



THE
CARTER CENTER



Waging Peace. Fighting Disease. Building Hope.

FINAL REPORT: OCTOBER 2021

Onchocerciasis Elimination Program for the Americas

September 30, 2012 – September 29, 2021

This report is made possible by the generous support of the American people through the United States Agency for International Development (USAID). The contents of this report are the responsibility of The Carter Center and do not necessarily reflect the views of USAID or the United States government. The Onchocerciasis Elimination Program for the Americas (OEPA) partnership includes: The Carter Center, the Ministries of Health (MOHs) of the six endemic countries (Mexico, Guatemala, Venezuela, Brazil, Colombia and Ecuador), the Pan American Health Organization (PAHO), USAID, the Bill & Melinda Gates Foundation, Merck & Co., Inc., Kenilworth, N.J. USA and the Mectizan® Donation Program (MDP), the U.S. Centers for Disease Control and Prevention (CDC), the Lions Clubs International Foundation (LCIF), and several universities in Latin America and the United States. USAID provided support for the OEPA project under grant No. AID-OAA-G-12-00020. The period of performance for OEPA is September 30, 2012 through September 29, 2021. For more information, go to https://www.cartercenter.org/health/river_blindness/oepe.html.



Dedication

The Onchocerciasis Elimination Program for the Americas (OEPA) has flourished through a positive and generous effort of international collaboration, thanks to leadership from USAID and widespread and bipartisan support from the U.S. Congress for the fight against neglected tropical diseases. The initiative stands as a true example of successful public-private partnership, including: The Carter Center, the Ministries of Health (MOHs) of the six endemic countries (Mexico, Guatemala, Venezuela, Brazil, Colombia and Ecuador), the Pan American Health Organization (PAHO), United States Agency for International Development (USAID), the Bill & Melinda Gates Foundation, Merck & Co., Inc., Kenilworth, N.J. and the Mectizan® Donation Program (MDP), the U.S. Centers for Disease Control and Prevention (CDC), the Lions Clubs International Foundation (LCIF), and several universities in Latin America and the United States.

During the last nine years, the OEPA project has led to significant milestones in onchocerciasis transmission elimination in the Americas—over half a million persons once at risk are now free of the threat of onchocerciasis, commonly known as river blindness, 11 of the 13 disease foci have eliminated transmission, and WHO has verified elimination of transmission in four of the six regional endemic countries. Home to just six percent of the at-risk population, the last remaining transmission zone in the Americas is the Yanomami Focus Area, comprised of the Brazilian Amazonas Focus and the Venezuelan South Focus. While more work remains to be done, 61% of communities in this hard-to-reach area have received over 20 – in some cases over 50 – rounds of successful high-coverage treatment, indicating that transmission in these communities may soon be interrupted. Many of these treatment rounds were made possible by the OEPA project. Additionally, the OEPA project helped prove the efficacy of twice-per-year treatment, pioneering a strategy that helped accelerate the global shift from onchocerciasis control to elimination of transmission. This strategy has now been adopted successfully in Sudan, Uganda, Ethiopia, and Nigeria.

OEPA has taken great strides towards a world no longer threatened by this blinding parasitic disease, and we look forward to continued partnership to complete elimination of onchocerciasis transmission in the Americas.

DR. FRANK O. RICHARDS, JR.
OEPA PROJECT DIRECTOR

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Acronyms

CDC	U.S. Centers for Disease Control and Prevention
IACO	InterAmerican Conference on Onchocerciasis
IHA	Indigenous Health Agent
IVT	International Verification Team
MDA	Mass Drug Administration
MDP	Mectizan® Donation Program
MERTU	CDC Medical Epidemiology Research & Training Unit
MOH	Ministry of Health
M&E	Monitoring and Evaluation
NGO	Nongovernmental Organization
NTDs	Neglected Tropical Diseases
OEPA	Onchocerciasis Elimination Program for the Americas, a regional initiative that has been a program of The Carter Center since 1996
OEPA Project	USAID-supported OEPA grant project from 2012-2021
PAHO	Pan American Health Organization
PCC	Program Coordinating Committee, steering committee of OEPA
USAID	United States Agency for International Development
WHO	World Health Organization

Executive Summary

When working to address neglected tropical diseases (NTDs), we have rare chances to witness truly pivotal moments impacting the most at-risk and vulnerable communities. The United States Agency for International Development (USAID) Onchocerciasis Elimination Program for the Americas (OEPA) project, with period of performance from September 30, 2012 through September 29, 2021, serves as a rare exception. As a result of this groundbreaking effort, four countries received WHO verification of elimination, 538,517 people are permanently safe from the transmission of onchocerciasis, and a future where transmission elimination is achieved is now in sight.

This report details the impact of the OEPA project. Over the course of the project's nine-year effort, The Carter Center coordinated a dynamic international effort in close partnership with national health ministries to address onchocerciasis, leveraging \$6.9 million in Mectizan® donations from Merck & Co., Inc., Kenilworth, N.J. Aligned with World Health Organization (WHO) standards for treatment and elimination, the OEPA project piloted innovative treatment models, documented progress towards elimination, and proved categorically that onchocerciasis transmission could be eliminated in historically endemic countries.

Throughout USAID's \$13 million OEPA project, promising practices and innovative models have been thoroughly examined and tested before dissemination within the region and to endemic countries in Africa. The lessons from the OEPA project have informed elimination standards at a global level. The project had tremendous global influence, informing cutting-edge program implementation models, peer-reviewed publications, and technical and strategic leadership in guideline-setting bodies.

The six countries (Brazil, Colombia, Ecuador, Guatemala, Mexico, and Venezuela) achieved much through support from USAID's OEPA project, with four of them (Colombia, Ecuador, Guatemala, and Mexico) receiving WHO's verification of onchocerciasis transmission elimination and the overall population at risk for onchocerciasis in the Americas being reduced by 94%, taking into account population growth; from 523,563 in 2001 to 35,518 in 2021. Over half a million – 566,845 – treatments were given over the performance period. Lessons and best practices from the OEPA project are now being applied to tackle onchocerciasis transmission in Africa. Despite this success, communities and individuals are still at risk of this devastating disease. This report provides documentation of impact, promising practices, and lessons of the project that will be instrumental in informing the final phase of elimination.



Project Overview

Through this nine-year commitment, the OEPA project supported the regional initiative to achieve transmission elimination in 11 of 13 foci in the Americas and WHO verification of transmission elimination in 4 of 6 countries – the first in the world to do so.

Onchocerciasis is transmitted through repeated bites by small black flies of the genus *Simulium*, which live and breed near fast-flowing streams and rivers. This habitat leads to the common name for the disease, “river blindness.” In the Americas, onchocerciasis was initially endemic to six countries where over 500,000 of the world’s poorest and most vulnerable people lived at risk for the disease.

OEPA,* supported largely by this USAID project, is an ongoing regional initiative and international partnership. It was launched in 1993 to eliminate onchocerciasis transmission from the Americas, and has been led by The Carter Center since 1996. Considerable progress has been made by implementing mass drug administration (MDA) of Mectizan® twice or four times per year, with at least 85% coverage of eligible populations. Over 11 million Mectizan® treatments have been given in

the Americas, eliminating transmission in 11 of the 13 originally endemic foci.

The overall goal of USAID’s OEPA project was to eliminate onchocerciasis transmission from the Americas. From 2012 to 2021, the project contributed significantly to this goal by dramatically reducing the threat of transmission of onchocerciasis in the Americas.

USAID’s support facilitated OEPA’s work in six countries (Brazil, Colombia, Ecuador, Guatemala, Mexico, and Venezuela). Working closely with national ministries of health (MOHs), OEPA has seen a dramatic reduction in need for MDA, with 94% of the current population no longer at risk. During the project period, four of the six countries successfully received WHO verification of elimination of onchocerciasis transmission: Colombia in 2013, Ecuador in 2014, Mexico in 2015, and Guatemala in 2016. These are the first and

only countries to date that have achieved elimination verification. USAID’s OEPA project contributed to these successes and worked to interrupt onchocerciasis transmission in the remaining endemic areas by providing technical assistance, delivering comprehensive training, developing practical tools and methods to scale innovations, and supporting the MDA of Mectizan®.

Since 2017, with transmission eliminated in 11 of the original 13 foci, USAID’s OEPA project has primarily focused on interrupting disease transmission in the last remaining active endemic zone in the Americas, the Yanomami Focus Area. Bisected by the border between Brazil and Venezuela, the Yanomami Focus

Area is comprised of the Brazilian Amazonas Focus and the Venezuelan South Focus.

The Program Coordinating Committee (PCC) is the steering committee of OEPA and serves as an advisory body to the Ministries of Health of endemic countries. The PCC consists of institutional representatives from the Pan American Health Organization (PAHO), the U.S. Centers for Disease Control and Prevention (CDC), and The Carter Center, along with national program representatives and onchocerciasis ‘at large’ experts. The PCC executive committee has consisted of Frank Richards (Chair, The Carter Center), Santiago Nichols (Regional Neglected Tropical Disease Advisor, PAHO) and Maria Eugenia Grillet

13 FOCI OF THE AMERICAS



* In this report, “OEPA” alone refers to the regional initiative that has been a program of The Carter Center since 1996, while “OEPA project,” “the project,” or “USAID’s OEPA project” refers to the grant that is the subject of this report.

(Professor of Entomology, Venezuela) for the entirety of the USAID OEPA project. The PCC typically meets twice a year: once midyear in Guatemala and the second time in tandem with the larger annual InterAmerican Conference on Onchocerciasis (IACO), which is a meeting of all OEPA stakeholders including representatives from target countries as well as donor organizations and other philanthropic partners (please see Global Partnerships on the following page for details). IACO provides an important opportunity to advocate to high-level government officials, who are also invited to the meetings. PAHO plays a key role in the verification process and in maintaining political will through resolutions that currently call for transmission interruption by 2022 throughout the region.

The Carter Center oversaw all implementations, management, and financing of the OEPA project, operating in close collaboration with the national programs, the CDC, PAHO, USAID, and the PCC. The regional headquarters of OEPA are in Guatemala, where OEPA staff – including Regional Advisors on onchocerciasis epidemiology, data systems, and community engagement – coordinated technical and financial assistance to the MOHs. The OEPA project's period of performance was September 30, 2012 through September 29, 2021.

At the international level, the OEPA project catalyzed innovation and substantive progress toward global onchocerciasis elimination goals. In coordination with other stakeholders, including PAHO and USAID, the OEPA project advanced many areas of work, including global policy leadership informing elimination protocols; design and dissemination of techniques, tools, software, and resources; and

regional coordination and advising on onchocerciasis elimination.

The OEPA project also supported IACO, which has hosted participants from around the world. IACO is well attended annually by over 80 public health professionals, ministry officials, experts, and contributing donors. Special guests have included former U.S. President Jimmy Carter, former Colombian President Juan Manuel Santos, PAHO Director Carissa Etienne, and former Guatemalan President Jimmy Morales, among others. Importantly, representatives from countries in the Americas that have been verified free of onchocerciasis continue to attend IACO meetings. IACO provides an essential exchange of information between national programs, donors, WHO, PAHO, Merck & Co., Inc., Kenilworth, N.J., and MDP, and nongovernmental organization (NGO) partners. Additionally, African programs in Uganda, Ethiopia, and Nigeria have attended IACO meetings to learn from the elimination approach pursued in OEPA and inform their own countries' work.

At the country level, the OEPA project worked closely with national MOHs to complete detailed assessments of endemic areas and provide technical, operational, and supplemental financial assistance. Depending on onchocerciasis transmission status, other funding sources, and each country's existing capacity to implement a national elimination campaign, USAID's OEPA project supported a range of interventions, including:

- Capacity strengthening to improve technical skills at regional and country levels
- Health systems strengthening through laboratory collaboration



River blindness can be controlled and even eliminated when countries mobilize the necessary political will and receive strong support from international partners.

