in the Yanomami Area, 78% during the second, 80% during the third, and 77% during the fourth). In 2015, 14,361 individuals are being targeted for quarterly treatment. The Likert scale in Figure O5 shows the treatment coverage ranges among the 179 communities targeted for four-times-per-year treatment in the Venezuelan South Focus. Many communities are not being reached due to difficulty in access. Figure O6 shows that there are many more heliports on the Brazilian side of the Yanomami area compared to Venezuela.

Considering that the Yanomami Area is the last active onchocerciasis transmission zone in the Americas, a binational agreement focused on completing onchocerciasis elimination in the Americas was signed by the Minister of Health of Brazil (Dr. Arthur Chioro) and the Minister of Popular Power for Health of the Bolivarian Republic of Venezuela (Dr. Francisco Armada at the May 19 – 24, 2014 session of the World Health Assembly (WHA), the decision-making body for the World Health Organization (WHO), in Geneva, Switzerland. Under this formal agreement the two countries will work together to eliminate river blindness from the Yanomami Area as soon as possible.

THE 24TH ANNUAL INTERAMERICAN CONFERENCE ON ONCHOCERCIASIS (IACO'14) IN MEXICO

On November 13 – 14, 2014, over 80 public health professionals, experts, partners and donors gathered in Mexico City for the 24th Annual InterAmerican Conference on Onchocerciasis (IACO). Special guests in attendance included former U.S. President Jimmy Carter; the Minister of Health of Mexico, Dr. Mercedes Juan; and the Secretary of Health Surveillance of Brazil, Dr. Jarbas Barbosa da Silva Jr., and the Vice Minister of Health of the Bolivarian Republic of Venezuela, Dr. Claudia Morón (Figure O7). The theme of the meeting was, "After 80 years of work, Mexico celebrates success and the region intensifies efforts in the Yanomami Area." Dr. Juan announced that the Mexican Ministry of Health had submitted Mexico's request for verification of this achievement to the World Health Organization (WHO). Guatemala also has met the requirements and reported preparing its own request to WHO (which was subsequently submitted in March 2015).

Dr. Barbosa and Dr. Moron addressed the conference and shared their commitment to put an end to the disease once and for all (Figure O7).

President Carter attended the meeting not only to congratulate Mexico and the region for program achievements, but also to celebrate a new partnership alliance between The Carter Center/ OEPA office and the Carlos Slim Foundation, which has pledged $6.9 million to fund OEPA activities. This celebration included a special event at the Museo Soumaya where President Carter and Mr. Slim addressed guests and shared the news of the partnership (Figure A13).

At During the IACO meeting, the Mectizan Donation Program gave Mr. John J. Moores Sr. its 2014 Merck Mectizan Award (Figure A14). Mr. Moores founded the River Blindness Foundation in 1990 after reading an article in the Houston Chronicle about the late Dr. William Baldwin's efforts to raise money to buy a van to travel through the Americas to distribute Mectizan®, which had been donated by Merck in 1987 to all who need it for as long as needed. At the time, strategies and mechanisms to get the drug out to the millions of people who needed it were being developed by the Mectizan® Expert Committee, but progress was slow. The donation of a drug on such a massive scale was unprecedented.

When Mr. Moores learned of Dr. Baldwin's mission to distribute the drug in Latin America, he founded the River Blindness Foundation. He donated an estimated $25 million to not only fulfill Dr. Baldwin's vision for the Americas and establish the Onchocerciasis Elimination Program for the Americas, but to also establish country programs in Cameroon, Nigeria, Uganda, and South Sudan. The Foundation also set up partnerships with other NGOs and bilateral funding agencies working on river blindness control including CBM, Africare, Sightsavers, International Eye Foundation, the Lion's Clubs International Foundation, the International Development Bank, and USAID to name a few.

In 1995, Mr. Moores transferred the River Blindness Foundation operations to The Carter Center, where its legacy continued to flourish. Today, nearly 25 years after the River Blindness Foundation was established, millions no longer suffer from the disease and the possibility of eliminating river blindness globally is becoming a reality.

2015 RECOMMENDATIONS FOR THE CARTER CENTER RBEP, OEPA

Promote identification of all as yet unknown Yanomami communities in the South Venezuela Focus (Yanomami Area) by the end of 2015.

Continue the implementation of four-times-per-year treatment, prioritizing hyper-endemic areas. High treatment coverage (>85%) in each round should be considered essential. In newly identified villages, the program will report the year treatment was launched, the number of rounds with any treatment coverage, the number of rounds with>85% treatment coverage, and the number of consecutive rounds of >85% coverage.

Promote the highest level of political support from Venezuela and Brazil for the elimination of onchocerciasis from the Yanomami Area, including support to a bi-national plan of operations and the possibility to work across the borders.

Follow-up and support the implementation of the bi-national plan of action between Brazil and Venezuela.

Solve transportation issues in hard-to-reach communities on the border of Venezuela and Brazil.

Collaborate with PAHO to work as a partner in the above efforts.

Guatemala: Complete country dossier for submission to WHO for verification of elimination, and assist in the planning of WHO verification visit in 2015, if possible. Continue health education in the foci where transmission has been eliminated.

Assist Mexico to prepare for the visit by the WHO verification team in 2015.

Continue to invite all countries to IACO regardless of verification of elimination status.

Encourage the Lions Clubs International Foundation to support the attendance of a Lions representative from each of the six countries to IACO.

Complete PTS in 2015 in the Northeast focus of Venezuela

Complete epidemiological evaluations in the South Focus of Venezuela.

General

Programs should collect more information, to share at the next review, on communities with low coverage (as shown on the Likert scale).

Programs should consider conducting treatment coverage surveys, in consultation with HQ.

Submit drug applications to WHO and MDP as early as possible, and no later than August of the year before the drug is needed, so that drugs arrive by December. This is especially important as programs move to twice- per- year treatments in many areas. Work with national agencies to facilitate appropriate documentation and clearance for all medications. Because drug requests are made well before treatment activities are done, treatment denominators will require adjustment during the treatment year. Keep TCC headquarters copied on all related correspondence.

Maintain laboratory support by TCC/RBEP for serology, entomology, and parasitology (including PCR testing in vectors and skin snips) led by University of Southern Florida (Dr. Thomas Unnasch). In consultation with USF, field laboratories should send samples to USF for quality control purposes.

Through national mechanisms, monitor government and partner financial contributions for elimination efforts in RBEP-assisted areas.

Seek more Lions participation to help maintain program visibility and support wherever possible.

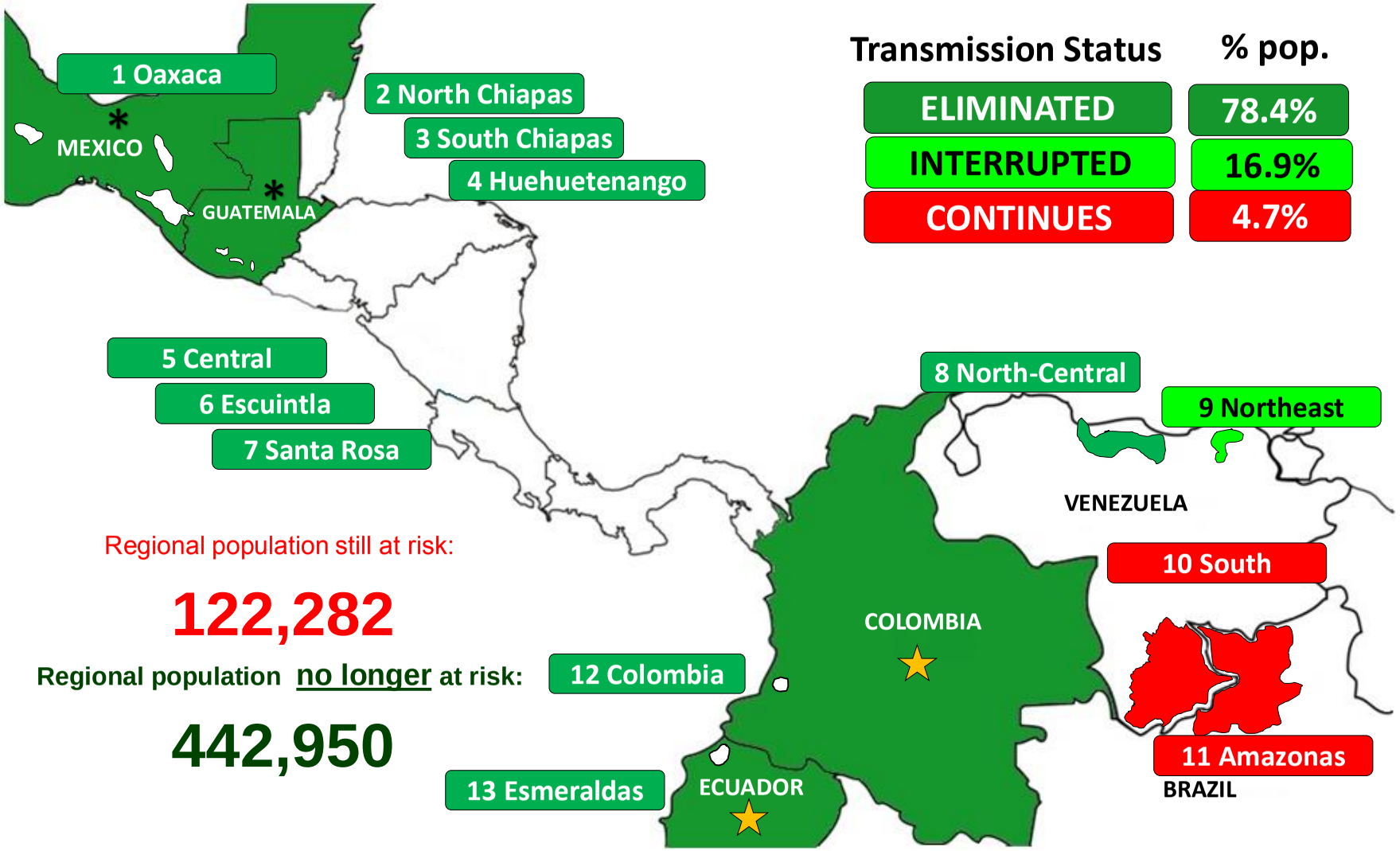
Carter Center program staff must complete or renew the Emory IRB certification if they are to be involved with research programs.

2015 Treatment Objectives:

Onchocerciasis	
UTG(2):	**17,400**
UTG(4):	**57,608**

Figure O1

Onchocerciasis Transmission in the Americas - 2014



* Have requested WHO verification of elimination.
★ WHO has verified elimination

Figure O2

OEPA, Regional Population at Risk, No Longer at Risk, under PTS and Eligible for Treatment 2014

Focus	Treatment Approach	Communities	Population at Risk	Population no longer at Risk	Population under PTS	Population Eligible for Treatment	Transmission Status
Lopez de Micay-COL		1		1,366			Eliminated in 2010 Verified in 2013 ★
Esmeraldas-EC		119		25,863			Eliminated in 2012 Verified in 2014 ★
North Chiapas -MX		13		7,125			Eliminated in 2010
Oaxaca-MX		98		44,919			Eliminated in 2011
South Chiapas -MX		559		117,825			Eliminated in 2014
Santa Rosa-GU		37		12,208			Eliminated in 2010
Escuintla-GU		117		62,590			Eliminated in 2010
Huehuetenango-GU		43		30,239			Eliminated in 2011
Central-GUA		321		126,430			Eliminated in 2014
Northcentral -VZ		45		14,385			Eliminated in 2014
Northeast -VZ		465	95,567		95,567		Interrupted in 2012
South-VZ	2x/year	45	4,015			3,334	Ongoing
	4x/year	179	8,785			7,470	
	Focus' total	224	12,800			10,804	
Amazonas-BZ	2x/year	98	6,388			5,180	Ongoing
	4x/year	120	7,527			6,062	
	Focus' total	218	13,915			11,242	
Regional total		**2,260**	**122,282**	**442,950**	**95,567**	**22,046**	

★ WHO has verified elimination

Updated: January 2015

Figure O3

Mectizan® Treatment History in the Americas 1989 –2014, and 2015 Target

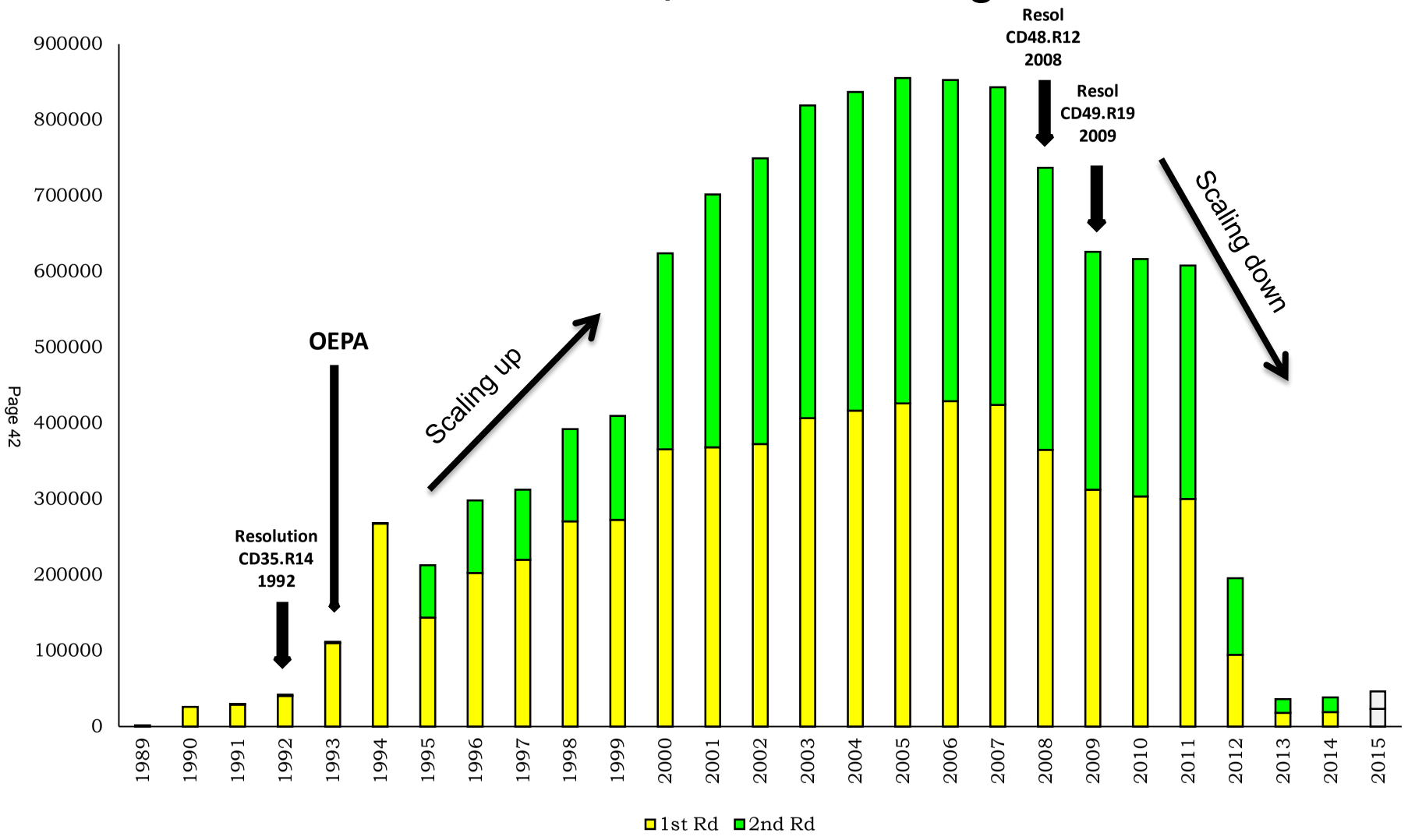


Figure O4

2014: OEPA Targets and Treatment Data

TWICE PER YEAR TREATMENT AREAS

Focus	Comms treated 2x	Meso-Comms	Hypo-Comms	Pop at risk 2x/year	Eligible for Treatment	Treated 1st Rd	Coverage 1st Rd (%)	Treated 2nd Rd	Coverage 1st Rd (%)	UTG(2)	Treated UTG(2)	Coverage UTG(2)
Amazonas-BRA	98	41	57	6,388	5,180	4,263	82	4,201	81	10,360	8,464	82
South-VEN	45	0	45	4,015	3,334	2,905	87	3,340	100	6,668	6,245	94
Total	**143**	**41**	**102**	**10,403**	**8,514**	**7,168**	**84**	**7,541**	**89**	**17,028**	**14,709**	**86**

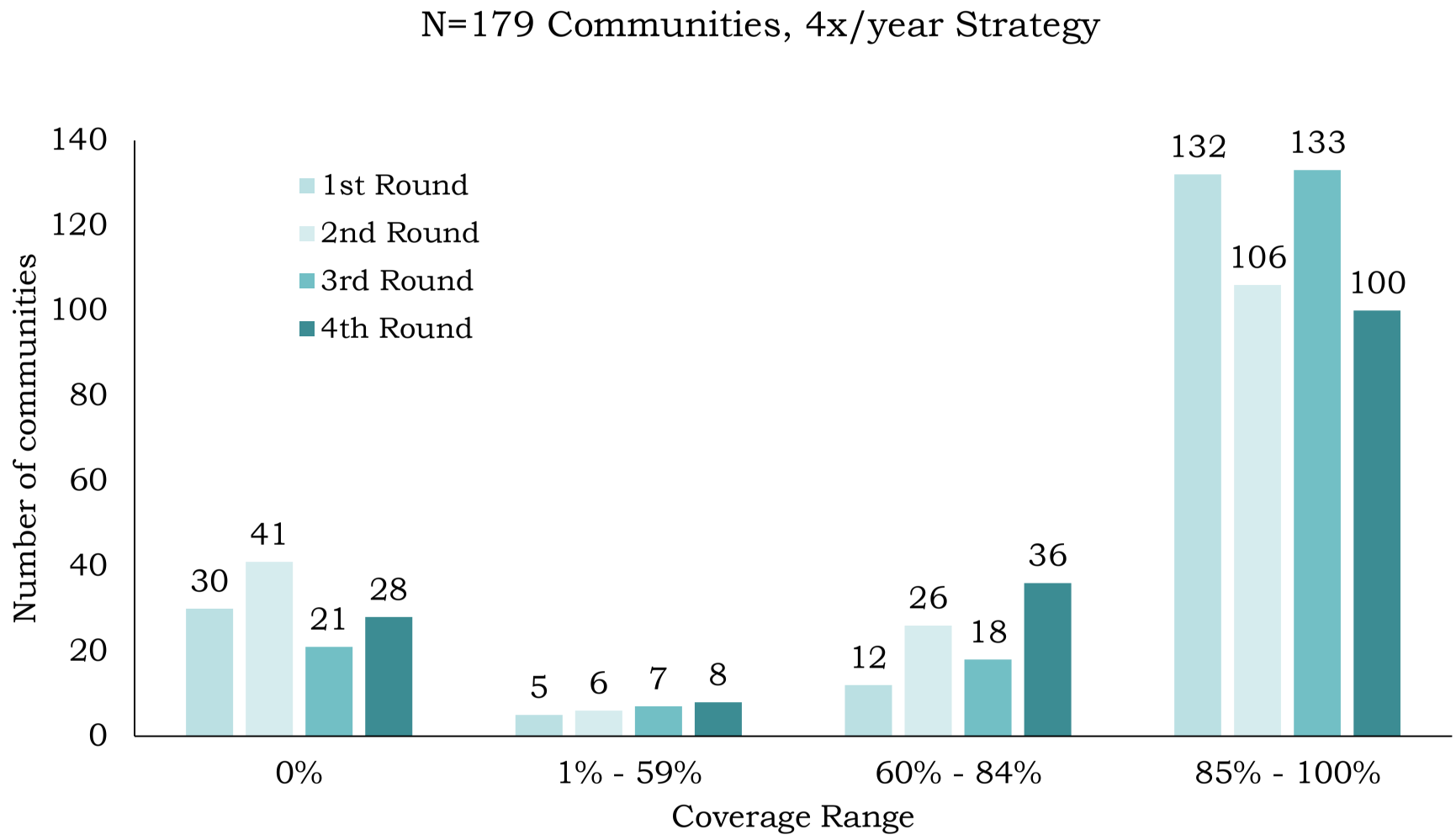
FOUR TIMES PER YEAR TREATMENT AREAS

Focus	Comms treated 4x/year	Hyper - Comms	Meso-Comms	Pop at risk 4x/year	Eligible for treatment	Eligible for treatment without EEP pop*	Treated Rd 1	Coverage Rd 1 (%)	Treated Rd 2	Coverage Rd 2 (%)	Treated Rd 3	Coverage Rd 3 (%)	Treated Rd 4*	Coverage Rd 4 (%)	UTG(4)	Treated UTG(4)	Coverage UTG(4)
Amazonas-BRA	120	101	19	7,527	6,062	NA	4,949	82	5,172	85	4,786	79	4,747	78	24,248	19,654	81
South-VEN	179	154	25	8,785	7,470	6,956	5,851	78	5,351	72	6,072	81	5212	75	29,366	22,486	77
Total	**299**	**255**	**44**	**16,312**	**13,532**	**13,018**	**10,800**	**80**	**10,523**	**78**	**10,858**	**80**	**9,959**	**77**	**53,614**	**42,140**	**79**

* 514 individuals in the South Focus of Venezuela took part in an evaluation (EEP) scheduled for the last quarter of 2014. They were not treated and the eligible population for that round was adapted accordingly.

Figure O5

Communities and Coverages Reached in 2014 at the Venezuelan South Focus



NOTE: 7 communities were not treated during the 4th round because of a scheduled EEP.

Figure O6

Bases for Air Transport: Yanomami Area

Slide: Joao Luiz

Figure O7

President Carter - 2014 InterAmerican Conference on Onchocerciasis

Dr. Barbosa da Silva Jr. and Dr. Morón

President Carter and Dr. Claudia Morón, Vice Minister Venezuela

Photo credit: The Carter Center/G. Aguilar

President Carter and Dr. Jarbas Barbosa da Silva Jr., Vice Minister Brazil

Panel discussion at the meeting.

UGANDA

Summary

Since the launching of its onchocerciasis elimination program in 2007, Uganda has interrupted transmission of onchocerciasis in 9 of the 18 foci (Abstract Figure A7 and A8). The nine foci where onchocerciasis transmission has been interrupted include: 1. Wadelai in 2010; 2. Mt. Elgon and 3. Itwara in 2011; 4. Mpamba-Nkusi, 5. Imaramagambo, 6. Maracha-Terego in 2012; 7. Kashoya-Kitomi 8. Wambabya-Rwamarongo in 2013; and 9. Obongi in 2014. This translates into about 1.77 million treatments for onchocerciasis no longer being required in Uganda.

The major challenge is to attain a desired treatment coverage of at least 90% of the ultimate treatment goal (UTG) in large Madi-Mid North focus districts that have only recently been pacified after years of insurgency. The communities in this focus have already began utilizing the traditional structure of "Rwot kweri" promoting health education, selection and training of CDDs and community supervisors. Where this structure has been successfully used, communities have reached the desired coverage.

Uganda has a number of foci (Bwindi,; Nyagak-Bondo,; and West Nile) where interruption of transmission was suspected but there was uncertainty due to shared international borders with DRC. Interventions cannot be halted unless the RB transmission status across the border is known. In 2014, the Uganda Onchocerciasis Elimination Expert Advisory Committee (UOEEAC) recommended that the Ministry of Health work with the DRC to conduct joint cross-border assessments, and to provide a report of their findings at the 2015 UOEEAC meeting. If this model is successful, it could offer a way forward in other foci with possible ongoing cross border transmission such as Lhubiriha and Madi-Mid North.

Background: Onchocerciasis affects 36 of the 112 districts in Uganda (Figure U1). The first Ugandan onchocerciasis transmission zone ('focus') to successfully eliminate the disease was Victoria, which claimed victory in the 1970s following a vector control campaign based on DDT spraying of rivers that liberated 3 million people from the vector of the disease. Onchocerciasis control using annual mass treatment with Treatment with Mectizan® began in 1991. The original Ministry of Health ivermectin program enjoyed financial support from The River Blindness Foundation (RBF), CBM, and Sightsavers. In 1996, The Carter Center (TCC) assumed the activities of RBF. In 1997, the African Program for Onchocerciasis Control (APOC) began supporting some Ugandan efforts and introduced the community-directed approach to Mectizan® distribution. APOC also supported successful vector elimination efforts in two foci (Itwara and Mpamba-Nkusi) that used ground larviciding with temephos (Abate®) together with annual Mectizan®® distribution. In 2006, The Lions-Carter Center partnership helped launch semi-annual treatments (every six months) to eliminate onchocerciasis from the Wadelai focus, with support from Merck (funding being administered through the NGDO Coalition for Onchocerciasis Control). Wadelai's

success was confirmed in 2010, but annual treatment with Mectizan and albendazole had to continue as the entire district of Nebbi district is also endemic for LF (Figure U7).

The Uganda Ministry of Health (MOH) was emboldened by their elimination successes, and announced a nationwide elimination policy in 2007 that was to be based on twice-per-year treatment (where necessary) and (where feasible) vector elimination/control (using ground-based larviciding), in addition to health education in the affected communities. The new flexible elimination policy, which aims for nationwide elimination of onchocerciasis by the year 2020, was immediately applauded and supported technically and financially by the Lions-Carter Center partnership and Sightsavers.

