

DRACUNCULIASIS, ONCHOCERCIASIS, SCHISTOSOMIASIS, AND TRACHOMA

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Abstract

The four diseases discussed in this chapter (dracunculiasis, onchocerciasis, schistosomiasis, and trachoma) are among the official T0 -1T T0 -1.37 TD.0002 Tw(an):B(d i)3.7s)Z(pr)Z(o):B(g)-1.7res)Z(s)1.2(i)3.7n)-1.7g):B(t)3.7o than 300,000 latrines and other complementary interventions. Because of the synergy between these diseases and poverty, controlling or eliminating the disease also reduces poverty and increases self-reliance.

Key words: eradication; disease elimination; disease control; Africa; Asia; Latin America; neglected tropical diseases; dracunculiasis; Guinea worm disease; onchocerciasis; river blindness; schistosomiasis; bilharziasis; lymphatic filariasis; trachoma; malaria; Nigeria; Ethiopia; Sudan; Uganda; Ghana; Cameroon; Brazil; Colombia; Guatemala; Mexico; Venezuela; mass drug administration; *Dracunculus medinensis*; *Onchocerca volvulus*; *Schistosoma mansoni*; *Schistosoma hematobium*; Onchocerciasis Elimination Program of the Americas; village-based health workers; health education; cloth filters; ABATE Larvicide; Mectizan (ivermectin); Zithromax; albendazole; praziquantel; tetracycline ointment; insecticide-treated bed nets; SAFE strategy; Carter Center; vitamin A deficiency; latrines; trichiasis

infection until just before the worm starts to emerge. During the worm's painful emergence, which commonly is associated with secondary bacterial infection of the exit wound, infected persons are incapacitated for periods averaging 2–3 months. Half or more of a village's population may suffer this infection at the same time, and the seasonal period of emergence often coincides with harvest or planting times of peak demand for agricultural labor. This disease thus has a substantial adverse effect on agricultural productivity and school attendance in addition to its primary effect on villagers' health.

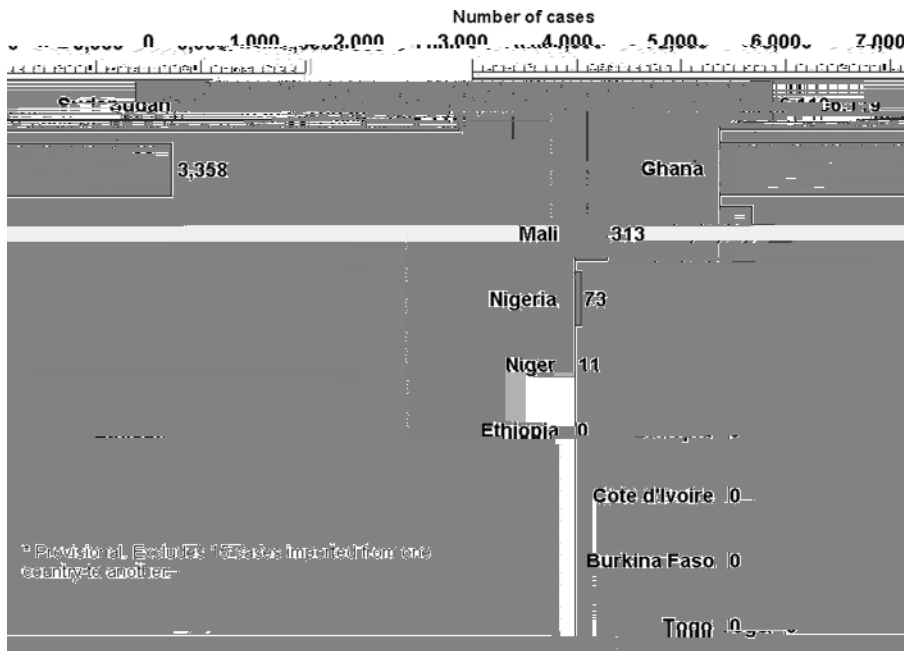


FIGURE 1. Distribution of indigenous cases of dracunculiasis reported during 2007.

