Transforming WHO Recommendations into Practice:

More Countries Achieving Interruption of Onchocerciasis Transmission in West Africa

Executive Summary

Onchocerciasis elimination in West Africa

Onchocerciasis (OV) or river blindness is a parasitic disease transmitted by infected blackflies (*Simulium* spp.). These blackflies breed along fast-flowing rivers and streams, often close to remote villages near fertile land where people rely on agriculture. OV is endemic in Africa, Yemen, and the Americas. Starting in the 1970's, control of the disease in West Africa was achieved through larviciding of breeding sites. Since 1988, treatment with ivermectin has been used in combination with larviciding or as a stand-alone strategy. In 2016, the World Health Organization (WHO) published new guidelines for stopping mass drug administration (MDA) for onchocerciasis and the verification of elimination of transmission (WHO 2016). These guidelines drive the paradigm shift from control to elimination of OV transmission.

Since then, National OV programs in Africa have shifted gears and are now implementing strategies to accelerate elimination of transmission through intensified MDA and improved mapping, monitoring, and evaluation. In 2017, the WHO OV Technical Advisory Sub-group (OTS) began to meet regularly to review the progress in program implementation and propose technical recommendations. Most countries have established national onchocerciasis elimination committees (NOEC), which provide technical and programmatic guidance to the national programs but also adapt and domesticate the WHO guidance.

As part of a digitalized OV MDA, Madeleine Ani, a community distributor, takes the height of program participant Chantal Adjalala while a recorder positions herself to read and record the measurement in a smartphone in Benin, November 2022. PC: Act|West, FHI360.

In Africa, many of the USAID-supported countries in the Act to End NTDs | West (Act | West) Program have achieved significant milestones. These include the first submission to WHO of a dossier for verification of elimination of OV in Africa by Niger; interruption of transmission in Senegal; and achieving the criteria for stopping MDA in many districts in Togo, Ghana, and Mali. Despite these successes, multiple challenges in program implementation show the need for more support from partners, donors, and the OV scientific community for national programs.

Status of the OV program implementation in West Africa

The Onchocerciasis Control Program in West Africa (OCP) started in 1975, funded by donors such as USAID and intending to eliminate human onchocerciasis as a disease of public health importance and an obstacle to socio-economic development primarily through vector control strategies: aerial and ground larviciding. In 1987, Merck & Co. committed to donating as much ivermectin as needed for as long as needed, free of charge, allowing for the mass treatment of the at-risk populations. By the end of 2002, the OCP covered 11 West African countries.

Gnigan Kezire, a community drug distributor, gives tablets to a program participant in the Assoli district, Kara region of Togo, as part of an integrated OV/STH integrated MDA, December 2023. PC: Act | West, HDI.

The OCP successfully eliminated OV as a public health problem in all 11 countries except Sierra Leone, where the OV program was interrupted by civil war. Introducing ivermectin led to a decline in OV morbidity in the supported countries. The African Program for Onchocerciasis Control (APOC) was launched in 1995 and closed in 2015. The APOC was funded by a group of donors, including USAID, and its mandate was to control human onchocerciasis through community-directed treatment with ivermectin (CDTI) in the African endemic countries, which the OCP did not cover. Five ex-OCP countries (Ghana, Benin, Togo, Guinea, and Sierra Leone) were included as APOC Special Intervention Zones for continued CDTI. By 2000, in partnership with endemic governments, non-governmental organizations, and affected communities, the APOC had treated 20,298,138 individuals in 49,654 communities in 63 projects in 14 countries through the CDTI.[1]

Since 2007, national OV programs in West Africa gradually received major funding from the USAID as part of integrated NTD programs, initially under the NTD Control Program (2006–2011), then through ENVISION (2011–2018) and End in Africa Projects (2010–2018), and subsequently through the Act | West program since 2018. CDTI was gradually transformed to integrated MDA with ivermectin and albendazole, where lymphatic filariasis (LF) and OV are co-endemic. The countries supported by Act | West are listed in Table 1. All these countries have made significant progress towards OV elimination, maintaining 100% geographical treatment coverage in known OV endemic areas, except Cameroon, where the progress in some districts has been hindered due to the co-endemicity of loiasis in OV-endemic districts.

[1] Homeida M, Braide E, Elhassan E, Amazigo UV, Liese B, Benton B, Noma M, Etya'alé D, Dadzie KY, Kale OO, Sékétéli A. APOC's strategy of community-directed treatment with ivermectin (CDTI) and its potential for providing additional health services to the poorest populations. African Programme for Onchocerciasis Control. Ann Trop Med Parasitol. 2002 Mar;96 Suppl 1:S93-104. doi: 10.1179/000349802125000673. PMID: 12081254.

TABLE 1: Act West Program support to OV activities, fiscal year 2020–2023

Activities/Country	Benin	Burkina Faso	Cameroon	Cote d'Ivoire	Ghana	Guinea	Mali	Niger	Senegal	SierraLeone	Togo
Blackfly breeding site assessments		●	●								
OEM (including exclusion mapping)			●		●						
MDA	●	●	●	●	●	●			●	●	●
Impact monitoring surveys / pre-Stop MDA surveys		●	●	●	●	●					●
Stop MDA surveys					●						●
Elimination plan development support	●			●		●			●		
Dossier development								●			
Surveillance (PTS/PES)								●			
NOEC support	●		●	●	●	●	●	●	●		●
Laboratory support											●
Cross border meeting	●	●		●	●	●	●		●	●	●
OV Tracker					●				●		●