Currently, onchocerciasis elimination in Uganda is supported by The Carter Center, the United States Agency for International Development (USAID) ENVISION project led by RTI International, Sightsavers, under the coordination of the Ministry of Health, and APOC. The Carter Center River Blindness Elimination Program (RBEP) assists in all 36 of the onchocerciasis endemic districts.[3] In Koboko and Yumbe districts, the assistance has been mainly in mapping, parasitological, entomological and serological assessments. Since 2007, The Carter Center has supported technical services, vector elimination activities and some community-directed treatment with ivermectin (CDTI) activities in Bulisa, Kibaale, Hoima, and Masindi, in partnership with Sightsavers, which operationally supports these districts. The Carter Center has also supported technical services in the districts of Kabarole and Kyenjojo in the Itwara focus. Ivermectin distribution through CDTI in the West Nile focus is supported by APOC and the Ministry of Health of Uganda. APOC also supports many of the other onchocerciasis endemic districts.

Lions have supported the Uganda effort through the Lions Clubs International Foundation (LCIF) SightFirst program for many years. LCIF's most recent grant began in August 2013. Ugandan Lions Clubs are very active participants in and advocates for the Carter Center-assisted river blindness control and elimination activities, including engaging and mobilizing members of parliament and other government officials. The Carter Center's Country Representative in Uganda, Ms. Peace Habomugisha, is a Lions Club member.

Uganda laboratory activity: In support of the elimination effort, The Carter Center has continued to fund equipment and reagents for the MOH laboratory that provides state-of-the-art diagnostic support to the elimination program. The laboratory is located at the MOH Vector Control Division in Kampala and provides polymerase chain reaction

[3] 36 oncho endemic districts: Bushenyi, Kabale, Kanungu, Kasese, Kisoro, Rubirizi, Buhweju, Kamwenge, Ibanda, and Mitooma (in southwest Uganda); Bulisa, Hoima, Kabarole, Kibaale, Kyenjonjo, and Masindi (in western Uganda); Adjumani, Arua, Koboko, Yumbe, Maracha, Moyo, Nebbi, Yumbe, and Zombo (in the West Nile region bordering the Democratic Republic of the Congo); Amuru, Gulu, Kitgum, Lamwo, Lira, Nwoya, Oyam and Pader districts (in the Mid North focus); and Bududa, Manafua, Mbale, and Sironko (in the Mount Elgon focus in the east, bordering Kenya).

(PCR) testing for black flies and skin snips, and serologic enzyme-linked immunosorbent assay (ELISA) testing for OV16 antibodies. Technical backup and reference lab support is provided by Dr. Thomas Unnasch's laboratory at the University of South Florida in Tampa, Florida. Since its launching, the Uganda laboratory has analyzed 52,190 OV16 specimens, and as a result has the greatest operational experience using this test of any lab in the world. In 2014, the lab analyzed 6,313 blood spots for OV16 antibodies. It also analysed *Simulium* vector black flies by PCR and the PoolScreen^{R} program. It also proved that the black fly species *S.bovis* was not transmitting onchocerciasis, and that transmission in the Lhubiriha focus, a border focus with DRC is on-going.

Expert advisory committee for national onchocerciasis elimination: To ensure that the elimination decisions are supported with the best scientific and technical advice, the Uganda MOH established the Ugandan Onchocerciasis Elimination Expert Advisory Committee (UOEEAC), which is currently chaired by Dr. Thomas Unnasch (University of South Florida). The UOEEAC meetings are supported financially by The Carter Center. UOEEAC responsibilities are to: 1) review programmatic activity reports from each elimination-targeted focus in Uganda annually; 2) advise the MOH on focus-specific monitoring and evaluation activities, and recommend halting of interventions when appropriate in accord with international and national guidelines; and 3) make any other recommendations to the MOH on activities needed to reach the national 2020 elimination goal. In addition to MOH representatives and institutional representatives from The Carter Center, and Sightsavers, the UOEEAC includes several members-at-large who are recognized for their international expertise in onchocerciasis: Dr. Unnasch (chair), Dr. Edridah Tukahebwa (Acting Assistant Commissioner of National Disease Control, MOH), Professor Rolf Garms (Bernhard-Nocht Institute), Dr. Frank Walsh (former director of entomology of the WHO Onchocerciasis Control Program). Tom Lakwo (National Coordinator for the onchocerciasis elimination program, MOH) and Ms. Peace Habomugisha (The Carter Center country representative) both serve as committee secretaries. The World Health Organization (WHO) Uganda representative and APOC attend these meetings as observers, to avoid any conflict of interest since WHO will likely coordinate future verification of the elimination activities. NTD representatives, the Uganda LF coordinator, local Lions, Mectizan Donation Program representatives, RTI/ENVISION, and other donors and technical bodies also attend as observers.

At its seventh session (August 6-8, 2014) the UOEEAC concluded that onchocerciasis transmission had been interrupted in the Obongi focus. The UOEEAC recommended that the MOH halt all interventions in this foci and move it to the post-treatment surveillance (PTS) phase (Figure U5). The UOEEAC also noted that suppression of transmission may have already taken place in the Nyamugasani focus, but additional epidemiological information needed to be collected in 2015 to determine if transmission interruption had been met according to WHO/MOH guidelines.

Treatments: The Carter Center-assisted treatments achieved 86.7% of the 2014 treatment target of 3,722,226.

The Uganda program continues to expand semiannual treatments (Abstract Figure A8). The Ultimate Treatment Goal (UTG) for Carter Center-assisted areas annual ivermectin treatment was 10,182 in 2014 (Figure U2), and achieved 98% coverage (9,962 treatments provided). In the areas targeted for twice-per-year treatment, the 2014 UTG(2) was 3,712,594 (Figure U3), and the program provided 3,217,189 treatments, 87% coverage. In total, the Uganda RBEP assisted in a total of 3,354,812 mass treatments in 2014 (as well as 127,661 passive and visitor treatments). The Uganda RBEP reached 100% of 68 villages targeted for annual treatment; for villages targeted for semi-annual treatment, 78% (2,814) were reached. The program needs to continue improving its implementation process in order to overcome challenges still being experienced in expansion areas of the Madi-Mid North focus, especially in Gulu, Kitgum and Pader districts, where coverage was poorest.

Training and Health Education: Uganda trained or retrained 26,672 Community-Directed Distributors (CDDs) and 7,813 Community-Directed Health Supervisors (CDHSs) in 2014. Of those trained in 2014, 37% of the CDDs and 34% of the CDHSs were female. The current ratio of CDDs to population served is 1 CDD to 85 persons served, and the supervisor-to-CDD ratio was 1:3.

Financial Contribution: Figure U6 shows APOC, Carter Center, LCIF, USAID, and government (district and national) financial contributions to onchocerciasis control/elimination in areas assisted by the RBEP. Starting in 2007, The Carter Center dramatically increased its funding with the launching of the new national elimination policy; APOC support remained relatively stable (US $103,641. The national government contribution increased from US $24,932 in 2013 to US $51,195 in 2014.

Sustainability and Integration: The RBEP-assisted CDTI program actively co-implements with the national lymphatic filariasis elimination effort, which reached 1,084,689 persons in the Carter Center assisted districts. Low coverage again was observed in Gulu, Kitgum and Pader districts of Madi-Mid North focus.

Co-implementation with the Vitamin A Supplementation (VAS) Program for young children (6-59 months) was done with Carter Center assistance in Kabale and Kanungu districts. In the first round, 8,175 children were treated at 20.3% treatment coverage; and in the second round 18,348 children were treated, at 45.5%. The low coverage was due to an inadequate supply of Vitamin A. The chronic shortage of Vitamin A did not allow extension of VAS to other districts.

2015 RECOMMENDATIONS FOR THE CARTER CENTER RBEP, UGANDA

Expand twice-per-year treatment to Moyo and Adjumani districts in the Madi onchocerciasis focus.

Intensify CDTI activities in the Madi-Mid North onchocerciasis focus particularly Gulu, Kitgum and Pader districts, with the aim of improving community involvement, and treatment coverage (at least 90% of UTG) in each treatment cycle every year. A special presentation on this focus will be requested at the next program review.

Continue re-orienting the CDTI activities in Madi/Mid North focus to the Rwot Kweri structure in order to boost treatment coverage by ensuring adequate number of CDDs and community supervisors in the communities in all the districts.

Provide financial and administrative support for the 2015 UOEEAC meeting.

Work closely with the MOH NTD program in order to promote effective and efficient LF and Oncho co-implementation where the two diseases are co-endemic.

Publish Uganda country experience with onchocerciasis elimination as well as the results of Uganda onchocerciasis elimination mathematical models (in collaboration with the University of Notre Dame).

Recommend that the FMOH work with DRC to conduct joint cross-border activities, and to provide a report of such activities at the 2015 UOEEAC.

Conduct an epidemiological assessment in Budongo focus.

Intensify PTS activities in all foci where treatment has been halted.

Continue entomological surveys (in Adjumani and Moyo), and other districts in Madi-Mid North focus.

Prof. Post should provide training to Ugandan staff on the morphometric PCA method to classify flies as belonging to the Adjumani and Moyo populations, so that the MOH staff can apply this method to other situations in the future.

Evaluate the feasibility of vector control in the Madi/Mid-North focus.

General

Encourage WHO and the concerned Ministries of Health to evaluate and treat cross border foci in a coordinated manner.

Encourage partners to revise complex village rollup forms that must be completed by CDDs and health workers that require recording treatment data by gender and age groups.

Programs should collect more information, to share at the next review, on communities with low coverage (as shown on the Likert scale).

Programs should conduct treatment coverage surveys, in consultation with HQ.
Submit drug applications to WHO and MDP as early as possible, and no later than August of the year before the drug is needed, so that drugs arrive by December. This is especially important as programs move to twice- per- year treatments in many areas. Work with national agencies to facilitate appropriate documentation and clearance for all medications. Because drug requests are made well before treatment activities are done, treatment denominators will require adjustment during the treatment year. Keep TCC headquarters copied on all related correspondence.

In African programs, seek to increase training, supervision, involvement of kinship groups, and gender balance among CDDs and community supervisors. Work toward a target ratio of at least 1 CDD:100 people and 1 community supervisor:5 CDDs.

Maintain laboratory support by TCC/RBEP for serology, entomology, and parasitology (including PCR testing in vectors and skin snips) led by University of Southern Florida (Dr. Thomas Unnasch). In consultation with USF, field laboratories should send samples to USF for quality control purposes.

Through national mechanisms, monitor government and partner financial contributions for elimination efforts in RBEP-assisted areas.

Seek more Lions participation to help maintain program visibility and support wherever possible.

Carter Center program staff must complete or renew the Emory IRB certification if they are to be involved with research programs.

Overall Treatment Objectives for onchocerciasis for 2015:

River Blindness	
Semiannual UTG(2)	**3,829,961**

Training Objectives	
CDDs:	**35,113**
Community Supervisors	**12,059**
Health Workers	**108**

Overall Treatment Objectives for onchocerciasis for 2014:

River Blindness	
Semiannual UTG(2)	**3,723,594**
Annual UTG (confirmed)	**10,182**

Training Objectives	
CDDs	**26,672**
Community Supervisors	**7,813**

Figure U1

Uganda's Progress Towards Elimination of Onchocerciasis: 2014

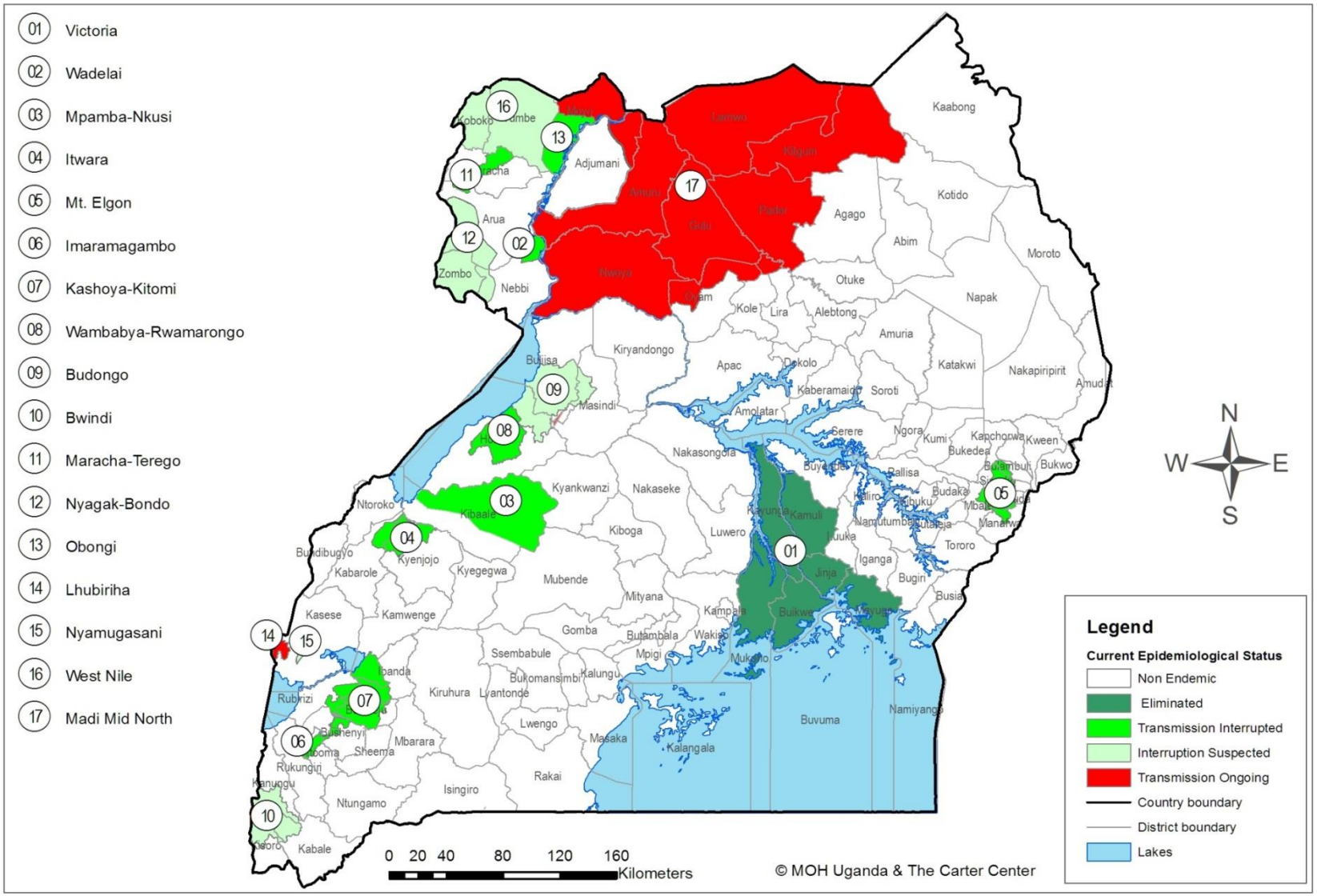
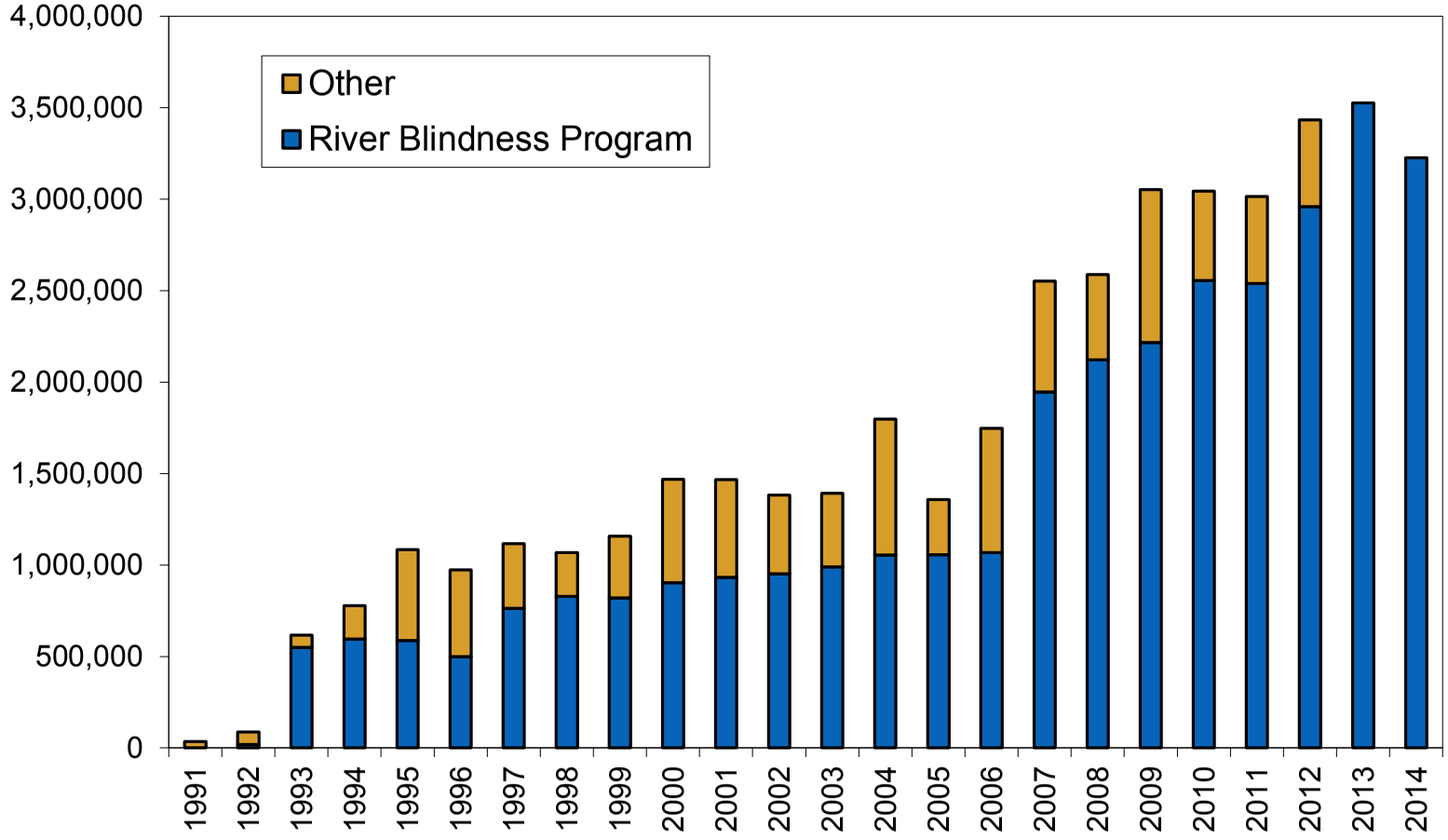


Figure U2

Uganda: Carter Center-Assisted Treatments and Total Mectizan® RB Treatments Provided, 1991-2014



*Treatments in 1992-1995 assisted by River Blindness Foundation.

Figure U3

Uganda - Transmission Interruption Suspected: 2014 Semiannual Treatments

Focus	District	Transmission Interruption Suspected	Total Population	UTG treated cumulative		UTG treated cumulative for both rounds	UTG 1	UTG 2	% TX cov of UTG 1		% TX cov of UTG 2	Active villages UTG		Active villages % for UTG	
				R1	R2				R1	R2		R1	R2	R1	R2
Budongo	Masindi	2014	49,418	37,524	35,764	73,288	40,395	80,790	93	89	91	60	60	100	100
	Buliisa	2014	28,072	23,861	23,935	47,796	24,398	48,796	98	98	98	54	54	100	100
	Hoima	2014	77,961	61,378	62,060	123,438	64,417	128,834	95	96	96	70	70	100	100
Bwindi	Kabale	2013	30,458	23,834	24,193	48,027	24,270	48,540	98	100	99	58	58	100	100
	Kanungu	2013	58,721	43,838	45,273	89,111	47,545	95,090	92	95	94	107	107	100	100
	Kisoro	2013	37,543	28,534	28,804	57,338	30,278	60,556	94	95	95	45	45	100	100
Nyagak	Nebbi	2014	129,528	101,029	101,136	202,165	105,611	211,222	96	96	96	168	168	100	100
	Zombo	2014	230,705	184,113	187,436	371,549	190,504	381,008	97	98	98	625	625	100	100
	Arua	2014	170,485	142,940	142,446	285,386	144,878	289,756	99	98	98	325	325	100	100
Obongi	Moyo	2014	37,539	29,128	0	29,128	30,848	0	94	0	94	61	61	100	0
Nyamugasani	Kasese	2011	11,037	9,962	N/A	9,962	10,182	10,182	98	N/A	98	7	7	100	100
Total			**861,467**	**686,141**	**651,047**	**1,337,188**	**1,216,318**	**1,354,774**	**56**	**55**	**56**	**2836**	**2836**	**100**	**100**

NB: Annual treatment was given only in Nyamugasani and Obongi foci

Figure U4

Uganda: Transmission Ongoing- 2014 Semiannual Treatments

Focus	District	Total Population	Popn treated cumulative		UTG treated in R1 and R2	UTG 1	UTG 2	% TX cov of (UTG 1)		% TX cov of UTG 2 in both Rounds	Active villages cumulative for 2014	Active villages UTG for 2014		Active villages % for UTG for 2014	
			R1	R2				R1	R2			R1	R2	R1	R2
Lhubiliha	Kasese	123,586	99,404	99,924	199,328	102,091	204,182	97	98	98	124	124	124	100	100
Madi	**Pader***	248,390	120,544	131,760	252,304	211,131	422,262	**57**	**62**	**60**	612	612	612	100	100
Mid North	**Kitgum***	98,620	47,022	69,140	116,162	82,931	165,862	**57**	**83**	**70**	234	234	234	100	100
	Gulu*	256,655	121,443	165,893	287,336	224,585	449,170	**54**	**74**	**64**	231	231	231	100	100
	Lamwo	130,883	94,603	97,942	192,545	104,707	209,414	90	94	92	327	327	327	100	100
	Amuru	224,734	168,417	174,261	342,678	180,039	360,078	94	97	95	67	67	67	100	100
	Nwoya	128,033	98,882	107,892	206,774	108,199	216,398	91	100	96	54	54	54	100	100
	Oyam	21,818	18,224	16,444	34,668	18,691	37,382	98	88	93	35	35	35	100	100
	Lira	66,768	53,571	53,690	107,261	55,365	110,730	97	97	97	225	225	225	100	100
	Moyo	85,520	69,425	70,813	140,238	74,657	149,314	93	95	94	164	164	164	100	100
	Adjumani	26,163	19,041	20,756	39,797	21,605	43,210	88	96	92	43	43	43	100	100
Total		**1,411,170**	**910,576**	**1,008,515**	**1,919,091**	**1,184,001**	**2,368,002**	**77**	**85**	**81**	**2,116**	**2,116**	**2,116**	**100**	**100**

*There was poor treatment coverage in Pader, Kitgum and Gulu in 2014.

