

Progress toward elimination of onchocerciasis in the Americas

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ciasis, and 187 million are at risk in 34 countries.

Onchocerciasis in the Americas and the history of the OEPA initiative

Estimates of the Americas' population at risk of onchocerciasis in the late 1980s was put at 5 million persons, but refinement mapping resulted in a 90% decrease of that number to about 500 000 in 13 geographically discrete transmission zones (foci) in six countries: Brazil, Colombia, Ecuador, Guatemala, Mexico and Venezuela (Figure 1). The three largest foci (the Central Zone in Guatemala, the South Chiapas in Mexico and the Northeast in Venezuela) contained about 60% of the regional at-risk population. By 1990, ivermectin MDA was active in three countries (Guatemala, Ecuador and Mexico), albeit with treatment coverage below what appeared necessary to interrupt transmission.^{5,6}

In 1991 the Pan American Health Organization (PAHO) was anxious to capitalize on recent disease elimination successes in the region of the Americas and identified the donation of ivermectin as an opportunity to organize a regional campaign to eliminate onchocerciasis. A PAHO resolution (CD35.R14) that year called for countries and partners to mobilize resources to use ivermectin MDAs to eliminate onchocerciasis-related eye disease (and where possible transmission) by 2007. The Onchocerciasis Elimination

^{1,2} Ivermectin (Mectizan, donated by MSD, also known as Merck & Co., Inc., Kenilworth, NJ, USA, is a safe and effective oral medicine that kills the mf and prevents skin and eye disease. It has been given in annual, semi-annual or quarterly mass drug administration (MDA) campaigns. In Africa, where 99% of the world's onchocerciasis cases occur, most MDAs are provided annually. The more frequent and higher the MDA coverage, the more quickly transmission can be interrupted and the parasite completely eliminated.^{3,4}

2001 guidelines. Colombia's single focus was the community of Lopez de Micay, with a population of 1366. This focus received 23 rounds of treatment under a twice-per-year approach, 20 of which reached greater than 85% coverage.¹⁷

Ecuador

Ecuador had a population of 25 863 at risk in 119 communities in a single focus that comprised several river systems in Esmeraldas. Ecuador had the distinction of the highest baseline levels of mf in the skin of any of the 13 foci and one of the region's most efficient vectors for transmitting onchocerciasis, *Simulium exiguum*. The Esmeraldas focus received 36 treatment rounds under a twice-per-year approach prior to interrupting transmission in 2009; 25 of these treatment rounds reached greater than 85% coverage. It received WHO verification of onchocerciasis transmission elimination in 2014, the second country to do so.^{18,19} The elimination success in Ecuador was an indication that the twice-per-year OEPA ivermectin strategy would likely be successful against African onchocerciasis transmission systems driven by similarly efficient vectors.

Mexico

Mexico had three onchocerciasis-endemic foci (South Chiapas, North Chiapas and Oaxaca) and overall the second largest population at risk in the Americas: 169 869 persons residing in 670

communities distributed within the states of Chiapas and Oaxaca. North Chiapas and Oaxaca received 26 and 28 rounds of treatment (17 and 18 reached greater than 85% coverage), respectively, utilizing a twice-per-year treatment strategy. The North Chiapas focus was the first to eliminate transmission in Mexico in 2010, followed by the Oaxaca focus in 2011.^{18,20} In the third and largest (559 communities) focus, South Chiapas, where the endemicity of the infection was highest, a four-times-per-year approach was implemented from 2003 to 2008 in 50 communities and from 2009 to 2011 in 163 communities; 36 four-times-per-year treatment rounds were distributed during that period, with 35 of them being greater than the 85% coverage goal. This was the first time this approach was used in the region and it helped South Chiapas achieve transmission elimination in 2014. The 396 communities that remained under the two-times-per-year approach

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focus (in 2008) and finally the Central focus (in 2011).^{23,24} The Guatemalan program eliminated onchocerciasis using the twice-per-year approach ranging from 18 to 28 rounds of treatment (13 to 22 reaching greater than 85% coverage) among the four foci. Guatemala received WHO verification of onchocerciasis transmission elimination in 2016 and was the first country to do so utilizing the revised WHO guidelines issued in 2016.¹

Venezuela

Venezuela has interrupted transmission of onchocerciasis in two of its three foci, where the combined at-risk population is 109 952. The Northcentral focus has successfully completed the 3 years of PTS required to declare elimination after 20 rounds of treatment (17 of which reached greater than 85% coverage) under the twice-per-year approach. In the Northeast focus the twice-per-year

OV16 testing of dried blood spots and PCR-based pool screening of vectors to detect *O. volvulus* DNA. Beginning in 1996 the OEPA has documented its progress annually in the Weekly Epidemiological Record, and countries publish their progress in peer-reviewed publications. Some of these were cited as key information for revision of the WHO guidelines in 2016,¹⁵ guidelines that were used immediately after their publication for the verification of elimination of onchocerciasis transmission in Guatemala. The achievements in the Americas helped inspire several African programs to move from a control to an elimination strategy, especially Sudan in 2006 and Uganda in 2007.

The PCC of the OEPA has played a key role as the steering committee of the OEPA program. But another key PCC goal is to foster country ownership, decision making, investment and political will to succeed. The PCC provides independent programmatic recommendations to national programs, being ever careful to recognize that it is the governments and ministries of health of the countries that have the responsibility of making all decisions pertaining to their programs. The country decides when key milestones in the elimination pathway have been met, such as when to stop MDA or when to request WHO verification. Furthermore, it is the WHO, and not the PCC, that is involved directly with each country in the process of verification. The PCC terms of reference, defining its role as an independent advisory committee to each Ministry of Health, have served as a model and inspiration for national onchocerciasis elimination committees in Ethiopia, Nigeria and Uganda (more details on elimination committees in Africa are given in the section of this supplement entitled 'The role of national elimination committees in eliminating onchocerciasis').

The 'final inch'

As demonstrated by the Guinea Worm Eradication Program in Africa,²⁸ ultimately the most challenging piece of the elimination puzzle in the Americas will be the 'final inch,' the Yanomami Area. While representing just 5% of the population in the Americas initially at risk for onchocerciasis, the costs required for personnel, supplies, security needs, flight hours and time required to reach these extensive remote areas are staggering. The continued partnership and endurance of numerous donors, coupled with the dedication of the technical teams in the countries, are critical to the success of this endeavor.

However, it is the current lack of political will to accomplish this task in Brazil and Venezuela that is the greatest barrier to success. While the Yanomami people can move freely across the border between Brazil and Venezuela, program officials are not allowed to cross the border to treat them. While the closest landing strips to some high-endemicity Venezuelan communities are in Brazil, they cannot be used as staging points for air support. Despite the 2014 binational agreement pledging annual meetings to approach onchocerciasis elimination in a joint fashion, high-level government officials have only met once (in Caracas in February 2015). Since then, the two countries have had increasingly tense relations that are unlikely to improve in the near future. We commend the Ministry of Health technical staff of both countries for their courage, their excellent working relationships and their tireless work in the Yanomami Area despite a lack of attention to the program from their political leaders.

Conclusion

From its beginning, the well-documented OEPA initiative has served as an excellent example of 'walking the onchocerciasis elimination walk.' Colombia, Ecuador, Mexico and Guatemala are the first countries in the world to receive WHO verification of onchocerciasis transmission elimination. Activ8.5(7.4(B)14(r)15.5(nTf.6110i)

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