Onchocerciasis (caused by *Onchocerca volvulus*) is transmitted to humans by the bite of infected *Simulid* black flies. It is found mostly in Africa, with a few foci in Yemen and six Latin American countries. About 123 million persons are at risk of contracting this infection. These adult filarial worms live for several years bundled together in fibrous nodules, from which they release thousands of microfilariae into the skin and subdermal tissues. Black flies are infected when they feed on infected people. The microfilariae cause the most damage when they accumulate in the eyes. After several years of repeated infections, humans may become blind. Because the black flies breed in fast-flowing rivers, and the disease is most common in association with such locales, it is sometimes called river blindness. The microfilariae in skin produce intense itching, which provokes severe scratching, resulting in disfiguring discoloration and thickening of the skin, which in turn often causes social ostracism. Populations often abandoned fertile farmland near rivers to escape the infection, thus causing significant economic effects.

This disease can be controlled by spraying the breeding sites of the black flies with larvicides, and for years that was the main intervention in the highly successful Onchocerciasis Control Program in 11 West African countries. After the New Jersey-based pharmaceutical firm Merck discovered Mectizan® (ivermectin), a drug that effectively suppressed infection by killing the microfilariae when administered orally once a year, that became the (less expensive) intervention of choice to control onchocerciasis. Merck's epochal decision, announced in 1987, to donate Mectizan for as long as needed, in whatever amounts were needed, to help control onchocerciasis, spawned additional programs to control onchocerciasis in the remaining endemic areas of Africa (African Program for Onchocerciasis Control, covering 16 countries) and to eliminate the infection in the six endemic countries of the Americas (Onchocerciasis Elimination Program of

gains of the Onchocerciasis Control Program. The estimated economic rate of return for controlling onchocerciasis is 17%.⁷

thousands of spiny eggs that work their way into the intestines or bladder to be excreted with feces or urine. The eggs also damage the bladder, intestines, liver, kidneys, lungs, and other organs, causing bloody urine, bloody diarrhea, heart failure, cirrhosis of the liver, and kidney disease. This debilitating infection can be an occupational hazard for rice farmers and fishermen, but children aged 5–15 years are the ones most heavily infected, because of their exposure to water while playing and swimming. Most public health programs in Africa to control schistosomiasis now involve health education to reduce pollution of water sources by feces and urine of infected humans, as well as annual oral mass treatment of at-risk populations with praziquantel, a highly effective drug that costs US\$0.15–\$0.20 per treatment. Use of chemicals to kill vector snails may be appropriate in selected circumstances, but this approach is generally too expensive.

The Carter Center is assisting three Nigerian states (Plateau, Nasarawa, and Delta [Fig. 3]) to control urinary schistosomiasis. The center does so by using the grassroots distribution system of health workers and village volunteers established with our assistance earlier for onchocerciasis to also deliver health education and conduct mass drug administration with praziquantel annually in areas affected by both parasites. Since 1999, this program has delivered a cumulative total of 1,079,335 treatments with praziquantel. Studies in a sample of villages in two areas showed a reduction in prevalence of bloody urine (assessed by dipstick) from 47% in 1999 to 8% in 2002, after just 2 years of annual praziquantel treatment.¹⁰ The costs of mapping and the purchase of praziquantel are major constraints to expanding schistosomiasis control efforts nationwide in Nigeria.¹¹ Because assessing the prevalence of



FIGURE 3. Carter Center–assisted states in Nigeria.