Figure U5

Uganda: Where Onchocerciasis has been Interrupted or is Suspected Interrupted

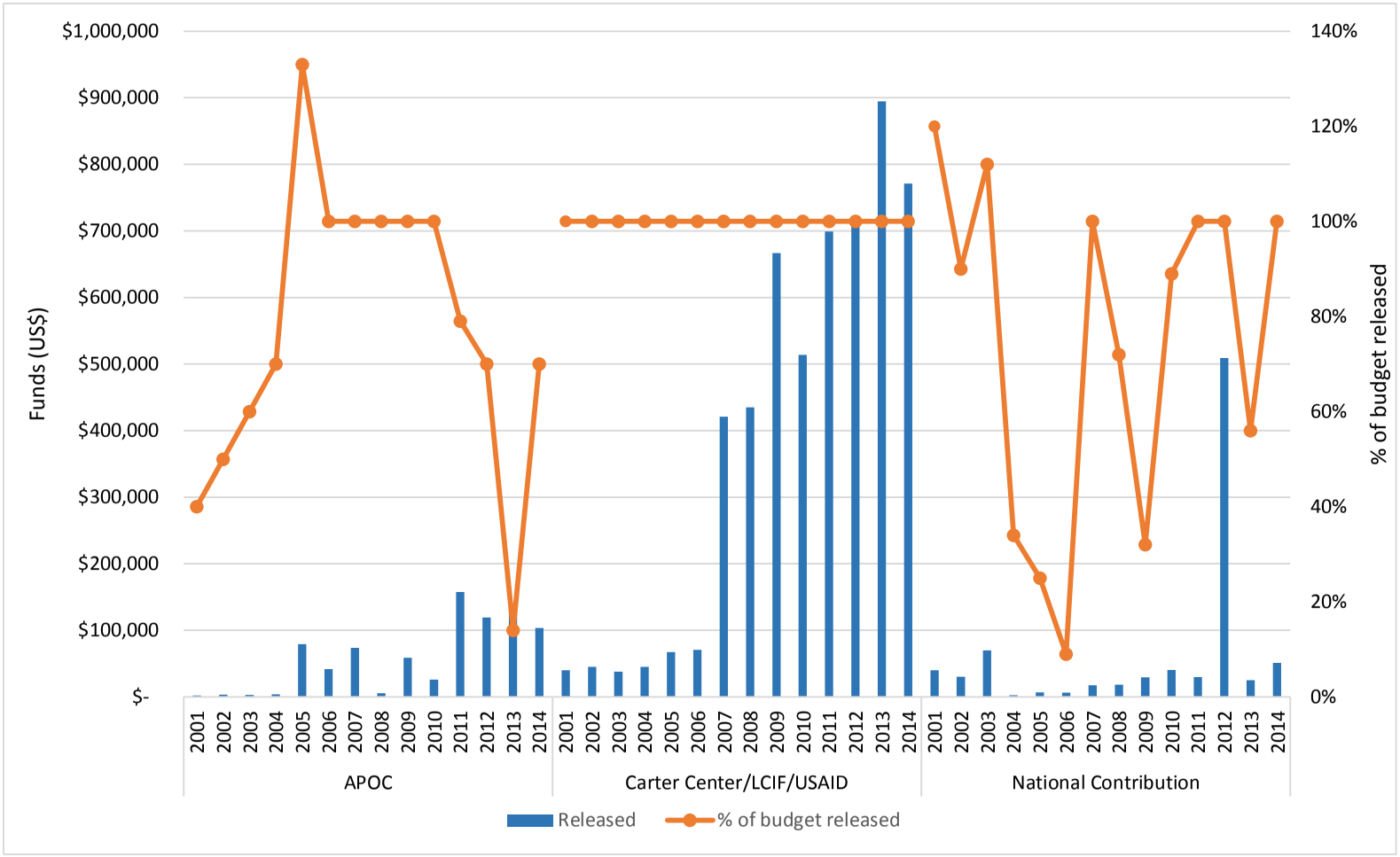
ID No.	Focus	Vector	District	# MDA Annual Rounds	# of MDA Semi Annual Rounds	Total Pop	Planned Annual Txs 2013	Planned Semi Annual Txs 2013	Status of Transmission
2	Wadelai	*S.neavei*	Nebbi	15	8	21,068	42,137		Interupted (2012)
4	Itwara	*S. neavei*	Kabarole	20	2	35,216	35,216		Interupted (2012)
			Kyenjojo	20	2	73,269	73,269		Interupted (2012)
5	Mt. Elgon	*S.neavei*	Manafwa	15	8	43,496	86,992		Interupted (2012)
			Mbale	15	8	53,832	107,665		Interupted (2012)
			Sironko	15	8	81,815	163,630		Interupted (2012)
			Bududa	15	8	173,142	346,284		Interupted (2012)
3	Mpamba-Nkusi	*S. neavei*	Kibale	17	8	203,859	407,719		Interupted (2013)
6	Imaramagambo	*S.neavei*	Bushenyi	18	0	109,458	109,458		Interupted (2013)
11	Maracha-Terego	*S.neavei/S.damnosum*	Maracha-Terego	19	0	182,469	182,469		Interupted (2013)
8	Wambabya-Rwamarongo	*S. neavei*	Hoima	16	13	75,733	125,308		Interrupted (2014)
7	Kashoya-Kitomi*	*S.neavei*	Buhweju	16	13	60,255		99,024	Interrupted (2014)
			Rubirizi	16	13	77,250		127,352	Interrupted (2014)
			Ibanda	16	13	26,144		43,610	Interrupted (2014)
			Kamwenge	18	13	45,626		74,346	Interrupted (2014)
13	Obongi / Moyo	*S.neavei/ S. damnosum*	Moyo	19	0	37,392	30,778		Interruption Suspected
15	Nyamugasani	*S. kilibanum*	Kasese	19	0	10,664	9,603		Interruption Suspected
10	Bwindi	*S.neavei/ S. damnosum*	Kabale	15	13	29,428		46,900	Interruption Suspected
			Kanungu	15	13	56,735		91,874	Interruption Suspected
			Kisoro	15	13	36,273		58,508	Interruption Suspected
17	West Nile	*S.neavei/ S. damnosum*	Yumbe	19	0	286,615	229,292		Interruption Suspected
			Koboko	19	0	167,076	133,661		Interruption Suspected
			Arua	19	0	138,063	134,696		Interruption Suspected

Light Green = Transmission Interrupted

Greyish Green = Interruption Suspected

Figure U6

Uganda: Financial Contributions in US Dollars (2001-2014)



The APOC and government contributions are reported by our Carter Center country representatives based on their best possible determinations from information available in country through the National Onchocerciasis Task Force and other local sources. Capital equipment replacement provided by APOC and government salaries are not considered.

Figure U7

2014 LF Treatments: Albendazole & Ivermectin for Lymphatic Filariasis in Carter Center-Assisted Oncho Districts

District Name	Total Population	Ultimate TX Goal (UTG)	Persons Treated	Popn TX of UTG 2014 %	Active Villages Cumulative for 2014	Active Villages UTG for 2014	Active Villages for UTG for 2014 %
Adjumani	26,163	21,605	19,041	88.1	43	43	100.0
Moyo	123,059	105,505	98,553	93.4	225	225	100.0
Gulu	256,655	224,585	121,443	**54.1**	229	229	100.0
Pader	248,390	211,131	120,544	**57.1**	612	612	100.0
Kitgum	98,620	82,931	47,022	**56.7**	234	234	100.0
Lamwo	130,883	104,707	94,603	90.4	327	327	100.0
Nwoya	128,033	108,199	98,882	91.4	54	54	100.0
Lira	66,768	55,365	53,690	97.0	225	225	100.0
Zombo	230,705	190,504	187,436	98.4	625	625	100.0
Nebbi	129,528	105,611	101,029	95.7	168	168	100.0
Arua	170,485	144,878	142,446	98.3	325	325	100.0
Total	**1,609,289**	**1,355,021**	**1,084,689**	**80.0**	**3,067**	**3,067**	**100.0**

SUDAN

Summary

Sudan has three known river blindness foci: Abu Hamad (River Nile state), Radom (South Darfur state), and Galabat (Gedaref state) (Figure S1). In 2014 the Abu Hamad focus was in its third and final year of post treatment surveillance (PTS). A major evaluation in Abu Hamad communities is planned for 2015; if there is no disease recrudescence, onchocerciasis can be declared eliminated in Abu Hamad area. Mectizan® treatments continued in the other two transmission zones of the country (Radom and Galabat).

Background:
In December 2006, the Government of Sudan (GOS) changed its onchocerciasis goals from control to elimination, concentrating initially on the isolated desert focus of Abu Hamad in River Nile state and then in Galabat in Gedaref State state in 2011 (Figure S1). The RBEP, with Lions SightFirst support, has principally worked on these elimination efforts in Abu Hamad and Galabat foci. Successful interruption of transmission was declared in Abu Hamad in 2012, and semi-annual treatment with Mectizan® ceased. Semi-annual treatment continues in Galabat (Figure S2).
The strategy in Radom focus of South Darfur remains a control strategy, as the area still experiences insecurity. The disease's geographical reach and the total affected population have never been determined since insecurity prevents mapping from being carried out safely.

Treatments: A total of 254,086 treatments were delivered by the Sudan program in 2014 in Galabat (232,164) in two rounds and Radom (21,922) one round (Figure S3). Due to civil conflict, a proper census of the affected population in Radom has not been performed to date, so an ultimate treatment goal cannot be determined. Accordingly, an annual treatment objective (ATO) based on the Mectizan® drug order request is used as the denominator.

Training and Health Education: During 2014, the program trained a total of 1,194 community-directed distributors (CDDs) of whom 41% were female. The percentage of 42% in 2013 has not changed significantly. All trained CDDs were from Galabat focus (Figure S4).

Mectizan®: During 2014,778,000 tablets were distributed in the Galabat and Radom foci with an average of 3.06 tablets per person. No severe adverse effects were reported. The program began in 2014 with a balance of 594,000 tablets.

Sustainability and Integration: In late 2007, the program began focusing on involving kinship/family groups in all foci in mobilization and health education, selection and training of CDDs, and distribution of Mectizan®. This policy has improved training figures and has reportedly also reduced demand for monetary incentives.

2015 RECOMMENDATIONS FOR THE CARTER CENTER RBEP, SUDAN

Abu Hamad

Assist in completing post-treatment surveillance evaluations in Abu Hamad in 2015.

Maintain close laboratory support by TCC/RBEP for serology, entomology, and parasitology (including PCR testing in vectors and skin snips) led by University of Southern Florida (Dr. Thomas Unnasch). In consultation with USF, field laboratories should send samples to USF for quality control purposes.
Add a fly catching point in the spillway rapids downstream of the Merowe Dam.

Galabat Focus in Gedaref State

Complete surveys on the border of Ethiopia (in Metema) and Sudan (in Galabat) in order to ascertain if MDA can be halted.

Encourage publication of experience of bi-national collaboration in assessment of cross-border focus.

Attend MOH 2015 review meeting on the results of the assessments of Abu Hamad and Galabat foci.

Establish additional sites for fly collection and determination of the bio-ecology of the *Simulium* vectors at the bordering sites of Metema in Ethiopia.

In collaboration with USF, conduct cytotaxonomy of the flies to identify the existing sub-species.

General

Encourage WHO and the concerned Ministries of Health to evaluate and treat cross border foci in a coordinated manner.

Encourage partners to revise complex village rollup forms that must be completed by CDDs and health workers that require recording treatment data by gender and age groups.

Programs should collect more information, to share at the next review, on communities with low coverage (as shown on the Likert scale).

Programs should conduct treatment coverage surveys, in consultation with HQ.

Submit drug applications to WHO and MDP as early as possible, and no later than August of the year before the drug is needed, so that drugs arrive by December. This is especially important as programs move to twice- per- year treatments in many areas. Work with national agencies to facilitate appropriate documentation and clearance for all medications. Because drug requests are made well before treatment activities are

done, treatment denominators will require adjustment during the treatment year. Keep TCC headquarters copied on all related correspondence.

In African programs, seek to increase training, supervision, involvement of kinship groups, and gender balance among CDDs and community supervisors. Work toward a target ratio of at least 1 CDD:100 people and 1 community supervisor:5 CDDs.

Maintain laboratory support by TCC/RBEP for serology, entomology, and parasitology (including PCR testing in vectors and skin snips) led by University of Southern Florida (Dr. Thomas Unnasch). In consultation with USF, field laboratories should send samples to USF for quality control purposes.

Through national mechanisms, monitor government and partner financial contributions for elimination efforts in RBEP-assisted areas.

Seek more Lions participation to help maintain program visibility and support wherever possible.

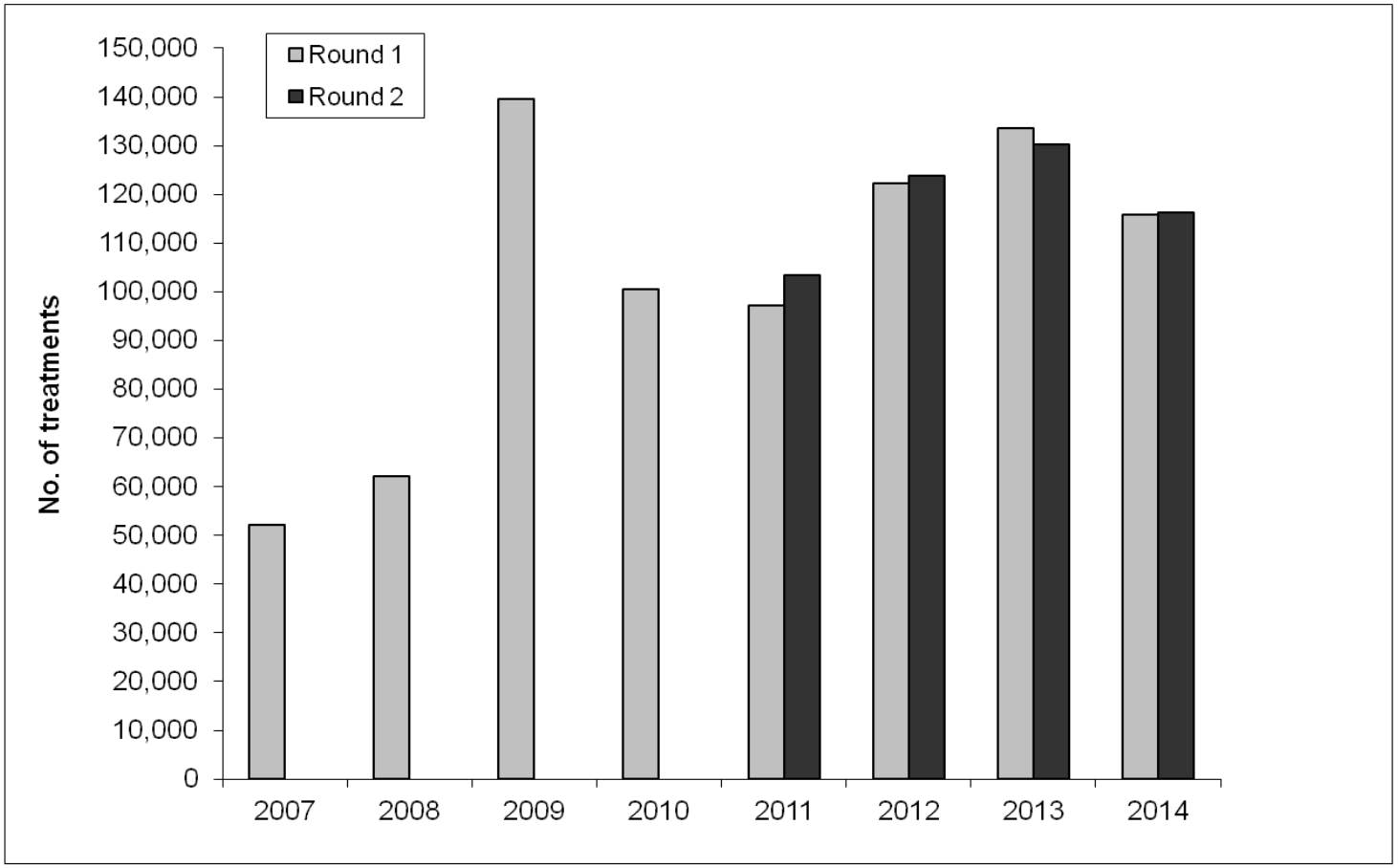
Carter Center program staff must complete or renew the Emory IRB certification if they are to be involved with research programs.

Treatment Objectives for onchocerciasis for 2015:

River Blindness	
Annual UTG	**23,427**
Semiannual UTG(2):	**246,179**

Map of Sudan Onchocerciasis Program Areas

Sudan: Number of Carter Center-Assisted Mectizan® Treatments delivered from 2007 to 2014 in Galabat Focus, Gedaref State



Sudan: 2014 Treatment Coverage

Strategy	State	Focus	Total Population	UTG 1	Treatments RD 1	% UTG	Treatments RD 2	% UTG	Total Treatments	UTG 2	Active Villages
Elimination	Gedaref	Galabat	144,811	123,090	115,877	94.1%	116,287	94.5%	232,164	246,180	130
Control	Southern Darfur	Radom	25,947	22,055	21,911	99.3%			21,055		19
	Passive		0	0	11	0	17	0	28	0	0
Grand Total			**170,758**	**145,145**	**137,799**		**116,304**		**253,247**	**246,180**	**149**

Number of CDDs Trained in Galabat Focus by Gender

Trained in 2013 and 2014

		2013					2014				
Focus	**District**	**Total CDDs**	**Male CDDs**	**% Male**	**Female CDDs**	**% Female**	**Total CDDs**	**Male CDDs**	**% Male**	**Female CDDs**	**% Female**
Galabat	Galabat	824	510	61.9	314	38.1	859	528	61.5	331	38.5
	Gorisha	319	170	53.3	149	46.7	335	176	52.5	159	47.5
Radom	District	100	100	0	0	0	100	0	0	0	0
Total		**1,243**	**780**	**62.8**	**463**	**37.3**	**1,294**	**704**	**54.4**	**490**	**37.9**

NIGERIA

Summary

The River Blindness Elimination Program (RBEP) strives to eliminate the transmission of onchocerciasis in the nine states it assists in Nigeria (Abia, Anambra, Delta, Ebonyi, Edo, Enugu, Imo, Nasarawa, and Plateau) (Figure N1) by 2020, in accord with the Federal Ministry of Health's Master Plan for NTDs. In 2014, 6,769,079 Mectizan® mass treatments (with health education) for onchocerciasis were distributed in Nigeria (Figures N2 and N3) with assistance from The Carter Center (TCC).

The Carter Center and its ministry of health partners successfully interrupted Lymphatic Filariasis (LF) transmission in Plateau and Nasarawa in 2012, and in 2013 the two states stopped nearly four million albendazole-Mectizan® treatments (with health education and long lasting insecticidal bed nets – LLIN) a year in 2013. The other seven states TCC assists began their own LF programs in 2014, and quickly scaled up to 10,042,479 treatments for the year (Figures N4 and N5). In the southeast, for the first time the Nigeria program successfully conducted twice-per-year MDA (using albendazole alone) for LF in Imo state; to our knowledge this was the first time twice-per-year MDA for LF has been used in Nigeria.

The Carter Center has been a leader in developing coordinated LF and malaria activities. The Federal Ministry of Health has accepted adopted this as an important policy.

In 2014 TCC assisted in providing 3,056,576 praziquantel treatments (with health education) for schistosomiasis in six states (Delta, Ebony, Edo, Enugu, Plateau and Nasarawa (Figures N6 and N7).

The Carter Center facilitated a nearly ten-fold increase in soil-transmitted helminth (STH) treatments with albendazole or mebendazole in the assisted states in 2014, with the seven southeast states[4] joining Plateau and Nasarawa to treat nearly 7 million school children; some twice within the year (Figures N8 and N9).

The expanded activities in Nigeria are thanks in large part to TCC's partnership with the USAID's ENVISION project, led by RTI International, along with other key partners, such as the Sir Emeka Offor Foundation and the Margaret A. Cargill Foundation.

[4] Abia, Anambra, Delta, Ebonyi, Edo, Enugu, and Imo are collectively referred to in this document as 'southeast.'

River Blindness

***Background*:** Nigeria is home to as much as 40% of the global population at risk for onchocerciasis, making it the most endemic country in the world. The National Onchocerciasis Control Program (NOCP) is the largest Mectizan® distribution program globally, reporting between 20-35 million treatments per year (Figure N3). In 2013, the Federal Ministry of Health (FMOH) of Nigeria released a new master plan for neglected tropical diseases (NTDs) that included a new national policy of onchocerciasis elimination by 2020.

The RBEP in Nigeria is headquartered in Jos, Plateau state, with supporting sub-offices in Benin City, Enugu, Lagos, and Owerri. Active in assisting nine states (Figure N1) since 1996, the TCC RBEP enjoyed LCIF support from 1999 to 2008, and core APOC support from 2000 to 2005. It currently receives funding from the Sir Emeka Offor Foundation, the Margaret A. Cargill Foundation, and USAID RTI ENVISION.

Treatments: In 2014, the TCC-assisted RBEP program in Nigeria provided health education and Mectizan® treatments to 6,769,079 persons (Figures N2 and N3), 98% of the UTG. No severe adverse events (SAEs) were reported following Mectizan® treatments in RBEP-assisted states in Nigeria in 2014. Particularly close monitoring for adverse reactions is carried out in the southeast because of the presence of *Loa loa* in that part of the country. *Loa loa* parasites release large numbers of microfilariae into the blood stream and death of these microfilariae after treatment with Mectizan® can, in rare cases, provoke severe adverse events (SAEs).

TCC-assisted treatments for LF, schistosomiasis, and STH are discussed in the Integrated Programs sections below.

Training and Health Education: In the nine9 states assisted by TCC there were 57,895 professional and lay health personnel involved in Mectizan® distribution in 2014: 42,420 CDDs; 10,995 community supervisors; and 4,480 health workers. One CDD served, on average, 201 persons. Just over half (51%) of CDDs were female.

Financial Contributions: The TCC-assisted RBEP in Nigeria received APOC core funding from 1998-2003. Since then, funding has been received through special APOC initiatives (Figure N10). The Nigeria RBEP-assisted areas have had chronically insufficient government contributions at national, state, and local levels. The increase in funding in 2014 is due to a generous integrated program grant from the For the past three years, major USAID funding USAID's ENVISION project, led by RTI International, that has led to a marked increase in treatments, particularly for LF (two-fold) and STH (nearly 10-fold) in particular. Financial contributions to the integrated programs are discussed in more detail in their sections below.

The Integrated Programs in Nigeria

Background: TCC-assisted programs in Nigeria pioneered the concept of integrated mass treatment for RB, LF and SCH, in which the logistics of an MDA program are shared across several programs (Hopkins 2001). The integrated program began in 1999 with integrated RB and urinary schistosomiasis interventions, expanding to include LF MDA in 2000, trachoma in 2001, and malaria in 2003. Background information on RB, LF and schistosomiasis is provided in Annex 6. Integration results in broader services, lower costs, and higher efficiency among disease programs that use similar strategies. In particular, where needed, praziquantel treatments given simultaneously with LF as 'triple drug administration' (ivermectin, albendazole, and praziquantel) are safe, and have enormous savings (40%) compared with giving two separate treatment rounds (ivermectin and albendazole separated from praziquantel) (Evans et al. 2011).

Lymphatic Filariasis: The goal of the LF program in Plateau and Nasarawa states is to interrupt LF transmission with annual combination MDA consisting of Mectizan® and albendazole, with health education and long lasting insecticidal bed nets. An in-depth history of the TCC effort in Plateau and Nasarawa states was published by Richards et al. (2011). When the program began, LF was widespread in Plateau and Nasarawa states, and mass treatment and health education was required in all cities and villages in the 30 LGAs. MDA started in 2000 and achieved scale in 2003 (Figure N4). In 2008, a survey for LF prevalence in the 30 LGAs comprising the 2-state area showed that 10 LGAs had achieved the elimination threshold (based on LF antigenemia prevalence) (King et al. 2012). Five of those LGAs were onchocerciasis-endemic, so Mectizan® treatment continued; in the other five LGAs MDA for LF was halted. In 2012, using the newly released WHO Treatment Assessment Survey (TAS), TCC and its MOH partners conducted LF antigenemia testing in children ages 6-7 years old in four evaluation units (EU), using school-based cluster surveys drawn from the remaining 20 LGAs in Plateau and Nasarawa. The results showed that transmission of LF had been interrupted, and the FMOH declared that MDA for LF could be halted. In 2012, the last treatments for LF were given and post treatment surveillance (PTS) started in 2013 (Figure N4). In 2014, a 3-year PTS survey confirmed that transmission remained interrupted in the five LGAs that stopped LF MDA in 2010. Further (3-year) PTS TAS surveys are planned for 2015 that will evaluate the entirety of the two state area.

In the seven TCC-assisted states in the southeast, LF MDA was launched in 2014 with support from USAID. The program began in LGAs with an existing river blindness program. Progress in 2014 was remarkable, with over 10 million treatments given in areas that had never had an LF program. Of interest is that the current WHO strategy for LF programs in Loa loa areas like southeast Nigeria is twice-per-year MDA with albendazole alone and LLIN, so avoiding Mectizan® and the associated risk of SAEs. Twice-per-year treatments with albendazole were attempted in Imo and Ebonyi state; Imo completed both rounds successfully (Figure N5), while Ebonyi did not, due to lack of availability of albendazole for the second round. To our knowledge this was the first experience of twice-per-year LF MDA in Nigeria.

The LF program will expand in 2015 into non-RB LGAs to reach full LF coverage; this expansion will require establishing new MDA infrastructure, including the purchase of motorcycles and vehicles, new training, etc., and will be particularly challenging.

Fighting Malaria and Lymphatic Filariasis with LLINs: In Nigeria, LF is transmitted by *Anopheles* mosquitoes, the same mosquito that transmits malaria. LLINs are one of the most important prevention tools for malaria and also are useful as an adjunct to MDA in the LF elimination program. Between 2009 and 2013, all nine TCC-supported states received LLINs as part of the nationwide mass distribution of nets that aimed to provide two nets to every household. TCC has assisted with the distribution of 9.5 million LLINs in Nigeria since 2004.

In Plateau and Nasarawa, rates of LF-infected mosquitoes have been determined by dissection since the launching of the program (Richards 2011). By the end of 2011, the year after mass LLIN distribution— the number of infected mosquitoes fell to 0% for the first time ever. It is very likely that the effect of the LLINs was synergistic with MDA and helped to interrupt LF transmission completely. GSK is supporting a three-year grant to the malaria and LF program in Plateau state. The project aims to increase both LLIN ownership and use in order to reduce malaria transmission and prevent recrudescence of LF.

Published results from a Bill and Melinda Gates Foundation study in two states in the southeast (Imo and Ebonyi) show that even in the absence of MDA, LLIN could interrupt LF transmission if used for sufficient time (Richards et al., 2013).

Schistosomiasis/STH Control: TCC assists schistosomiasis control in six states (Plateau, Nasarawa, Ebonyi, Edo, Enugu and Delta), providing 2,756,257 praziquantel treatments in 2014 (Figures N6 and N7). TCC receives support for schistosomiasis work from the Izumi Foundation and USAID, and praziquantel is donated through the World Health Organization (WHO) by Merck KGaA (E-Merck), Germany. Double or triple drug administration is used wherever RB and LF MDA programs are also active, but only after one round of stand-alone treatment (i.e. drug administration staggered by at least 2 weeks) has occurred.

In 2014, with support from USAID, surveys for both urinary and intestinal schistosomiasis, as well as STH, were conducted in all TCC-assisted states. Over 100,000 fecal and urine specimens were examined during these surveys. Preliminary results showed that schistosomiasis prevalence was over the 10% threshold for MDA treatment in six of the nine TCC assisted states, while STH was over the 20% threshold for MDA in all nine TCC-assisted states.

In the four endemic states in the southeast, adults and children were treated for schistosomiasis in LGAs with average prevalence of greater than 50%, and school-aged children alone were treated where prevalence exceeded 10%, in accordance with WHO guidelines. In Plateau and Nasarawa states, where average LGA schistosomiasis prevalence did not exceed 50%, treatment was offered to all school-aged children. In

Plateau and Nasarawa, the program is shifting from a community-based LF model toward a school based (schistosomiasis/STH) model. The implications of this transition need to be studied.

As for STH, school children are targeted for treatment in all 9 states, and 7.7 million treatments were given; 858,152 were second-round treatments. Treatments occur twice-per-year in the most highly endemic areas (Figures N8 and N9). Enugu and Ebonyi were unsuccessful in delivering their second round STH treatments because drugs arrived too late for two rounds of treatment in some areas.