Background

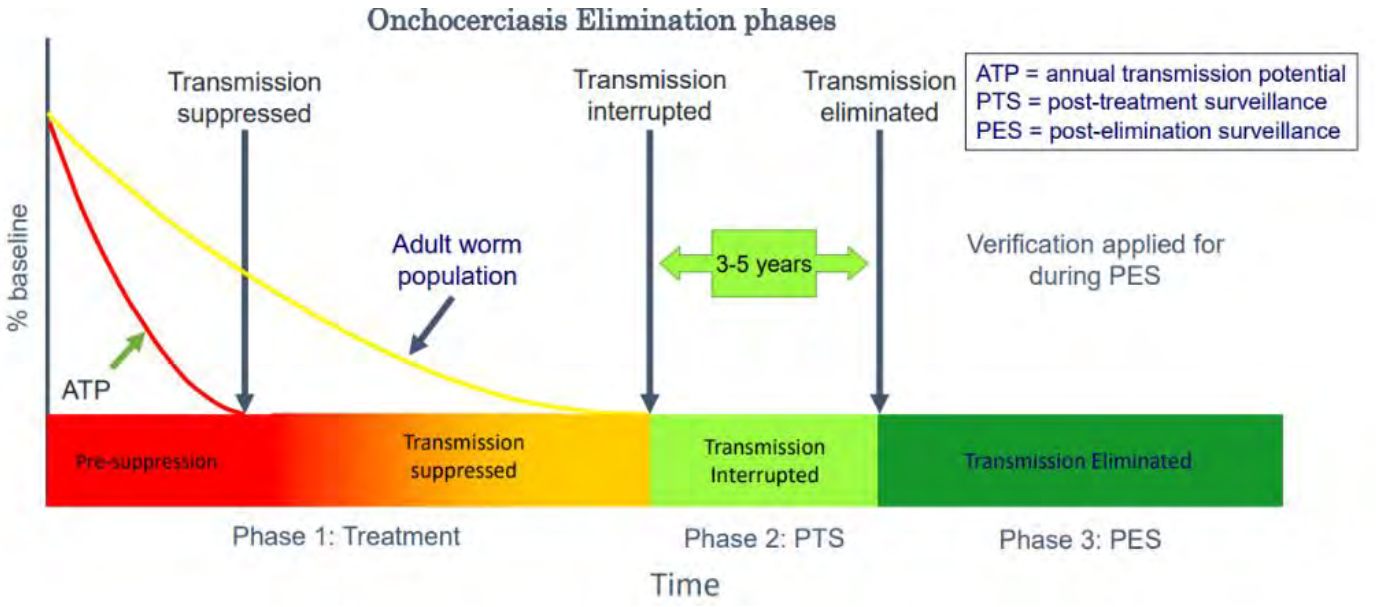
History from the OCP/APOC era to the inception of the Act | West program

The WHO-led OCP was established in 1974 and closed in 2002. The OCP was essentially a vector control program that deployed significant logistics and technical means to control OV through aerial and ground larviciding in the endemic river basins in 11 countries in West Africa. Towards the end of the OCP, ivermectin treatment was introduced through mobile teams. Then, CDTI was introduced in many OV project areas for mass treatment of the at-risk population following the donation of ivermectin in 1987. Ten of 11 Act | West countries were covered under the OCP. The APOC was launched in 1995 and ended in 2015. APOC was a CDTI program for the African endemic countries not covered by OCP, including the Act | West country Cameroon. Five ex-OCP countries (parts of Ghana, Benin, Togo, Guinea, and Sierra Leone) were later included as APOC Special Intervention Zones for continued CDTI due to an unsatisfactory entomological and epidemiological situation at the end of OCP. Under the OCP/APOC, ivermectin treatment targeted only meso- and hyper-endemic areas. Multiple agencies, including USAID, funded OCP and APOC. The USAID has continued its OV support as part of the integrated NTD programs.

Summary of the WHO/OTS guidelines

The key guiding principles of the OV program stem from the conceptual framework (Figure 1), highlighted in the WHO 2016 guidelines. The OV programs in the endemic countries have acquired significant field expertise and capacity in the organization and rollout of critical functions of the OV programs, mainly the organization and implementation of CDTI or MDA with ivermectin.

Figure 1: OV Conceptual framework



During the OCP era, at the inception of the OV program, baseline mapping was conducted focusing on blackfly breeding sites across river basins, and epidemiological assessment was conducted using skin snips at randomly selected first-line villages located nearest to those sites.[2] During the APOC, the mapping used rapid epidemiological mapping of onchocerciasis (REMO) and rapid epidemiological assessment (REA).[3] The endemic communities were classified as hypo-, meso-, and hyper-endemic, with the initial objective of controlling OV as a public health problem. The treatment with ivermectin started in meso- and hyper-endemic communities.

From the OCP/APOC era, program implementation and impact assessments relied on periodic surveillance in sentinel communities. In West Africa, monitoring surveys were rolled out every 4–5 years in sentinel villages where around 300 people aged ≥ 1 year old were surveyed to demonstrate transmission reduction. Entomological evaluation is recommended for detecting parasite larvae in vector populations because of the long prepatent period in human infection.

Before 2000, most entomological analyses used black fly dissection and annual transmission potential (ATP) for entomological assessments. Since the shift from control to elimination of transmission, investigations such as impact monitoring, pre-Stop MDA, and Stop MDA surveys involve serological testing using blood samples eluded from dried blood spots (DBS) in laboratory either on OV16 rapid diagnostic test (RDT) or on OV16 ELISA. Entomological assessments use the O-150 pool-screen PCR or the newer OvND5 qPCR. These surveys are implemented to ascertain the suppression or interruption of transmission.