DR. CARISSA F. ETIENNE, DIRECTOR OF THE PAN AMERICAN HEALTH ORGANIZATION, REGIONAL OFFICE FOR THE AMERICAS OF THE WORLD HEALTH ORGANIZATION

- Strategic planning with national programs
- Advocacy for national elimination programs locally, regionally, and internationally
- Social mobilization, including creation and adaptation of health education materials, to facilitate and promote program activities
- Mapping of suspected endemic areas
- Mass drug administration
- Monitoring and evaluation of disease transmission indicators
- Technical assistance and supervision in planning and execution of assessments to measure impact
- Financial support
- Training for health personnel and indigenous health agents
- Hiring consultant ophthalmologists, entomologists, and anthropologists to support national elimination programs
- Providing software for modeling future transmission interruption and for mapping communities

A MODEL PUBLIC-PRIVATE PARTNERSHIP

During the period of performance, the OEPA project built on a public-private partnership, including The Carter Center, the Ministries of Health (MOHs) of the six endemic countries (Mexico, Guatemala, Venezuela, Brazil, Colombia and Ecuador), PAHO, USAID, the Bill & Melinda Gates Foundation, Merck & Co., Inc., Kenilworth, N.J. and the Mectizan® Donation Program (MDP), the U.S. Centers for Disease Control and Prevention (CDC), the Lions Clubs International Foundation (LCIF), and several universities in Latin America and the United States. The Carter Center also managed additional funding and programmatic support from the following partners:

- OPEC Fund for International Development
- The Alwaleed Bin Talal Foundation
- The Carlos Slim Foundation

Each of the six endemic countries provided counterpart funding to the OEPA project worth over \$24 million. While national onchocerciasis elimination programs are members of the regional initiative, they were part of the MOH in each country.



Governments owned the onchocerciasis elimination programs, and government health workers were responsible for MDA and epidemiological assessments. The OEPA project sought to support national elimination programs and work through existing structures to increase national capacity and strengthen long-term health systems.

Twice yearly treatment with Mectizan® anywhere onchocerciasis exists has long been the strategy for interrupting transmission in the Americas. A longstanding commitment from Merck & Co., Inc., Kenilworth, N.J. to donate Mectizan® to as many as needed for

as long as necessary has enabled widespread MDA and intensification of MDA in endemic areas, accelerating progress toward transmission elimination through treatment as many as four times per year in some places in Mexico, Venezuela, and Brazil. Building on the strength of this guarantee, USAID's OEPA project was instrumental in supporting the distribution of Mectizan® to all those who needed it. **From 2012 to 2021, Merck & Co., Inc., Kenilworth, N.J., donated more than \$6.9 million in drugs to OEPA-supported countries.** Please refer to Appendix D for an overview of all contributions to the OEPA Regional Initiative during the grant period.

USAID'S INVESTMENT IN ONCHOCERCIASIS PROGRAMMING

In the Americas, elimination of transmission of onchocerciasis has always been the established goal, and OEPA was founded to oversee and coordinate efforts in the six countries endemic for the disease. Through this grant, **USAID is a principal contributor to OEPA's achievements, and the major milestones of WHO verification of elimination of transmission from Colombia (2013), Ecuador**

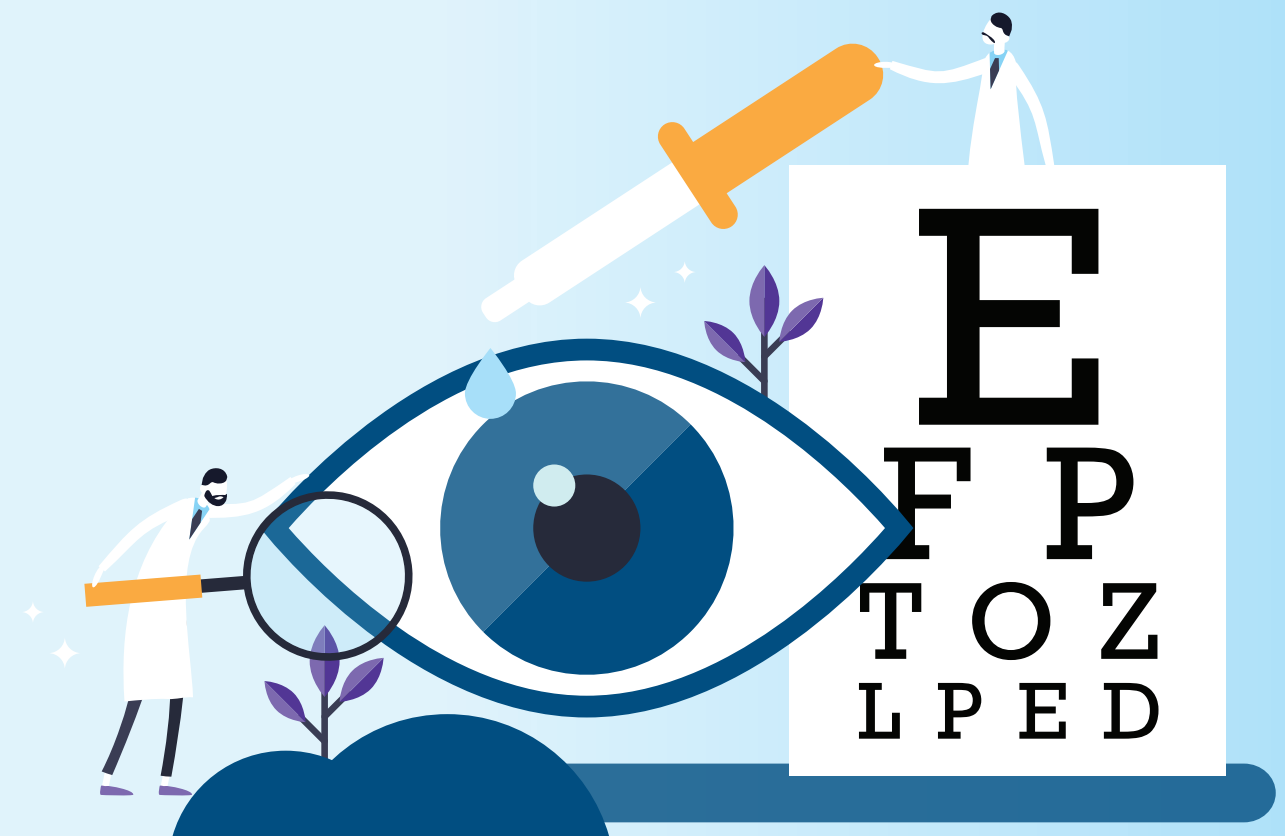
(2014), Mexico (2015), and Guatemala (2016) occurred during the project's lifespan. Over the last nine years, USAID's investment leveraged private sector resources to implement targeted MDA efforts in the Yanomami Focus Area, including enhanced approaches to distribution which substantially impacted transmission in endemic areas.

Sharing the results of the OEPA project at country, regional, and global levels has directly influenced the way WHO, PAHO, and country programs in the Americas and beyond work toward onchocerciasis elimination.



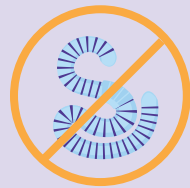


OEPA Project Impact



OEPA Project Results

USAID's OEPA project worked hand in hand with national MOHs to expand access to treatment for at-risk individuals and document progress towards interruption or elimination of transmission of onchocerciasis.



Four of six countries received onchocerciasis elimination verification by WHO,

serving as global proof that elimination is possible.



11 of 13 transmission foci in five countries eliminated.



75% of the administrative areas in the transmission foci in the Yanomami Focus Area

are believed to have interrupted transmission of onchocerciasis.



0 new cases of blindness

attributed to onchocerciasis in the region.



More than 560,000 onchocerciasis treatments

were delivered with OEPA project support from 2012-2021.



Over 530,000 people are no longer at risk

for onchocerciasis.



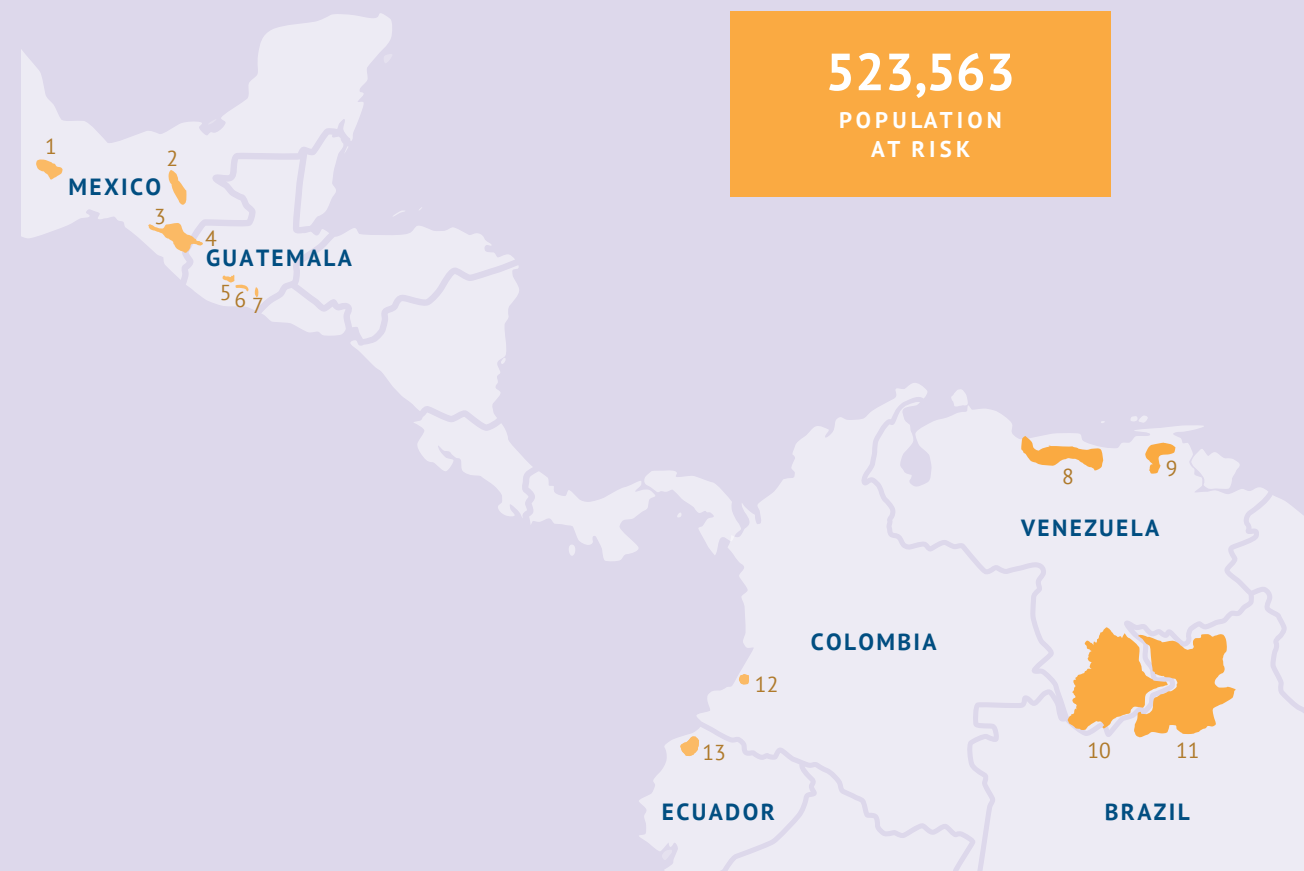
Leveraged over \$6.9 million in drug donations

and \$24 million in country counterpart funding.



