*Journal of Scientific Research and Development (2023) Vol. 22 (1) 194-205*

***A bi-annual journal published by the Faculty of Science, University of Lagos, Nigeria***

*http://jsrd.unilag.edu.ng/index.php/jsrd*

# Monitoring and evaluation of lymphatic filariasis and onchocerciasis in six endermic communitites in Ogun State South West Nigeria

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*(Received 13 March 2023/Revised 06 July 2023/Accepted October 24 2023)*

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Abstract

In Africa Onchocerciasis and Lymphatic filariasis have been reported as co-endemic diseases in certain countries. Certain communities in Ogun State has been reported to be co-endemic for both diseases. Mass Drug Administration of medicines had used Aldendazole and Ivermectine as the drug of choice for the prevention and control of Oncocerciasis and lymphatic filariasis in these endemic communities over the years in Ogun State. This study aims to assess the current prevalence and intensity of these disease in endemic areas of Ogun State and to determine an effective onsight diagnostic tool that can facilitate assessment of disease prevalence in endemic communities in Ogun State so as to meet the Global mandate of 2030 by Global Program for Elimination of Lymphatic filariasis . Oncho/LF IgG4 biplex was used to assess the prevalence of Lymphatic filariasis and Oncocerciasis in two Local Government Areas of Ogun State. The consenting participants were made up of a total population of 526 individuals who were, 250 males and 266 females after filling informed consent form. This individuals were 103 persons from Ajilete, 69 from Oke-Ella and 97 from Eredo all in Yewa South Local Government Area while the remaining voluntary participants were 124 from Oke- Ella, 64 from Alapoti and 69 from Igbesa in Ad0-Odo/Ota Local Government Areas of Ogun State. Overall prevalence of infection for Lymphatic filariasis was (1.14%). Prevalence of Infection was highest in Igbesa (4.4%), followed by Alapoti (3.3%) and lastly by Eredo (1.03%). Others recorded 0.0% prevalence of infection. For Oncocerciasis total prevalence rate of infection was 0.09% with only Eredo which had a prevalence infection rate of 1.03%. Result revealed that Onchocerciasis in this region had reached the treachhold level of elimination while Lymphatic filariasis is yet to be so reported. There is need for continuity and intensive administration of Mass Drug Administration of Medicine, as possible eventual elimination seems in view.

**Key words:** Aldendazole**,** Lymphatic filariasis Mass Drug Administration of Medicine, Oncho/LF IgG4 biplex, Oncocerciasis

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Introduction

There are two filarial nematode diseases which constitute are major cause of disability and mobidity in Sub-Saharan Africa. These disease has been found to be co-endemic in Ogun State. They are lymphatic filariasis caused by *Wuchereria bancrofti*) and onchocerciasis caused by *Onchocerca volvulus*. Infection with these parasites are responsible for significant morbidity across the continent, causing limb elephantiasis, hydrocele, breast elephantiasis, acute dermatitis, river blindness, respectively [1,2,3]. LF and onchocerciasis are targeted by the WHO 2012 Roadmap on NTDs [4] for elimination in selected African countries by 2030 using preventive chemotherapy. This strategy is implemented through community-wide mass drug administration (MDA), delivered yearly (and in some cases twice yearly) to all at-risk populations until transmission has been interrupted, combined with vector control measures where feasible [4].

Large-scale MDA programmes, implemented locally in endemic communities but coordinated and supported regionally, have been ongoing in Africa for over 25 years, first for onchocerciasis [5] and since 2000 for LF [6]. These are widely considered among the most successful and cost-effective public health interventions ever launched [5, 7]. However, there are important factors limiting their sustainability, including the availability of effective drug regimens that ensure a rapid interruption of transmission. For onchocerciasis, ivermectin has been the only drug used for MDA since Merck & Co. Inc. first announced its donation to endemic countries in 1987 [8], whilst for LF the drug of choice is treatment is a combination of either diethylcarbamazine (DEC, donated by Eisai Co. Ltd) - in non-onchocerciasis endemic areas - or ivermectin, given annually, plus albendazole (donated by GlaxoSmithKline) [9]. Although relatively safe and efficacious against microfilariae , these regimens are not considered to exert a powerful macrofilaricidal in adult worms. Instead, ivermectin has a temporary sterilising effect on female *O. volvulus* [10] and, in combination with albendazole, also on *W. bancrofti* [11]). Thus in order to interrupt transmission, MDA must be continued, at high levels of treatment coverage and adherence [12], for at least as long as the duration of the reproductive lifespan of the adult worms [13] and from 9 to 11 years for *O. volvulus*, with 95% of the worms ending reproduction by the age of 13 to 15 years [14].