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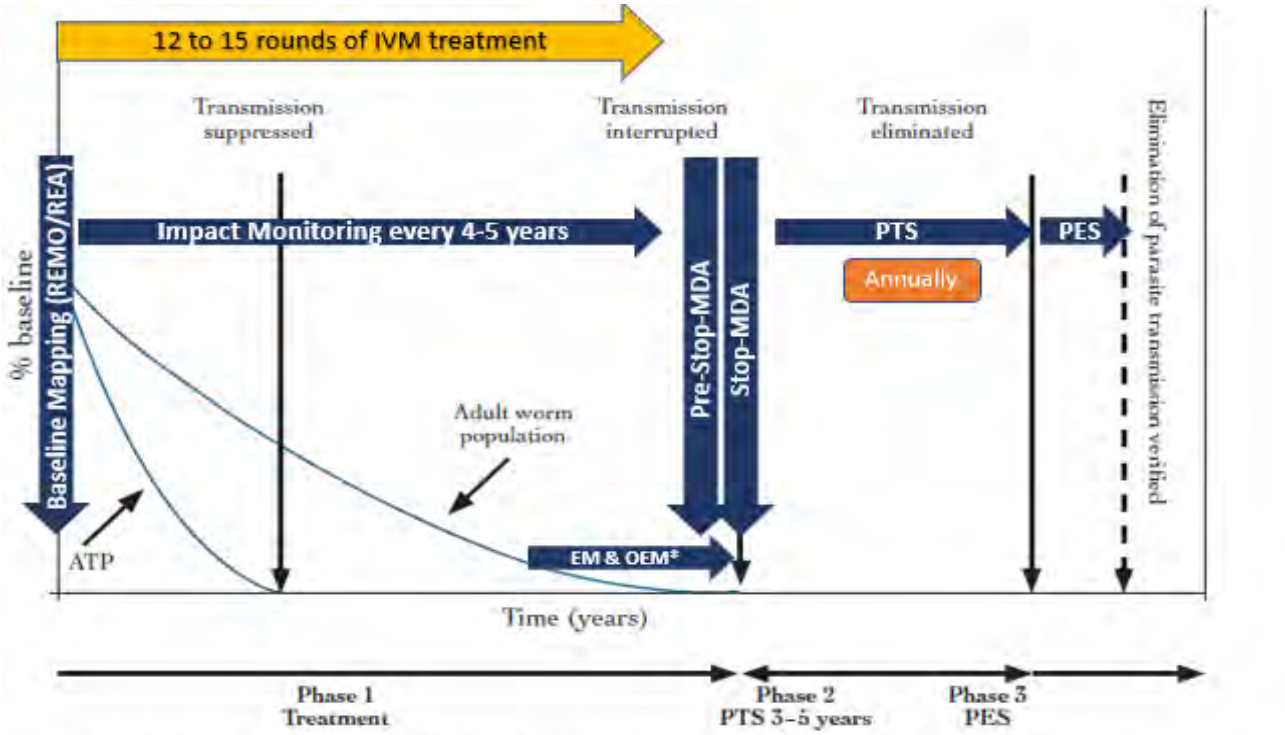
[2] De Sole et al. Onchocerciasis distribution and severity in five West African countries. Bull World Health Organ. 1991;69(6): 689-698

[3] Ngoumou, Pierre, Walsh, J. F., WHO Programme for the Prevention of Blindness & UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases. (1993). A manual for rapid epidemiological mapping of onchocerciasis / P. Ngoumou and J. F. Walsh. World Health Organization. https://apps.who.int/iris/handle/10665/59537

Post-treatment surveillance (PTS) surveys are implemented annually, mainly focusing on entomology until the elimination of transmission has been verified. The post-elimination surveillance (PES) occurs after the post-treatment surveillance (PTS) phase (Figure 2). The national onchocerciasis committees follow the WHO guidelines; the OTS recommendations are implemented but adapted to specific contexts of the countries..

FIGURE 2: OV Disease-Specific Assessments



ATP: Annual Transmission Potential; EM: Exclusion Mapping; OEM: Onchocerciasis elimination mapping; PTS: Post-treatment Surveillance; PES: Post-Elimination Surveillance; *i-TAS- OEM could be integrated with TAS (LF survey)

Adapting the WHO/OTS guidelines or recommendations requires in-depth knowledge of the program implementation context, including the socio-demographic environment, hydrography, seasonality, and geospatial factors. Some countries, like Togo, have decided to align the transmission zones with the regional administrative units. Others, like Senegal, have transmission zones that fit river basin delineation (*Faleme* and *Gambie* rivers*)*. Mali has OV foci embedded in large river basins. Hence, epidemiological and entomological surveys are conducted within geographic areas determined by the countries.