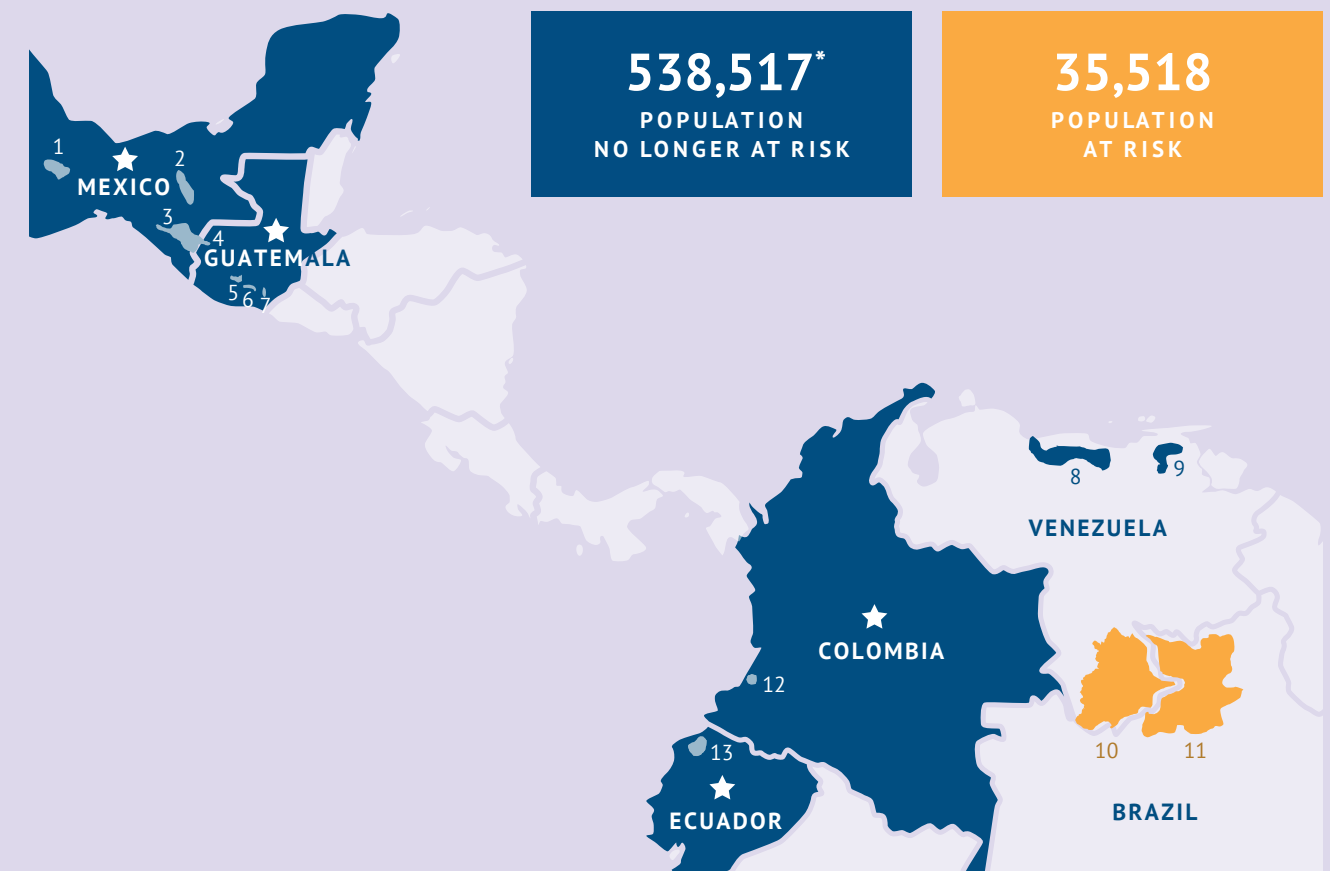
TRANSMISSION OF ONCHOCERCIASIS CONTINUING IN 13 FOCI IN SIX COUNTRIES

2001



TRANSMISSION OF ONCHOCERCIASIS ELIMINATED IN 4 COUNTRIES AND 11 FOCI

2021



TRANSMISSION STATUS

0% ELIMINATED

100% ONGOING

1. Oaxaca, 2. North Chiapas, 3. South Chiapas, 4. Huehuetenango, 5. Central, 6. Escuintla, 7. Santa Rosa, 8. North-Central, 9. Northeast, 10. South, 11. Amazonas, 12. Lopez de Micay, 13. Esmeraldas

TRANSMISSION STATUS

94% ELIMINATED

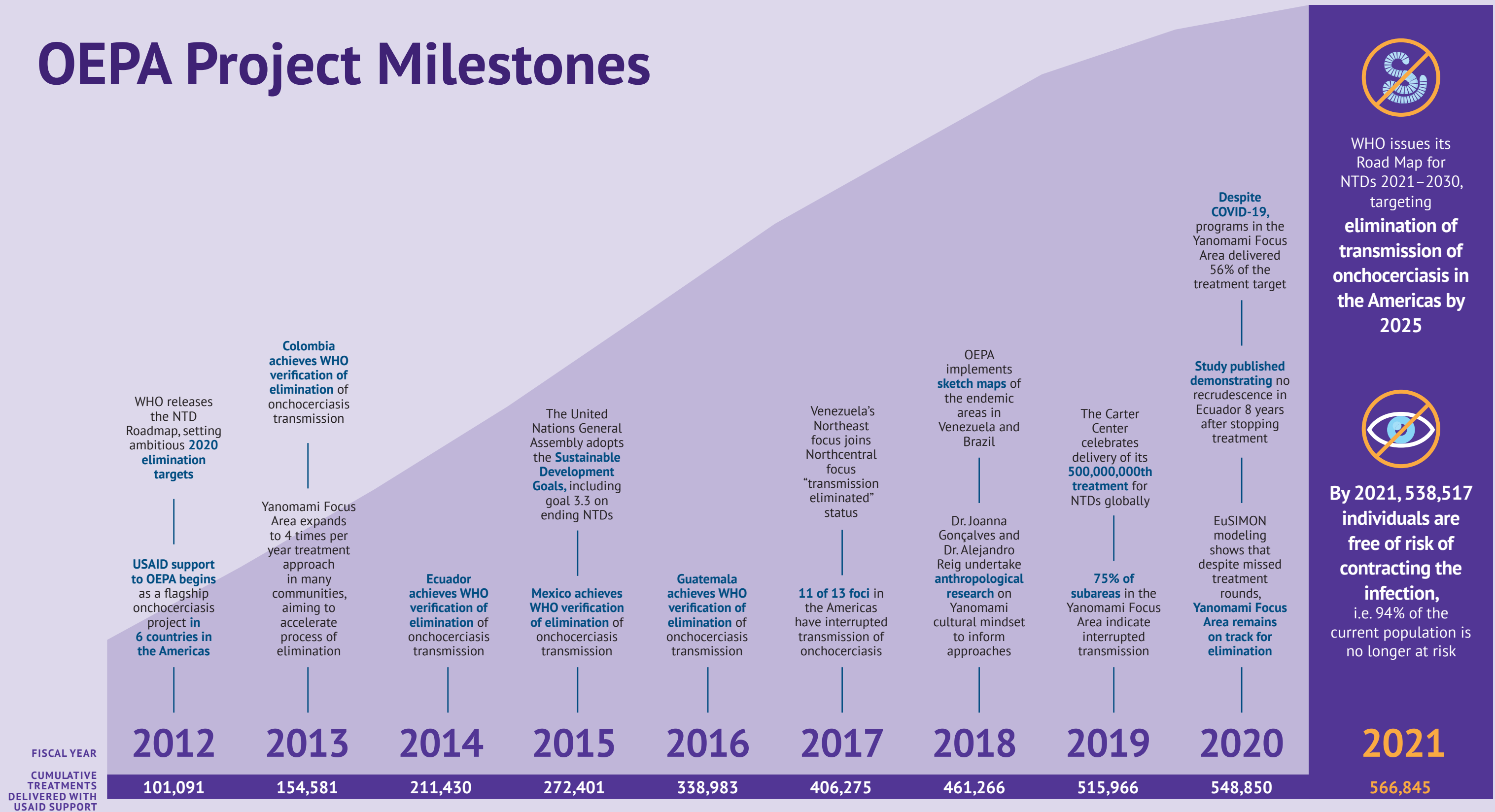
6% ONGOING

★ WHO HAS VERIFIED ELIMINATION

1. Oaxaca, 2. North Chiapas, 3. South Chiapas, 4. Huehuetenango, 5. Central, 6. Escuintla, 7. Santa Rosa, 8. North-Central, 9. Northeast, 10. South, 11. Amazonas, 12. Lopez de Micay, 13. Esmeraldas

* Populations adjusted for growth

OEPA Project Milestones



*Includes provisionally reported 2021 first round treatments

Status of Elimination Goals

ELIMINATION OF ONCHOCERCIASIS IN THE AMERICAS

Context

Onchocerciasis is a blinding disease endemic to regions of Latin America and Africa that affects approximately 218 million people in 30 countries, 1.15 million of whom are blinded or severely visually impaired. Over 99% of river blindness occurs in Africa. In Latin America, onchocerciasis was originally present in 13 foci distributed within Brazil, Colombia, Ecuador, Mexico, Guatemala, and Venezuela. At the onset of the USAID OEPA project in 2012, six of these had eliminated transmission, four had interrupted transmission, and one focus had suppressed transmission. The regional population at risk for onchocerciasis was 379,234, with 184,310 persons no longer at risk.

Since 2012, funding from USAID supported the delivery of Mectizan® treatments, health education, and assessments in the endemic countries to interrupt transmission. In foci where interruption of transmission was achieved, funding also supported completion of a three-year post-treatment surveillance

period. **As of 2016, four countries had achieved verification of elimination and two of three endemic areas in Venezuela had met elimination criteria.** In these four countries, funding also supported the preparation of formal requests – including comprehensive dossiers with detailed epidemiological data indicating transmission elimination – for PAHO/WHO to verify elimination, as well as initial dossier preparation in Brazil and Venezuela.

Transmission persists in some parts of the Yanomami Focus Area. As of 2021 at least 35,518 people are still considered to be at risk in Brazil and Venezuela. The primary remaining challenge is stopping transmission in this hard-to-reach border area, located deep in the Amazon. Accompanying challenges include completion of post-treatment surveillance activities and helping WHO and PAHO to complete national verification procedures in Brazil and Venezuela.

OEPA Project's Impact

With leadership from national MOHs and international experts, USAID's OEPA project and collaborators:

- 94% of those living in endemic areas— 538,517 people—are no longer at risk

for onchocerciasis in OEPA-supported countries.

- Colombia, Ecuador, Mexico, and Guatemala achieved WHO verification of elimination of onchocerciasis.
- Two of three endemic areas in Venezuela have eliminated transmission.

The OEPA project supported countries' elimination goals in various ways, helping them:

1. Identify and track transmission

Mapping is an essential step in determining where or where not to treat for onchocerciasis and is now considered to be complete in OEPA-supported countries. In the hard-to-reach Yanomami Focus Area, the OEPA project located communities using remote sensing. The OEPA project support also enhanced trainings of Indigenous Health Agents (IHAs), who further assisted the project in keeping track of mobile communities that tend to move and/or divide every few years.

2. Pilot and pivot to innovative MDA approaches

The OEPA project supported the delivery of over 560,000 onchocerciasis treatments across six countries through large scale treatment campaigns. The OEPA project's support for MDA included providing financial assistance, assisting with logistics, supporting countries to receive Mectizan® donations in coordination with Merck & Co., Inc., Kenilworth, N.J. and providing opportunities to enhance relationships between country MOHs and PAHO. Most importantly, the OEPA project supported countries to conduct timely MDA with high coverage (over 85% of the treatment-eligible population), reaching elimination of transmission of onchocerciasis in 11 of 13 foci in the Americas by the end of 2017—a dramatic achievement that

brought the number of individuals at risk today down to just over 35,000.