For filarial control programmes to be successful in shorter timeframes, regimens that kill or irreversibly sterilise adult worms are required [15]. As an alternative to developing a new compound, it has been suggested that simultaneous provision of triple drug therapy (IDA; ivermectin + DEC + albendazole) may improve LF microfilarial clearance and further impact upon adult worms [16]. A pilot study carried outbin Papua New Guinea has reported that single dose IDA treatment rapidly eliminated all *W. bancrofti* mf from peripheral blood. Encouragingly, all participants treated with this regimen remained amicrofilaraemic for at least 2 years following treatment, suggesting sterilisation or killing of adult worms [16]. Recent simulation modelling based on these findings has further suggested that the triple-drug regimen has potential to accelerate the elimination of LF, conditional on achieving high population coverage and low systematic non-adherence to MDA [17]. To appreciate fully the potential of IDA for reducing the duration of MDA interventions against LF, it is

imperative that these findings be replicated within larger trial settings.

Whilst IDA may help to accelerate the elimination of LF, it is important to delineate the settings where its use for MDA would be safe and appropriate [18]. One major concern is the risk of severe adverse events (SAEs), which can arise following microfilaricidal medication. In the limited setting of the IDA pilot trial, adverse events were more common in those treated with the triple therapy, although no SAEs were recorded [16]. This may have important implications for programme safety and compliance. DEC cannot be used in areas where onchocerciasis is present, because it induces a strong local inflammation in patients with ocular (*O. volvulus*) mf [19].. This has led to the recommendation that twice-yearly albendazole be implemented together with distribution of long-lasting insecticidal nets for control of LF in *L. loa* co-endemic areas [23]. Another aspect that may hamper the large-scale implementation of IDA in only-LF endemic areas is the risk for individuals migrating from onchocerciasis endemic areas, a frequent occurrence in central African countries. This risk could be mitigated somewhat by obtaining information about the history of residence of those individuals to be treated.

These challenges have prompted two areas of research that together comprise an enhanced 'test and treat' strategy: novel diagnostics to enable rapid identification of those with high

## MATERIALS AND METHODS

### Ethical statement

Ethical clearance was obtained from the Epidemiology Unit of the Ogun State Ministry of Health. With the assistance of the health workers, community heads, ward heads, CDA heads, informed consent form was administered to each participant after the purpose of research was read out and explained in their local dialect., the purpose of research was explained to participants.

### Study area

Ogun State, located in south-west Nigeria covers a land mass of 16,085km$^2$ and lies between longitude 2$^0$ 45'E and 3$^0$55' E and latitude 7$^0$ 01'N and 7$^0$13'N. The State is bordered to the west by the Republic of Benin, to the east by Ondo, to the north by Osun and Oyo States and to the south by Lagos State and the Atlantic Ocean (Figure 1). Ogun State in highly urbanized, with a population of about 5 million inhabitants and a population growth rate estimated at 3% annually. The State is administered through 20 Local Government Areas (LGAs). The population is 95% Yoruba by tribe. Ogun State covers a wide range of vegetation zones. The vegetation ranges from freshwater swamp with mangrove forests in the south-east to the woody guinea savannah in the north-western tip of the state. Annual rainfall ranges from 900 mm in the northern parts to 1600 mm along the coasts. The major occupation of the population is farming, timber logging and trading.

**Sample size determination**

Sample size was determined using Cochrans formula at 21% prevalence from previous research study

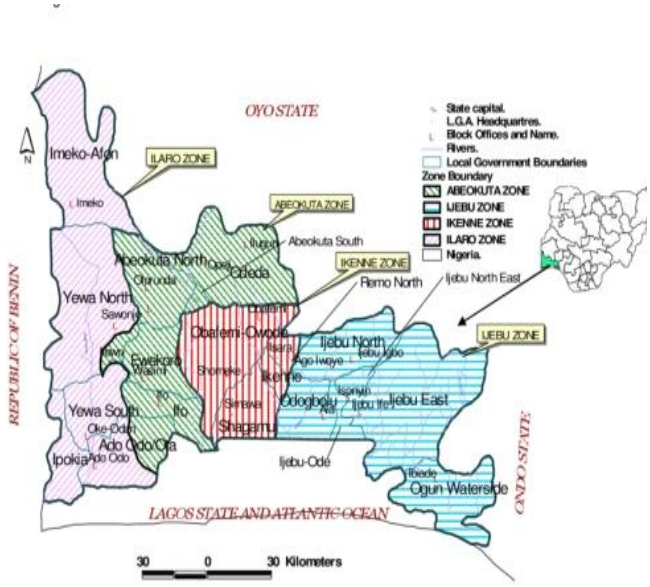


**Figure 1:** Map of Ogun State

**Sample collection**

Two (2) mls of venous blood were collected from each study participant into clean and sterile EDTA bottles. The samples were collected between the hours of 10pm and 2am which coincides with the nocturnal periodicity of the parasite.