I. Key Point 1: Mass Drug Administration (MDA) to Pre-Stop MDA

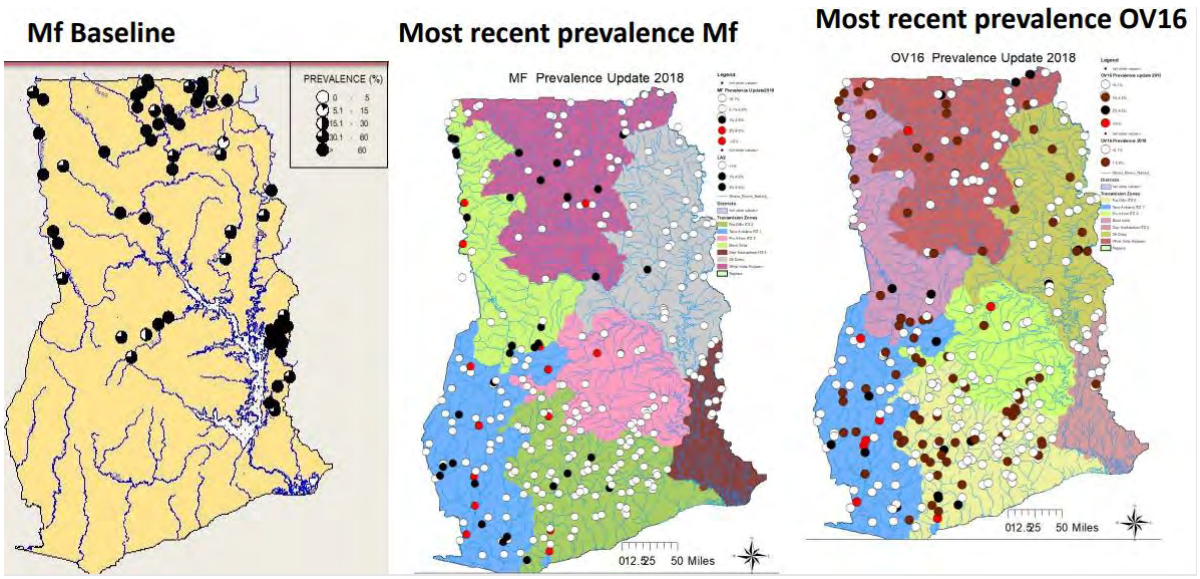
Reaching the pre-Stop MDA stage

It takes 12–15 years of MDA with effective treatment coverage (80%) to reach the stage of conducting pre-Stop MDA surveys before assessing the interruption of transmission of OV. By 2023, all 11 Act | West countries had conducted more than fifteen rounds of MDA, except those areas in Cameroon with co-endemic loiasis. Ten of the 11 countries had intense vector control in part or all of the countries under the former OCP, except Sierra Leone, where vector control was interrupted due to civil war. Burkina Faso, Cameroon, Ghana, and Togo have already conducted pre-stop MDA surveys based on the impact monitoring results from sentinel villages. See Box 1 for Ghana's experience.

Box 1: Ghana's epidemiological survey results: microfilaridermia at baseline and microfilaridermia and OV16 antibody in 2018

Ghana was one of the 11 countries covered by OCP with vector control and ivermectin treatment of at-risk populations. The treatment strategy included treatment by mobile teams, CDTI, and integrated LF-OV MDA. Since 2019, biannual MDA has been conducted. Following decades of MDA and the successful implementation of biannual MDA in several districts, most endemic districts in Ghana have reached the stage of pre-Stop MDA survey. The OV control activities started in 1976 with vector control activities under OCP. Aerial larviciding was the main strategy used in the Northern Savannah regions and lasted 26 years. Since the introduction of the IVM, treatment has been conducted initially by national mobile teams. In 1997, CDTI was introduced by OCP to identify and treat the eligible population in endemic communities. Following the cessation of the OCP operation in 2002, several communities were classified by APOC as Special Intervention Zones (SIZ) or areas of hyperendemicity, in which partial CDTI activities were undertaken. From 2004, MDA was conducted as part of the LF elimination program combined with the OV program, resulting in significant improvements in geographic and therapeutic coverage. An impact assessment was carried out in 2017 (following 12 to 17 rounds of MDAs) using the OV-16 RDT test and collected dried blood samples (DBS) in children between 5–9 years for Ov-16 ELISA test later and skin snips assessment in adults above 20 years in all the then ten regions in Ghana. The study demonstrated low seroprevalence and a drastic reduction in the prevalence of infection in the two transmission zones (TZ) (maps below), namely the Pra/Offin and Asukawkaw/Dayi transmission zones. The two TZs recorded very low mf prevalence and Ov-16 seroprevalence of < 1% and < 0.1%, respectively, in most communities, while few communities had both mf prevalence and Ov-16 seroprevalence between 1% and 4.9%. After additional 2–3 years of biannual MDA implemented since 2018, these two transmission zones undertook pre stop survey using the OTS methodology in 2019 and passed as the results show prevalence below 2% seroprevalence by ELISA.

Box 1, continued: Ghana's epidemiological survey results: microfilaridermia at baseline and microfilaridermia and OV16 antibody in 2018



Onchocerciasis elimination mapping (OEM), exclusion mapping, and desk reviews to determine the suitability of OV transmission

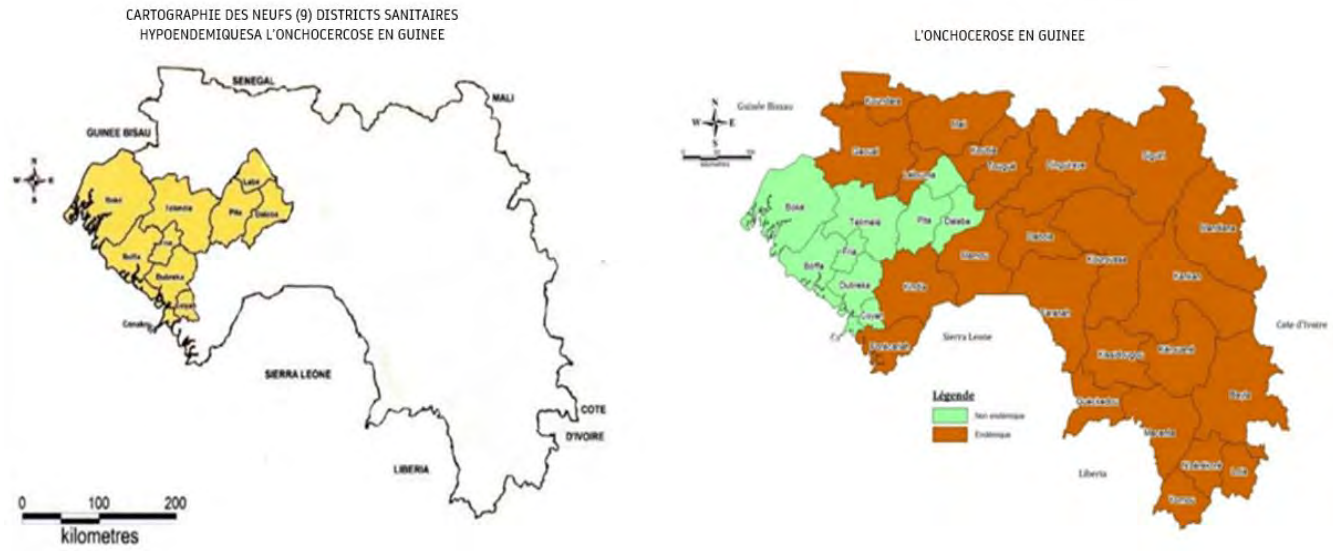
While some countries had independently moved toward eliminating transmission, in 2016, the WHO shifted its programmatic focus in Africa from controlling the disease to eliminating transmission. For a country to be verified as having eliminated OV transmission, it must ensure that no hypo-endemic areas are left untreated. In addition, all areas where transmission could be suspected or sustained must be cleared. Under the OCP/APOC, only meso-endemic and hyperendemic areas have been treated, and many hypo-endemic districts remain untreated either alone or through integrated LF-OV MDA. The WHO/OTS recommends conducting the onchocerciasis elimination mapping (OEM) in ivermectin-naïve areas. In all areas previously designated as hypo-endemic or assumed to be non-endemic and therefore excluded from OV control programs, the OEM determines whether OV is endemic at a level above the threshold which warrants MDA intervention.