3. Track progress to elimination

Across six countries, the OEPA project assisted endemic foci to conduct impact and surveillance surveys and collated data from past surveys in preparation for verification exercises. These surveys were necessary to track progress toward the elimination of onchocerciasis and to comply with WHO guidelines. The OEPA project also helped countries improve the process, quality, and standardization of onchocerciasis surveys. PCC meetings were essential to facilitate the regular scientific deliberations necessary to properly plan for future surveys, review recent survey results, and course-correct when methods proved insufficient, or survey or lab teams needed additional training. Often the experts present at PCC meetings were able to notice small inconsistencies in data that required taking another look at a community's serology rates or gathering a new sample of vector black flies for PCR testing. Further, the national program PCC members were able to exchange information and guide each other by sharing experiences.

4. Validate elimination and document post elimination status

As countries progressed toward onchocerciasis elimination, the OEPA project shifted support from a focus on MDA to a focus on a three-year post-treatment surveillance period, required for the WHO verification process. In addition to supporting four countries in monitoring and ensuring continued verification of WHO elimination, the OEPA project supported the Mexican and Guatemalan MOHs in the development of documentation to secure WHO verification.

“OEPA’s extraordinary achievement of having eliminated transmission in four of the six endemic countries in the region, and showing significant progress in the last two countries, has provided proof of concept that it is possible to eliminate the disease with ivermectin alone, in effective semi-annual treatments with community participation.”

MAURICIO SAUERBREY, DIRECTOR OF OEPA

GLOBAL LEADERSHIP

The success of the OEPA project in providing proof of concept for onchocerciasis elimination in the Americas has served as a clarion call to empower many African countries to announce national onchocerciasis elimination goals. MOH staff and program managers from African countries who have attended IACO left with new confidence and enthusiasm that elimination of onchocerciasis transmission

can be achieved, and they used elements of the OEPA model for their own national programs. The shift of African programs toward elimination has brought significant success in several countries, including Ethiopia, Nigeria, Sudan, and Uganda. Ethiopia, Sudan, and Uganda are using the twice-per-year treatment strategy in all endemic onchocerciasis areas, and Nigeria is applying the same strategy in endemic areas with ongoing transmission that are not on track for elimination.

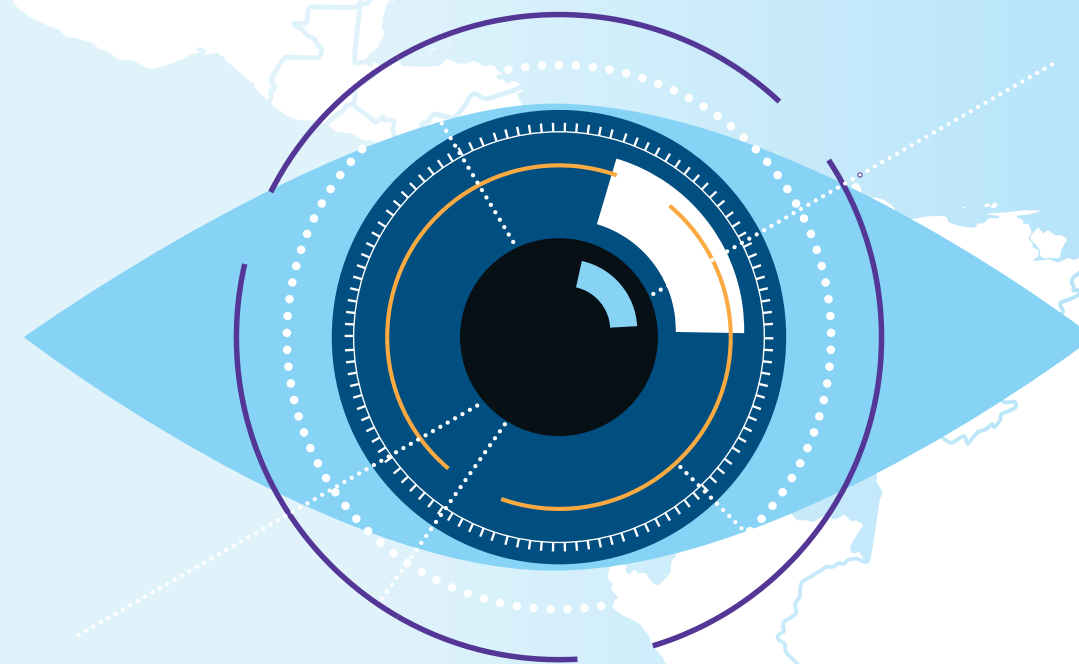


Achieved proof of concept,

propelling a shift in global approach from onchocerciasis control to onchocerciasis elimination.



OEPA Project Impact by Country



Colombia

Colombia's onchocerciasis cases were concentrated in Lopez de Micay, a formerly endemic community with an at-risk population of 1,366. Colombia's Onchocerciasis Elimination Program led the country's efforts to provide MDA in Lopez de Micay to eliminate onchocerciasis and now oversees post-elimination surveillance of the disease.

From 2012 to 2021, the OEPA project supported the National Onchocerciasis Elimination Program in Colombia to complete the final steps to become the first country in the world to obtain WHO verification of elimination of the disease, proving that elimination is possible with semiannual Mectizan® treatments, and encouraging countries in Africa to adapt twice per year treatment as the means for shifting from a control to an elimination approach. With OEPA project support for dossier preparation, the country achieved WHO verification of elimination in 2013. President Juan Manuel Santos received the verification document from the PAHO country representative Gina Watson, in a ceremony held in July 2013, in Bogotá, Colombia, attended by President Jimmy Carter.



“The Colombia river blindness program did more than just rid the country of a horrible disease. The community focus of the program empowered people to take on other community improvement projects, like improving access to safe water and basic sanitation, providing better nutrition and health care, and even constructing a school. The river blindness elimination program ended a disease and created hope.

ALBA LUCIA MORALES, HEALTH EDUCATION ADVISOR WITH OEPA

OEPA PROJECT IMPACT IN COLOMBIA



Colombia is the first country in the world

to be WHO verified for having eliminated onchocerciasis.



1,366 people

are no longer at risk for onchocerciasis.



A national expert committee

on onchocerciasis elimination was created to prepare the country onchocerciasis dossier to be submitted to WHO for verification.



Community members were essential to success.

All community members received training on onchocerciasis and other public health programs in which they could actively take part.

NATIONAL LEADERSHIP AND SUSTAINABILITY

Colombia's MOH and the Colombia Onchocerciasis Elimination Program, with OEPA project support, completed and submitted the national dossier to WHO and received the WHO/PAHO verification team who visited Lopez de Micay and ultimately recommended to the WHO Director General that Colombia be verified. President Jimmy Carter was in Colombia for the delivery of the elimination document to President Santos, the first such event in history. Since that time the OEPA project has worked with Colombia to ensure that post elimination surveillance continues to be a priority for the government.

LESSONS LEARNED

When working with small, isolated populations such as Lopez de Micay's, it is feasible, if not essential, to **continuously engage the community and enable them to play a key role in the leadership** and implementation of the project. To reach an at-risk population with limited literacy skills, the national program and OEPA developed visual teaching tools including slideshows, table games, memory exercises, and flipcharts called "Naicionito" that proved particularly effective as a means of educating the population at small community gatherings. While some of this work predated USAID's OEPA project, the key lesson learned was that **after a successful program like Colombia's onchocerciasis elimination effort, motivated community members will remain interested and active**, seeking to implement other projects to better their community's health and well-being.

Ecuador

Elimination of onchocerciasis in Ecuador posed a considerable challenge, as the main black fly vector in the country, *Simulium exiguum*, is one of the most efficient onchocerciasis vectors in the Americas, comparable to those found in Africa. The transmission cycle is much more difficult to break when the vector is highly efficient in transmitting the parasite.

Ecuador's single transmission focus in Esmeraldas had one of the oldest programs in the region, dating from the 1990s. There were at least 25,863 persons at risk for onchocerciasis in 119 communities. Over 485,000 treatments for onchocerciasis were delivered between 1990 and 2009, the last year of treatment distribution. Ecuador's Onchocerciasis Elimination Program is part of a national Multidisciplinary Health Team and leads the country's efforts to treat and eliminate onchocerciasis and conduct post-elimination surveillance epidemiological assessments.

The OEPA project worked hand in hand with the national Onchocerciasis Elimination Program to take its final steps towards elimination of transmission. USAID's OEPA project supported Ecuador to complete the evaluations required during the post-treatment surveillance period, prepare its dossier, and receive the WHO onchocerciasis elimination verification team. The country achieved WHO verification of elimination in 2014.

OEPA PROJECT IMPACT IN ECUADOR



Ecuador is the second country in the world

to be granted verification of elimination of onchocerciasis by WHO.



25,863 people

are no longer at risk for onchocerciasis.



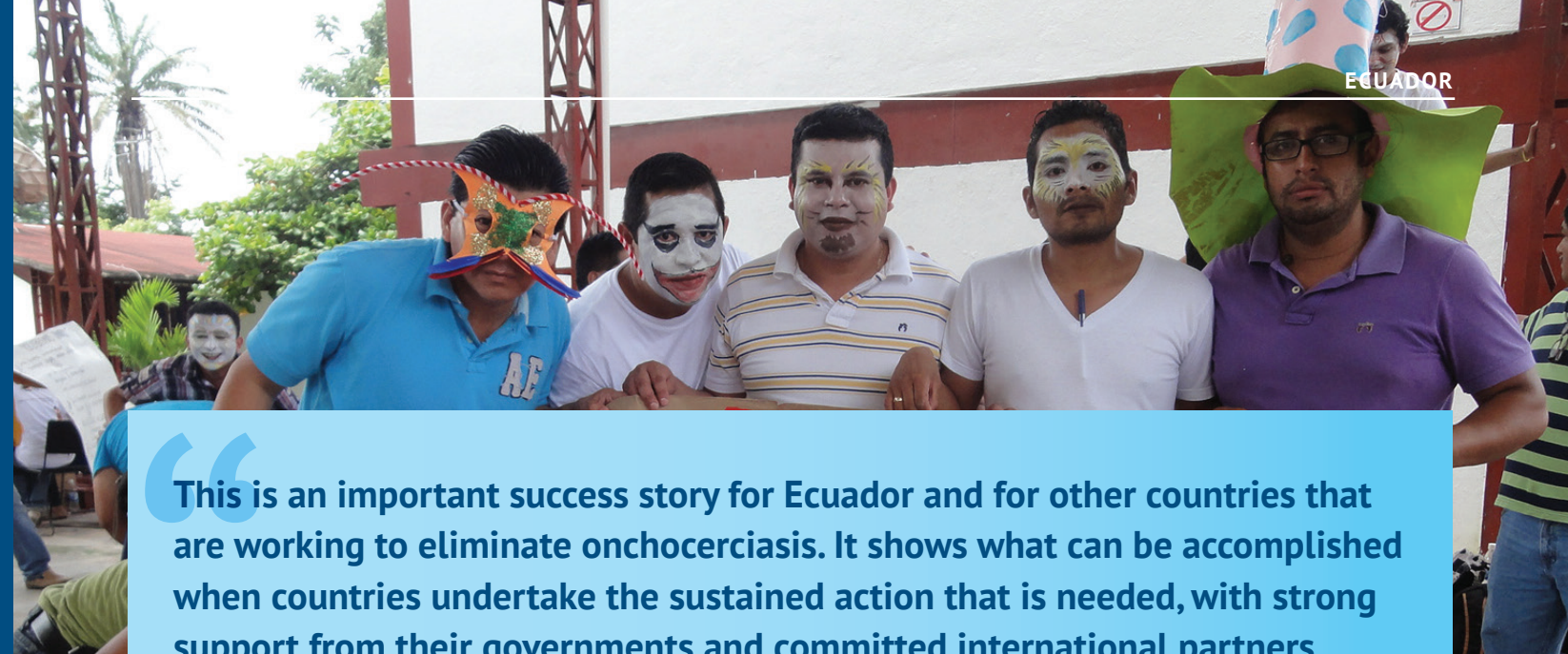
All community members

were offered health education and were very receptive to the elimination efforts.