**Rapid diagnostic tests**

The SD Oncho/LF $IgG_4$ biplex test strip was used for parasite detection in this study. Exactly 10 µL of blood were applied to the sample well of the test strip along with four drops of assay diluent in the appropriate well. The strip was read after 30 minutes. A valid positive result shows visible lines in the control and test (for either Oncho or LF) lines while three visible lines indicate positivity for both Oncho and LF. The test is negative if the only visible line were on the control, while absence of a visible reaction in both control and test lines indicate invalid results (Mladonicky et al).

( Cochrane ,2023). Systematic random sampling and cluster survey was used to gather the participants at a health center in each community.

**Data analyses**

Prevalence was estimated as percentages, with 95% confidence interval. The chi-square test was used for the comparison of proportions. Statistical significance was estimated at p-value $\leq 0.05$. The data collected was analyzed using STATA (Version 15) and MedCalc Software (Version 18.6). Mf prevalence = ba × dc × 100, where a = the number of individuals in the community examined for CFA, b = number of those examined for CFA being positive, c = number of CFA positives examined for mf, and d = number of those examined for mf being positive.

**RESULTS**

A total population of 526 individuals who were, 250 males and 266 females after filling informed consent form. This

individuals were 103 persons from Ajilete, 69 from Oke-Ella and 97 from Eredo all in Yewa South Local Government Area while the remaining voluntary participants were 124 from Oke- Ella, 64 from Alapoti and 69 from Igbesa in Ad0-Odo/Ota Local Government Areas of Ogun State. Overall prevalence of infection for Lymphatic filariasis was (1.14%). Prevalence of Infection was highest in Igbesa (4.4%), followed by Alapoti (3.3%) and lastly by Eredo (1.03%). Others recorded 0.0% prevalence of infection. For Oncocerciasis total prevalence rate of infection was 0.09% with only Eredo which had a prevalence infection rate of 1.03%. Result revealed that Onchocerciasis in this region had reached the treachhold level of elimination while Lymphatic filariasis is yet to be so reported. There is need for continuity and intensive administration of Mass Drug Administration of Medicine, as possible eventual elimination seems in view.

Using the Oncho/LF $IgG_4$ biplex, 1.14% of all the study participants tested positive for LF (Plate 1). Males (0.38%) had higher prevalence of infection compared to females (0.19%) (Table 1). Prevalence was neither related to age nor sex of participants at $p>0.05$. Infection was only detected in two communities, namely Eredo in Yewa North in Ilaro Zone and Alapoti in Yewa South of Ado/Odo Local Government Area. The prevalence of infection was higher in Alapoti (3.13%) than Eredo (1.03%) (Table1). Comparing the prevalence rate obtained using the Oncho/LF $IgG_4$ biplex in this study with previous reports of the LGA health centre in some of the communities showed a decline in prevalence (Table 2).

Microscopy revealed the presence of both adult worms and larval forms of *Wuchereria bancrofti* in the six communities sampled (Plates 2 - 4). Overall, prevalence of infection was higher with microscopy compared to the rapid test strip (Tables 2 - 8). Findings also showed least prevalence in areas where MAM had been administered. Prevalence of infection was highest in children and among individuals between ages of 30 – 40 years, followed by those between the ages of 40 and 50 years. However, infection prevalence was not related to age at $p > 0.05$. Prevalence of infection was significantly higher in females than males ($p < 0.05$).

Clinical manifestations of LF were observed across the communities. These included elephantiasis of the limbs, breasts and scrotal sacs (hydrocele). These signs were more common among females than males. There was however no significant difference between sex with respect to clinical signs ($p < 0.05$). Clinical signs were significantly more common among participants between the ages of 20 and 40 years ($p < 0.05$).

Findings of the KAP survey showed that majority of the study participants were within ages 31 and 40 years and had secondary education (52.6%) as the highest form of education.