2015 RECOMMENDATIONS FOR THE CARTER CENTER RBEP, NIGERIA

Undertake treatment coverage surveys using one of the online tools developed by the Task Force, in close consultation with headquarters.

Conduct training and capacity building in the new expansion areas.

Scale up capacity of Jos lab to serve as a national NTD support lab.

Complete "community census" to ensure that all existing communities are known in the Southeast states we support. Continue working to fine tune denominators of UTG and UTG(2). Ensure treatment of the identified split and new villages (9,088 and 677, respectively).

Plan MDAs so that migrant populations will be in their village of registration when MDA is given.

Lymphatic Filariasis/Malaria:

New LF Malaria FMOH guidelines: Work to scale up and operationalize guidelines in TCC assisted areas, especially with regard to LLIN use, care, and resupply.

Publish results of CDD net monitoring from Kanke LGA.

Expand behavior change communications (BCC) for bed nets into additional LGAs in Plateau and Southeast Nigeria.

Complete malaria survey (postponed from 2014) in 2015.

Complete LF TAS in twenty-six LGAs in Plateau and Nasarawa where MDA was previously halted.

Help scale up LF MDA in SE Nigeria as resources permit, using guidelines appropriate for Loa loa areas, using twice- per- year albendazole monotherapy. Conduct LF mf surveys in sentinel villages (SVs) in Imo and Ebonyi states where albendazole alone is being given to document decrease in microfilaremia under this monotherapy strategy.

Work with University of Notre Dame on mathematical modeling Seri sentinel village.

Onchocerciasis:

Work with federal and state ministries of health in defining and implementing standards for elimination of RB. Encourage FMOH to form an onchocerciasis elimination committee.

Ask the onchocerciasis elimination committee (or another FMOH body responsible for elimination decision making) to determine which additional studies/surveys are needed to allow stopping MDA for RB in Plateau and Nasarawa. The committee should

determine whether these surveys should include border states such as Kaduna. If possible, collect such additional information in 2015 so that MDA might be halted in 2016.

Launch twice-per-year treatment on the Edo-Ondo border in 2015.

Determine and map the limits of onchocerciasis in all hypoendemic LGAs. Map *Loa loa* in untreated LGAs using the blood smears to confirm RAPLOA results to determine where Mectizan MDA can be administered for hypoendemic onchocerciasis or for LF. Determine where onchocerciasis transmission is active through PCR testing of black fly vectors (deployment of new black fly traps) and OV16 surveys.

Encourage FMOH, WHO/APOC, and partner NGDOs to evaluate and treat state cross-border foci in a coordinated manner. This is especially important in Plateau, Nasarawa, Edo and Ondo states.

Work with University of Notre Dame on mathematical modeling of Bayan Dutse sentinel village.

Schistosomiasis/STH:
Obtain the final 'cleaned' data set, and then produce the final report for the USAID/RTI ENVISION-supported integrated mapping for schistosomiasis, STH, trachoma, and *L. loa,* which took place in TCC-assisted states in 2014. Consider publication of these results, especially the analysis of maximum values versus averages, for STH and schistosomiasis.

Assist in providing praziquantel and albendazole to school-age children based on mapping results and WHO guidelines, where resources permit. Work with FMOH to operationalize the WHO guidelines. Consider cost and administrative advantages of treating annually in schools, at certain grade levels, rather than an entire school every other year or every three years, as recommended by WHO.

CDDs are being asked to update community registers and identify non-enrolled eligible children and mobilize them for treatment in schools. A special presentation on the effectiveness of this effort in reaching non-enrolled children will be requested at the next program review.

General
Encourage WHO and the concerned Ministries of Health to evaluate and treat cross-border foci in a coordinated manner.

Encourage partners to revise complex village rollup forms that must be completed by CDDs and health workers that require recording treatment data by gender and age groups.

Programs should collect more information, to share at the next review, on communities with low coverage (as shown on the Likert scale).

Programs should conduct treatment coverage surveys, in consultation with HQ.

Submit drug applications to WHO and MDP as early as possible, and no later than August of the year before the drug is needed, so that drugs arrive by December. This is especially important as programs move to twice-per-year treatments in many areas. Work with national agencies to facilitate appropriate documentation and clearance for all medications. Because drug requests are made well before treatment activities are done, treatment denominators will require adjustment during the treatment year. Keep TCC headquarters copied on all related correspondence.

In African programs, seek to increase training, supervision, involvement of kinship groups, and gender balance among CDDs and community supervisors. Work toward a target ratio of at least 1 CDD:100 people and 1 community supervisor:5 CDDs.

Maintain laboratory support by TCC/RBEP for serology, entomology, and parasitology (including PCR testing in vectors and skin snips) led by University of South Florida (Dr. Thomas Unnasch). In consultation with USF, field laboratories should send samples to USF for quality control purposes.

Through national mechanisms, monitor government and partner financial contributions for elimination efforts in RBEP-assisted areas.

Seek more Lions participation to help maintain program visibility and support wherever possible.

Carter Center program staff must complete or renew the Emory IRB certification if they are to be involved with research programs.

Plateau and Nasarawa States 2015 Objectives:

Treatment Objectives	
RB UTG	**1,909,366**
SCH UTG	**579,075**
STH UTG	**884,211**

Training Objectives:

River Blindness	
CDDs	**5,890**
Community Supervisors	**731**
Health Workers	**408**

Schistosomiasis and Soil Transmitted Helminths	
CDDs	**13,388**
Community Supervisors	**2,678**
Health Workers	**928**
Teachers	**6,762**

Southeast States 2015 Objectives:

Treatments Objectives	
RB UTG	**5,127,859**
LF UTG	**33,069,678**
STH UTG	**9,539,598**
SCH UTG	**252,355**

River Blindness	
CDDs	**26,571**
Community Supervisors	**5,407**
Health Workers	**4,102**

Lymphatic Filariasis	
CDDs	**41,236**
Community Supervisors	**8,458**
Health Workers	**3,824**

Schistosomiasis	
CDDs	**1,700**
Community Supervisors	**340**
Health Workers	**300**
Teachers	**3,917**

Soil Transmitted Helminths	
CDDs	**0**
Community Supervisors	**7,285**
Health Workers	**3,863**
Teachers	**5,440**

Figure N1

Nigeria: Carter Center-Assisted States

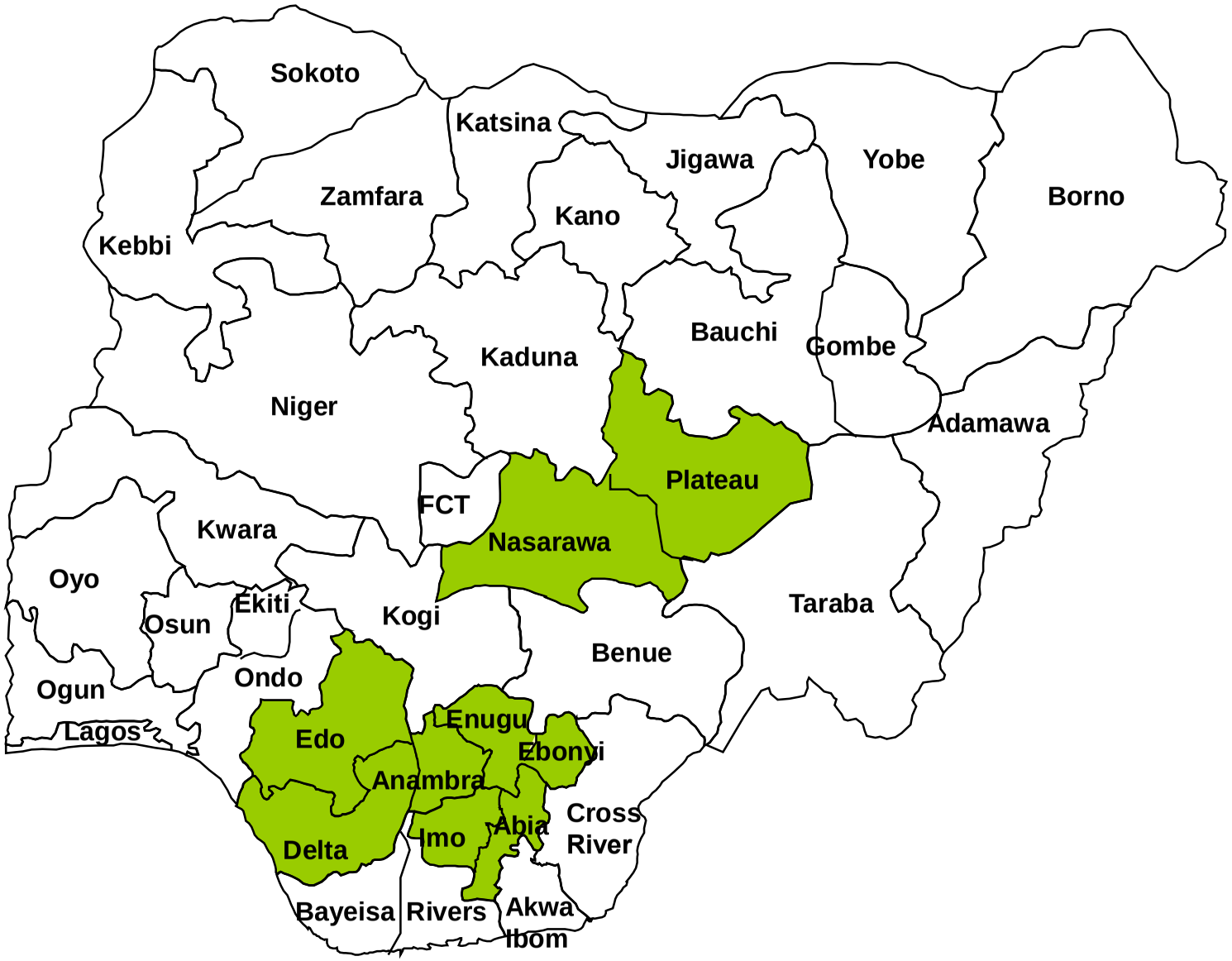


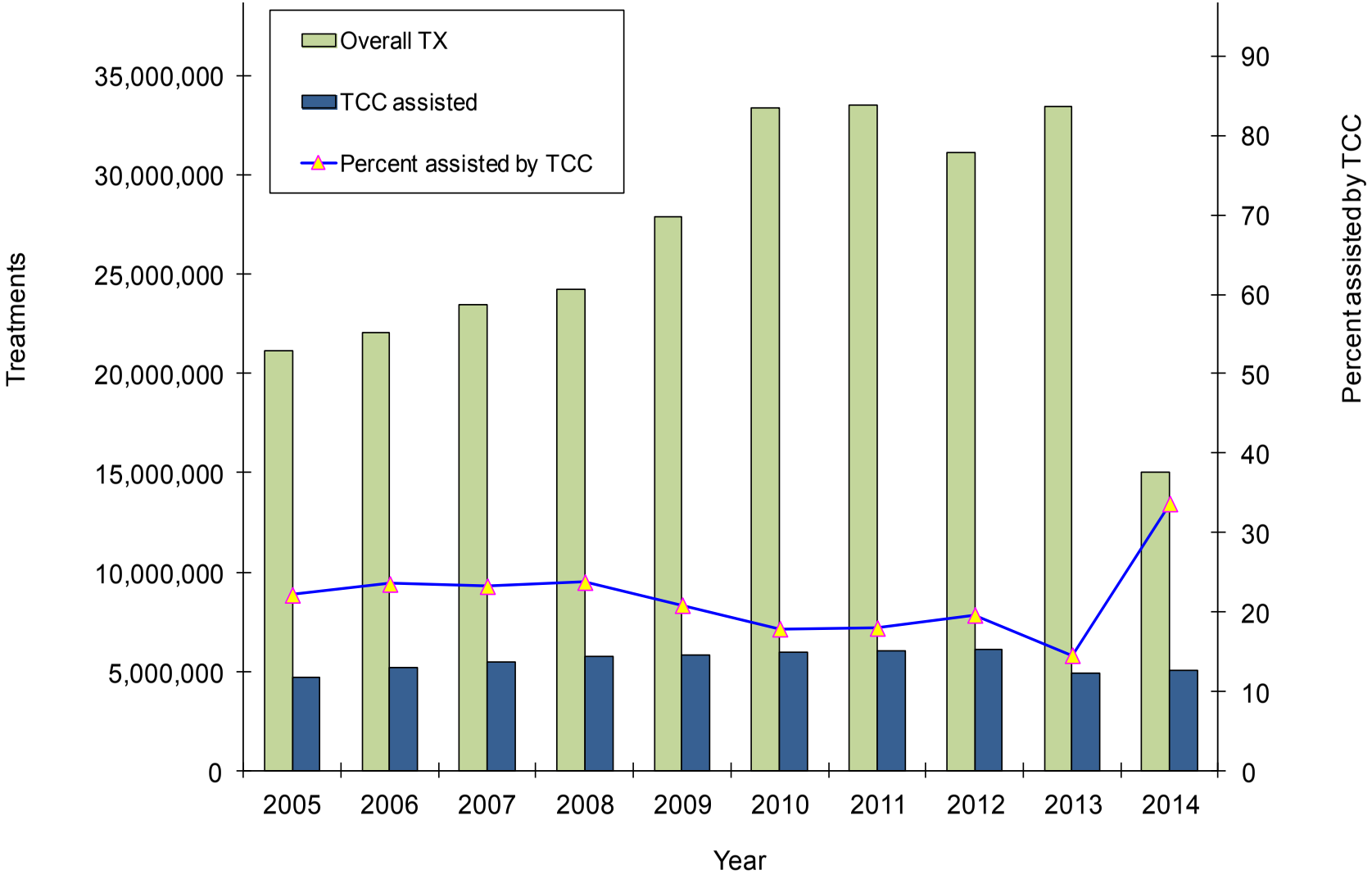
Figure N2

Nigeria: Carter Center-Assisted Areas
2014 River Blindness Treatments

State	Total Popn	Ultimate TX Goal (UTG)	PopnTreated	% of Total Popn Treated	% of UTG Treated	Active villages Treated	Active Villages UTG	% of Active Villages Covered
Enugu	1,122,819	898,255	878,233	78%	98%	4,229	4,229	100%
Anambra	805,073	646,252	645,579	80%	100%	1,669	1,669	100%
Ebonyi	676,809	545,447	544,832	81%	100%	2,369	2,369	100%
Edo	1,439,603	1,151,682	1,151,141	80%	100%	1,345	1,345	100%
Delta	681,536	545,229	544,205	80%	100%	725	725	100%
Imo	964,449	845,559	827,946	86%	98%	3,116	3,134	99%
Abia	563,199	460,559	456,190	81%	99%	1,621	2,193	74%
Plateau	930,889	744,711	691,642	74%	93%	290	296	98%
Nasarawa	1,340,813	1,072,651	1,029,311	77%	96%	589	589	100%
TOTAL	**8,525,190**	**6,910,345**	**6,769,079**	**79%**	**98%**	**15,953**	**16,549**	**96%**

Figure N3

Nigeria: Carter Center-Assisted Treatments and Total Mectizan® Treatments Provided 1992-2014*



* Treatments in TCC areas from 1992-1995 were assisted by RBF. The 2014 national figure is provisional.

Figure N4

Nigeria: Carter Center-Assisted Lymphatic Filariasis Treatments (with Mectizan® and Albendazole) 2000-2014, and 2015 Goal

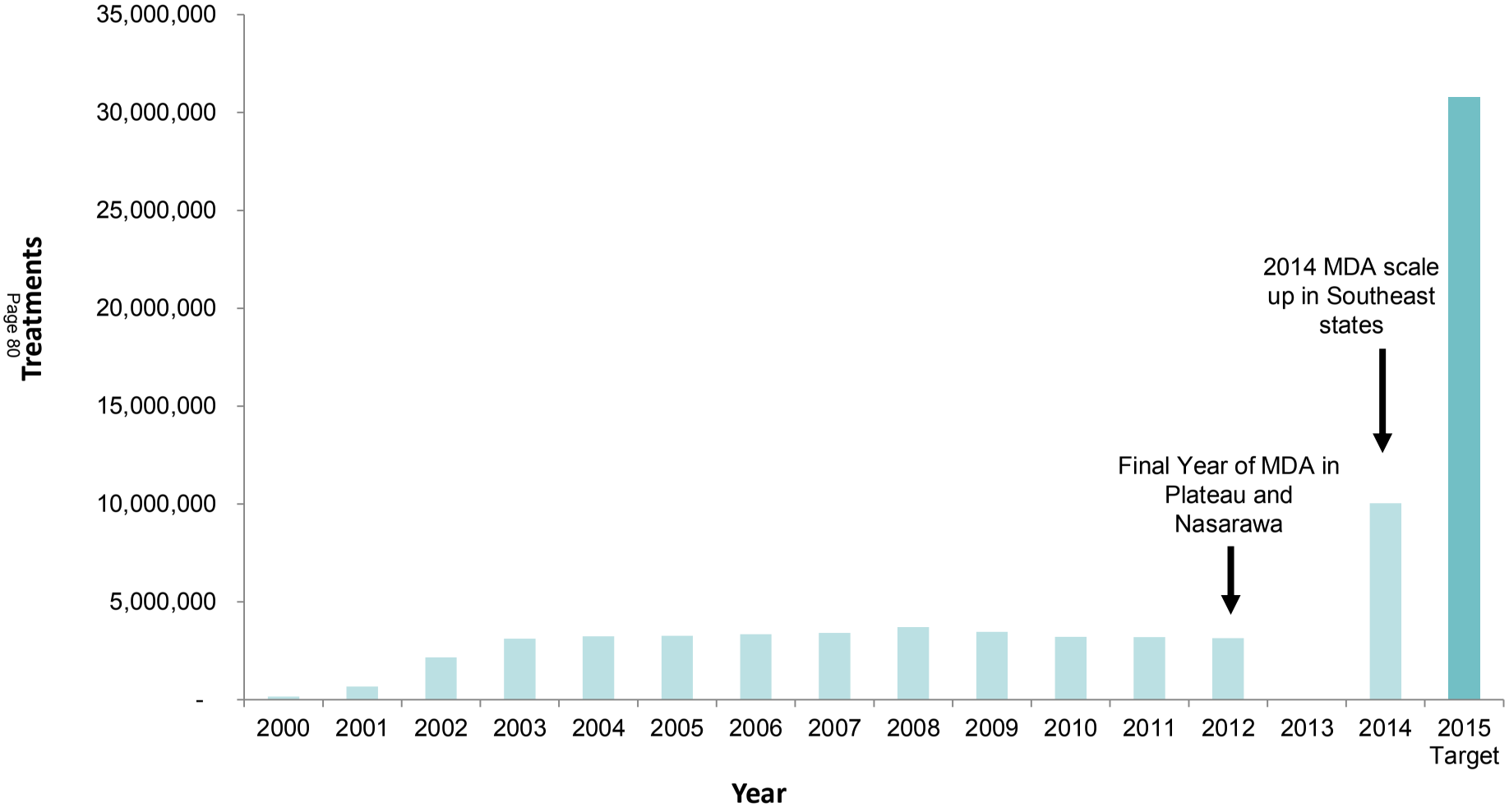


Figure N5

Nigeria: Carter Center-Assisted Areas
2014 Lymphatic Filariasis Treatments

Round 1 and Annual Treatments

State	Total Popn	Ultimate TX Goal (UTG)	Popn Treated Cumulative	% of Total Popn Treated	% of UTG Treated	Active Villages Cumulative	Active Villages UTG	% of Active Villages Covered
Enugu	1,122,819	898,255	878,233	78%	98%	4,229	4,229	100%
Anambra	805,073	646,252	645,579	80%	100%	1,669	1,669	100%
Ebonyi	676,809	545,447	544,832	81%	100%	2,369	2,369	100%
Edo	1,439,603	1,151,682	1,151,141	80%	100%	1,345	1,345	100%
Delta	681,536	545,229	544,205	80%	100%	725	725	100%
Imo	964,449	845,559	827,946	86%	98%	3,116	3,134	99%
Abia	563,199	460,559	456,190	81%	99%	1,621	2,193	**74%**
Plateau	930,889	744,711	691,642	74%	93%	290	296	98%
Nasarawa	1,340,813	1,072,651	1,029,311	77%	96%	589	589	100%
TOTAL	**8,525,190**	**6,910,345**	**6,769,079**	**79%**	**98%**	**15,953**	**16,549**	**96%**

Treatments in Round 2

State	Total Popn	R2 Treatment Objective (ATO)	Popn Treated Cumulative	% of Total Popn Treated	% of ATO Treated	Target Villages Cumulative	Target Villages ATO	% of Target Villages Covered
Imo	222,405	177,924	148,673	67%	84%	140	162	86%
Ebonyi	239,218	191,374	0	0%	0%	0	347	0%
TOTAL	**461,623**	**369,298**	**148,673**	**32%**	**40%**	**140**	**509**	**28%**

Figure N6

Nigeria: 2014 Carter Center-Assisted Schistosomiasis Treatments

State	Annual Treatment Objective (ATO)	Popn treated	% of ATO treated	Target villages treated	Target villages ATO	% of Target villages covered
Delta	264,623	264,370	100%	303	303	100%
Ebonyi	587,360	435,676	74%	1,147	1,690	68%
Edo	376,155	299,794	80%	191	195	98%
Enugu	108,349	67,734	63%	321	382	84%
Plateau	1,084,427	1,074,093	99%	2,561	2,577	99%
Nasarawa	635,662	614,590	97%	1,027	1,067	96%
TOTAL	**3,056,576**	**2,756,257**	**90%**	**5,550**	**6,214**	**89%**

Figure N7

Scale up of Carter Center-Assisted Schistosomiasis Treatments in Nigeria and 2015 Goal

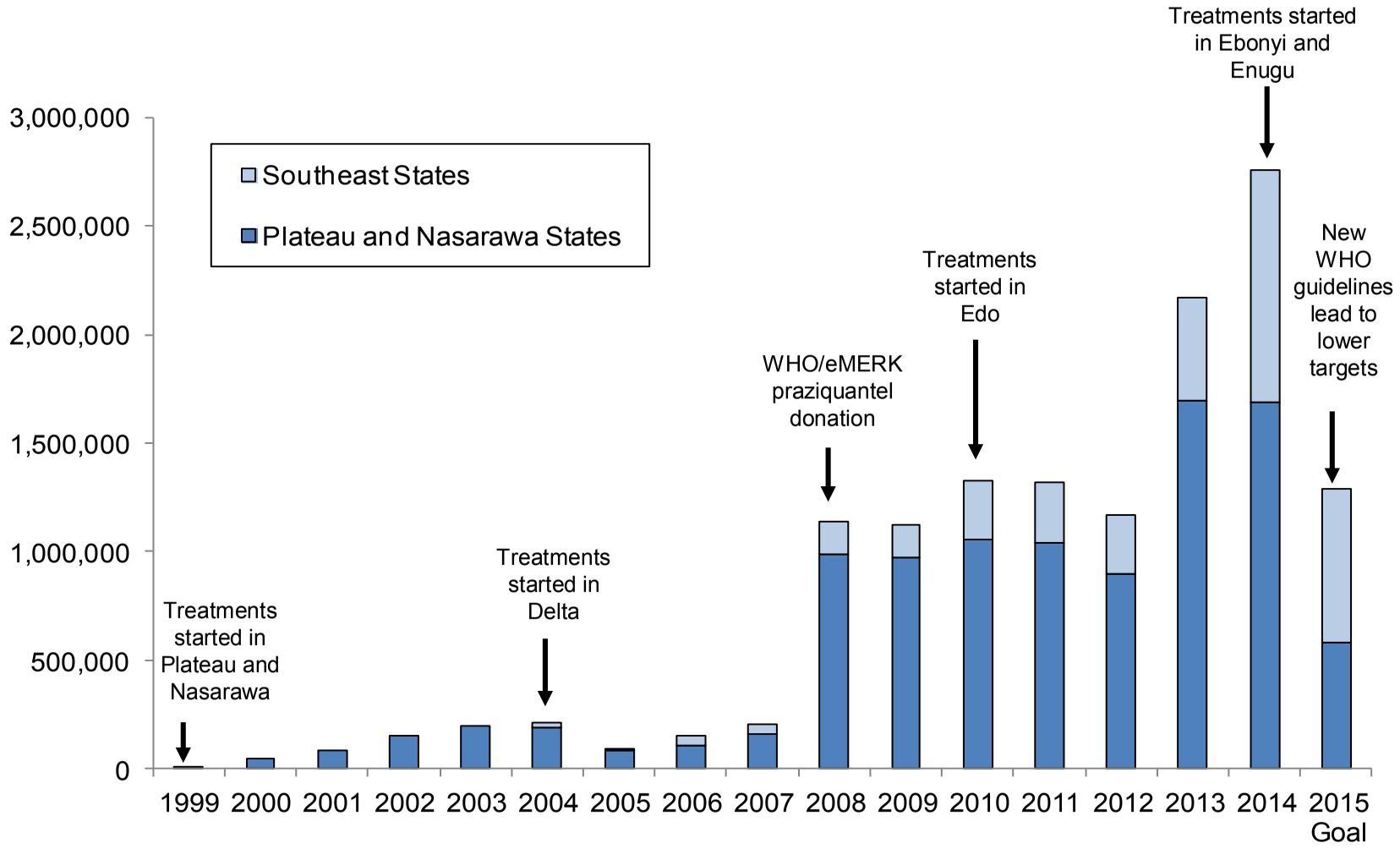


Figure N8

Nigeria: 2014 Carter Center-Assisted Soil Transmitted Helminthiasis Treatments

Round 1 and Annual Treatments

State	Ultimate TX Goal (UTG)	Popn Treated	% of UTG Treated	Target Villages Treated	Target Villages ATO	% of Target Villages Covered
Abia	264,703	265,398	100%	1,669	2,193	76%
Anambra	1,306,746	1,253,117	96%	1,158	1,158	100%
Delta	320,322	146,013	46%	322	619	52%
Ebonyi	968,735	968,735	100%	1,742	1,968	89%
Edo	676,613	646,341	96%	810	820	99%
Enugu	294,583	246,241	84%	1,880	1,943	97%
Imo	2,055,011	1,627,973	79%	4,224	4,467	95%
Nasarawa	635,662	614,590	97%	1,027	1,067	96%
Plateau	1,084,427	1,074,093	99%	2,561	2,577	99%
TOTAL	**7,606,802**	**6,842,501**	**90%**	**15,393**	**16,812**	**92%**