Lymphatic filariasis (LF) in Africa is caused by *Wuchereria bancrofti*, a filarial worm related to the parasite that causes onchocerciasis, but LF is transmitted (in Africa) in rural areas by the same

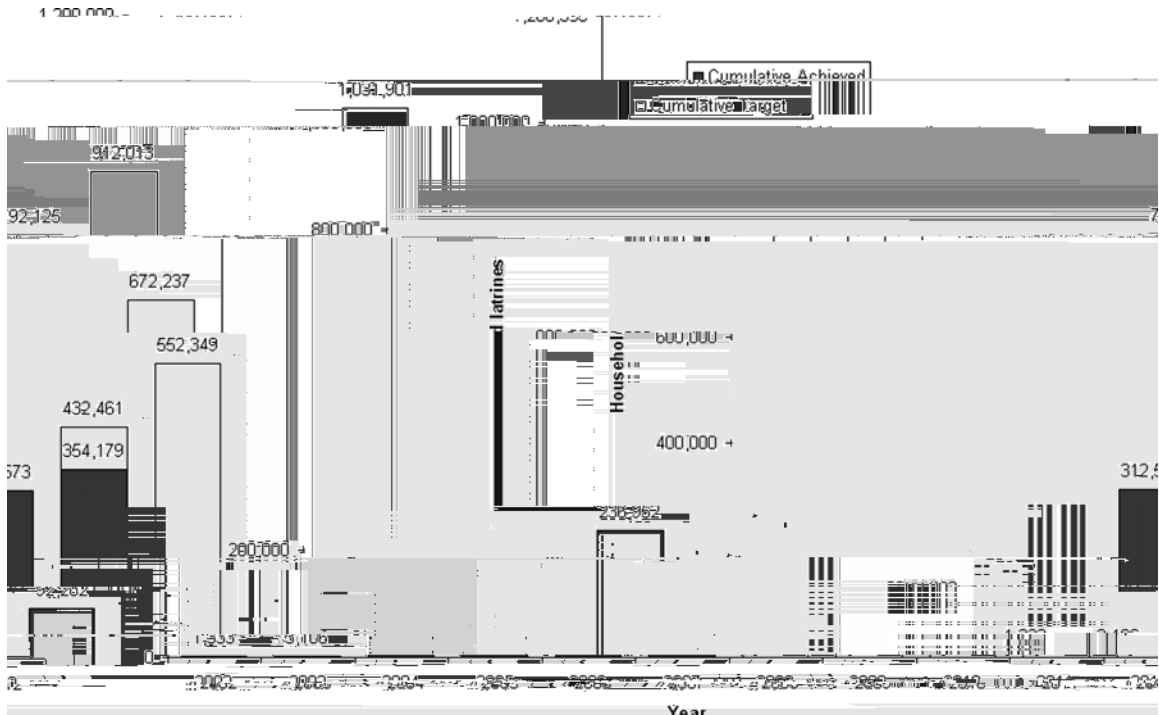


FIGURE 4. Latrine construction required to achieve Millennium Development Goal 7 in Amhara Region of Ethiopia by 2012.

In 2007, at the request of the ministry of health of Ethiopia, the Carter Center purchased and assisted the distribution of 3 million long-lasting insecticidal bed nets (LLINs) to help prevent malaria in the areas we are assisting to combat trachoma and onchocerciasis (Fig. 5), using the same health workers and infrastructure. This action was part of Ethiopia's successful campaign to distribute 20 million LLINs to protect its entire at-risk population of 50 million persons before the end of 2007.