From 2018 to 2023, several countries under the Act | West program have implemented parts or all the components of an OEM. For example, with the END Fund funding, Mali and Niger conducted exclusion mapping and field prospection in districts outside the endemic areas, excluding them from further serological surveys. Guinea, with Sightsavers funding, conducted Phase 1 serological assessment in first-line villages in nine districts formerly considered nonendemic (Box 2 below).

Box 2: Guinea's OEM experience

In FY 2021, breeding site mapping was completed in 33 HDs with financial support from Sightsavers. 242 *Simulium damnosum* complex breeding sites were inventoried in all basins surveyed, and 72 were positive for larvae. In all the positive sites, the larvae were collected and preserved. In FY 2022, OV elimination mapping (OEM) was completed in nine HDs with financial support from Sightsavers. An estimated 4,500 dried blood spot (DBS) samples were collected from 232 villages and analyzed with OV16 RDT. Of the nine HDs, six (Boké, Fria, Coyah, Dubréka, Telimélé, and Labé) have one or more villages with a prevalence above 5%, and three have villages with a prevalence below 5%. According to the WHO/OTS recommendations, these six HDs need to start MDA and will be included in the FY 2024 MDA, and the other three HDs (Boffa, Dalaba, and Pita) will carry out the second phase of mapping to be funded by Sightsavers.

OEM maps in Guinea



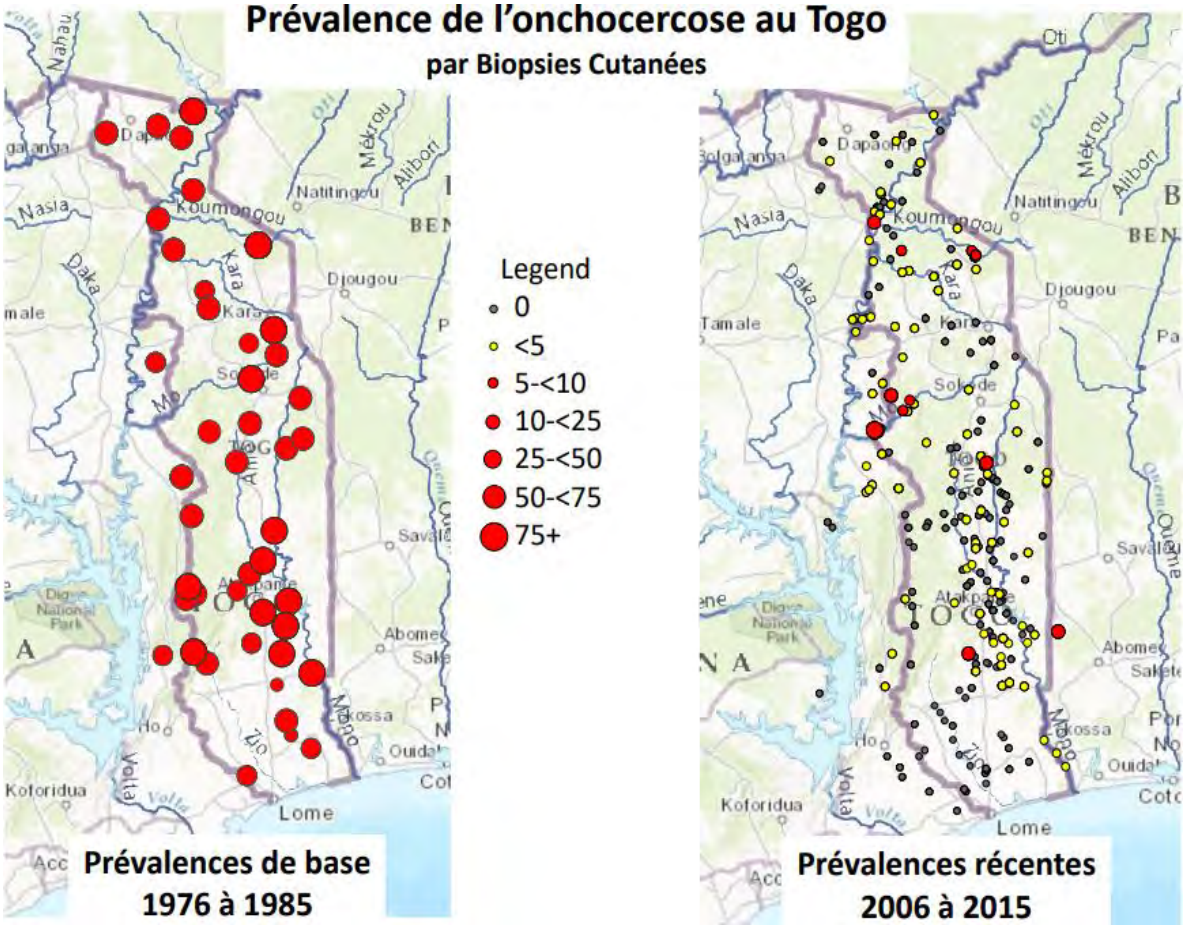
II. Key Point 2: Stopping MDA

Reaching the Stop-MDA stage

As recommended by the WHO, once a transmission zone has successfully passed the pre-Stop MDA survey, a full Stop MDA survey can be conducted, which includes entomological and serological assessments. By 2023, several Act | West countries have qualified or conducted Stop MDA surveys in parts or whole of the countries. Senegal has qualified and completed Stop MDA surveys in all the endemic districts (co-funded by END Fund and Act | West). Mali has qualified for and is conducting Stop MDA surveys in all but three districts, with funding from the END Fund. Togo has qualified and is conducting Stop MDA surveys in four transmission zones (see Box 3).