Treatments in Round 2

State	Ultimate TX Goal (UTG)	Popn Treated	% of UTG Treated	Target Villages Treated	Target Villages ATO	% of Target Villages Covered
Abia	68,103	68,100	100%	54	54	100%
Delta	148,376	148,356	100%	335	335	100%
Ebonyi	282,319	0	0%	0	910	0%
Edo	446,499	446,497	100%	556	556	100%
Enugu	38,211	0	0%	0	110	0%
Imo	255,143	195,199	77%	61	61	100%
TOTAL	**1,238,651**	**858,152**	**69%**	**1,006**	**2,026**	**50%**

Figure N9

Soil Transmitted Helminthiasis Treatments, 2013, 2014, and 2015 Goal

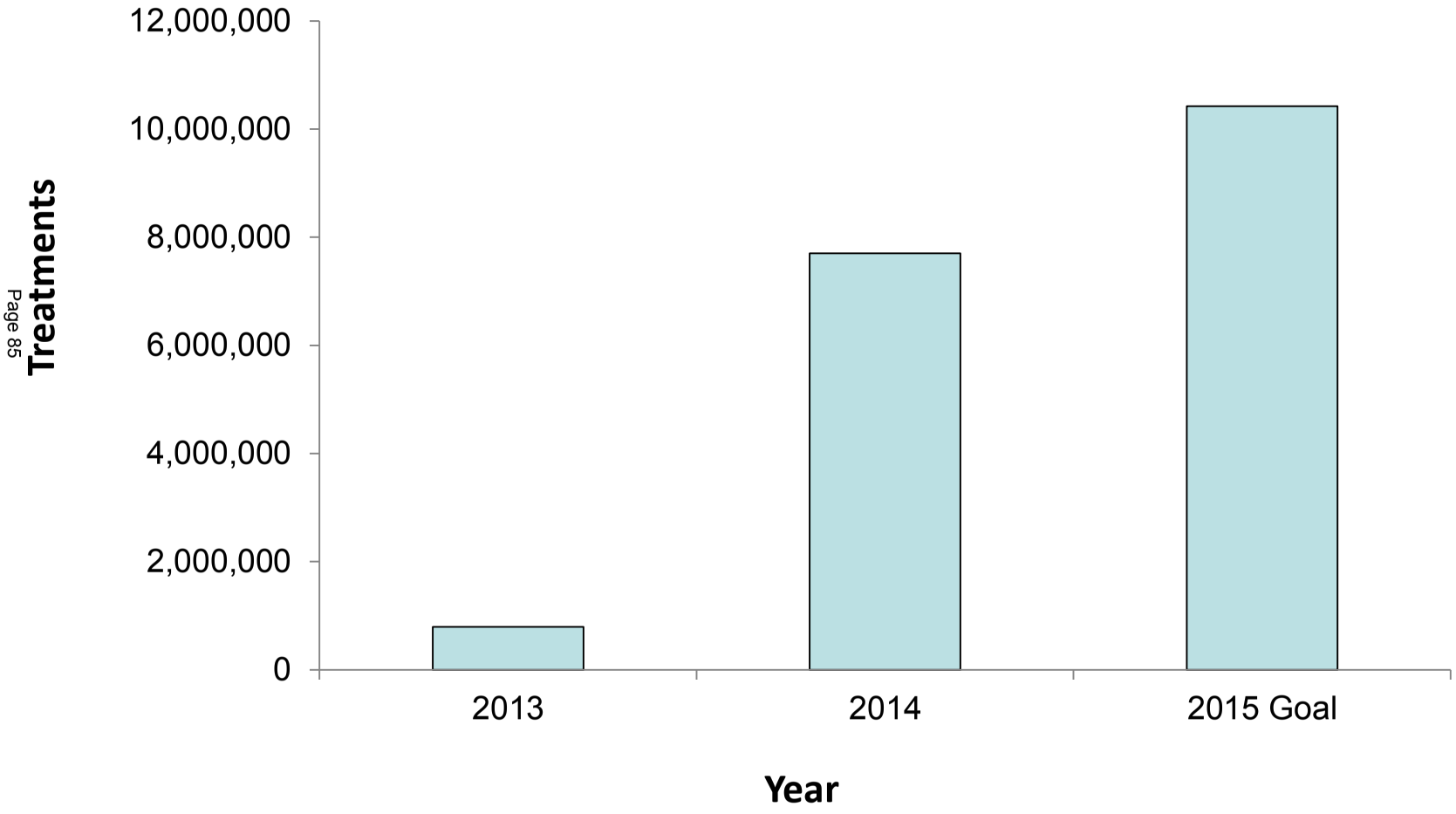
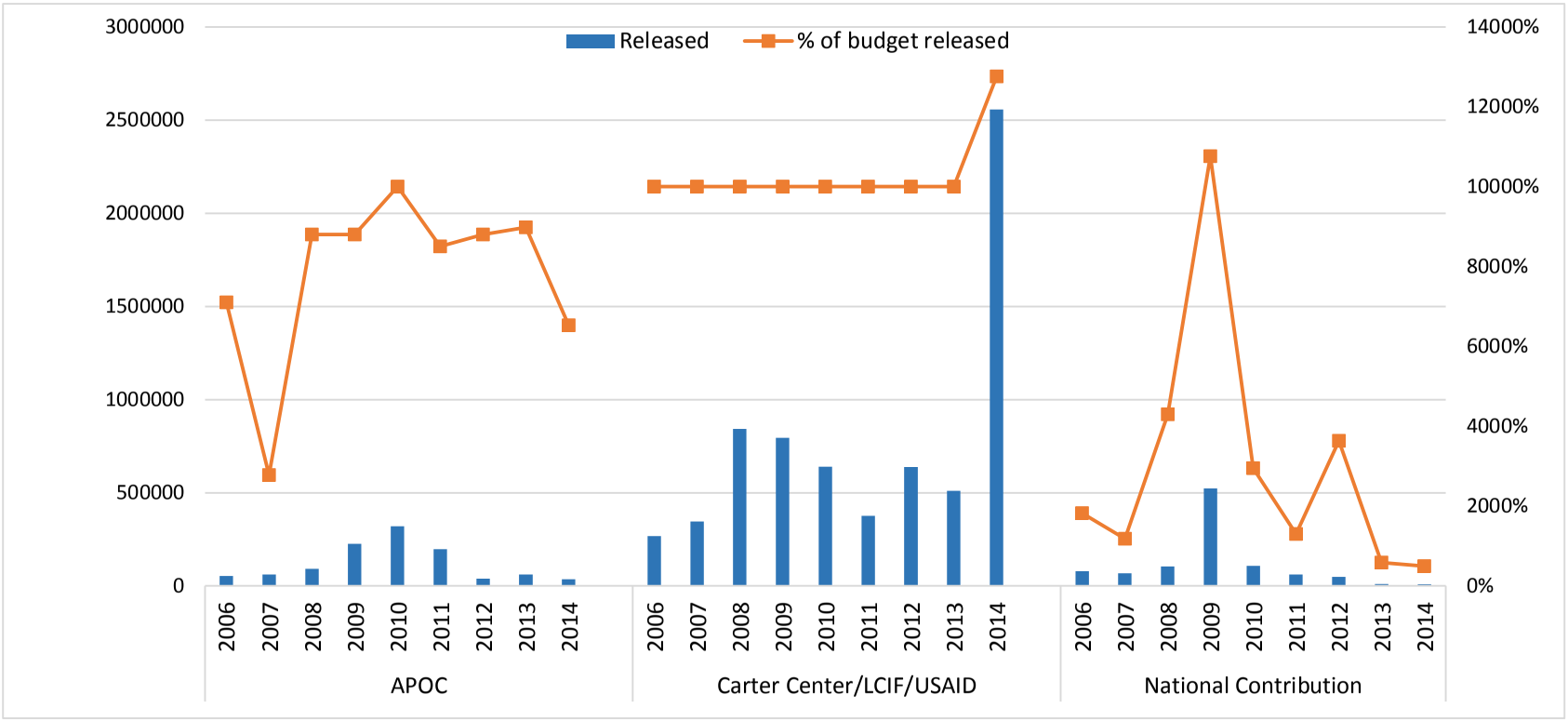


Figure N10

Nigeria: Financial Contribution* to RBEP by Individual Partners in US dollars (2006 – 2014)



* The APOC and government contributions are reported by our Carter Center country representatives based on their best possible determinations from information available in country through the National Onchocerciasis Task Force and other local sources. Capital equipment replacement provided by APOC and government salaries are not considered.

ETHIOPIA

Summary

In 2012 the Federal Ministry of Health (FMOH) of Ethiopia released a new master plan for NTDs that included a change in policy from indefinite RB control to RB elimination by 2020. As part of this policy change, in 2012 with support from Lions and other partners, The Carter Center assisted the MOH to provide almost 4.9 million treatments; a 50% expansion over treatments assisted in 2011. The increase was due to the launching of semi-annual treatments in new, previously unrecognized hyper, meso, and hypoendemic areas bordering old CDTI zones. About 8.5 million treatments were delivered in 2013, representing 3.6 million more treatments than were delivered in 2012, and an increase of 75%. During 2014, the Carter Center assisted a total of 11,068,287 treatments representing a 30% increase from 2013 (Figure A17).

During 2014, the new Carter Center–supported molecular laboratory in the Ethiopia Public Health Institute (EPHI) was renovated and equipped, and lab personnel were trained at the University of South Florida. The lab is expected to be fully operational in 2015.

Further LF mapping of Ethiopia has been done with assistance of the Task Force for Global Health, and an expansion of LF treatment in Carter Center river blindness assisted areas is expected in 2015 along with expanded semi-annual treatment for river blindness largely in new areas.

Background: Ethiopia is the second most populous country in Africa with a population of about 94 million. Onchocerciasis was first reported in southwestern regions in 1939, while the northwestern part of the country was recognized to be endemic in the 1970s. The National Onchocerciasis Task Force (NOTF) was established in 2000, and the African Program for Onchocerciasis Control (APOC) began supporting Rapid Epidemiological Mapping of Onchocerciasis (REMO) in Ethiopia in 2001. This mapping identified and targeted 10 areas where the overall prevalence of onchocerciasis was estimated to be more than 40% (≥20% nodule rate) and thus eligible for APOC's community-directed treatment with ivermectin (CDTI) projects. The Carter Center, Lions Clubs International Foundation, and local Lions Clubs partnered with the FMOH and APOC in 8 of these 10 projects, beginning with Kaffa and Sheka zones in 2001. Since then, the River Blindness Elimination Program has expanded to include Bench-Maji, North Gondar, Illubabor, Jimma, Metekel and Gambella (Figure E1).

In 2014, financial support from the Lions Clubs International Foundation, and the Margaret A. Cargill Foundation, and the Alwaleed bin Talal Foundation provided renewed financial support to the Ethiopia effort, which contributed to the geographic expansion of semi-annual treatments with ivermectin through the river blindness elimination program. Members of Lions Clubs District 411-A play an important role in both The River Blindness and Trachoma Control Programs in the Lions-Carter Center SightFirst project areas of Ethiopia. The Carter Center also is grateful for the generous support of the Alwaleed Bin Talal Foundation and other partners to this effort.

Expert Advisory Committee for National Onchocerciasis Elimination: The Ethiopia Onchocerciasis Elimination Expert Advisory Committee (EOEEAC), an official advisory group to the Federal Ministry of Health of Ethiopia (FMOH), held its first meeting in Addis Ababa on October 6-8, 2014. The Honorable Minister of State for Health Dr. Kebede Worku presided over the meeting during the first day, and opening addresses were made by Dr Pierre M'Pele-Kilebou (WHO Representative) and the Honorable World Lauriat Dr. Tebebe Berhan (Lions). The EOEEAC becomes the second national expert advisory committee for onchocerciasis elimination in Africa after Uganda. The EOEEAC, which is composed of national and international experts, is tasked with providing the FMOH with a road map to nationwide interruption of onchocerciaisis transmission by 2020, with WHO verification as a goal shortly thereafter. Dr. Mark Eberhard, former director, Division of Parasitic Diseases and Malaria, CDC, was elected chairperson. Mr. Oumer Shafi, FMOH and Dr. Zerihun Tadesse, Country Representative of The Carter Center, are Co-Secretaries of the committee. The key outcomes of the inaugural meeting were that: a) Ethiopia will have guidelines that use the roadmap phases outlined in the World Health Organization (WHO) Geneva 2001/2013 onchocerciasis elimination guidelines; b) the program should institute twice per year MDA in all newly discovered and untreated active transmission areas; and c) the program should switch from annual to twice per year treatments in all treated areas where slow progress will preclude reaching the 2020 goal. The committee also recommended that national mapping be completed as rapidly as possible to determine other undiscovered or unrecognized areas of active onchocerciasis transmission so that these can be placed on MDA as quickly as possible.

Expansion of Semi-annual treatments: In 2013, The Carter Center-assisted RB program consolidated the transition from annual to semi-annual treatments that began in 2012 in some areas of Illubabor, Jimma and North Gondar zones, as well as in Kaffa, Sheka and Bench-Maji zones. In 2014, this expansion continued in new areas of Illubabor, Jimma, North Gondar, Metekel and Gambella (Figures E1 and E2).

Treatments: During 2014, a total of 1,954,621 people received annual treatments, while 9,113,666 treatments were given semi-annually., thus the total number of treatments provided in 2014 was 11,068,287. As in 2013, Ethiopia continued to be the largest Carter Center RBEP-assisted treatment program in 2014. Annual treatments were delivered in 10,115 communities and semi-annual treatments in 24,352, covering a total of 34,601 communities. Annual treatments covered reached 98% of UTG and semi-annual treatments reached 99.1% of the UTG(2), with geographic coverage at 100% of targeted villages (Figures E3 and E4). Carter Center-assisted treatments represented 88.3% of all treatments given in Ethiopia in 2013 (Figure E5), up from 76% in 2012.

Training and Health Education: Training was provided to 137,737 community-directed distributors (CDDs) in 2014 (Figure E6); this was an increase of 50,101 trained CDDs (57%) over 2013. The percent of female CDDs showed a substantial increase, from from 46% in 2013 to 50.5% in 2014, continuing the trend begun in 2012 (Figure E7). Bench Maji, Jima, Kaffa, Illubabor, North Gondar, and Sheka reached ratios of better than the target of 1 CDD per 100 population, with the ratio of CDDs per population improved from 1 CDD per 70 population in 2013 to 1:57 in 2014.

A total of 26,933 community supervisors were trained in 2014, overseeing an average of 5 CDDs each, compared to 7 CDDs per supervisor in 2013. The proportion of female community supervisors who are women increased from 32% in 2013 to 47% in 2014.

Financial Contribution: Carter Center 2014 contributions (that include key funding from the Lions Clubs International Foundation, the Margaret A. Cargill Foundation, the Alwaleed Bin Talal Foundation, and individual donors to The Carter Center) continued at a stable level. The figure shown for the government investment in the program dramatically decreased because it does not include funding provided for activities (as this was not reported); only salary figures were available (Figure E8).

Lymphatic Filariasis (LF): The LF program in Ethiopia began in 2008 with the support of GSK support for surveys in zones in western Ethiopia. Co-endemicity of LF in Carter Center-assisted onchocerciasis areas was found in several woredas and, in 2009, GSK supported a pilot project to build LF treatments on the existing RB program in Gambella region, providing roughly 75,000 treatments. In 2012, with further support from GSK, treatments expanded to LF RB co-endemic woredas in Bench Maji, Metekel, and North Gondar zones, increasing the UTG nearly 10 fold. In 2014, a total of 882,704 LF treatments were given, for 96.8% of the UTG of 912,044. As the RB program expands into new areas, co-endemicity with LF needs to be determined to adjust treatment regimens to include albendazole (Figure E9).

Other Integration: In the North Gondar zone (Amhara region) the RB LF integrated program works with Carter Center-assisted trachoma control activities.

2015 RECOMMENDATIONS FOR THE CARTER CENTER RBEP, ETHIOPIA

Onchocerciasis

Conduct extensive training and capacity building in the new expansion areas.
Delineate onchocerciasis transmission zones in all endemic zones.

Complete impact assessments in the old CDTI areas of Jimma, Metekel, and Gambella zones. Determine from these impact assessments where annual strategies should shift to twice per-year treatments. Continue twice-per-year treatments in all the assisted areas where it has already been established.

Launch twice-per-year treatment in 2015, in the proposed expansion zones of Awi, East and West Gojjam, Dawuro and Konta zones, and any new expansion woredas of zones already under treatment as well as old CDTI areas where transmission is continuing.
Conduct baseline surveys in new expansion zones and previously untreated areas.

Continue river prospection in all assisted zones in order to identify river systems responsible for black fly breeding and onchocerciasis transmission.

Expand the use of black fly traps in all identified fly collection sites in old and new transmission zones.

As resources allow, continue mapping of the eastern extent of river blindness in Ethiopia.

Complete lab analysis of the large backlog of blood spots and black flies in time for the 2015 EOEEAC meeting.

With assistance from the UCSF lab, conduct cytotaxonomy of the flies to identify the existing sub-species in delineated transmission zones.

Provide financial and administrative support for the 2015 EOEEAC meeting.

Complete surveys on the border of Ethiopia (in Metema) and Sudan (in Galabat) in order for the EOEEAC to ascertain if a recommendation can be made to the FMOH that MDA can be halted there.

Lymphatic Filariasis

Continue integrating LF activities with Onchocerciasis in all co-endemic project zones.

Publish results of sentinel villages work demonstrating LF infection (nocturnal microfilaremia) rates of up to 11% in areas treated for years with ivermectin for onchocerciasis (these results are of great international interest).

Add albendazole to Mectizan where TCC assists, and where RB and LF are co-endemic.

Conduct Transmission Assessment Survey in Gambella.

Establish sentinel villages in new LF districts.

General

Encourage WHO and the concerned Ministries of Health to evaluate and treat cross border foci in a coordinated manner.

Encourage partners to revise complex village rollup forms that must be completed by CDDs and health workers that require recording treatment data by gender and age groups.

Programs should collect more information, to share at the next review, on communities with low coverage (as shown on the Likert scale).

Programs should conduct treatment coverage surveys, in consultation with HQ.

Submit drug applications to WHO and MDP as early as possible, and no later than August of the year before the drug is needed, so that drugs arrive by December. This is especially important as programs move to twice-per-year treatments in many areas. Work with national agencies to facilitate appropriate documentation and clearance for all medications. Because drug requests are made well before treatment activities are done, treatment denominators will require adjustment during the treatment year. Keep TCC headquarters copied on all related correspondence.

In African programs, seek to increase training, supervision, involvement of kinship groups, and gender balance among CDDs and community supervisors. Work toward a target ratio of at least 1 CDD:100 people and 1 community supervisor:5 CDDs.

Maintain laboratory support by TCC/RBEP for serology, entomology, and parasitology (including PCR testing in vectors and skin snips) led by University of Southern Florida (Dr. Thomas Unnasch). In consultation with USF, field laboratories should send samples to USF for quality control purposes.

Through national mechanisms, monitor government and partner financial contributions for elimination efforts in RBEP-assisted areas.

Seek more Lions participation to help maintain program visibility and support wherever possible.

Carter Center program staff must complete or renew the Emory IRB certification if they are to be involved with research programs.

Treatment Objectives for 2015:

River Blindness	
Annual UTG	**568,100**
Semiannual UTG(2)	**14,163,262**

Lymphatic Filariasis	
UTG	**1,106,582**

Training Objectives	
CDDs	**167,211**
Community Supervisors	**55,736**
Health Workers	**6,880**

Figure E1

Ethiopia: Carter Center-Assisted CDTI Projects

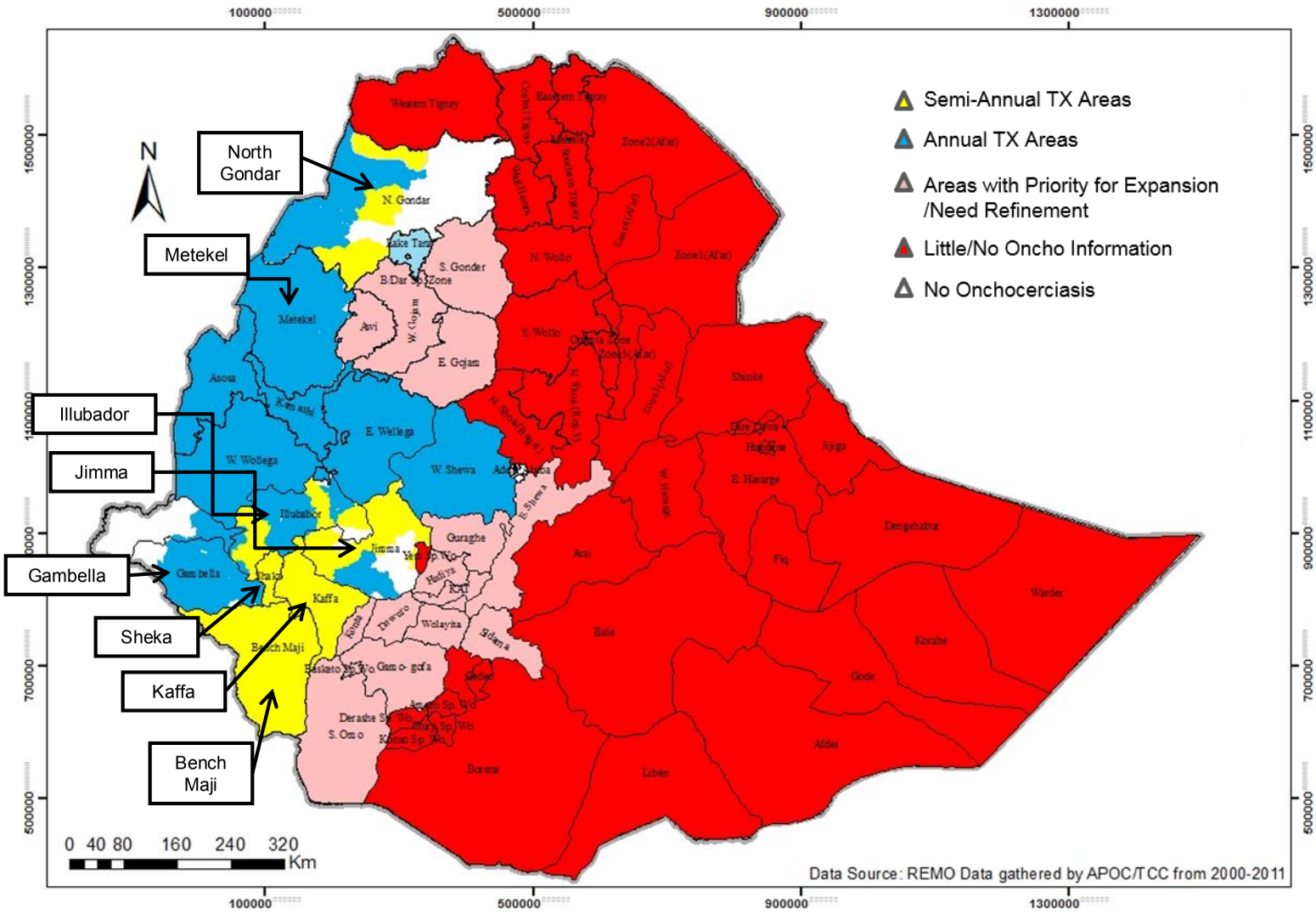


Figure E2

Ethiopia: Carter Center-Assisted CDTI Projects in 2014

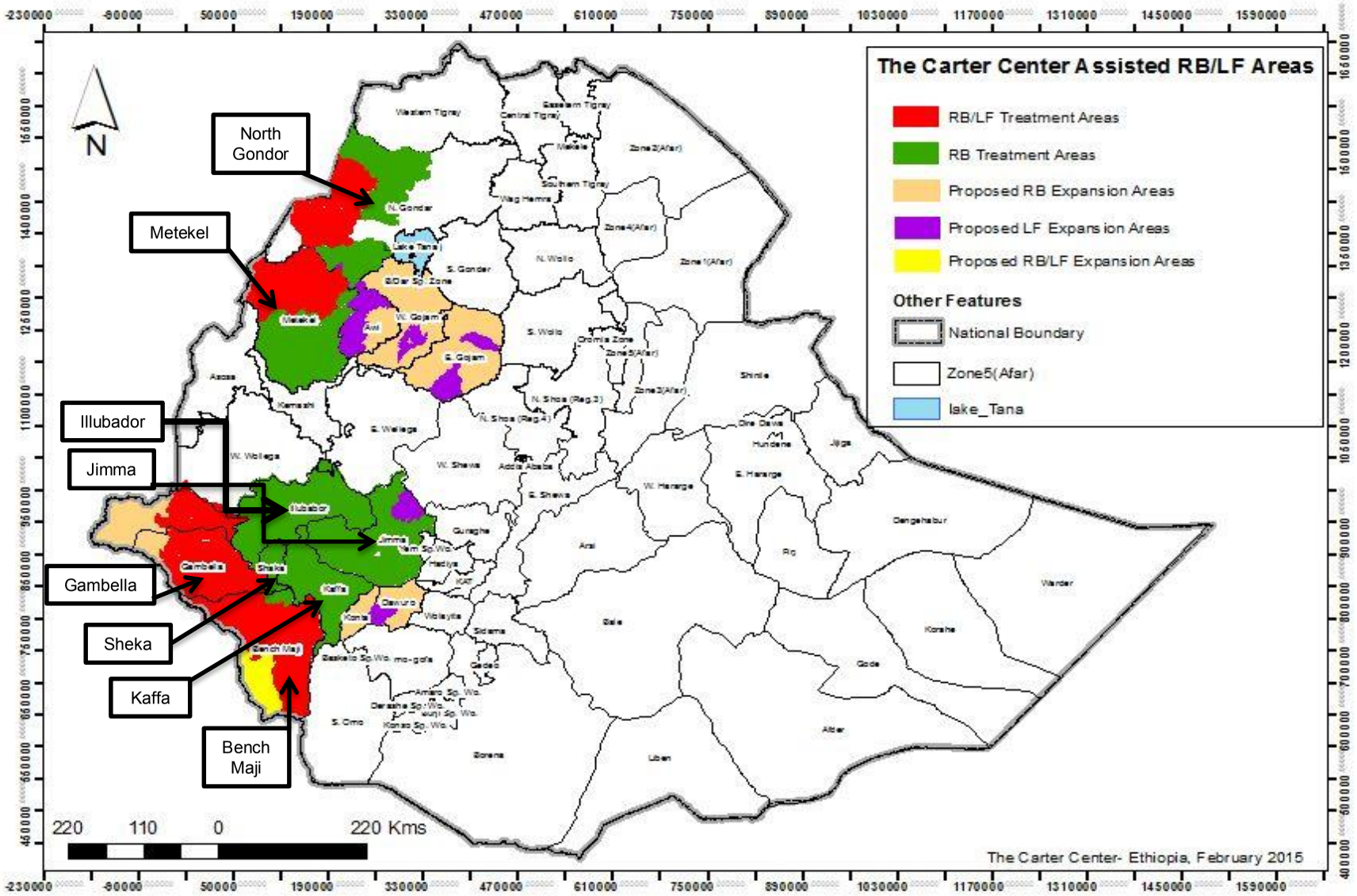


Figure E3

Ethiopia: 2014 Carter Center-Assisted Annual River Blindness Treatments

Zone	Total Population	Ultimate TX Goal (UTG)	Popn treated cumulative	Total Popn TX %	Popn TX % of UTG	Active Villages Treated Cumulative	Active Villages UTG	% of Active Villages Covered
N. Gondar	366,608	307,951	305,043	83.2	99.1	827	827	100
Illubabor	793,702	666,710	655,473	82.6	98.3	4,067	4,067	100
Jimma	908,109	762,812	753,345	83	98.8	4,399	4,399	100
Metekel	181,873	152,773	152,290	83.7	99.7	405	405	100
Gambella	122,280	102,715	88,470	72.4	86.1	417	417	100
Total	**2,372,572**	**1,992,961**	**1,954,621**	**82.4**	**98**	**10,115**	**10,115**	**100**

