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After 70 years of ghting an age-old scourge, onchocerciasis in Uganda, the end is in sight

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Onchocerciasis causes severe itching, serious skin disease and ocular damage leading to visual impairment or permanent blindness. It is associated with hanging groin, epilepsy, Nakalanga dwar sm and, most recently, nodding disease. This disease affected communities in 17 transmission foci in 37 districts of Uganda, where about 6.7 million people are once at risk. The efforts against onchocerciasis in Uganda commenced in the late 1940s, when vector control was launched using dichlorodiphenyltrichloroethane; by 1973, *Simulium damnosum* had been eliminated in the Victoria focus. Success outside of the Victoria focus was short-lived due to changes in government priorities and the political upheavals of the 1970s and 1980s. With the return of political stability,

cool, green forests, as well as riverine fringing forest environments. Their ight range of less than 6 km is much less than S. damnosum.[7]

The main historical habitats for S. damnosum s.l. in Uganda during the 1950s were the Victoria Nile River, where Christy originally described S. damnosum, with almost 100% of the inhabitants af icted with onchocerciasis; the Murchison Nile from the Atura River ending in Murchison Falls; and the Rwenzori focus that extended into the Democratic Republic of the Congo (DRC), with a prevalence of onchocerciasis ranging from 54 to 91%. [6]

Onchocerciasis transmitted by S. neaveiwas originally reported in the following areas of Uganda: Budongo Forest, where the baseline skin micro laria (mf) rate for sawmill workers was 78%, and 46% among students in the forestry college [8]; Mount Elgon, where the baseline mf prevalence rate was 80%; West Nile, where the mf prevalence rate was 56% [3]; and Kigezi (now known as the Bwindi focus), where the prevalence rate was 80%[9] (Figure 1). In 1973 a new onchocerciasis focus east and southeast of Lake George (now designated the Kashoya-Kitomi focus) was reported, but no prevalence rate was provided.[10]

Control of onchocerciasis (1950 –1973)

Previously, dichlorodiphenyltrichloroethane (DDT) was widely used for onchocerciasis control in Uganda. Successful intermittent control efforts in the Victoria Nile focus on the Nile River commenced in 1952.[11,12] This resulted in S. damnosum elimination along a 70 km stretch of the Nile River between Lake Victoria and Lake Kyoga by 1973. In 1974, after a military coup, all the expatriate leaders of national vector control activities were forced to leave Uganda and further monitoring of the Victoria Nile focus was halted; however, activities by the Vector Control Division of the Ministry of Health continued there until 1977.

In the Murchison Nile focus, a trial of DDT vector control of S. damnosum was attempted in 1959 to protect workers constructing a hydroelectric power station. After that trial a reinvasion by S. damnosum from Atura on the Murchison Nile was documented.[13] In 1971, DDT larviciding was extended to cover the whole Rwenzori focus.[13] In the Budongo S. neaveifocus, the vector was nearly eliminated by 1962. [14,15] Mass drug administration (MDA) with diethylcarbamazine citrate (DEC) was also provided.[15] In the Mount Elgon focus, vector control was initiated in 1957, and in 1972 the prevalence was determined to have dropped to 5 –10%. Vector control was also piloted in the West Nile focus in 1955.[3] In the Kigezi onchocerciasis endemic area, DEC was provided to patients at health facilities until 1992, when the program introduced ivermectin through community-based MDA programs. There is no evidence that any vector control or MDA was carried out in the Kashoya-Kitomi

A national elimination policy (2007–2016)

The Uganda Ministry of Health crafted a new policy for nationwide onchocerciasis transmission elimination that was launched by the president of Uganda, His Excellency, Yoweri Museveni, at a national meeting held in Kampala in January 2007. The renamed Uganda Onchocerciasis Elimination Program (UOEP) had several charges. First, it was no longer business as usual, and all tools (ivermectin and vector control) were to be used in combination when and where necessary. Twice-per-year ivermectin treatment was to be the norm except in areas where once-per-year had been clearly effective in breaking transmission. Second, a molecular laboratory based on the Guatemala model was established to help monitor progress towards elimination. Third, an independent technical advisory committee, the Uganda Onchocerciasis Elimination Expert Advisory Committee (UOEEAC), was established to help the ministry progress towards nationwide elimination. Key assisting partners (The Carter Center, Lion Clubs of Uganda and Lion Clubs International Foundation [LCIF], Mectizan Donation Program and Sightsavers) would have seats on the UOEEAC. The UOEP and UOEEAC embarked on the following:

Re ning the onchocerciasis map and launching twice-per-year treatment

The UOEP aggressively embarked on reining and completing the onchocerciasis map of Uganda in order to include any hypoendemic communities that may have been left untreated. Vector elimination was achieved in the Victoria focus and (likely) in the Itwara and Mpamba-Nkusi foci in 2007 (Figure 3). A population of 4.9 million people living in 37 districts were still at risk of onchocerciasis in 16 foci (not counting Victoria) and transmission interruption appeared to have been reached in the Nyamugasani, Maracha-Terego, Obongi, Imaramagambo, Itwara and West Nile foci. Twice-per-year treatment with ivermectin through CDTI continued in Wadelai and was launched in the Budongo, Bwindi, Kashoya-Kitomi, Mount Elgon and Mpamba-Nkusi foci in 2007, Wambabya-Rwamarongo in 2008 and later in Nyagak-Bondo (2012), Madi-Mid North (2013) and Lhubiriha (2015).

Establishment of the molecular laboratory

In 2008 the Ministry of Health provided space for the UOEP's molecular laboratory at the Vector Control Division as well as personnel to run it. The Carter Center provided equipment and nancial support to the laboratory and the University of South Florida laboratory trained the Uganda laboratory personnel. The new laboratory has allowed close monitoring of the impact of interventions on onchocerciasis transmission. Its experience, the largest operation among onchocerciasis molecular laboratories in Africa, has been published.[26] By mid-2016 it had analysed more than 65 000 blood spot samples with the OV16 ELISA, as well as thousands of Simulium ies and skin snips from some foci using the O-150 PCR. The University of South Florida continues to ensure acceptable quality control standards.