Box 3: Togo's vector control work, including skin snip biopsy results

Togo vector control (ground and aerial larviciding) started in 1976 in the northern part of the country and extended to the South in 1988. Ivermectin distribution began in 1988 under OCP through mobile teams' strategy; the country then moved through annual MDA to biannual treatments in the special intervention zones in the river basins of Oti, Keran, Kara, and Mo and covered 11 districts from 2002 to 2007. The program achieved more than 91% geographic and 88% epidemiological coverage since 2001 in Kara, Central, *Plateaux*, Maritimes, and *Savanes* regions. *Savanes* and *Maritimes* reached 3.3% and 0.3% skin snip biopsy prevalence in 2015 (Figure 3). The two regions have had over ten rounds of treatment since 2016. Additionally, pre-Stop and impact monitoring surveys in 2018-2020 showed 0% OV16 ELISA seroprevalence, which qualified for conducting full Stop MDA surveys.



Epidemiological and entomological surveys for stopping MDA

The Stop MDA surveys aim to provide serologically and entomologically evidence to support the decision to stop MDA in a transmission zone. The WHO guidelines in 2016 and the supplementary recommendations by WHO/OTS in 2017 provided survey methodologies and indicator thresholds for deciding to stop MDA.

- For the serological survey, 3000 children aged 5–9 years through cluster sampling must be tested by OV16 ELISA in a transmission zone. The upper bound of the 95% confidence interval of the OV16 antibody prevalence should be less than or equal to 0.1%.

- For entomological surveys, a minimum of 6000 blackflies collected from a transmission zone should be tested by O-150 PCR. The upper bound of the 95% confidence interval of the prevalence of infective flies should be less than 0.1% in parous flies or less than 0.05% in all flies.

Togo has trained personnel and established laboratory infrastructure for OV. USAID funds through the Act | West program have been instrumental in reinforcing the lab capacity and accelerating OV sample processing. The Institut National d'Hygiene (INH) laboratory conducts Ov16 ELISA and O-150 PCR analysis and processes thousands of ELISA samples and PCR on flies supporting OV elimination. The lab support was instrumental in implementing OV surveys. In 2022, the Stop MDA surveys were carried out in the *Maritimes* and *Savanes* transmission zones (see Box 4).

Box 4: Togo's stop MDA surveys

In the *Maritimes* region of **Togo**, a pre-stop MDA assessment was conducted in 2017 using Ov16 ELISA. The DBS results were presented to the OEC in 2019, which requested additional PCR analysis to be carried out on *Simulium* flies collected at previous transmission sites and new breeding sites. In FY21, Togo collected flies in the Maritime region from both recent and old breeding sites, and PCR testing (Blackfly O-150 pool screening) was conducted in FY22 with support from Sightsavers. The entomology data (0.0/1000 infectivity rate from 11629 blackflies analyzed, except in the *afangadji* area) were presented to the OEC meeting on June 2–3, 2022. Indeed, the data showed positive PCR results in flies from *Afangadji* area in the region where out of 3,732 flies captured and analyzed, two were positive for PCR, which indicates a rate of infection of 0.05% with a 95% confidence interval (0,004–0,15), which WHO recommends that MDA be continued. The blackflies in the other areas of the Maritime region were negative. For the epidemiological survey, the surveyors collected 8,946 samples from children 5–9 years old in April 2022. The results of the OV16 ELISA were 0%. Based on these results, the OEC recommended stopping MDA in the Maritime region, except in the area called *Afangadji*, where MDA should continue, combined with additional entomological and epidemiological surveillance.

Figure 4: Maritimes: 2020 Epidemiology Results

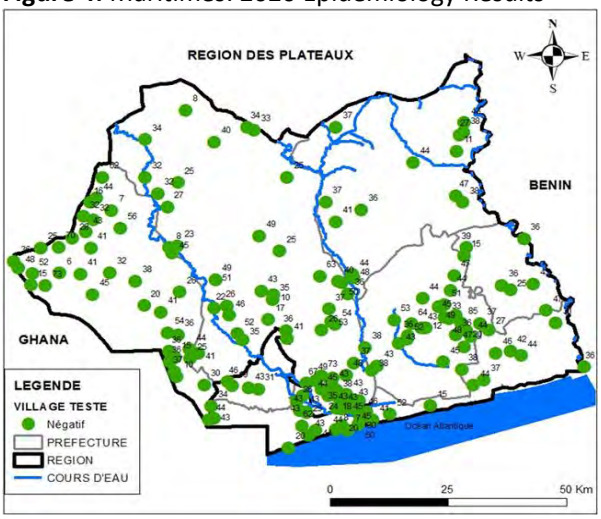
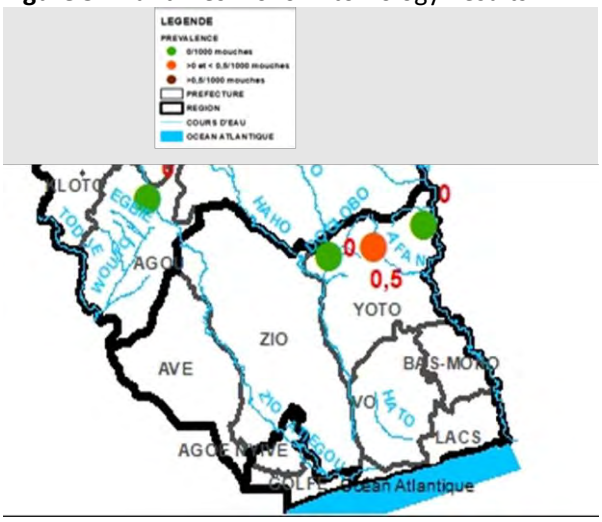