Post-Elimination Surveillance conducted in the focus 8 years after halting treatment shows

no disease recrudescence after verification of elimination.



“This is an important success story for Ecuador and for other countries that are working to eliminate onchocerciasis. It shows what can be accomplished when countries undertake the sustained action that is needed, with strong support from their governments and committed international partners.”

DR. CARISSA ETIENNE, PAHO DIRECTOR

NATIONAL LEADERSHIP AND SUSTAINABILITY

The work of Ecuador's MOH and its Multidisciplinary Health approach in the endemic communities for more than 20 years forged a strong and long-lasting relationship based on hard work and respect, which paved the way to other health interventions. The OEPA project assisted the MOH to submit a request to WHO to initiate the verification elimination process, including preparing detailed dossiers of epidemiological data collected through the project showing transmission elimination.

LESSONS LEARNED

At the initiation of OEPA, the Esmeraldas Focus was considered one of the greatest challenges to elimination of onchocerciasis in the region. Achieving disease elimination in that highly endemic area showed that **uninterrupted semiannual treatment rounds with Mectizan® to at least 85% of the eligible population** made elimination of onchocerciasis

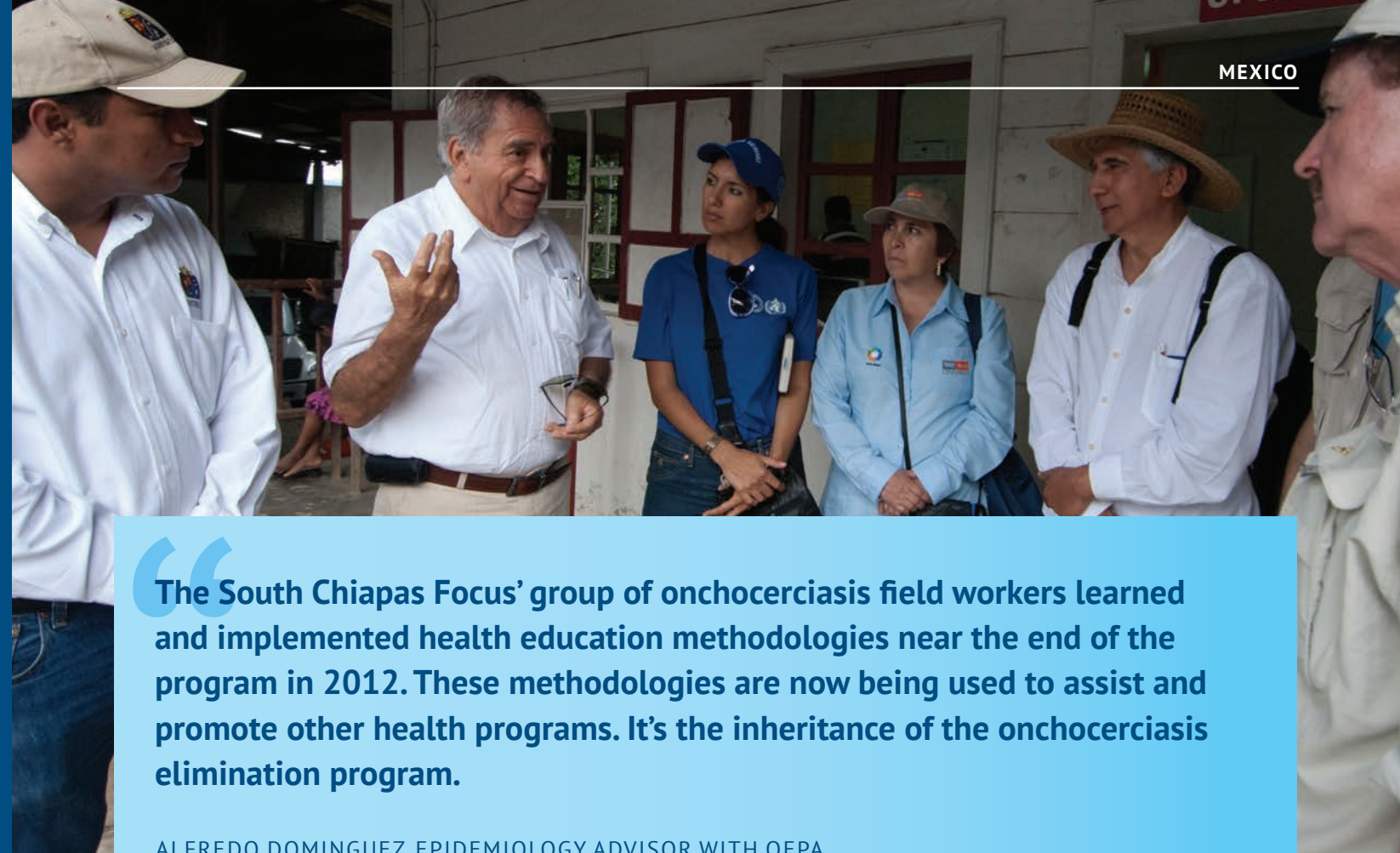
feasible, even in areas with the highest baseline levels of infection. The successful elimination of the disease in Ecuador provided a powerful endorsement of the twice-per-year Mectizan® strategy and was an indication that this approach would likely be successful against onchocerciasis in African countries driven by similarly efficient vectors.

Ecuador is also the only formerly endemic country to **conduct post elimination surveillance assessments in the endemic area using a serological approach**, rather than an entomological one. Results from those assessments showed no disease recrudescence six years after receiving WHO verification and eight years after halting treatment, further underscoring the effectiveness of the semiannual Mectizan® MDA strategy. Another lesson learned was that **serological surveillance is less labor intensive and technical than vector collections**, which were difficult to sustain after WHO verification was achieved and internal funding was lost for a stand-alone onchocerciasis program in Ecuador. This lesson is likely to be incorporated in the next set of WHO onchocerciasis elimination guidelines.

Mexico

In Mexico's North Chiapas, Oaxaca, and South Chiapas foci, 169,869 persons were formerly at risk for onchocerciasis in 670 communities at the start of the OEPA project – the second largest endemic population in the Americas. MDA was halted in Mexico's largest focus (South Chiapas) at the beginning of 2012, and post-treatment surveillance was completed in 2014.

The oldest onchocerciasis elimination program in the Americas, dating to the 1930s, Mexico's Onchocerciasis Elimination Program was initially based on nodulectomy, switching to Mectizan® treatment of patients in the 1990s, and then to MDA twice per year in the 2000s. The USAID OEPA project assisted Mexico to complete its post-treatment surveillance evaluations, write its dossier, and receive the WHO verification team. The country achieved WHO verification of elimination in 2015. The OEPA project supported the Onchocerciasis Elimination Program in Mexico to adapt the 'Art as a Bridge to Health' approach developed in Guatemala to launch a health education campaign that would keep communities informed and vigilant during the post-treatment and post elimination surveillance periods.



“The South Chiapas Focus’ group of onchocerciasis field workers learned and implemented health education methodologies near the end of the program in 2012. These methodologies are now being used to assist and promote other health programs. It’s the inheritance of the onchocerciasis elimination program.”

ALFREDO DOMINGUEZ, EPIDEMIOLOGY ADVISOR WITH OEPA

OEPA PROJECT IMPACT IN MEXICO



Mexico is the third country to achieve verification

of elimination of onchocerciasis by WHO in 2015.



169,869 people

are no longer at risk for onchocerciasis (this was formerly the second largest endemic population in the region).



A pioneer in quarterly ivermectin treatment distribution, **Mexico was the first country to start quarterly Mectizan® treatment in 2003**

to hasten the interruption of transmission of the parasite and achieve transmission interruption.

NATIONAL LEADERSHIP AND SUSTAINABILITY

Mexico's MOH and its National Onchocerciasis Elimination Program worked to ensure that onchocerciasis elimination efforts were prioritized by the government and that the impressive progress made to date was sustainable and replicable. The whole operation of treatment delivery rested on the shoulders of 160 field workers devoted exclusively to onchocerciasis.

LESSONS LEARNED

Mexico is unique in the Americas in that it has had, and still has, **expert, dedicated field workers for onchocerciasis, salaried by the MOH.** These workers, devoted to only one disease,

are rare in the Americas where there is a recent policy of programmatic integration and a strong resistance to vertical initiatives. **The strength of the Mexican program, however, is in the retention of expertise needed for ongoing surveillance.** In fact, the best 'proof of principle' for onchocerciasis elimination remains in Mexico, where communities are still monitored annually to detect infection recrudescence. In the other three countries that have successfully eliminated onchocerciasis (Colombia, Ecuador, and Guatemala), WHO verification of elimination represented a big change for MOH workers, creating the need for them to be retrained and reassigned to other health programs. These countries argue that the **cost savings from onchocerciasis elimination should be diversified to multidisciplinary duties,** enhancing sustainability and continuity for the control of other vector borne diseases.

Guatemala

Guatemala was home to the largest endemic population in the Americas, with 231,467 people formerly at risk for onchocerciasis across 518 communities in four foci, including the Central Focus, the largest in the Americas. Guatemala's National Onchocerciasis Elimination Program led the country's efforts to treat and eliminate onchocerciasis.

The OEPA project worked with the National Onchocerciasis Elimination Program to complete post-treatment surveillance in the Central Focus in 2014. During this time a major and unique post-treatment surveillance health education campaign was launched in Central Focus based on a unique 'Art as a Bridge to Health' initiative that engaged artists to keep communities informed and vigilant for a possible return of the manifestations of onchocerciasis. With assistance from the OEPA project, the final post-treatment surveillance entomological evaluations were successfully conducted, the country dossier written, and a WHO verification team was hosted. The country achieved WHO verification of elimination in 2016. President Jimmy Morales received the verification document certifying elimination of transmission from Dr. Carissa Etienne at the IACO meeting in November 2016, a hundred years after the discovery of the onchocerciasis in the Americas by the renowned Guatemalan researcher Dr. Rodolfo Robles. Other celebrations took place around the country with posters and parades, including a day-long seminar on onchocerciasis in Guatemala at San Carlos University, one of the oldest universities in the Americas.



“The Guatemalan Onchocerciasis Program implemented varied and continuous health activities through which multidisciplinary health teams discovered and developed skills that allowed a better understanding and communication with the communities. This made possible achieving the program's ultimate goal.”

CAROL CROVELLA, GUATEMALA ONCHOCERCIASIS PROGRAM TECHNICAL COORDINATOR

OEPA PROJECT IMPACT IN GUATEMALA



Guatemala is the fourth country in the Americas

to have achieved verification of elimination of the disease by WHO in 2016.



231,467 people

(the largest endemic population in the Americas) are no longer at risk for onchocerciasis in the country.



A national expert committee

on onchocerciasis elimination was created with OEPA project support to write the country dossier and establish post-elimination surveillance.



Volunteer collaborators in all formerly endemic communities were trained

on onchocerciasis and remain vigilant for onchocerciasis recrudescence during the post elimination surveillance period.

NATIONAL LEADERSHIP AND SUSTAINABILITY

The Guatemalan government demonstrated tremendous leadership throughout the country's 100-year fight against river blindness. As the epicenter of onchocerciasis in the Americas, Guatemala has been the home to the headquarters of OEPA since its launching in 1996 and was also the base for the CDC Medical Epidemiology Research and Training Unit (MERTU). The MOH worked closely with MERTU and OEPA to develop and publish strategies and approaches to onchocerciasis elimination that were ultimately accepted by PAHO and used successfully throughout the region. The PCC continues to meet in Guatemala City, and more IACOs have been held in Guatemala than in any other country. Twice-per-year, directly observed MDA proved to interrupt infection in the vector. In addition, GIS mapping was developed, Knowledge Attitude and Practice surveys were applied, and adverse events to treatment were studied. Today, the program has protocols in place

for the unlikely event of disease resurgence, ensuring that communities and health teams remain vigilant during the post elimination surveillance phase.

