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**OGUTTU AND OTHERS**

## **ONCHOCERCIASIS SEROSURVEILLANCE IN UGANDA**

**Serosurveillance to Monitor Onchocerciasis Elimination: The Ugandan Experience**

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### **Abstract.**

Uganda is the only African country whose onchocerciasis elimination program uses a two-pronged approach of vector control and mass drug distribution. The Ugandan program relies heavily upon the use of serosurveys of children to monitor progress toward elimination. The program has tested over 39,000 individuals from 11 foci for *Onchocerca volvulus* exposure, using the Ov16 ELISA test. The data show that the Ov16 ELISA is a useful operational tool to monitor onchocerciasis transmission interruption in Africa at the World Health Organization (WHO) recommended threshold of < 0.1% in children. The Ugandan experience has also resulted in a re-examination of the statistical methods used to estimate the boundary of the upper 95% confidence interval for the WHO prevalence threshold when all samples tested are negative. This has resulted in the development of Bayesian and hypergeometric statistical methods that reduce the number of individuals who must be tested to meet the WHO criterion.

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### **INTRODUCTION**



foci are found in the western and northern regions of the country (Figure 1). The vector in the western foci is *Simulium neavei*, whereas *S. neavei* and *Simulium damnosum sensu lato* serve as vectors in the northern foci.<sup>16,17</sup> Onchocerciasis was eliminated by DDT river treatments in the Victoria focus in the 1960s.<sup>18,19</sup> The Ugandan Onchocerciasis Elimination Program (UOEP) is unique in that it is currently the only program that incorporates both mass ivermectin distribution and vector control or local elimination into its strategic plan.<sup>15</sup> This combination of approaches has resulted in the rapid interruption of transmission of *O. volvulus* in at least two foci in Uganda.<sup>9,20-22</sup> However, the incorporation of vector control and focreW nBT0 0 0 rg/TT0 1 Tf12 0 0 12 72 6447









that many of the seropositive children converted to seronegativity in the 3 years between the two



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Kaduna State, Nigeria: first evidence of the potential for elimination in the operational area of the African Programme for Onchocerciasis Control. *Parasit Vect* 5: 28.

8. Traore MO, Sarr MD, Badji A, Bissan Y, Diawara L, Doumbia K, Goita SF, Konate L, Mounkoro K, Seck AF, Toe L, Toure S, Remme JH, 2012. Proof-of-principle of onchocerciasis elimination with ivermectin treatment in endemic foci in Africa: final results of a study in Mali and Senegal. *PLOS Neg Trop Dis* 6: e1825.
9. Katarbarwa M, Walsh F, Habomugisha P, Lakwo T, Agunyo S, Oguttu D, Unnasch TR, Unoba D, Byamukama E, Tukesiga E, Ndyomugyenye R, Richards FO, 2012. Transmission



21.

Garms R, Lakwo TL, Ndyomugyenyi R, Kipp W, Rubaale T, Tukesiga E, Katamanywa J, Post RJ, Amazigo UV, 2009. The elimination of the vector *Simulium neavei* from the Itwara onchocerciasis focus in Uganda by ground larviciding. *Acta Trop* 111: 203–210.

22.

Lakwo TL, Garms R, Rubaale T, Katarwa M, Walsh F, Habomugisha P, Oguttu D, Unnasch T, Namanya H, Tukesiga E, Katamanywa J, Bamuhiiga J, Byamukama E, Agunyo S, Richards F, 2013. The disappearance of onchocerciasis from the Itwara focus, western Uganda after elimination of the vector *Simulium neavei* and 19 years of annual ivermectin treatments. *Acta Trop* 126: 218–221.

23.

Lindblade KA, Arana B, Zea-Flores G, Rizzo N, Porter CH, Dominguez A, Cruz-Ortiz N, Unnasch TR, Punkosdy GA, Richards J, Sauerbrey MnBT0 0bh1.04 10 0 0 nBT0 0 0 rg/TT0 I1(a)-2(m)17(u)

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## Figures and Tables

FIGURE 1. Map of onchocerciasis foci in Uganda included in this study: The foci included in this study and their current epidemiological status are shown by different color codes. The names of the foci are as follows: 1 = Maracha Terengo; 2 = Mpamba-Nkusi; 3 = Imaramagambo; 4 = Itwara; 5 = Mt Elgon; 6 = Wambabya-Rwamarongo; 7 = Budongo; 8 = Wadelai; 9 = Bwindi; 10 = Kashoya; 11 = Nyamugasani. This figure appears in color at [www.ajtmh.org](http://www.ajtmh.org).

FIGURE 2. Prevalence of IgG4 antibodies recognizing Ov16 in children in Ugandan foci of onchocerciasis by age group: Error bars indicate 95% confidence intervals (CIs) for the prevalence estimates.

FIGURE 3. Prevalence of IgG4 antibodies recognizing Ov16 in children in different parishes of the Budongo focus: Error bars indicate 95% confidence intervals for the prevalence estimates.