Figure E4

Ethiopia: 2014 Carter Center-Assisted <u>Semi-Annual</u> River Blindness Treatments

Zone	Total Population	Ultimate Tx Goal (2) [UTG (2)]	Treatments Round 1	Treatments Round 2	Cumulative Treatments (Rds 1 & 2)	Total TX % of UTG (2) for 2014	Active Villages Cumulative for 2014		Active villages UTG for 2014	Active Villages % for UTG 2014	
							Round 1	Round 2		Round 1	Round 2
Kaffa	1,069,890	1,797,415	884,825	920,216	1,805,041	100.4	4,194	5,443	4,194	98.6	100
Sheka	221,487	372,098	180,151	181,255	361,406	97.1	1,292	1,280	1,292	98.5	100
Bench-Maji	784,466	1,317,903	644,632	673,345	1,317,977	100.0	3,121	2,809	3,121	100	100
North Gondar	329,733	553,951	269,399	280,333	549,732	99.2	759	759	759	100	100
Illubabor	725,134	1,218,225	587,917	591,988	1,179,905	96.9	3,893	3,882	3,893	99	100
Jimma	2,089,823	3,510,903	1,714,808	1,756,850	3,471,658	98.9	10,477	10,511	10,477	100	100
Metekel	177,417	298,061	142,522	173,110	315,632	105.9	471	489	471	100	100
Gambella	64,453	108,281	53,872	58,443	112,315	89.9	145	157	145	100	100
Total	**5,462,403**	**9,176,837**	**4,478,126**	**4,635,540**	**9,113,666**	**99.1**	**24,352**	**25,330**	**24,352**	**99.6**	**100**

Figure E5

Ethiopia: Carter Center-Assisted Mectizan® Treatments as Percentage of Total Treatments Provided, 2001-2014

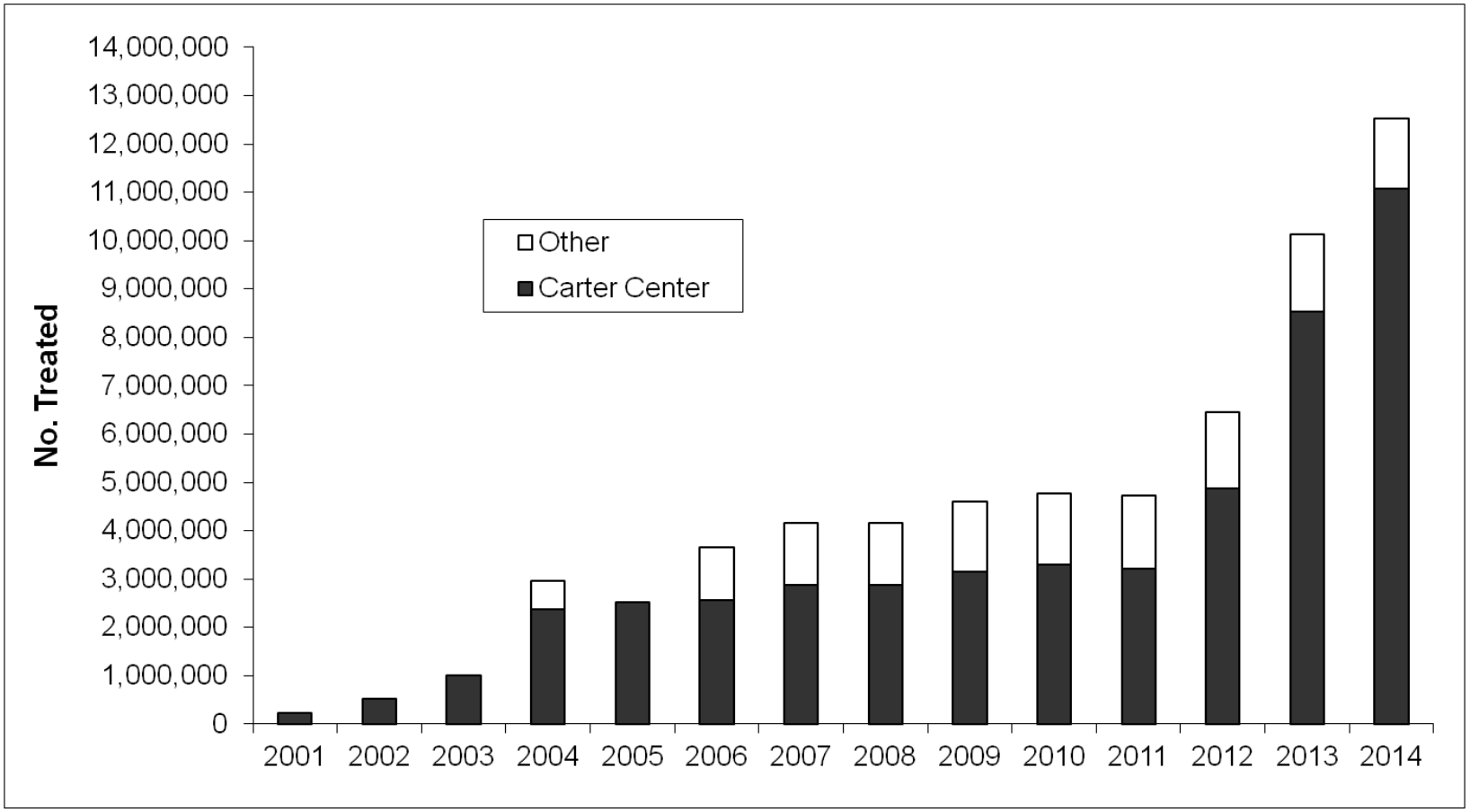


Figure E6

Ethiopia: Community Directed Distributors (CDDs) and Community Supervisors (CSs) Trained (2004 - 2013)

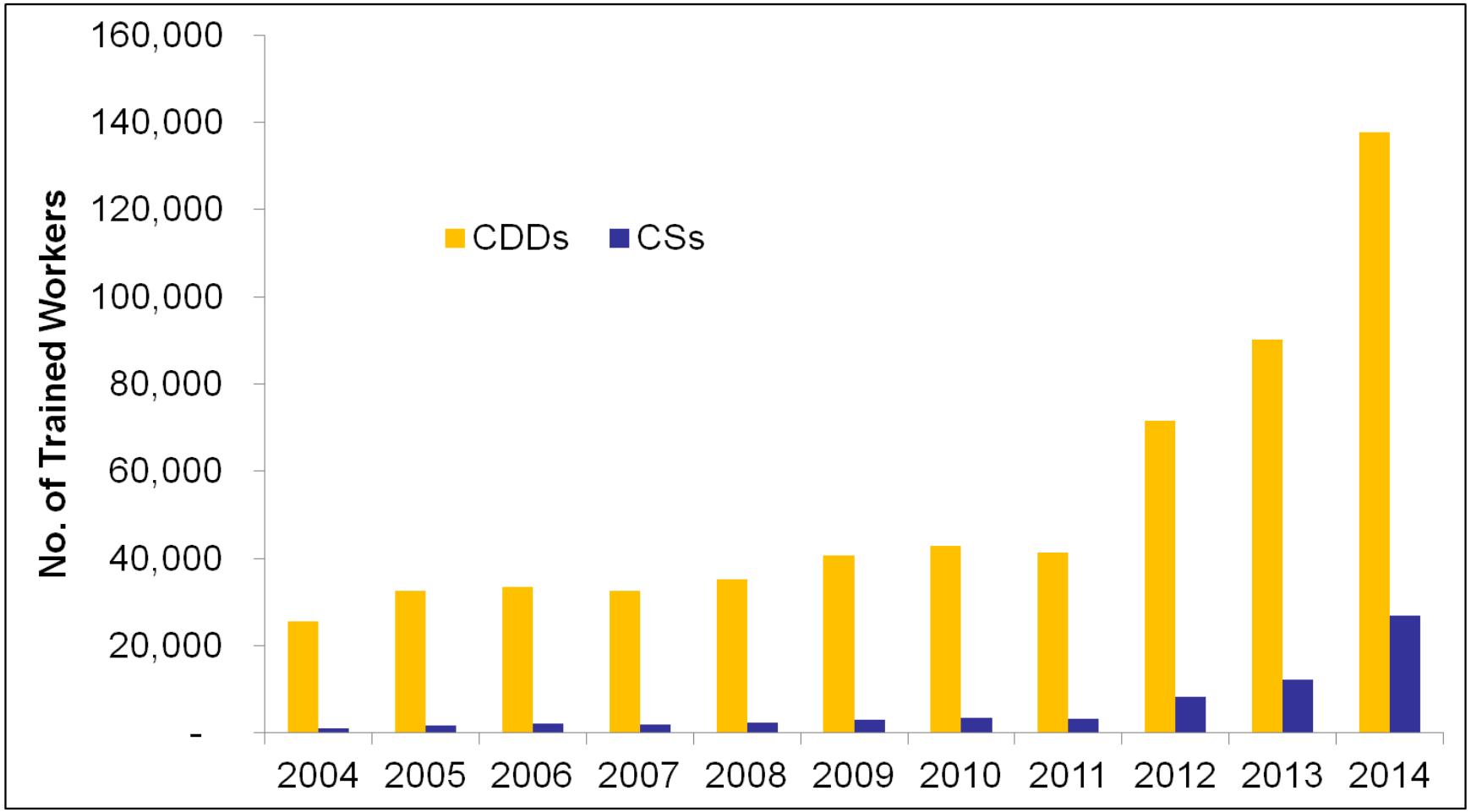


Figure E7

Ethiopia: CDD Gender Breakdown 2001 - 2014

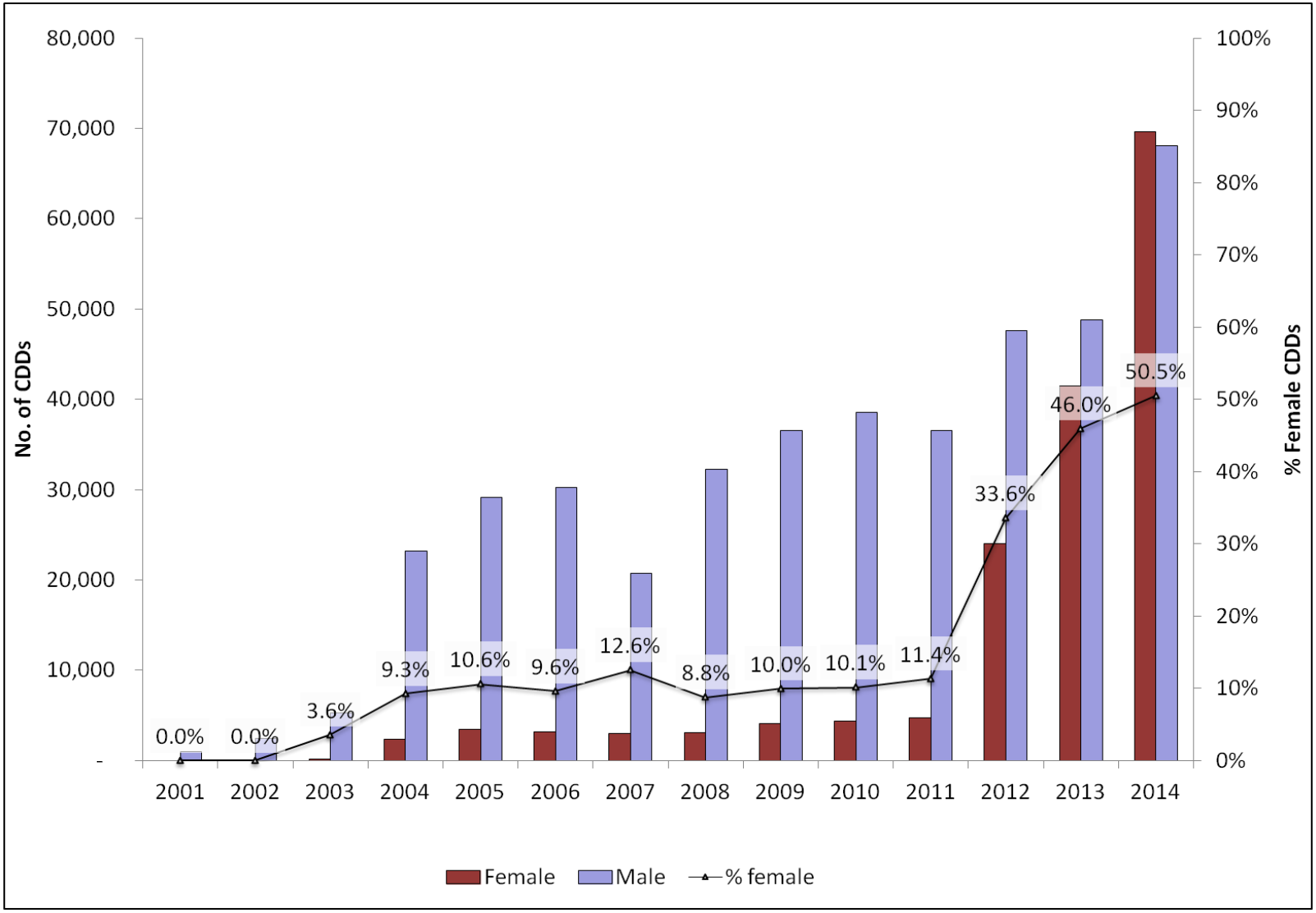
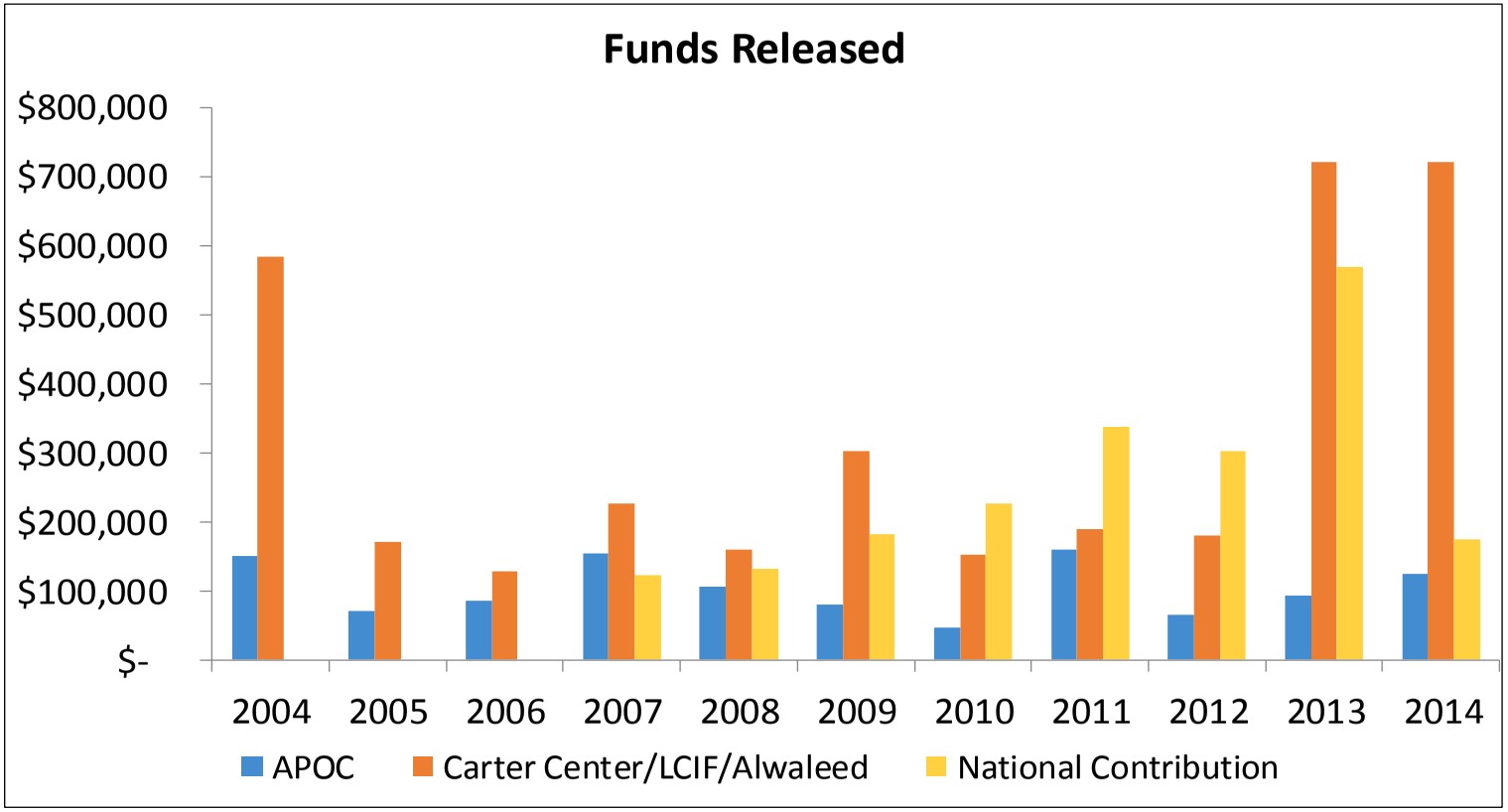


Figure E8

Ethiopia: Financial Contribution by Different Partners 2004 - 2014

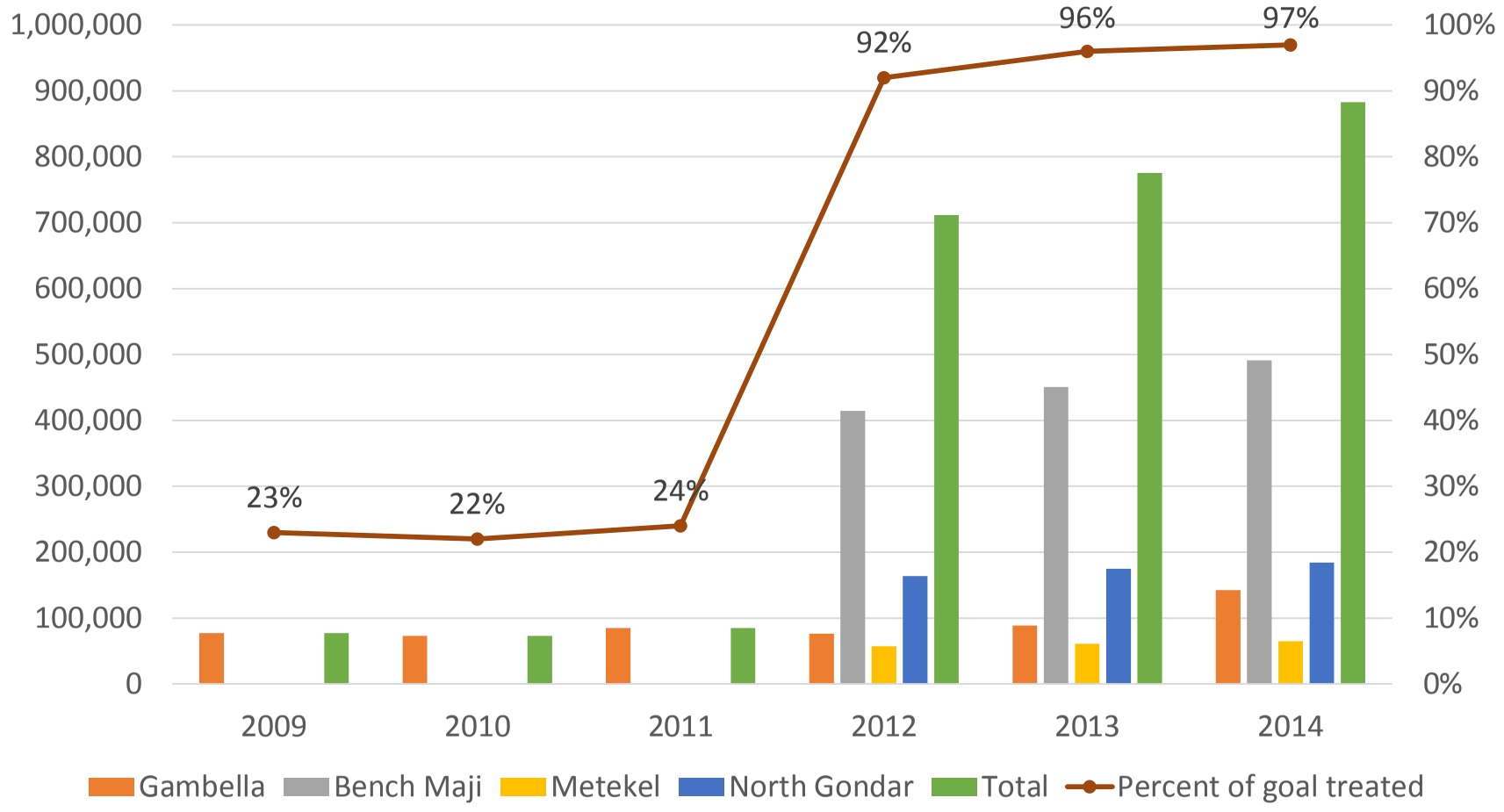


1. The APOC and government contributions are reported by our Carter Center country representatives based on their best possible determinations from information available in country through the National Onchocerciasis Task Force and other local sources. Capital equipment replacement provided by APOC and government salaries are not considered.

2. Actual Cash contribution by Government to program implementation is not available. The graphic above only shows Staff salaries.