LESSONS LEARNED

During the USAID OEPA project years, the important lesson learned was that **artists can have a key role in providing health education**, community mobilization, and demonstrating how people can have fun **celebrating the elimination of a disease through parades, murals, and other forms of artistic expression**. The initiative educated and engaged hundreds of residents in once endemic communities. While drug delivery in those areas had ceased, these activities were vital to keeping the population alert in case of a resurgence of the disease, while also supporting community building and fostering cooperation between health groups. Further, this approach was carried into post-treatment surveillance activities in Mexico and was well-received.

Brazil

One of two foci still reporting active transmission of onchocerciasis in the Americas, Brazil's Amazonas focus is home to a total at-risk population of over 18,000 persons, distributed across 273 communities with varying endemic levels. The Amazonas focus is contiguous with the other active focus in the Americas, Venezuela's South Focus. Together they comprise the Yanomami Focus Area, named after the primary indigenous group that resides there. The Brazilian Onchocerciasis Elimination Program leads the country's efforts to provide high coverage MDA to eliminate onchocerciasis transmission, and with support from the OEPA project maintains communications and coordination with the Venezuelan team working on its side of the border to eliminate onchocerciasis.

From 2012 to 2021, the OEPA project supported Brazil to reach its onchocerciasis elimination goals, supporting 245,924 treatments. This support allowed the Brazilian Onchocerciasis Elimination Program to offer treatment to all communities eligible to receive the drug within the onchocerciasis endemic area, to conduct epidemiological impact assessments, and to hire a program manager and field supervisors. The involvement of this staff proved instrumental in many ways, including setting up the program's detailed record keeping system that allows reporting of treatments and epidemiological assessments. These staff also designed and tailored methodologies and tools to enhance program implementation.

OEPA PROJECT IMPACT IN BRAZIL



Over 11,000 individuals

live in areas suspected to have interrupted transmission for onchocerciasis after receiving >20 effective Mectizan® treatment rounds.*



22 of 31 onchocerciasis-endemic subareas

have received more than 20 effective treatment rounds with Mectizan®.



9 endemic subareas with 96 communities

and a population of about 6,000 are currently the primary focus of the program's efforts.



A national expert committee

on onchocerciasis elimination was created with OEPA project support.

* A treatment coverage of >85% of the eligible population is considered "an effective treatment round."

Brazil's Onchocerciasis Program has significantly contributed to all health programs being implemented in the endemic area with detailed mapping based on sketch maps and georeferences of the endemic communities and areas of interest. Those maps have been especially useful to reflect spatial changes in the communities and remote, hard to access areas.

JOAO LUIZ PEREIRA DE ARAÚJO, TECHNICAL ASSISTANT TO BRAZIL'S ONCHOCERCIASIS ELIMINATION PROGRAM

NATIONAL LEADERSHIP AND SUSTAINABILITY

Brazil's MOH, Special Indigenous Health Secretary, and national Onchocerciasis Elimination Program work together to ensure that onchocerciasis elimination efforts are part of the multidisciplinary health programs in the Amazonas Focus, and guarantee that the impressive progress made to date is sustainable. Since 2016, the Special Indigenous Health Secretary has worked in partnership with the Universidade de Sao Paulo, the Centro Universitário Luterano de Palmas and Instituto Oswaldo Cruz, UNICEF, and PAHO, among others to launch several training programs for health professionals and IHAs working in all subareas of the Indigenous Territory. This is an important activity not just for transmission elimination, but also for overall health systems strengthening.

LESSONS LEARNED

In Brazil, some subareas showed historical low treatment coverages for a myriad of reasons

including conflicts with other communities or with illegal miners and hunting expeditions. Thus, the **program hired field supervisors who would take turns visiting those subareas to observe treatment distribution and health teams' adherence to treatment criteria** and suggest solutions to problems, monitor local IHAs performance, and provide training to health teams, IHAs, and community members. The approach has yielded excellent results, as evidenced by improved treatment coverage, high-quality training, and high-impact methodologies proposed by the professionals hired.

Another lesson learned stems from Brazil's efforts to provide four-times-per-year treatment in the Yanomami Focus Area to accelerate the program to elimination by the 2022 deadline. The challenges of operating in the Amazon prevented the program from reaching effective coverage in any of the four treatment rounds. The MOH learned that it is **better to get two effective treatment rounds a year than four ineffective rounds** and abandoned the quarterly approach in 2018.

Venezuela

Venezuela originally had three foci of onchocerciasis transmission. Two were in the northern part of the country (the Northcentral and Northeast foci) with a total of 109,952 at-risk persons residing in 510 communities. Transmission in the Northcentral focus was eliminated in 2013, upon completion of post-treatment surveillance. The Northeast focus was the largest focus in the country. As in Mexico, quarterly MDA was provided from 2010 to 2012 to hasten elimination. The OEPA project supported 2012 assessments that indicated that transmission had been interrupted. MDA was stopped and post-treatment surveillance launched in 2013. From 2015 to 2017, the OEPA project supported entomology assessments that showed that transmission had been eliminated.

Venezuela's South Focus is in the remote Amazon rainforest. It has a population at risk for onchocerciasis of 17,518 individuals distributed in 381 communities scattered in a large area with no roads; access is by boat or air (fixed wing or helicopter). Together with Brazil's Amazonas focus, it forms the Yanomami Focus Area. From 2012 to 2021, the OEPA project worked in the South Focus to: 1) deliver treatment to the eligible population in endemic areas; 2) conduct impact epidemiological and entomological assessments; 3) give training and technical support to staff and IHAs; and 4) detect all Yanomami communities unknown to the MOH using remote sensing. Since 2012, 320,921 treatments for onchocerciasis have been delivered in Venezuela.

OEPA PROJECT IMPACT IN VENEZUELA



Approximately 109,952 people

in the Northcentral and Northeast foci of Venezuela are no longer at risk of onchocerciasis, representing 19% of the region's formerly endemic population.



The OEPA project supported training of program staff and 99 Indigenous Health Agents (IHAs),

who now oversee all program operations: treatment distribution, epidemiological assessments, community workshops, training of recently recruited IHAs, and also provision of other health interventions.



Assessments and modeling have shown 75% of subdistricts

in the South Focus are suspected to have interrupted transmission of onchocerciasis.



Among the most important achievements of the Venezuela South Focus are the incorporation of 250 of the 381 known onchocerciasis endemic communities to the health system, the likely interruption of transmission in 70% of the endemic area, the binational map created with Brazil, and the training of new IHAs' cohorts.

CARLOS BOTTO, PROGRAM COORDINATOR AT THE VENEZUELA SOUTH FOCUS

NATIONAL LEADERSHIP AND SUSTAINABILITY

Venezuela's Onchocerciasis Elimination Program leads the country's efforts to treat and eliminate onchocerciasis. The national program and OEPA have worked to ensure that onchocerciasis elimination efforts are prioritized, that health teams are given every opportunity possible to access the most remote communities, and that the impressive progress made to date is maintained with continued high-coverage treatment. The current program priority is the hard-to-reach communities of the South Focus.

Venezuela's national program has been very dedicated to the empowerment of the Yanomami community members, hosting anthropologists and developing trainings that empower IHAs to not only offer treatment to their neighbors, but also to train other IHAs.

Professor Maria Eugenia Grillet, a Venezuelan academic entomologist, serves on the PCC Executive Committee with Dr. Frank Richards and Dr. Santiago Nichols, PAHO Regional Advisory in Neglected Tropical Diseases.

LESSONS LEARNED

The participation of the community members as IHAs has been key in advancing the onchocerciasis elimination agenda, as well as for the control and elimination of other diseases, such as malaria; data for one IHA's accomplishments in the South Focus show that coverage in communities was increased by over 100%.

In 2015, the Venezuelan South Focus team began an initiative to **recover old missionary landing strips to facilitate more fixed wing flights to provide treatment** to remote communities and to reduce dependence on more expensive, less available helicopters. Through this effort, the number of landing strips have increased from 4 to 14; three with the help of local Yanomami residents. An estimated 6,600 persons (37% of the total population in the focus) are now more easily accessed for treatment thanks to these recovered landing strips.

Venezuela targeted four-times-per-year MDA in the South Focus to hasten elimination. Shortages of fuel and transport prevented high coverage in any of the four treatment rounds. The MOH learned that it is **better to get two effective treatment rounds a year than four ineffective rounds** and abandoned the quarterly approach in 2020.

OEPA Project Challenges

COVID-19 PANDEMIC

Mectizan® distribution plans were uninterrupted in Brazil during the COVID-19 pandemic because government health workers were charged with providing essential public health services that could not be stopped, such as vaccination programs and malaria diagnosis and treatment. The Brazilian government immediately put into place COVID-19 mitigation efforts within these outreach efforts. Onchocerciasis MDA was integrated into the provision plan of these essential services. In contrast, in Venezuela there was no government essential service outreach infrastructure with which to incorporate MDA, so Mectizan® distribution was delayed or canceled. **Mitigation and safety measures were put in place in Venezuela to allow MDA activities to resume in 2021** while ensuring the

health of the Yanomami community members and of health workers. Despite COVID-related delays to the OEPA project, modeling results are encouraging and do not predict that the elimination trajectory will be delayed in the Yanomami Focus Area if full coverage MDA can be restarted by 2022.

Regular program activities in 2021 introduced COVID-19 risk due to groups of people having close physical proximity indoors. **All activities supported by the OEPA project adhered to COVID-19 prevention guidance including social distancing, masks, handwashing and sanitizing, and cleaning of meeting spaces. Health workers providing treatments and IHA trainings were also tested before every visit to endemic communities in both Brazil and Venezuela to prevent community spread of COVID-19 in the Yanomami Focus Area.**



PHYSICAL ACCESS

Physical access to at-risk communities in the Yanomami Focus Area posed a significant challenge for the program due to the difficult rainforest terrain, the remoteness of the target populations, and limited access to ground transportation. Helicopters and fixed wing planes were necessary for health workers to have reliable and flexible access to most communities on both sides of the border. Both helicopters and fixed wing planes are expensive, with helicopters being by far the most costly to operate. In the past, the Venezuelan MOH relied on military helicopters for much of its access to the South Focus, but with the ongoing political and economic crises in the country this is no longer a reliable option.

In 2015, the Venezuelan South Focus team began an initiative to recover old missionary landing strips to facilitate access for fixed wing planes and reduce dependence on helicopters. A total of ten landing strips have now been recovered from jungle overgrowth and are operational. This resourceful strategy has had a significant impact on the OEPA project's ability to reach remote communities that often failed to meet coverage targets due to lack of regular access.

POLITICAL AND ECONOMIC CRISES

The program is continually searching for ways to be productive in Venezuela during ongoing crises characterized by political discontent, hyperinflation, and escalating crime

and mortality. During the grant period, many program activities were reduced due to instability, and food and fuel shortages made purchases of materials needed for long forays into the jungle extremely difficult. Shortages of fuel used by fixed wing aircraft were especially problematic in 2020 and 2021. Despite these obstacles, the Venezuela team continued to work on mapping projects and took advantage of whatever means of transportation became available (land, boat, or air) to reach the endemic communities. The program reached 89% of its 629 communities at least once, and usually multiple times in 2019.