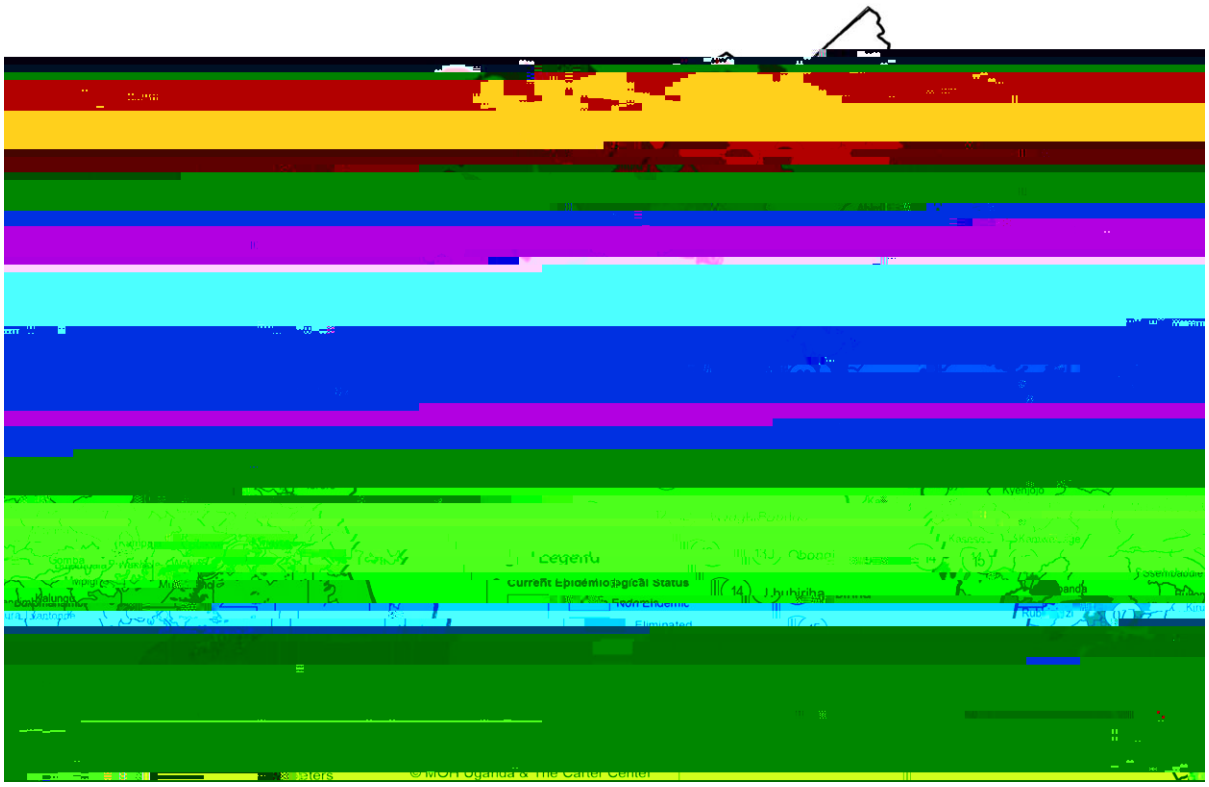

Figure 3. Map of Uganda showing the status of onchocerciasis in 2007.

Uganda Onchocerciasis Elimination Expert Advisory Committee

The UOEEAC held its rst meeting in 2008. Its membership is comprised of the Ministry of Health (including representatives from district health services), non-governmental development organization partners and independent national and international experts on the disease. The WHO and Mectizan Donation Program representatives are usually in attendance as observers.[27–29] The UOEEAC provides technical advice to the UOEP through review, monitoring and evaluation of each of the 17 foci and recommends effective approaches and methods for hastening oncho-

Lymphatic lariasis (LF) co-endemicity

A number of foci where the national guidelines indicated that ivermectin MDA could be halted could not do so because of co-endemicity with LF. In such foci, the UOEEAC recommended that transmission interruption be declared but that the 3-year PTS period would not begin until LF MDA interventions (with ivermectin and albendazole) were discontinued. Examples of this situation include the Maracha-Terego, West Nile and Wadelai foci (Table 1). Wadelai is a particularly telling example, where onchocerciasis transmission was declared interrupted in 2010 but the PTS period did not begin until 7 years later (2017) when LF MDA was nally halted. Other onchocerciasis–LF co-endemic foci that are likely to encounter this challenge of coordinated PTS are the Nyagak-Bondo and Madi-Mid North foci. The presence of the Ministry of Health LF focal person as a participant (observer status) at the UOEEAC has been particularly important for reporting the status of the LF initiative to allow PTS coordination of the two programs.

Coordination with the LF program has implications for nances, personnel and time given the need for extended monitoring of entomological indicators stipulated in guidelines. It should be noted that while the current WHO onchocerciasis guidelines require that onchocerciasis PTS can only begin after MDA for LF has stopped, the reciprocal situation is not found in LF operating procedures; for example, post-MDA LF surveillance may launch without regard to ongoing onchocerciasis ivermectin monotherapy MDA since the WHO recommended LF treatment is combined therapy.

Conclusion

When Uganda declared an objective of nationwide onchocerciasis elimination by 2020, the tempo of activities accelerated dramatically. Treatment coverage improved under the twice-yearly ivermectin treatment and ground-based larviciding accelerated the interruption of transmission. The new energy motivated targeted communities and was instrumental in keeping health workers focused and interested. The establishment of an independent technical advisory committee, the availability of sensitive and highly speci c diagnostic tools at a national laboratory and the obvious annual progress in moving foci along the pathway to elimination are other reasons for the rapid progress towards nationwide onchocerciasis elimination. The main challenge remains cross-border issues with the DRC and RSS, yet the 2020 target for nationwide elimination of onchocerciasis remains within reach.

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