Figure E9

Lymphatic Filariasis Treatments in Ethiopia by Region and Year 2009 to 2014



ANNEX 1: A Timeline of the River Blindness Campaign at the Carter Center

- **1996:** The Carter Center assumed activities of the River Blindness Foundation and began assisting RB programs in the Americas, Nigeria, Cameroon, Sudan and Uganda. Ethiopia started in 2001.
- **1998:** Richards, with other TCC authors (Miri and Sauerbrey) writes about opportunities for RB elimination in a special edition of the Bulletin of WHO entitled "Global Disease Elimination and Eradication as Public Health Strategies". He also writes about the history of the launching of the OEPA initiative (Bull PAHO).
- **2000:** OEPA needed a 'definition of success' endorsed by WHO; with a push from President Carter, WHO agreed to hold an important meeting to establish certification criteria for onchocerciasis elimination (WHO 2001). These guidelines remain a key milestone and are used by OEPA and the Uganda program. Richards, writing in *Lancet*, notes the importance of the LF program in advancing the RB elimination agenda.
- **2002:** Carter Center and WHO (with Gates Foundation support) co-hosted the Conference on RB Eradicability that concluded RB can be eliminated in the Americas but not yet throughout Africa with current tools (ivermectin alone). The challenge was noted of the parasite *Loa loa*, which occurs in some areas that have RB: ivermectin given to a person having *Loa loa* infection can result in severe nervous system reactions, including coma. (Dadzie 2003)
- **2003:** Richards coauthors a paper on mass treatment decision making in *Loa loa* areas where onchocerciasis occurs. (Addis 2003)
- **2005:** Paper published by Hopkins, Richards, and Katabarwa ("Whither Onchocerciasis Control in Africa?") challenges feasibility of indefinite RB control in Africa without continued external support. Calls for governments to do more to fund their programs, and calls for further research into RB elimination in Africa. (Hopkins 2005)
- **2006:** TCC agrees to assist Sudan in elimination efforts in the Abu Hamad focus on the River Nile. (Higazi 2011, 2013)
- **2007:** TCC's ITFDE reviews RB eradicability and notes evidence that ivermectin alone may interrupt transmission in Africa, but that the challenge of *Loa loa* is not resolved. (WHO 2007). TCC/RBP agrees to assist Uganda in its new goal of national RB elimination.
- **2009:** A key WHO/TDR study by Diawara (2009) that was conducted in Senegal and Mali with Gates Foundation support (derived as an outcome of the 2001 Conference on Eradicability) proves RB elimination is possible with 17 years of ivermectin alone under some conditions in Africa. Gates, MDP, TCC and APOC all call for "Shrinking the Map" in Africa (WHO 2009). Rakers (TCC staff) reports that RB programs in Nigeria would collapse without external support, questioning the 'sustainability' theory.
- **2010:** TCC reports considerable success in RB elimination efforts in the Americas (series of *Weekly Epidemiological Record* articles) and parts of Africa. However, Katabarwa (TCC/RBP staff) notes a need to expand treatment into the so-called hypoendemic areas excluded by APOC's treatment strategies. He also challenges the Diawara report by noting failures of once-per-year treatment with ivermectin alone for

17 years in TCC-assisted North Province, Cameroon; TCC calls for twice-per-year treatment in these areas (Katabarwa 2011). At an international conference TCC reports an analysis of the impact of annual ivermectin and albendazole (for lymphatic filariasis) on onchocerciasis transmission elimination in many areas of Plateau and Nasarawa States of Nigeria.

- **2011:** TCC's International Task Force for Disease Eradication reviews the RB and LF elimination efforts in Africa, applauds the move by APOC from RB control to elimination, and calls for better coordination of RB and LF interventions as well as with malaria bed net distribution efforts (*Weekly Epidemiological Record* 2011). An expert committee (with Frank Richards, the TCC RBP Director, as a member), meeting under the auspices of the World Bank, recommends an elimination goal for ten African countries by 2020, including Nigeria, Uganda, and Ethiopia. In late 2012, the World Bank/APOC governing board recommends onchocerciasis elimination now be APOCs goal.
- **2012:** Sudan announces interruption of transmission in Abu Hamad focus (Higazi 2013). TCC's River Blindness Program obtained Board of Trustees' approval for an eight-year plan to interrupt RB transmission everywhere we assist, by 2020. WHO sends verification team to Colombia to determine if the country has eliminated onchocerciasis.
- **2013:** The name of TCC's River Blindness Program was changed to The Carter Center's River Blindness Elimination Program (RBEP) to reflect the paradigm shift to focusing efforts on eliminating RB transmission everywhere we work. Colombia is the first country in the world verified by WHO to be free of onchocerciasis. Ecuador applies to WHO for verification of elimination.
- **2014:** WHO sends verification team to Ecuador to determine if the country has eliminated onchocerciasis. ITFDE reviews RB/LF in Africa again. Published in WER.
- **2015:** WHO verifies that Ecuador has eliminated onchocerciasis, and sends verification team to Mexico to determine if that country has as well.

ANNEX 2: The Carter Center RBEP Reporting Processes and Research Agenda

At-risk Villages (ARVS): An epidemiological mapping exercise was a prerequisite to identifying at-risk villages (ARVS) for mass Mectizan® treatment programs. The assessment techniques used in the mapping exercise in Africa varied from those used in the Americas. An overview of the two approaches follows.

In much of Africa, a staged village sampling scheme called Rapid Epidemiological Mapping of Onchocerciasis (REMO) was executed with assistance from WHO to define endemic "zones" that should capture most or all villages having onchocercal nodule rates ≥20% in adults (which roughly corresponds to a microfilariae in skin prevalence ≥40%) for mass treatment. The mapping strategy is based on studies that have shown that most ocular and dermal morbidity from onchocerciasis occurs in villages where the nodule prevalence exceeds 20%. In the first stage of REMO, survey villages are selected based on a review of large-scale maps of areas that appear to be environmentally able to support black fly breeding and, therefore, transmission of *O. volvulus*. In the second stage, the survey villages are visited by field teams and a convenience sample of 30-50 adults are examined (by palpation) for characteristic onchocercal nodules. The mean nodule prevalence for each village sample is mapped (often using geographic information systems) and the map is used to define endemic zones called 'community directed treatment with ivermectin (CDTI) treatment zones.' These zones typically are defined by sample villages having nodule prevalence of ≥20 %. All villages within the CDTI treatment zone are offered mass Mectizan® treatment annually. This approach is modified for areas where the parasite *Loa loa* exists. The approach of REMO excludes some areas from CDTI, where there may be onchocerciasis but nodules rates are under 20% (the so-called "hypoendemic areas"). As the policy shifts from control to elimination, the role of hypoendemic areas in *Onchocerca volvulus* transmission is being critically re-examined. The River Blindness Elimination Program (RBEP) contributes to this area of investigation in our assisted areas (see Katabarwa, *Trop Med Int Health*. 2010; 15:645-52). Based on evidence we have collected, we firmly believe that transmission occurs in some hypoendemic areas and that they must therefore be promptly reassessed and if necessary treated with CDTI under the elimination approach.

In the Americas, the goal is to eliminate both morbidity and transmission from *O. volvulus* and, as a result, all villages where transmission can occur are considered "at-risk" and are offered mass Mectizan® treatment activities every three or six months. Thus, a broader net is cast for mass treatment where elimination is the goal and the concept of excluding hypoendemic villages does not exist. For the Americas, where the endemic foci are characteristically smaller and more defined than Africa, every village in known or suspected endemic areas has a rapid epidemiological assessment of 50 adults, who have both nodule examinations and superficial skin biopsies to identify *O. volvulus* microfilaria in skin. Villages in which one or more persons are positive (sample prevalence ≧2%) are considered "at-risk" and are recommended for the mass treatment

campaign. Thus, the cutoff prevalence for treatment was much lower for the Americas compared to Africa until recently when elimination in Africa became the focus.

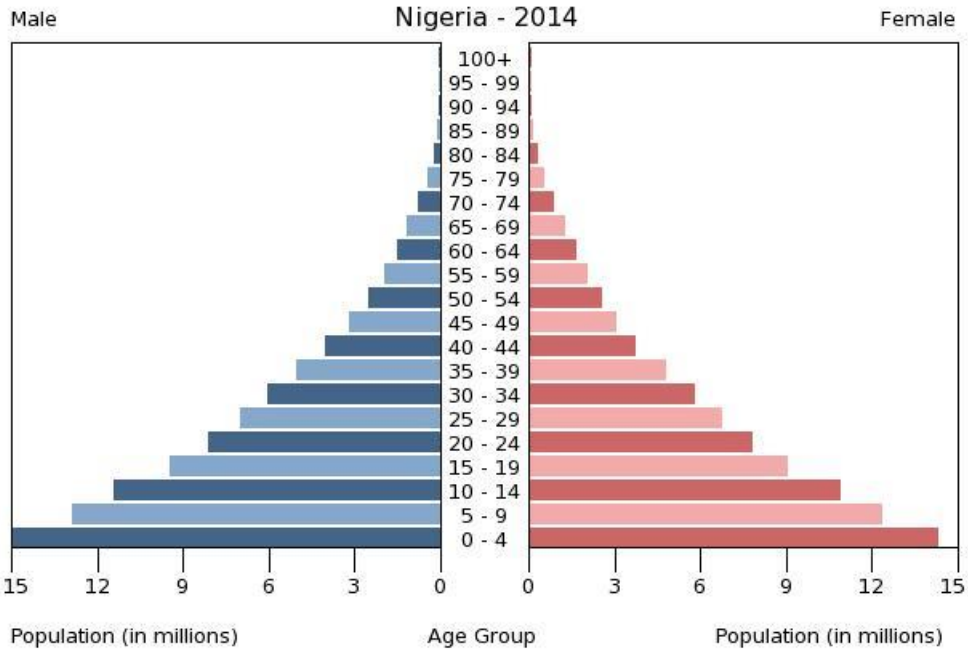
Data Reporting: The Carter Center program offices report monthly to The Carter Center headquarters in Atlanta. These reports include: 1) numbers of villages and persons treated during the previous month (reporting of treatments are updated quarterly for the Americas); 2) the status of the Mectizan® tablet supply; 3) training and health education activities; 4) epidemiological assessment, research, and program monitoring activities; and 5) administrative issues. Standardized tables and graphs are used across programs. The treatment data that are reported originate from village level records prepared during mass treatment activities carried out by village distributors and/or national Ministry of Health (MOH) personnel. The accuracy of these reports is routinely confirmed with random spot checks performed primarily by MOH personnel, supplemented by a standardized monitoring questionnaire administered by The Carter Center and MOH staff. Summary reports of numbers of villages and persons treated are compiled at the district level and forwarded (whenever possible through MOH surveillance and reporting channels) to both headquarters of the national onchocerciasis programs and the national Carter Center offices. In the Americas, the MOHs in the six countries report treatments quarterly to the OEPA office in Guatemala City, which then provides a combined regional report to The Carter Center and to the Program Coordination Committee (PCC), InterAmerican Conference on Onchocerciasis (IACO) and the Pan American Health Organization (PAHO)/World Health Organization (WHO) in its regular meetings; OEPA updates are provided in WHO's annual *Weekly Epidemiological Record (WER)* articles (See Annex 8). African MOHs report their annual results directly to WHO and APOC, which has recently begun publishing its results in the WER as well.

The data from monthly reports are supplemented with additional information at the annual Carter Center River Blindness Elimination Program Review held during the first quarter of the following year. At these reviews, all Carter Center program directors and other partners convene to finalize treatment figures for the previous year and establish new treatment objectives for the coming year. Data on Mectizan® treatments provided by other programs/partners operating in other parts of the countries where The Carter Center assists also are discussed (if these data are available), as well as results from research initiatives. The Carter Center reports its final annual treatment figures to the Mectizan Donation Program (MDP), Merck, and the NGDO Onchocerciasis Coordination office at the WHO, Geneva.

RBEP Treatment Indices: Treatments are reported as numbers of persons and number of at-risk villages (ARVS) treated for the month by district, focus, region, state or zone, depending on the geographical stratification of the country. Cumulative treatment figures for the year are compared to the Annual Treatment Objectives (ATOs) or Ultimate Treatment Goals (UTGs). The decision on whether to use ATOs or UTGs is based on projections of program capacity. Mature programs that sufficiently reach all targeted communities within their entire program area are said to be at "full geographic coverage," and use the UTG index as their coverage denominator (see below). UTG

figures typically increase by about five percent annually to account for normal population growth.

The eligible populations of at-risk villages (ARVS) targeted for active mass distribution receive community-wide Mectizan® treatment. The eligible at-risk population (EARP) includes all persons living in ARVS who are eligible to receive Mectizan® (i.e., who are either ≥5 years of age, ≥15 kg in weight, or ≥90 cm in height, and who are in good health). Although RBEP mass treatment activities exclude pregnant women, these women should be treated later during the treatment year (treatment may be given one week or more after parturition) and therefore all adult women are included in the UTG calculation. In practice, the UTG is established by ARV census from the most recent treatment rounds. The UTG is expected to be the same figure used in the annual request for tablets submitted to the Mectizan Donation Program. WHO uses total population as their treatment denominator, so RBEP routinely reports both coverage of eligible population (UTG) and coverage of total population ("therapeutic coverage") to satisfy those program's needs. The rationale for RBEP's focus on the UTG denominator has been published (Richards et al., *American Journal of Tropical Medicine and Hygiene* 2001; 65:108-14). In general, total population coverage is 18-20% less than UTG (eligible) population coverage, in accord with population pyramids in areas being served, where approximately 20% of the population is under 5 years of age or otherwise (sick or pregnant) ineligible for Mectizan® treatment (see example below, Nigeria).



[5]

The UTG(2) and UTG(4) denominators are used by elimination programs where semiannual or quarterly treatments are delivered: the values are twice or four times the UTG, and represent treatments delivered, not persons treated. Full coverage in control

[5] Source: CIA Factbook. https://www.cia.gov/library/publications/the-world-factbook/geos/ni.html.

programs is defined as 90% achievement of the UTG established for active mass treatment. Full coverage for elimination programs is 90% of the UTG(2) in African projects, or 85% of the UTG(2) or UTG(4) for OEPA. The differences in full coverage thresholds result from different recommendations by the African and American expert steering committees. Passive treatments are Mectizan® treatments for onchocerciasis provided through health care units located in hypoendemic communities (where estimated onchocerciasis nodule prevalence is under 20%) in the control program strategy. As the program transitions to the elimination paradigm, hypoendemic villages are beginning to receive mass treatment and the passive treatment strategy is no longer applicable.

ANNEX 3: List of Program Review Participants

The Carter Center Atlanta

Ms. Sarah Bartlett
Dr. Stephen Blount
Mr. Martin Brooks
Ms. Kenya Casey
Mr. Yohannes Dawd
Ms. Madelle Hatch
Ms. Alicia Higginbotham
Dr. Donald R. Hopkins
Ms. Lauri Hudson-Davis
Ms. Patsy Irvin
Dr. Moses Katabarwa
Ms. Nicole Kruse
Ms. Martha Lucas
Mr. Scott Nash
Mr. Oz Nelson
Dr. Gregory Noland
Ms. Lindsay Rakers
Dr. Frank Richards
Mr. Randall Slaven
Ms. Emily Staub
Ms. Aisha Stewart
Ms. Shandal Sullivan
Mr. Marc Tewari
Mr. Craig Withers

The Carter Center Field Office Staff

Ms. Seble Aliye Debela – Ethiopia
Dr. Nabil AwadAlla - Sudan
Dr. Abel Eigege - Nigeria
Dr. Emmanuel Emukah – Nigeria
Dr. Tekola Endeshaw - Ethiopia
Ms. Peace Habomugisha - Uganda
Dr. Emmanuel Miri – Nigeria
Mr. Justine Ocaka - Uganda
Mr. Adamu Sallau – Nigeria
Dr. Mauricio Sauerbrey - Americas
Dr. Zerihun Tadesse - Ethiopia
Mr. Aseged Taye - Ethiopia

Centers for Disease Control & Prevention

Dr. Vitaliano Cama
Dr. Paul Cantey
Dr. LeAnne Fox
Ms. Emily Griswold
Dr. Julie Gutman
Dr. Patrick Lammie
Capt. Monica Parise
Dr. Laurence Slutsker

Country Representatives

Dr. Ahma Kebede Habtemichael - Ethiopia
Dr. Thomson Lakwo – Uganda
Dr. Kamal Osman – Sudan
Dr. Bridget Okoeguale – Nigeria
Mr. Oumer Shafi – Ethiopia
Dr. Edridah Tukahebwa Muheki – Uganda
Mr. Isam Zarroug - Sudan

University and NGDO Personnel and Special Guests

Ms. Rosaline Agiamoh - Sir Emeka Offor Foundation
Mr. Phillip Albano – Lions Clubs International Foundation
Dr. Akudo Anyanwu - Task Force for Global Health
Hon. Dr. Tebebe Y. Berhan – Lions Clubs International Foundation
Ms. Katie Crowley – RTI International
Dr. Camilla Ducker – UK Dept. for International Development
Mr. Chukwuemeka Ekpo - Sir Emeka Offor Foundation
Dr. Elizabeth Elhassan - Sightsavers
Ms. Loretta Epuechi - Sir Emeka Offor Foundation
Dr. Darin Evans – U.S. Agency for International Development
Ms. Dunia Faulx – PATH
Ms. Tina Flores – Rabin Martin
Dr. Katherine Gass - Task Force for Global Health
Dr. Rafe Henderson
Amb. (Ret.) Howard Jeter - Sir Emeka Offor Foundation
Mr. Archille Kabore - RTI International
Ms. Joni Lawrence - Task Force for Global Health
Ms. Licia Lemos – Emory University Fellowship Program
Ms. Helen Lim - Task Force for Global Health
Dr. Edwin Michael – University of Notre Dame
Mr. Scott McPherson - RTI International
Mr. Aryc Mosher – Bill & Melinda Gates Foundation
Dr. Johnson Ngorok - Sightsavers
Mr. Benjamin Nwobi - RTI International
Dr. Kisito Ogoussan - Task Force for Global Health
Mr. Peter Onuh - Sir Emeka Offor Foundation
Mrs. Caroline O'Riordan – Guest of Major Gifts,The Carter Center
Dr. Eric Ottesen - Task Force for Global Health/RTI International
Dr. Maria Rebollo - Task Force for Global Health
Dr. Mark Rosenberg - Task Force for Global Health
Ms. Alexis Serna - RTI International
Ms. Gretchen Stoddard – Izumi Foundation
Amb. Geoffrey Teneilabe – Consulate General of Nigeria
Dr. Thomas Unnasch - University of South Florida
Dr. Tony Ukety – World Health Organization
Dr. Steven Williams - Task Force for Global Health
Ms. Yuko Yoshida – Izumi Foundation

ANNEX 4: Agenda

Nineteenth Annual Carter Center River Blindness Elimination
Program Review Agenda
Tuesday, February 24 – Thursday, February 26, 2015
The Carter Center, Atlanta, GA

Day 1: Tuesday, February 24, 2015

8:00	***Shuttle pickup at hotel***	
8:30 – 9:00	***Continental breakfast***	
9:00 – 9:10 9:10 – 9:45	Welcome Overview and Introductions	Dr. Donald Hopkins Dr. Frank Richards
Morning session chair: Dr. Mauricio Sauerbrey		
9:45 – 10:15 10:15 – 10:30	Nigeria: Plateau and Nasarawa States: treatment *Discussion*	Dr. Abel Eigege
10:30 – 11:00	***Coffee Break***	
11:00 – 11:20 11:20 – 11:30	Kanke bed net BCC and expansion into the Southeast *Discussion*	Mr. Adamu Sallau
11:30 – 12:00 12:00 – 12:15	Nigeria: Impact, training, integration and community ownership *Discussion*	Dr. Emmanuel Miri
12:15 – 12:25 12:25 – 12:35	Post Treatment Surveillance (PTS) *Discussion*	Dr. Greg Noland
12:35 – 2:00	***Lunch***	
Afternoon session chair: Ms. Peace Habomugisha		
2:00 – 2:55 2:55 – 3:10	Nigeria: TCC-assisted Southeast States: treatment activities *Discussion*	Dr. Emmanuel Emukah
3:10 – 3:20 3:20 – 3:30	Soil-transmitted helminths and schistosomiasis mapping *Discussion*	Ms. Lindsay Rakers
3:30 – 3:50 3:50 – 4:00	Loa Loa Protocol *Discussion*	Dr. Emmanuel Emukah
4:00 – 4:30	***Coffee Break***	
4:30 – 5:00 5:00 – 5:15	Twice- per- year treatments, WHO Joint Application, other matters *Discussion*	Mectizan Donation Program
5:15 – 5:25 5:25 – 5:35	Seri (LF) and Byan Dutse (Onchocerciasis) sentinel villages *Discussion*	Ms. Emily Griswold
5:35 – 5:40 5:40 – 5:45	RTI branding and marking (Nigeria and Uganda) *Discussion*	Ms. Patrice Davis-Duncan
5:45	***Session Adjourned*** ***Edgewood Shopping Trip - Pickup from Hotel – 6:30p***	

Day 2: Wednesday, February 25, 2015

8:00	***Shuttle pickup at hotel***	
8:30 – 9:00	***Continental breakfast***	
Morning session chair: Dr. Nabil Aziz		
9:00 – 9:45 9:45 – 10:00	OEPA Overview 2014 OEPA: Steps forward in the South Focus of Venezuela in 2014 *Discussion*	Dr. Mauricio Sauerbrey
10:00 – 10:50 10:50 – 11:00	Uganda: treatments *Discussion*	Ms. Peace Habomugisha
11:00 – 11:10 11:10 – 11:20	Uganda Onchocerciasis Elimination Expert Advisory Committee update *Discussion*	Dr. Thomas Unnasch
11:20 – 12:00	***Lunch/Group Photo***	
12:00 – 12:15 12:15 – 12:30	Uganda onchocerciasis elimination, impact and PTS update *Discussion*	Dr. Thomson Lakwo
12:30	***Session Adjourned***	
12:30	***Shuttle departs for hotel***	

Due to the threat of inclement weather, the agenda was revised and shortened.

Day 3: Thursday, February 26, 2015

9:30	***Shuttle pickup at hotel***	
9:45 – 10:15	***Continental breakfast***	
Morning session chair: Dr. Emmanuel Miri		
10:15 - 10:20	Announcements	Dr. Frank Richards
10:20 – 10:50 10:50 – 11:00	Modeling of onchocerciasis elimination in Uganda *Discussion*	Prof. Edwin Michael
11:00 – 11:20 11:20 – 11:40	Coverage survey methodologies for PC NTDs *Discussion*	Dr. Katherine Gass
11:40 –11:55 11:55 – 12:05	CDC Senegal River Blindness Elimination Evaluation *Discussion*	Dr. Vitaliano Cama
12:05 – 12:30	Ethiopia Treatments	Mr. Aseged Taye
12:30 – 1:30	***Lunch***	
Afternoon session chair: Dr. Frank Richards		
1:30 – 1:40 1:40 – 1:50 1:50 – 2:00	*Discussion* Impact of lymphatic filariasis and onchocerciasis programs *Discussion*	Mr. Aseged Taye Dr. Tekola Endeshaw
2:00 – 2:10 2:10 – 2:20	Ethiopia Onchocerciasis Elimination Expert Advisory Committee Update *Discussion*	Dr. Frank Richards
2:20 – 2:50 2:50 – 3:00	Sudan treatments and post treatment surveillance surveys *Discussion*	Dr. Nabil Aziz and Dr. Asam Zroug
3:00 – 3:10 3:10 – 3:20 3:20 – 3:30	Presentations on the Border between Galabat (Sudan) and Matema (Ethiopia) *Discussion*	Dr. Asam Zroug and Mr. Aseged Taye
3:30 – 4:00	***Coffee Break***	
4:00 – 4:10 4:10 – 4:20	Seasonality versus program treatment timeline *Discussion*	Ms. Lauri Hudson-Davis
4:20 – 5:20	**Summary and closure of the Nineteenth Session**	Dr. Donald Hopkins Dr. Frank Richards
5:20	***2014 Carter Center River Blindness Program Review Adjourned***	
5:20 – 7:00	***Reception: The Carter Center Library & Museum***	
7:00	***Shuttle departs for hotel***	

Due to inclement weather, the agenda was revised.