CROSS-BORDER COLLABORATION

The Yanomami Focus Area is bisected by the international border between Brazil and

Venezuela, but because the indigenous population actively moves back and forth across this frontier, it comprises a single transmission zone. Interruption of transmission must occur on both sides of the border for elimination to be achieved, but the strained relationship between the two countries has stunted the international collaboration needed to achieve this goal. OEPA has played a central role in efforts to engage with both Brazil and Venezuela to provide greater cross-border cooperation and coordination, including participating in the first binational meeting in 2018 to develop a shared mapping platform and database. Progress towards these binational mapping efforts have since been stymied by ongoing political tensions, but support from USAID through OEPA has allowed program activities in each country to advance and has helped to maintain a positive relationship between the two countries' river blindness programs.



OEPA Project Lessons Learned

During the nine-year OEPA project, the priorities of the international coordinated response to onchocerciasis evolved and changed in response to the intermediate results occurring in endemic countries. As new findings were discovered and released, the OEPA project likewise evolved.

Most notably, the OEPA project found that **effective treatment coverage (>85% of eligible population) must be achieved in every treatment round** to advance towards the goal of elimination of onchocerciasis transmission in the Americas. Further, community-based treatment involving local collaborators is key and should be combined with health education to obtain community participation in the program. This became particularly evident working with very isolated communities, determining that **indigenous populations must be consulted by and involved in their own public health programs**. Through collaborative anthropological research, the OEPA project determined that a pursuit of understanding of local cultural practices can help

a program succeed while being respectful, empowering, and efficient.

In addition, USAID's OEPA project determined that **a data-driven approach is essential to success**: all program decisions and strategy must rely on data, with baseline as well as regular impact assessments. This is particularly essential to pursuit of verification of elimination, where substantial data is required by WHO, but that **verification data should be supplemented with context-specific information** needed to manage the program.

The OEPA project also found great improvement using **tailored management tools and contextually appropriate mathematical modeling programs** to guide field operations. In addition to data-driven management, the OEPA project found that an advisory committee that meets frequently and includes national program and expert members – in this case the OEPA PCC – is a strong driving force for an elimination program.



There will be a need for **more investment during the last mile of an elimination program, despite significant treatment decrease**. The OEPA experience is like polio and Guinea worm eradication in that the 'final inch' can be the most difficult, cost more, and take more time than originally anticipated. The 'long last mile' can stress donors and program staff. Enduring political support is key to overcome this challenge.

Finally, work toward elimination requires international coordination and collaboration. It is important to keep a record of achievements via **regular publication in scientific journals**. Annual articles regarding the initiative have appeared in the *Weekly Epidemiological Record* since 1996, and most foci have been the subject of specific reports in peer-reviewed literature by national authors.

OEPA Project Promising Practices & Recommendations

PROMISING PRACTICE – USE OF INDIGENOUS HEALTH AGENTS

Daniel Borges Silva is a Yanomami health worker responsible for the Komitarope area of Venezuela. Soon after starting his work as an IHA, Daniel recruited and trained a group of nine collaborators, including three women, to treat their local communities. This team harvests, hunts, and camps in the jungle for up to 40 days at a time on treks to offer Mectizan® to the communities. Through meetings with shamans and community “patas” (elders) they explain their mission and gain consent to proceed to treat residents. As a result of this approach, Mectizan® treatment coverage in Komitarope has dramatically increased.



One of the critical successes of the OEPA project was consistently and repeatedly engaging international thought leaders, national actors, and endemic communities in the process of promoting and validating onchocerciasis elimination. **Cross-pollination of ideas among regionally distinct programs** (Africa and the Americas in this case) can have a powerful impact on global health policy and the success of public health initiatives. For example, the elimination of onchocerciasis with **twice-per-year treatment** in Ecuador provides excellent support for a treatment strategy of twice-per-year in the Africa context, given the

similarity of the vector efficiency in Ecuador to vectors in many African countries.

Four countries in the Americas have received WHO verification of elimination leaning primarily on serology and entomology data, strengthening the credibility and suitability of the WHO elimination guidelines, especially for the OV16 ELISA test, a serological enzyme-linked immunosorbent assay that is now routinely used. Four different WHO International Verification Teams (IVT) of independent experts on onchocerciasis were appointed by WHO/PAHO to visit and report



PROMISING PRACTICE – ART AS A BRIDGE TO HEALTH

Caja Lúdica has shown health workers and community leaders how to use artistic tools to keep communities engaged during post-treatment surveillance, ensuring Mexico and Guatemala, once the two most river blindness-endemic countries in the Americas, will not see a reoccurrence of this debilitating parasitic disease.

ALBA LUCÍA MORALES, OEPA'S HEALTH EDUCATION ADVISOR.

their recommendations on the formerly endemic countries, after a detailed review of the data. This approach will likely be used in Africa, which has yet to verify a country free of onchocerciasis.

The OEPA project determined that layering data-driven and culturally sensitive programming elements was essential to progress and maintenance of elimination gains. For example, in the South Focus of Venezuela, health leaders have been pleasantly surprised at the **capability of IHAs to distribute treatments**; there are changing perceptions of the roles that can be played by different health actors. The results of working with IHAs were in part so successful because the training modules were specifically designed for IHAs, strengthened by anthropological studies, and designed to ensure cultural relevance and sensitivity. In complement, modeling exercises can play a powerful role in maintaining program momentum and optimism, and they pair effectively with enhanced technical

approaches to **track progress by community with numerous detailed indicators and mapping software**.

In addition, the OEPA project garnered substantial success leveraging **the interactive health education approach 'Art as a Bridge to Health' as a mechanism for community involvement, particularly during post-treatment surveillance**. As countries must successfully complete a three-year period with zero cases, the OEPA project sought a variety of avenues to ensure that no new cases were found. During this surveillance period in Mexico, health care workers implemented Caja Lúdica's creative techniques to impart important messages, including why treatments have stopped, why it remains necessary to continue collecting flies and human specimens, and how communities can stay vigilant and involved in helping to prove the disease is gone for good. These efforts proved incredibly successful across endemic countries.

Conclusion

The proof of concept for onchocerciasis elimination in four countries in the Americas achieved during the OEPA project has served as a clarion call, helping to empower many African countries to announce national onchocerciasis elimination goals. Ministry of Health staff and Program Managers from African countries who have attended the annual OEPA IACO meeting left with new confidence and enthusiasm that elimination of onchocerciasis transmission can be achieved and strategies to apply elements of the OEPA model for their own national programs. Four countries – Ethiopia, Nigeria, Sudan and Uganda – are now using twice-per-year treatment in some or all of their onchocerciasis-endemic areas, with great success.

The Carter Center and our government partners strive to be productive in Venezuela throughout the country's political, economic, humanitarian and health crises; this situation has been the largest threat to program success. While many activities were reduced in the later years of USAID's OEPA project due to the crisis, the Venezuela team continued to work on remote sensing projects and took

advantage of any available transportation means to reach the endemic communities.

OEPA has strongly recommended to Brazil and Venezuela to increase IHA involvement in Mectizan® MDA. It has become increasingly clear that IHAs are key to high treatment coverage in Venezuela amidst challenging circumstances. USAID's OEPA project helped to build and implement strategies to further increase IHA numbers and roles, as well as advocate for increasing the involvement of women in the program.

The nine years of USAID support that helped facilitate the achievements detailed here have been invaluable to the fight to eliminate onchocerciasis transmission, and the four gold stars of WHO verification show in no uncertain terms that success is possible. Together USAID and the OEPA project partners have taken great strides towards a world no longer threatened by this blinding parasitic disease, and in continued partnership intend to make onchocerciasis in the Americas history.

Global Influence

PUBLICATIONS

2021

Onchocerciasis in America: Venezuela One Step Away from its Elimination. *South Asian Journal of Parasitology*.

2020

Use of Ov16-Based Serology for Post-Elimination Surveillance of Onchocerciasis in Ecuador. *American Journal of Tropical Medicine and Hygiene*.

Progress in eliminating onchocerciasis in the WHO Region of the Americas: advances towards transmission suppression in parts of the Yanomami focus area. *Weekly Epidemiological Record*.

2019

Landscape Epidemiology of Human Onchocerciasis in Southern Venezuela. *Science Direct*.

Elimination of onchocerciasis in Africa by 2025: the need for a broad perspective. *Infectious Diseases of Poverty*.

Progress in eliminating onchocerciasis in the WHO Region of the Americas: doxycycline treatment as an end-game strategy. *Weekly Epidemiological Record*.

The positive influence the Onchocerciasis Elimination Program for the Americas has had on Africa programs. *Infectious Diseases of Poverty*.

2018

Diagnostics for onchocerciasis in the era of elimination. *International Health*.

Elimination of onchocerciasis from Colombia: first proof of concept of river blindness elimination in the world. *Parasites & Vectors*.

Elimination of onchocerciasis in Ecuador: findings of post-treatment surveillance. *Parasites & Vectors*.

Onchocerciasis: The beginning of the end. *International Health*.

Onchocerciasis: shifting the target from control to elimination requires a new first-step—elimination mapping. *International Health*.

Transitioning from river blindness control to elimination: steps toward stopping treatment. *International Health*.

Operational Performance of the Onchocerca volvulus “OEPA” Ov16 ELISA Serological Assay in Mapping, Guiding Decisions to Stop Mass Drug Administration, and Post-treatment Surveillance Surveys. *American Journal of Tropical Medicine and Hygiene*.

Progress towards eliminating onchocerciasis in the WHO Region of the Americas: advances in mapping the Yanomami focus area. *Weekly Epidemiological Record*.

The role of the NGDO Coordination Group for the Elimination of Onchocerciasis. *International Health*.

The role of national committees in eliminating onchocerciasis. *International Health*.

Progress toward elimination of onchocerciasis in the Americas. *International Health*.

2017

Progress towards eliminating onchocerciasis in the WHO Region of the Americas: elimination of transmission in the north-east focus of the Bolivarian Republic of Venezuela. *Weekly Epidemiological Record*.

2016

Evidence of suppression of onchocerciasis transmission in the Venezuelan Amazonian focus. *Parasites & Vectors*.

Knowledge, Attitudes and Practices Survey Conducted Three Years after Halting Ivermectin Mass Treatment for Onchocerciasis in Guatemala. *PLOS Neglected Tropical Diseases*.

Progress towards eliminating onchocerciasis in the WHO Region of the Americas: verification of elimination of transmission in Guatemala. *Weekly Epidemiological Record*.

2015

Elimination of Onchocerciasis from Mexico. *PLOS Neglected Tropical Diseases*.

One Hundred Years After Its Discovery in Guatemala by Rodolfo Robles, Onchocerca volvulus Transmission Has Been Eliminated from the Central Endemic Zone. *American Journal of Hygiene and Tropical Medicine*.

Progress towards eliminating onchocerciasis in the WHO Region of the Americas: verification of elimination of transmission granted by WHO to Mexico. *Weekly Epidemiological Record*.

Evaluation of a Community-Based Trapping Program to Collect Simulium ochraceum sensu lato for Verification of Onchocerciasis Elimination. *PLOS Neglected Tropical Diseases*.

2014

Elimination of onchocerciasis in the WHO Region of the Americas: Ecuador’s Progress towards Verification of Elimination. *Weekly Epidemiological Record*.

Twice-yearly ivermectin for onchocerciasis: the time is now. *Lancet Infectious Diseases*.

2013

Interruption of Transmission of Onchocerca volvulus in the Southern Chiapas Focus, México. *PLOS Neglected Tropical Diseases*.

Progress towards eliminating onchocerciasis in the WHO Region of the Americas: Verification by WHO of Elimination of Transmission in Colombia. *Weekly Epidemiological Record*.

Progress toward elimination of onchocerciasis in the Americas - 1993-2012. *Morbidity and Mortality Weekly Report*.

2012

Elimination of *Onchocerca volvulus* Transmission in the Huehuetenango Focus of Guatemala. *Journal of Parasitology Research*.

Progress towards eliminating onchocerciasis in the WHO Region of the Americas in 2011: Interruption of Transmission in Guatemala and Mexico. *Weekly Epidemiological Record*.