Figure 5: Maritimes: 2020 Entomology Results



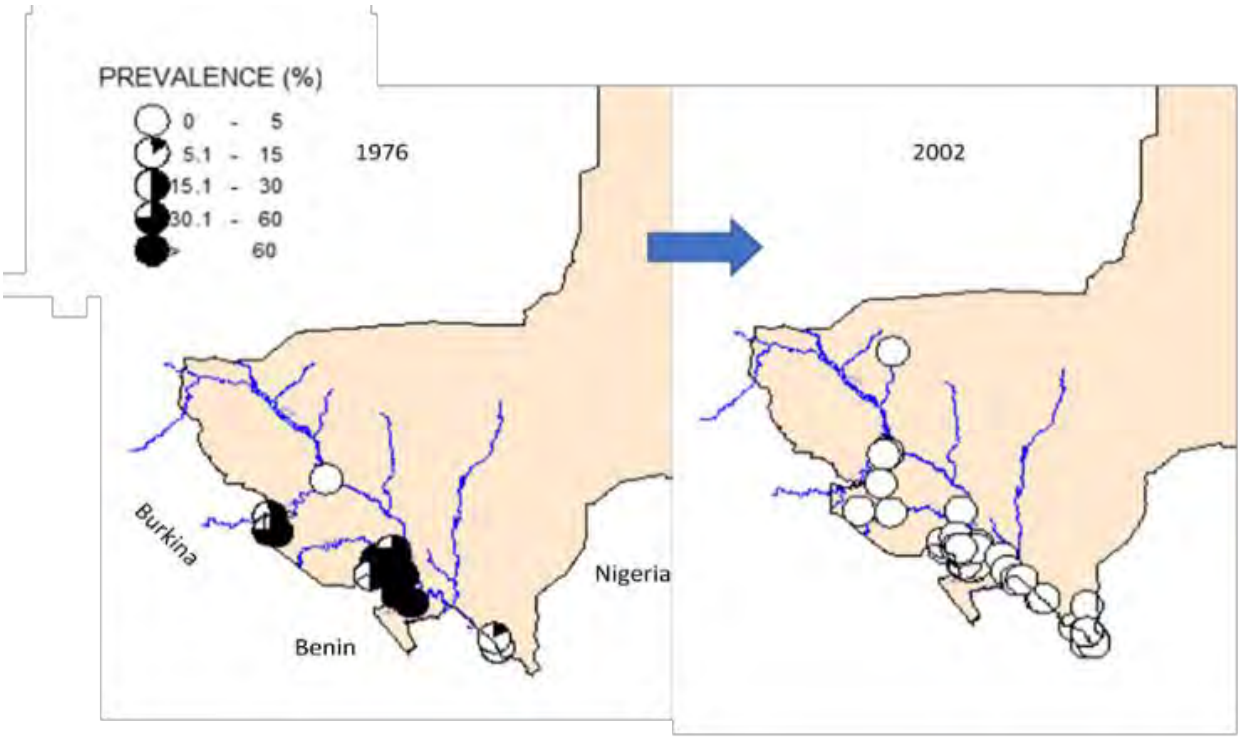
III. Key Point 3: Post-treatment Surveillance; Cross-cutting issues/Sustainability

Reaching the surveillance stage

Among the Act | West countries, Niger was the first to reach the verification of elimination stage. In Niger, the baseline mapping, including nodules palpation and skin snip biopsy in suspected villages, was conducted in 1974. Ten health districts were classified as endemic (Tera, Bankilare, Gotheye, Torodi, Say, Boboye, Falmeye, Kollo, Dioundiou, and Gaya). The control was essentially vector-based from 1976 to 1989 under the OCP. The OV prevalence by skin snip gradually declined to 0% in sentinel villages without conducting specific OV MDA. By the end of OCP, Niger reached the control of OV as a public health problem in 2002 (Figure 6) and started surveillance at the sentinel villages. In 2003 ten former OV districts were found co-endemic with lymphatic filariasis. They started LF MDA in 2007 with albendazole and ivermectin in all LF-OV co-endemic districts, including formerly hypo-endemic and meso-endemic communities. Following decades of elimination efforts, according to the WHO 2016 guidelines requirements and the WHO/OTS supplementary recommendations in 2017, an OV entomological surveillance survey was conducted in 2018, and an epidemiological surveillance survey was conducted in 2018-2019 with funding from USAID and END Fund to gather required evidence that Niger had eliminated OV transmission. Accordingly, 126,098 blackflies from endemic districts were analyzed by O-150 PCR with 0% positivity (upper bound of 95% confidence interval 0.001%), and 16,406 children aged 5–9 years from the endemic districts were tested by OV16 ELISA with 0% positivity (upper bound of 95% confidence interval 0.0%).

In February 2023, Niger submitted its dossier to verify the elimination of OV transmission to WHO. The WHO independent expert committee visited Niger to verify the dossier in July 2023. Niger is a peculiar case, as elimination was likely achieved mainly based on successful vector control activities prior to 2002 but lacked guidance for verification. The country will launch post-elimination surveillance activities as recommended in the WHO 2016 guidelines, which would also be included in an integrated disease surveillance and sustainability strategy. Indeed, countries should ensure that detection and control of onchocerciasis recrudescence are integrated and become a routine function of national disease surveillance and control services.