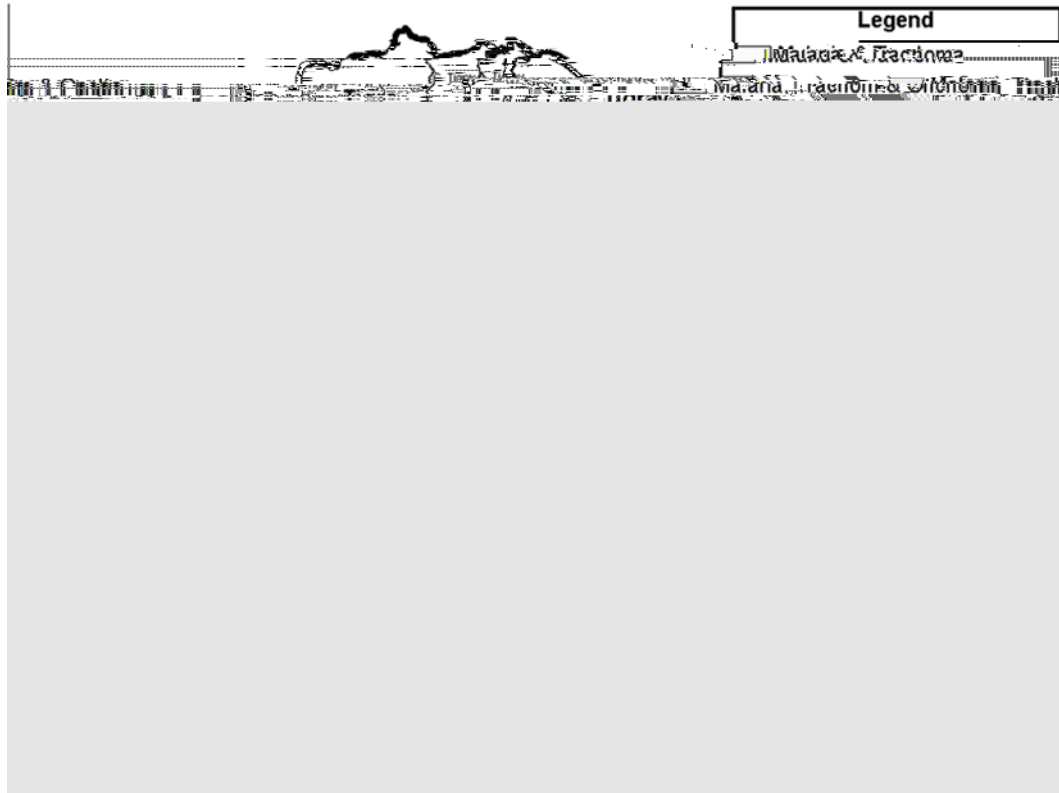


FIGURE 5. Carter Center (TCC)–assisted control programs in Ethiopia.

Conclusion

In addition to the many direct benefits of these programs in improved health and nutrition, there are many indirect benefits. The antihelminthic drugs used have ancillary benefits because they are also effective against other parasitic intestinal infections, such as *Ascaris* and hookworm. A reduced parasitic burden also improves the cognitive ability of children and results in fewer malarious episodes,^{17 18 19 20} reduced anemia in pregnant women, higher birth weight in newborns, and reduced infant and child mortality.²¹ The antibiotic for trachoma is also effective against respiratory infections, especially in children, and has some antimalaria effect. The use of LLINs to prevent malaria also prevents some other vectors from transmitting diseases, and use of latrines built to reduce transmission of trachoma also prevents transmission of other diseases such as diarrhea, intestinal parasites, and schistosomiasis.

The campaign against dracunculiasis is unique among the interventions described in this report, because it is the only eradication program among them. However, the OEPA program in Latin America is working to eliminate onchocerciasis with some relevance to Africa, the LF effort in Nigeria is testing the feasibility of eliminating LF transmission in Africa, and the trachoma program in Ethiopia is working to eliminate blindness due to trachoma in a sustainable way with ramifications for a worldwide effort. All four programs illustrate the potential direct and indirect benefits of village-based interventions that engage the power of local mobilization at the community level. To do so. All 8al so.2d the t.m.e9quise ofis

and dignity, as well as assiduous attention to details in the selection, training, retraining, supervision, encouragement, feedback, and provision of supplies to the village volunteers.

¹¹ RICHARDS, F., A. EIGEGE, E. MIRI, *et al.* 2006. Integration of mass drug administration programs in Nigeria: The challenge of schistosomiasis. *Bull. World Health Organ.* **8**: 1–4.

¹² GUTMAN, J., A. FAGBEMI, K. ALPHONSUS, *et al.* 2008. Missed treatment opportunities for