Guide to detecting a potential recrudescence of onchocerciasis during the post-treatment surveillance period: the American paradigm. *Research and Reports in Tropical Medicine*.

PRESENTATIONS**WHO and PAHO Forums**

World Health Organization's Global Malaria Programme Meeting 'Getting to Zero by 2020: Supporting Actions, Tracking Progress, Certifying Elimination.'

53rd PAHO Directing Council

WHO Evidence Review Group on Mass Drug Administration, Mass Screening and Treatment, and Focused Screening and Treatment.

Onchocerciasis Technical Subcommittee (OTS) meeting.

International Program Reviews

2020 Virtual Program Review for the River Blindness Elimination Programs.

2019 Virtual Program Review for the River Blindness Elimination Programs.

2018 Program Review for the River Blindness Elimination Programs.

2017 Program Review for the River Blindness Elimination Programs.

2016 Program Review for the River Blindness Elimination Programs.

2015 Program Review for the River Blindness Elimination Programs.

2014 Program Review for the Lions-Carter Center SightFirst River Blindness Elimination Programs.

2013 Program Review for The Lions-Carter Center SightFirst River Blindness Elimination Programs.

2012 Program Review for The Lions-Carter Center SightFirst River Blindness Programs.

Other Forums

69th Annual Meeting of the American Society of Tropical Medicine and Hygiene, Virtual Conference, November, 2020.

FLAP XXIV Congreso Latinoamericano de Parasitología.

The Carlos Slim Foundation Health Awards 2017.

American Society of Parasitologists President's Symposium honoring Nobel Prize laureate Professor William C. Campbell (co-discoverer of ivermectin).

The Ninth Session of Uganda Onchocerciasis Elimination Expert Advisory Committee (UOEEAC) Meeting.

Bill and Melinda Gates Foundation/Task Force for Global Health meeting of the Community of Researchers in NTDs (CorNTD).

Bill and Melinda Gates Foundation 2015 Global Partners Forum

Infectious Diseases Society of America (IDSA): IDWeek 2015.

NGO Network for Neglected Tropical Diseases (NNN).

LXVIII Reunión Annual de Salud Pública.

Xth Meeting of the Coordinators of the National Onchocerciasis Control Programmes (NOCP).

2013 BH Kean – Boxer Family Foundation Lecture in Global Health, Weill-Cornell Medical College.

18th Joint Action Forum of the African Programme for Onchocerciasis (APOC).

WORKING GROUPS

InterAmerican Conference on Onchocerciasis.

Program Coordinating Committee of the Onchocerciasis Elimination Program for the Americas.

Non-Governmental Development Organization Coordinating Group for Onchocerciasis Control.

Mectizan® Expert Committee (2015-2019).

Strategic Technical and Advisory Group (STAG) on Neglected Tropical Diseases, WHO Geneva (2012-2017).

CDC Onchocerciasis Expert Advisory Committee (2012-2014).

Appendices



APPENDIX A: PROJECT SUMMARY DATA TABLES

Population at risk, no longer at risk, under post-treatment surveillance and eligible for treatment, 2021

FOCUS	NUMBER OF COMMUNITIES	POPULATION AT RISK	POPULATION OUT OF RISK	POPULATION ELIGIBLE FOR TREATMENT	TRANSMISSION STATUS
Lopez de Micay-COL	1		1,366		Eliminated in 2010 Verified in 2013
Esmeraldas-ECU	119		25,863		Eliminated in 2012 Verified in 2014
North Chiapas-MEX	13		7,125		Eliminated in 2010, 2011, 2014 Verified in 2015
Oaxaca-MEX	98		44,919		
South Chiapas-MEX	559		117,825		
Escuintla-GUA	117		62,590		Eliminated in 2010, 2010, 2011, 2014 Verified in 2016
Santa Rosa-GUA	37		12,208		
Huehuetenango-GUA	43		30,239		
Central-GUA	321		126,430		
Northcentral -VEN	45		14,385		Eliminated in 2013
Northeast -VEN	465		95,567		Eliminated in 2017
South-VEN	381	17,518		15,433	Ongoing
Amazonas-BRA	273	18,000		14,954	Ongoing
REGIONAL TOTAL	2,472	35,518	538,517	30,387	

Most recent epidemiological indicators of onchocerciasis in the foci of the Americas

COUNTRY	FOCUS	BASELINE		MOST RECENT						TX ROUNDS >85% TO 2020	TRANSMISSION STATUS
		MICRO-FILARIA (MF) IN ANTERIOR CHAMBER OF EYE	MF IN SKIN	MICRO-FILARIA (MF) IN ANTERIOR CHAMBER OF EYE	MF IN CORNEA (PREVIOUSLY PK)	INFECTIVITY RATE (TI)	ANNUAL TRANSMISSION POTENTIAL	SEROLOGY	MF IN SKIN		
MEXICO	OAXACA	0%	7.30%	0%	0%	0/2000	0	0%	0%	18	Interrupted in 2008
						(0 - 0.13)	(0 - 1.2)				Eliminated in 2011
		(1995)	(1983)	(2008)	(2008)	(2011)	(2011)	(2008)	(2008)		WHO verified in 2015
	NORTH CHIAPAS	0.60%	1.50%	0.00%	0.00%	0/2000	0	0%	0.00%	17	Interrupted in 2007
						(0 - 0.3)	(0 - 1.3)				Eliminated in 2010
		(1995)	(1995)	(2006)	(2006)	(2010)	(2010)	(2006)	(2006)		WHO verified in 2015
	SOUTH CHIAPAS	1.50%	14.50%	0%	0%	0/2000	0	0.05%	0.30%	25	Interrupted in 2011
						(0 - 0.1)	(0 - 1.7)				Eliminated in 2014
		(1995)	(1995)	(2008)	(2008)	(2014)	(2014)	(2010)	(2008)		WHO verified in 2015
GUATEMALA	HUEHUETENANGO	7.20%	2.90%	0.00%	0.00%	0/2000	0	0%	0.00%	17	Interrupted in 2008
						(0 - 0.4)	(0 - 1.1)				Eliminated in 2011
		(1981)	(1987)	(2007)	(2007)	(2011)	(2011)	(2007)	(2006)		WHO verified in 2016
	CENTRAL	20.70%	52.20%	0.30%	0.30%	0/2000	0	0%	0%	22	Interrupted in 2011
						(0 - 0.03)	(0 - 1.1)				Eliminated in 2014
		(1981)	(1994)	(2009)	(2009)	(2014)	(2014)	(2011)	(2010)		WHO verified in 2016
	ESCUINTLA	6.20%	29.50%	0.00%	0.00%	0/2000	0	0%	N/A	13	Interrupted in 2007
						(0 - 0.27)	(0 - 1.0)				Eliminated in 2010
		(1979)	(1979)	(2006)	(2006)	(2009-2010)	(2009-2010)	(2006-2007)			WHO verified in 2016
SANTA ROSA	NA	3.00%	0%	0%	0/2000	0	0%	N/A	16	Interrupted in 2006	
					(0 - 0.56)	(0 - 1.4)				Eliminated in 2010	
	NA	(1983)	(2005)	(2005)	(2009-2010)	(2009-2010)	(2009)			WHO verified in 2016	

COUNTRY	FOCUS	BASELINE		MOST RECENT						TX ROUNDS >85% TO 2020	TRANSMISSION STATUS
		MICRO-FILARIA (MF) IN ANTERIOR CHAMBER OF EYE	MF IN SKIN	MICRO-FILARIA (MF) IN ANTERIOR CHAMBER OF EYE	MF IN CORNEA (PREVIOUSLY PK)	INFECTIVITY RATE (TI)	ANNUAL TRANSMISSION POTENTIAL	SEROLOGY	MF IN SKIN		
VENEZUELA	NORTH-CENTRAL	31.00%	44.30%	0%	0%	0/2000	0	0%	0%	17	Interrupted in 2010
						(0 - 0.1)	(0 - 1.3)				Eliminated in 2014
		(1999)	(1999)	(2010)	(2010)	(2013)	(2013)	(2010)	(2010)		
	NORTHEAST	21.70%	28.00%	0.20%	0.80%	0.38/2000	1.87	0%	0.30%	20	Interrupted in 2012
						(0.22 - 0.73)	(1.08 - 3.6)				Eliminated in 2017
		(1999)	(1999)	(2012)	(2012)	(2015-2017)	(2015-2017)	(2012)	(2012)		
SOUTH	10.50%	75.00%	1.00%	6.10%	0/2000	0		9.80%	2 - 56	Ongoing	
					(0 - 0.1)	(0 - 4.5)					
	(1998)	(1998)	(2015)	(2015)	(2012-2013)	(2012-2013)		(2015)			
BRAZIL	AMAZONAS	31.20%	63.30%	0%	3.60%	0.1	0.8	6.1	2.50%	18 - 45	Ongoing
						(0.08 - 0.32)	(0.5 - 1.9)				
COLOMBIA	LOPEZ DE MICAY	0%	39.60%	0%	0%	0/2000	0	0%	0%	20	Interrupted in 2007
						(0 - 0.28)	(0 - 2.9)				Eliminated in 2010
ECUADOR	ESMERALDAS	24.70%	78.70%	0%	0%	0/2000	0	0.05%	0%	25	Interrupted in 2009
						(0 - 0.1)	(0 - 1.0)				Eliminated in 2012
		(1991)	(1991)	(2008)	(2008)	(2012)	(2012)	(2009)	(2008)		WHO verified in 2014

APPENDIX B: KEY PARTNERS

USAID
 U.S. Centers for Disease Control and Prevention
 The Carter Center
 The MOHs of the six endemic countries (Brazil, Colombia, Ecuador, Guatemala, Mexico, and Venezuela)
 PAHO
 WHO
 Merck & Co., Inc., Kenilworth, N.J. and its Mectizan® Donation Program (MDP)
 The Lions Clubs International Foundation and local Lions Clubs of endemic countries
 The Bill and Melinda Gates Foundation
 The Carlos Slim Foundation
 OPEC Fund for International Development
 The Alwaleed Bin Talal Foundation
 Global Institute for Disease Elimination (GLIDE)

APPENDIX C: PRINCIPLE CONSULTANTS

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 Dr. Joanna Gonçalves, Anthropological researcher, Venezuela Ministry of Health
 Dr. Alejandro Reig, Anthropological researcher, Institute of Social and Cultural Anthropology, University of Oxford

APPENDIX D: OVERVIEW OF CONTRIBUTIONS TO THE OEPA REGIONAL INITIATIVE

in millions of USD

SOURCE	2012	2013	2014	2015	2016	2017	2018	2019/20	TOTAL	%
Countries (counterpart funding from MOH's)	7.73	4.4	1.34	2.79	2.62	2.2	1.54	1.81	24.4	40%
USAID OEPA Project	1.58	1.30	1.20	1.86	1.69	1.13	2.19	2.04	13.0	22%
Other contributors to OEPA through The Carter Center: BMGF, LCIF, Merck/MDP, CDC/USAID, Carlos Slim Foundation, OFID, Alwaleed Philanthropies and Other Donors	1.63	1.41	1.68	1.27	1.51	2.15	1.22	5.19	16.06	27%
Merck/MDP (in kind)	3.64	0.00	0.75	0.00	0.94	0.39	0.44	0.72	6.9	11.4%
TOTAL	14.58	7.11	4.97	5.92	6.76	5.9	5.38	9.76	60.4	100%

* Abbreviations include: Bill & Melinda Gates Foundation, Lions Clubs International Foundation, Mectizan Donation Program, U.S. Agency for International Development, U.S. Centers for Disease Control and Prevention, OPEC Fund for International Development

PHOTO CREDITS

All photos: The Carter Center and the Onchocerciasis Elimination Program for the Americas (OEPA).