Figure 6: Prevalence of *O. volvulus* in humans using skin snip from the start to end of OCP in Niger, 1976-2002



Dossier development story and best practices

Little experience exists in OV dossier development in Africa. The successful elimination of OV in the Americas (Columbia, Guatemala, Ecuador, and Mexico) constitutes a learning path for countries close to elimination. Several West African countries, including Togo, Senegal, and Mali, will likely reach the elimination stage in five years. The Niger elimination dossier submitted to WHO in 2023 was a joint effort by Niger's national program, partners (Helen Keller and FHI360), and donors (USAID and the END Fund). The national OV expert elimination committee played a pivotal role in developing, finalizing, and submitting the dossier. The Niger NOEC, which was established in 2018, guided the national program to collect necessary data according to the WHO guidelines and dossier requirements. After reviewing all the available data, the NOEC in 2021 concluded that Niger had met the elimination criteria of OV transmission and recommended that the dossier be developed and submitted to WHO for verification.

The Minister of Health, Niger, submits the OV elimination dossier to the WR, WHO-Niger. Photo credit: Act |West/Helen Keller Intl.

Following are the key steps to Niger's successful dossier submission:

1. A dossier development group (DDG) was established, including in-country NOEC members and program staff. The dossier template followed the WHO-recommended dossier structure and examples from South American countries.
2. The DDG held several workshops to review and collate historical documents and data and to draft the dossier.
3. The draft was then shared with international OEC members for input. A NOEC meeting was held in August 2022 with all committee members and partners to review the draft dossier and to recommend revising and improving the document.
4. External consultants were provided by End Fund and Act | West to assist with finalizing the writing of the dossier.
5. Finally, a special NOEC meeting was held in February 2023 to review and approve the dossier for submission to WHO. During the meeting, the Minister of Health, Niger, officially submitted the dossier to the Country Representative of WHO, Niger.

Critical challenges to implementing WHO OV recommendations

Despite the successes in endemic countries, multiple challenges exist in program implementation. The challenges need to be addressed timely for national programs to achieve the onchocerciasis elimination goals specified in the WHO NTD 2030 road map. The critical challenges are as follows:

1. **Lack of in-country OV laboratory capacity.** Only a few laboratories are specialized in OV and have the infrastructures and OV-trained technicians. For decades, support for OV control was limited to two programs in Africa, the OCP and APOC, and laboratory expertise was limited to central laboratories managed by these programs. Most OV samples were shipped to the Multidisease Surveillance Center (MDSC), now the ESPEN laboratory, in Ouagadougou, Burkina Faso, for processing. Following the closure of APOC in 2015, several countries in West Africa, including Ghana, Togo, Cameroon, Niger, and Benin, developed OV laboratory capacity to analyze the OV samples in-country. However, most national OV programs still need the in-country ability to conduct serological and entomological tests by OV16 ELISA and O-150 PCR, respectively. This results in a long delay in processing and testing samples already collected. The ESPEN lab still plays a central role in training lab technicians, processing OV samples, and providing technical support to country programs.

2. **Laboratory analysis of samples is problematic because of the poor performance of some assays and the lack of resources.** The laboratory is an essential component of the OV program. As the programs mature, more serological and entomological assessments are anticipated. However, a standardized serological test with good sensitivity and specificity is unavailable. The WHO 2016 guidelines recommend that OV16 ELISA be used to verify stopping MDA. Although several ELISA protocols are available, none meets the required target product profile (TPP), with either low sensitivity or low specificity. This could result in the OV program stopping MDA prematurely or never stopping MDA.

3. **Limitation of OV rapid diagnostic tests (RDT).** The OV16 RDTs have also shown some limitations, especially low sensitivity when used on whole blood in the field. It would underestimate the actual infection status, particularly in areas of low endemicity. The OV16 RDT testing of the elution of dried blood spots collected in the field in the laboratory, however, provides valid and reliable results for OV. This technique and procedure are now being used for pre-Stop MDA surveys in most countries. However, this adds a layer of logistic, technical, and cost complexity to the OV programs that already face challenges in their laboratory capacity.

4. **Procurement of diagnostics and commodities is lengthy.** Laboratory processing is often extended because of the backlogs due to the laboratory capacity already mentioned. In addition, the lack of reagents and test kits due to the lengthy procurement process and supply is another bottleneck adding to the significant delays in laboratory analysis. Partners, donors, and other stakeholders are working to streamline and accelerate the procurement of OV lab commodities and supplies.

5. **Co-endemicity of loiasis in OV areas.** Loiasis is an infection caused by a filarial worm, Loa loa. Ivermectin treatment for OV could potentially cause serious adverse events (SAE) in patients infected with Loa loa with high worm intensity. These SAEs could lead to the death of patients if not cared for properly. There are “test and treat” strategies or alternative drugs, but these are costly and programmatically difficult to implement.

6. **Insufficient entomology capacity.** The historic entomology expertise from the OCP and APOC era no longer exists since most entomologists have retired, and there are very few training opportunities for OV entomologists. This has resulted in a significant gap in OV entomology expertise for identifying breeding sites and defining transmission limits, vector control, blackfly catching, and analysis. WHO has developed a manual for OV entomology to help fill the knowledge gap in OV field entomology. At the country level, some initiatives have been developed with support from partners like Sightsavers and the Reaching the Last Mile Fund project, which are funding the training of young entomologists, field entomological surveys, and lab analysis. In addition, the Noguchi Memorial Institute for Medical Research in Ghana is building capacity in OV entomology for researchers and young professionals to provide support to national OV programs. As more entomological surveys are planned for stopping MDA, post-treatment, and post-verification, entomology capacity is now critical.

Conclusion

The OV country programs, especially in West Africa, are fast evolving as the dynamic of elimination of transmission requires more stringent and rigorous assessments to ascertain the key milestones are reached. Despite the challenges in diagnostics, laboratory issues, and loiasis co-endemicity in some settings, the progress toward elimination has been remarkable. As more support goes to the OV programming and the NOEC domesticates WHO and OTS guidance, country programs can thrive and overcome upcoming challenges.

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