ANNEX 5: Participant Contact List

Mr. Solomon Adelamo The Carter Center - Nigeria No.1, Jeka Kadima Street Tudun Wada Ring Road Jos, Plateau State NIGERIA Email: soloneiramo@yahoo.com		Ms. Rosaline Agiamoh Sir Emeka Offor Foundation 12 Amazon Street Maitama Abuja NIGERIA Phone: 234 806 757 4288 Email: rosaline.agiamoh@sireofforfoundation.org
Mr. Phillip Albano Lions Clubs International Foundation 300 West 22nd Street Oak Brook, Illinois 60523-8815 Phone: 630 468 6895 Email: phillip.albano@lionsclubs.org		Ms. Seble Aliye Debela The Carter Center - Ethiopia Po Box 13373 Addis Ababa ETHIOPIA Email: seblealiye@yahoo.com
Dr. Akudo Anyanwu Task Force for Global Health Children Without Worms 325 Swanton Way Decatur, GA 3-0030 Email: aanyanwu@taskforce.org		Dr. Nabil Aziz Mikhail AwadAlla The Carter Center - Sudan PO Box 48 c/o Acropole Hotel Khartoum SUDAN Phone: 249 183 771745 Fax: 249 183 785536 Email: nabilazizm@hotmail.com
Ms. Sarah Bartlett The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 5130 Fax: 404 688 1701 Email: sarah.bartlett@cartercenter.org		Dr. Tebebe Y. Berhan Lions Clubs International Foundation PO Box 40193 Addis Ababa ETHIOPIA Phone: 251 11 551 4928 Email: tebebe.yberhan@ethionet.et
Dr. Stephen Blount The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 3888 Fax: 404 874 5515 Email: stephen.blount@cartercenter.org		Ms. Kelly Callahan The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 3833 Fax: 404 874 5515 Email: kelly.callahan@cartercenter.org

Dr. Vitaliano Cama Centers for Disease Control & Prevention 1600 Clifton Road NE Bldg 23, Rm. 10-164 MS D-65 Atlanta, GA 30329-4018 Phone: 404 718 4131 Fax: 404 718 4193 Email: vcama@cdc.gov		Dr. Paul Cantey Centers for Disease Control & Prevention 1600 Clifton Road NE Bldg 24, Rm 3125 MS A06 Atlanta, GA 30329-4018 Email: gdn9@cdc.gov
Ms. Kenya Casey The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 3876 Fax: 404 874 5515 Email: kenya.casey@cartercenter.org		Ms. Katie Crowley RTI International Suite 750 701 13th Street NW Washington, District of Columbia 20005-3967 Phone: 202 728 1942 Email: kcrowley@rti.org
Mr. Yohannes Dawd The Carter Center 453 Freedom Parkway, One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 3872 Fax: 404 874 5515 Email: yohannes.dawd@cartercenter.org		Dr. Camilla Ducker UK Department for International Development 22 Whitehall London, SW1A 2EG United Kingdom Email: camilladucker@gmail.com
Dr. Abel Eigege The Carter Center - Nigeria No.1, Jeka Kadima Street Tudun Wada Ring Road Jos, Plateau State NIGERIA Phone: 234 803 7022967 Fax: 234 73 460097 Email: eigegea@yahoo.com		Mr. Chukwuemeka Ekpo Sir Emeka Offor Foundation 22 Lobito Crescent Wuse II Abuja NIGERIA Phone: 234 709 812 4159
Dr. Elizabeth Elhassan Sightsavers Grosvenor Hall Bolnore Road, Haywards Heath West Sussex, RH16 4BX Phone: 233 264435933 Email: eelhassan@sightsavers.org		Dr. Emmanuel Chukwudurim Emukah The Carter Center - Nigeria Plot R/60, GRA High Court Road Owerri, Imo State NIGERIA Phone: 234 83 231883; 234 83 231090 Fax: 234 83 231883 Email: emukahe@yahoo.com

Dr. Tekola Endeshaw The Carter Center - Ethiopia Po Box 13373 Addis Ababa ETHIOPIA Phone: 251 116 631863 Email: teko1960@yahoo.ca		Ms. Loretta Epuechi Sir Emeka Offor Foundation 22 Lobito Crescent Wuse II Abuja NIGERIA Phone: 234 808 592 7103 Email: loretta.epuechi@thechromegroup.net
Dr. Darin Evans U.S. Agency for International Development Suite 200 1201 Pennsylvania Avenue NW Washington, District of Colombia 20004 Email: daevans@usaid.gov		Ms. Dunia Faulx PATH 2201 Westlake Ave Suite 200 Seattle, WA 9-8121 Email: dfaulx@path.org
Ms. Tina Flores Rabin Martin 110 West 57th Street New York, New York 10019-3319 Phone: 212 365 7518 Email: tina.flores@rabinmartin.com		Dr. LeAnne Fox Centers for Disease Control & Prevention 1600 Clifton Road NE Bldg. 24, 3rd Fl A06 Atlanta, GA 30329-4018 Phone: 404 718 4739 Fax: 4047184816 Email: lff4@cdc.gov
Dr. Katherine Gass Task Force for Global Health NTD-SC 325 Swanton Way Decatur, GA 3-0030 Phone: 404 974 3548 Email: kgass@taskforce.org		Ms. Emily Griswold The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 420 429 3891 Email: emily.griswold@cartercenter.org
Dr. Julie Gutman Centers for Disease Control & Prevention 1600 Clifton Road NE Bldg. 24, 3rd Fl. MS A06 Atlanta, GA 30329-4018 Phone: 404 718 4730 Email: jgutman@cdc.gov; gutmanjr@gmail.com		Ms. Peace Habomugisha The Carter Center - Uganda Plot 15 Bombo Road Vector Control Building Kampala UGANDA Phone: 256 41 251025 Fax: 256 41 349139 Email: peace.habomugisha@cartercenter.org

Ms. Jennifer Hallaman The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 5107 Email: jennifer.hallaman@cartercenter.org		Ms. Madelle Hatch The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 5160 Fax: 404 688 1701 Email: madelle.hatch@cartercenter.org
Dr. Rafe Henderson 1098 McConnell Drive Decatur, GA 30033-3402 Email: rafeh@bellsouth.net		Ms. Alicia Higginbotham The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 3808 Fax: 404 688 1701 Email: alicia.higginbotham@cartercenter.org
Dr. Donald R. Hopkins The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 3837 Fax: 404 874 5515 Email:shandal.sullivan@cartercenter.org		Ms. Lauri Hudson-Davis The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 3886 Fax: 404 420 3881 Email: lauri.hudson-davis@cartercenter.org
Amb. (ret.) Howard Jeter Sir Emeka Offor Foundation 22 Lobito Crescent Wuse II Abuja NIGERIA Phone: 202 413 2788 Email: jeterhf@aol.com		Mr. Achille Kabore RTI International Suite 750 701 13th Street NW Washington, District of Columbia 20005-3968 Phone: 202 340 8888 Email: akabore@rti.org
Dr. Moses Katabarwa The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 3896 Fax: 404 420 3881 Email: moses.katabarwa@cartercenter.org		Dr. Ahma Kebede Habtemichael Federal Ministry of Health - Ethiopia Disease Prevention and Control Directorate PO Box 1234 Addis Ababa ETHIOPIA Phone: 251-112754645 Fax: 251-112-757722 Email: ehnriddirector@ethionet.et

Ms. Nicole Kruse The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 5132 Fax: 404 688 1701 Email: nicole.kruse@cartercenter.org		Mr. Thomson Luroni Lakwo Ministry of Health - Uganda PO Box 12027 Plot 15 Bombo Road Vector Control Building, Kampala UGANDA Phone: 256 041 348332 Email: tlakwo@gmail.com
Dr. Patrick Lammie Centers for Disease Control & Prevention 1600 Clifton Road NE Bldg. 23, 10th Fl. 10-161 MS D65 Atlanta, GA 30329-4018 Phone: 404 718 4135 Email: pjl1@cdc.gov		Ms. Joni Lawrence Task Force for Global Health Mectizan Donation Program 325 Swanton Way Decatur, GA 3-0030 Email: jlawrence@taskforce.org
Ms. Licia Lemos The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 5100 Fax: 404 420 3881 Email: licia.lemos@emory.edu		Mr. Scott McPherson RTI International Suite 750 701 13th Street NW Washington, District of Columbia 20005-3969 Email: smcpherson@rti.org
Prof. Edwin Michael University of Notre Dame Eck Institute for Global Health, 349 Galvin Life Sciences Center Notre Dame, IN 46556-0369 Phone: 574 631 2234 Email: Edwin.Michael.18@nd.edu		Dr. Emmanuel Miri The Carter Center - Nigeria No.1, Jeka Kadima Street Tudun Wada Ring Road Jos, Plateau State NIGERIA Phone: 234 73 460 097; 234 73 461 861 Direct: 234 73 463 871 Fax: 234 73 460097 Email: cartercenterng@yahoo.com
Mr. Asam Mohamed Alli Zroug National Coordinator NPPB, Federal Ministry of Health - Sudan PO Box 3631 Khartoum SUDAN Email: imazarroug@gmail.com		Mr. Scott Nash The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 3838 Fax: 404 874 5515 Email: scott.nash@cartercenter.org

Mr. Aryc Mosher Bill & Melinda Gates Foundation Post Office Box 23350 Seattle, Washington 98102 Phone: 206 726 7143 Email: aryc.mosher@gatesfoundation.org		Dr. Johnson Ngorok Sightsavers Grosvenor Hall Bolnore Road, Haywards Heath West Sussex, RH16 4BX Phone: 256 414230299 Email: jngorok@sightsavers.org
Dr. Gregory Noland The Carter Center 453 Freedom Parkway, One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 3897 Fax: 404 420 3881 Email: gregory.noland@cartercenter.org		Mr. Benjamin Nwobi RTI International Suite 750 701 13th Street NW Washington, District of Columbia 20005-3970 Email: bnwobi@ng-ntd.rti.org
Mr. Justine Ocaka The Carter Center - Uganda Plot 15 Bombo Road Vector Control Building Kampala UGANDA Phone: 257 41 251025 Email: jocaka@hotmail.com		Dr. Kisito Ogoussan Task Force for Global Health Neglected Tropical Diseases Support Center (NTD-SC), 325 Swanton Way Decatur, GA 30030 Phone: 404 687 5633 Fax: 404 371 0466 Email: kogoussan@taskforce.org
Dr. Bridget Okoeguale Federal Ministry of Health-Nigeria Phase III, Ahmadu Bello Way Abuja NIGERIA Phone: 234 803 703 8113 Email: bridgeclinic2002@yahoo.com		Mr. Peter Onuh Sir Emeka Offor Foundation 22 Lobito Crescent Wuse II Abuja NIGERIA Phone: 234 703 251 5061 Email: peter.onuh@sireofforfoundation.org
Dr. Eric Ottesen Task Force for Global Health NTD-SC 325 Swanton Way Decatur, GA 30030 Phone: 404 687 5604 Mobile: 404 377 9483 Fax: 404 371 1087 Email: eottesen@taskforce.org		Capt. Monica Parise Centers for Disease Control & Prevention 1600 Clifton Road NE MS A06 Atlanta, Georgia 30329-4018 Phone: 404 718 4784 Email: mparise@cdc.gov

Ms. Lindsay Rakers The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 3894 Fax: 404 420 3881 Email: lindsay.rakers@cartercenter.org		Dr. Frank Richards The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 3899 Fax: 404 420 3881 Email: frank.richards@cartercenter.org
Dr. Mark Rosenberg Task Force for Global Health 325 Swanton Way Decatur, GA 30030 Phone: 404 687 5635 Fax: 404 371 1087 Email: mrosenberg@taskforce.org		Mr. Adamu Keana Sallau The Carter Center - Nigeria No.1, Jeka Kadima Street Tudun Wada Ring Road Jos, Plateau State NIGERIA Email: cartercenterng@yahoo.com
Dr. Mauricio Sauerbrey OEPA 14 Calle 3-51 Zona 10 Edificio Murano Center Oficina 1401 Ciudad de Guatemala, 1010 GUATEMALA Phone: 502 23666 106/107 Fax: 502 23 666 127 Email: oepa@oepa.net		Ms. Alexis Serna RTI International Suite 750 701 13th Street NW Washington, District of Columbia 20005-3972 Phone: 202 974 7811 Email: aserna@rti.org
Mr. Oumer Shafi Federal Ministry of Health - Ethiopia Disease Prevention and Control Directorate, PO Box 1234 Addis Ababa ETHIOPIA Phone: 115152054 Fax: 011-515-9615 Email: oumerjaji@gmail.com		Mr. Randall Slaven The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 3866 Fax: 404 688 1701 Email: randallslaven@cartercenter.org
Dr. Laurence Slutsker Centers for Disease Control & Prevention 1600 Clifton Road NE Bldg. 21, 9th Floor MS D69 Atlanta, GA 30329-4018 Phone: 404 639 7430 Fax: 404 639 7490 Email: LMS5@cdc.gov		Ms. Emily Staub The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 5126 Email: emily.staub@cartercenter.org

Ms. Aisha Stewart The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 3858 Fax: 404 874 5515 Email: aisha.stewart@cartercenter.org		Ms. Gretchen Stoddard Izumi Foundation One Financial Center 28th Floor Boston, Masachussets 02111-2621 Phone: 617 292 2333 Email: stoddard@izumi.org
Dr. Zerihun Tadesse Gebreselassie The Carter Center - Ethiopia Po Box 13373 Addis Ababa ETHIOPIA Phone: 251-11 661 5980 Fax: 251 1 011 6632469 Email: zerihtad@yahoo.co.uk		Mr. Aseged Taye Zeleke The Carter Center - Ethiopia Po Box 13373 Addis Ababa ETHIOPIA Phone: 251 116 631863 Fax: 251 116 624562 Email: a.tayez@gmail.com
Dr. Edridah Tukahebwa Muheki Ministry of Health - Uganda PO Box 12028 Plot 15 Bombo Road Vector Control Building Kampala UGANDA Phone: 256- 772-443-659 Email: edmuheki@gmail.com		Dr. Tony Ukety World Health Organization Avenue Appia 20 CH-1211 Geneva 27 SWITZERLAND Phone: 41-22-7911450 Fax: 41-22-7914772 Email: uketyt@who.int
Dr. Thomas Unnasch University of South Florida College of Public Health Global Health Infectious Disease Research Program 3720 Spectrum Boulevard, Suite 304 Tampa, FL 33612 Phone: 813 974 0507 Fax: 813 974 0992 Email: tunnasch@health.usf.edu		Dr. Steven Williams Task Force for Global Health NTD-SC 325 Swanton Way Decatur, GA 30030 Phone: 404 924 8231 Email: swilliams@taskforce.org
Mr. Craig Withers The Carter Center 453 Freedom Parkway One Copenhill Avenue Atlanta, GA 30307 Phone: 404 420 3851 Fax: 404 874 5515 Email: craig.withers@cartercenter.org		Ms. Yuko Yoshida Izumi Foundation One Financial Center 28th Floor Boston, Masachussets 02111-2621 Phone: 617 292 2333 Email: yoshida@izumi.org

ANNEX 6: The Lymphatic Filariasis (LF) Elimination Program

LF in Africa is caused by *Wuchereria bancrofti*, a filarial worm that is transmitted in rural and urban areas by *Anopheline* and *Culex sp*. mosquitoes, respectively. The adult worms live in the lymphatic vessels and cause dysfunction, often leading to poor drainage of lymphatic fluid. Clinical consequences include collection of lymph that results in swelling of limbs and genital organs (lymphoedema, "elephantiasis" and hydrocele), and painful recurrent bacterial infections ('attacks' of acute adenolymphangitis). The female worms release microfilariae, which are tiny embryonic worms that circulate in blood at night, when the mosquito vectors bite. Microfilariae 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. Microfilariae are killed by annual single-dose combination therapy, with either Mectizan® (donated by Merck) and albendazole (donated by GlaxoSmithKline), or diethylcarbamazine (DEC) and albendazole (in areas where there is no onchocerciasis and/or *Loa loa* infection). Annual mass drug administration (MDA) prevents mosquitoes from becoming 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). In 2013, the WHO issued a 'provisional strategy' for *Loa loa* areas that includes the dual approach of MDA monotherapy with albendazole, together with long-lasting insecticidal (bed) nets (LLIN).

Nigerians suffer in disproportionate numbers from LF. Disease mapping of the country confirms that Nigeria is third globally behind India and Indonesia in the human suffering from this parasite. With 761 out of 774 LGAs of 36 States and the Federal Capital Territory mapped, 574 LGAs (75%) are endemic and over 100 million Nigerians are at risk. The Carter Center, working with the Federal Ministry of Health (FMOH) of Nigeria and with the state and local government ministries in Plateau and Nasarawa states, has assisted in establishing an LF elimination program in Plateau and Nasarawa states. The effort is based on a strategy of health education (HE) and annual drug combination therapy with albendazole and Mectizan®. The manufacturers of the drugs have global donation programs for LF: GlaxoSmithKline (GSK) donates albendazole and Merck donates Mectizan®. After years of high treatment coverage, LF has been eliminated in the two states, and they are now under post- treatment surveillance for five years. Through a grant from the Bill & Melinda Gates Foundation, The Carter Center also conducted field research on the use of LLINs alone to combat LF in Imo and Ebonyi states, which are areas where LF MDA with Mectizan® is not currently possible due to the presence of *Loa loa*. Results showed LLINs have had significant impact on mosquito infection (Richards et al., *American Journal of Tropical Medicine and Hygiene* 2013). Thanks to the Global Fund Round 8, LLINs have now been mass distributed for malaria prevention, two per household, in the majority of Nigeria; this supplements health education and drug combination therapy as one more way to fight LF. The national malaria and lymphatic filariasis programs are actively involved in The Carter Center-assisted program, and The Carter Center has assisted (in differing degrees) in the mass distribution of LLINs in all nine states where we work. Due in part to strong Carter Center advocacy, Nigeria launched its FMOH Guidelines for Malaria-Lymphatic

Filariasis Co-implementation in Nigeria in June 2013. We feel this opportunity for synergy should not be missed.

Most recently, LF treatments in Nigeria have expanded (in 2014) to the seven states we assist in the southeast, as part of the USAID ENVISION project, led by RTI International. Treatments started primarily in areas with an existing river blindness program (over 10 million treatments in 2014 alone), but in 2015 are expanding to address all LF-endemic areas in the nine states (with a target of 34 million treatments).

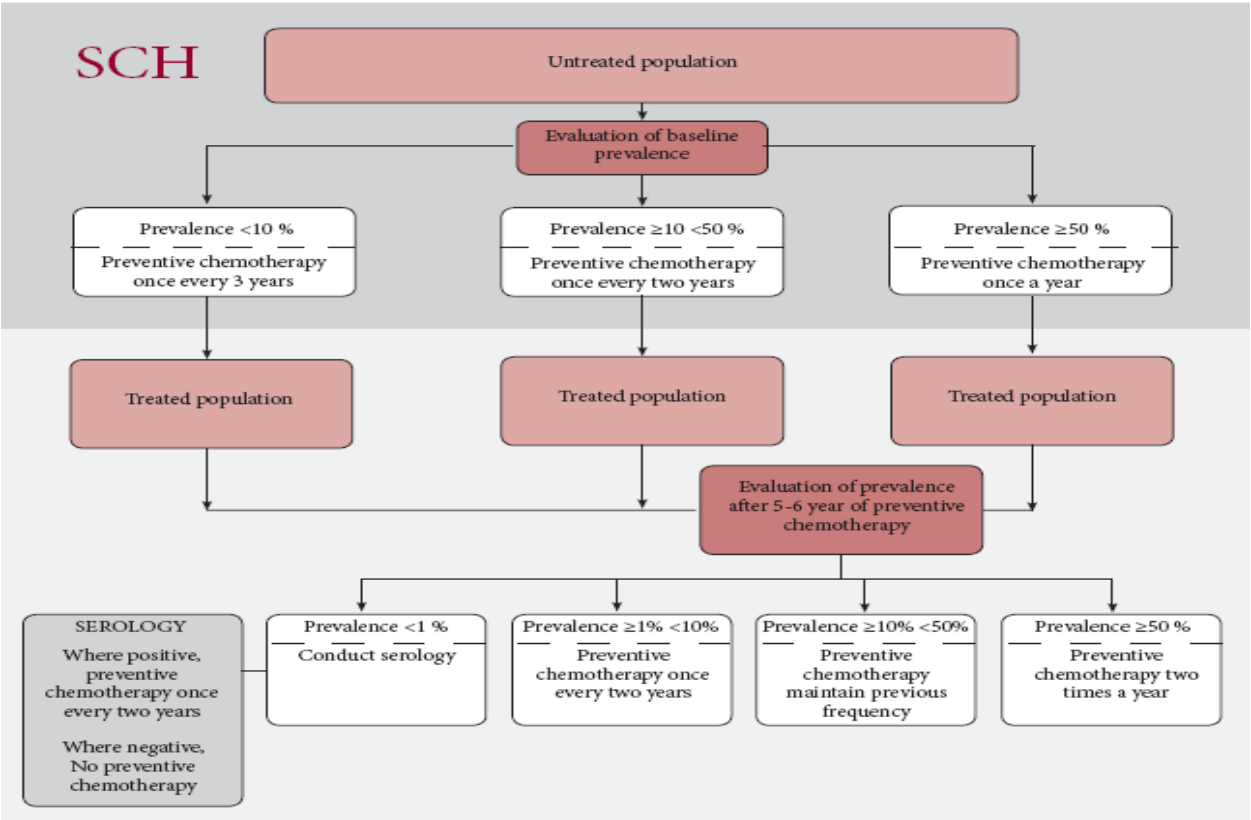
The LF program in Ethiopia was launched in 2008, starting with LF surveys for antigenemia conducted in several zones in western Ethiopia in areas where MDA for RB was ongoing (results reported in Shiferaw et al. Lymphatic filariasis in western Ethiopia with special emphasis on prevalence of *Wuchereria bancrofti* antigenaemia in and around onchocerciasis endemic areas. *Transactions Royal Society Tropical Medicine and Hygiene* 2011). With GSK support, The Carter Center assisted in the launching of a Ministry of Health LF elimination pilot program in 2009 that provided roughly 75,000 treatments annually. Now the program is delivering more than 10 times that each year. Additional mapping is required in Ethiopia. The Carter Center has assisted (in differing degrees) in the mass distribution of LLINs for malaria in several regions of Ethiopia. These LLINs are undoubtedly impacting LF transmission.

ANNEX 7: The Schistosomiasis/Soil Transmitted Helminthiasis Control Program

SCHISTOSOMES

Schistosomiasis is acquired from contact with infected fresh water. Cercariae, released from infected snails, penetrate the skin and develop into adult worms that reside in venules of the intestines (*Schistosoma mansoni*) or bladder and genitals (*S. haematobium*). Female worms lay thousands of eggs that exit the body in feces or urine. If the eggs gain access to fresh water, they hatch and release miracidae, which swim in search of certain types of snails that they penetrate and infect. In the snails, the miracidiae transform and multiply, releasing cercariae, thus continuing the lifecycle. Disease from schistosomiasis comes from the inflammation caused by the eggs deposited into human tissues by the female worms. These eggs cause inflammation, organ damage, bleeding, and anemia. School-aged children (ages five to 14) are the most heavily affected by schistosomiasis and act as the main disseminators of this infection through their urination and defecation in or near fresh water. MDA with the safe and effective oral medicine praziquantel can significantly reduce schistosomiasis morbidity. Praziquantel kills the adult worms and so prevents the eggs from accumulating in tissues.

The current WHO guidelines for schistosomiasis treatment are below:



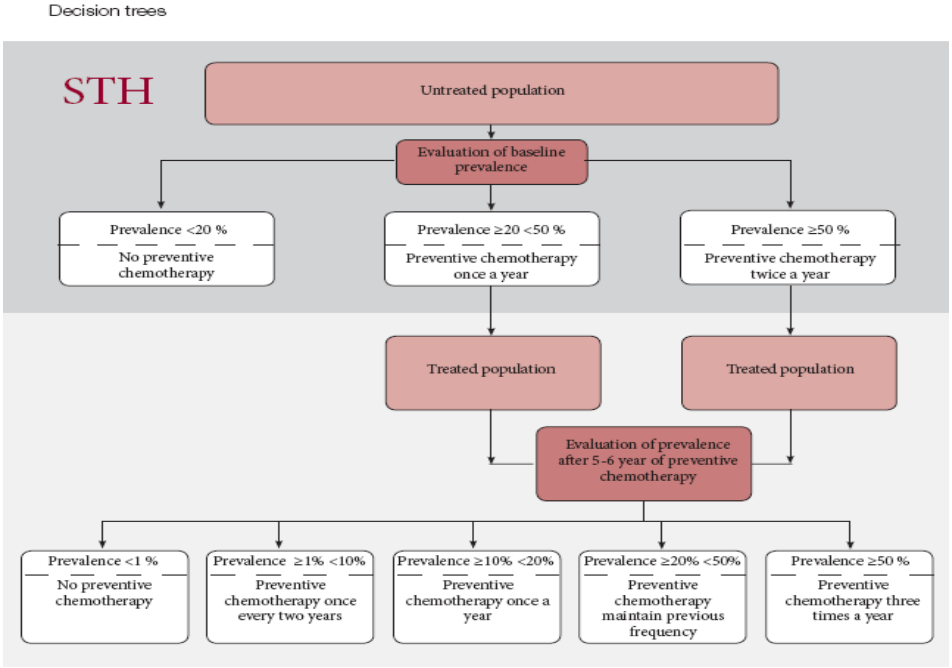
SOIL-TRANSMITTED HELMINTHS

Soil-Transmitted Helminthiasis (STH) is caused by a group of intestinal worms that infect humans and are among the most common infections worldwide. The causal agents in humans are the following intestinal lumen dwelling nematodes: *Ascaris lumbricoides* (roundworm), *Trichuris trichiura* (whipworm), or *Ancylostoma duodenale*, and *Necator americanus* (hookworms). While the outwardly visible signs of STH infection are limited, the developmental effects on children can be severe.

Transmission of soil transmitted helminths occurs through feces. Eggs from the adult females are passed into the environment in feces, where they become infective within days (hookworm and whipworm) or weeks (roundworm). Once in the environment, infective eggs are passed to humans either by ingestion of fecally contaminated food or water (*Ascaris* and *Trichuris*) or through penetration of skin by larvae (*Ancylostoma* and *Necator*). The infective eggs of the whipworm hatch, mature, mate, and lay eggs in the intestines within 70-90 days. Both the roundworm, once hatched, and hookworm will migrate through the circulatory system until they reach the lungs. From there, they pass through the trachea and mouth where they are ingested, traveling from there to the intestines. They then mature, mate, and release eggs within 6-8 weeks.

Heavy infections result in blood loss leading to increased risk of anemia and hypoproteinemia which, in children, can lead to poor physical and developmental growth causing stunting and decreased mental acuity. In adults, this may reduce productivity. In some cases, pulmonary complications can occur caused by the migration of roundworm or hookworm larvae through the lungs and in the case of *Ascaris,* bowel obstructions can occasionally lead to death.

The current WHO guidelines for STH treatment are shown in the diagram below



The challenges in implementing schistosomiasis and STH programs in TCC Nigeria programs have included: 1) Complex WHO guidelines (shown above); 2) unclear global goals (control versus elimination, the latter requiring a major sanitation infrastructure investment); 3) alternating year treatment schedules for schistosomiasis (including treatment programs every third year); 4) twice- per- year treatment programs for STH; 5) focus on ministry of education partners ('school-based') rather than ministry of health, which has been the traditional partner of TCC RBEP; 6) focus on teachers rather than community distributors (house to house); 7) exclusion of infected preschool children and adults in most cases; 8) algorithms with thresholds statistically indistinguishable from one another; 9) mapping based on averages exclude communities that need interventions; 10) difficult calculations of coverage due to challenges with denominator determinations; 11) difficulty in justifying the closure of a long standing infrastructure (community-based interventions) that work well, to start a new approach (school based) is hard to justify.

ANNEX 8: Publications by Year Authored or Coauthored by RBEP Personnel

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