**Table 1:** Prevalence of *Wuchereria bancrofti* using biplex test strip.

| **Disease** | **LYMPHATIC FILARIASIS** | | | | | | **ONCHOCERCIASIS** | | | | | | **Overall Population LF** | | | **Overall Population Oncho.** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Population** | FEMALES | | | MALES | | | FEMALES | | | MALES | | | TPS | TPI | % TPI | TPS | TPI | % TPI |
| **Location** | No Sample | No + | % P | No Sample | No + | % P | No Sample | No + | %P | No. Sample | No. + | % P | | | | | | |
| Ajilete | 49 | 0 | 0.00 | 54 | 0 | 0.00 | 49 | 0 | 0.00 | 54 | 0 | 0.00 | 103 | 0 | 0.00 | 103 | 0 | 0.00 |
| Ketu Adew-Owe | 54 | 0 | 0.00 | 70 | 0 | 0.00 | 54 | 0 | 0.00 | 70 | 0 | 0.00 | 124 | 0 | 0.00 | 124 | 0 | 0.00 |
| Oke –Ella | 46 | 0 | 0.00 | 23 | 0 | 0.00 | 46 | 0 | 0.00 | 23 | 0 | 0.00 | 69 | 0 | 0.00 | 69 | 0 | 0.00 |
| Eredo | 63 | 1 | 1.59 | 36 | 0 | 0.00 | 63 | 0 | 0.00 | 34 | 1 | 2.94 | 97 | 1 | 1.03 | 97 | 1 | 1.03 |
| Alapoti | 38 | 0 | 0.00 | 26 | 2 | 7.69 | 38 | 0 | 0.00 | 26 | 0 | 0.00 | 64 | 2 | 3.13 | 64 | 0 | 0.00 |
| Igbesa | 47 | 2 | 4.26 | 22 | 1 | 4.55 | 47 | 0 | 0.00 | 22 | 0 | 0.00 | 69 | 3 | 4.34 | 69 | 0 | 0.00 |
| TOTAL | 297 | 3 | 1.01 | 231 | 3 | 1.30 | 297 | 0 | 0.00 | 231 | 1 | 0.43 | 526 | 6 | 1.14 | 526 | 1 | 0.19 |

**Plate 1:** Positivity for LF in the blood sample of infected participant using biplex

**Plate 2:** Adult *Wuchereria bancrofti* as observed under the microscope from Giemsa stained thick blood film from the study population.

**Plate 3:** Mirofilaria of *Wuchereri bancrofti* as observed under the microscope from Giesma stained thick blood film in study population

**Plate 4:** Mirofilaria of *Wuchereri bancrofti* as observed under the microscope from Giesma stained thick blood film in study population

**Table 2:** Past and current prevalence rate in the sampled communities

| Communities | Past Prevalence % | Current Prevalence % |
|---|---|---|
| **Eredo** | 54.45 | 1.03 |
| **Oke Ella** | 42.7 | 0.00 |
| **Ajilete** | 47.6 | 0.00 |
| **Ado/odo** | 21 | 3.13 |

**Table 3:** Prevalence of infection using microscopy in Ajilete community

| AJILETE AGE DISTRIBUTION | FEMALE SAMPLED | FEMALE INFECTED (P %) | MALE SAMPLED | MALE INFECTED (P %) | GMI FEMALE | GMI MALE MF/ML |
|---|---|---|---|---|---|---|
| **>20** | 14 | 3 (21.43) | 29 | 1 (3.45) | 3.65 | 3.0 |
| **21-30** | 9 | 8 (88.89) | 6 | 0 (0.00) | 4.47 | 2.0 |
| **31-40** | 9 | 6 (66.67) | 6 | 4 (66.67) | 2.00 | 3.0 |
| **41-50** | 7 | 4 (57.14) | 9 | 5 (55.56) | 2.10 | 2.83 |
| **51-60** | 5 | 5 (100.00) | 3 | 1 (33.33) | 3.17 | 7.00 |
| **<61** | 5 | 0 (0.00) | 1 | 1 (100.00) | 0.00 | 2.00 |
| **TOTAL** | 49 | 26 (53.06) | 54 | 12 (22.22) | 15.3 | 19.8 |

**Table 4:** Prevalence of infection using microscopy in Igebsa communit

| IGESA IGBESA AGE DISTRIBUTION | FEMALE SAMPLED | FEMALE INFECTED (P %) | MALE SAMPLED | MALE INFECTED (P %) | GMI FEMALE MF/ML | GMI MALE MF/ML |
|---|---|---|---|---|---|---|
| **>20** | 4 | 1 (25) | 2 | 2 (100) | 3.00 | 3.87 |
| **21-30** | 8 | 0 (0) | 9 | 1 (11.11) | 0.00 | 0.00 |
| **31-40** | 20 | 4 (20) | 3 | 1 (33.33) | 4.54 | 11.00 |
| **41-50** | 5 | 0 (0) | 5 | 0 (0) | 0.00 | 0.00 |
| **51-60** | 6 | 0 (0) | 2 | 1 (50) | 2.00 | 2.00 |
| **<61** | 2 | 1 (50) | 1 | 0 (0) | 2.00 | 0.00 |
| **UNCLASSIFIED** | 2 | (0) | 0 | 0 (0) | 0.00 | 0.00 |
| **TOTAL** | 47 | 6 (12.77) | 22 | 5 (22.73) | 11.54 | 16.80 |

**Table 5:** Prevalence of infection using microscopy in Oke-Ella community

| OKE ELLA AGE DISTRIBUTION | FEMALE SAMPLED | FEMALE INFECTED (P %) | MALE SAMPLED | MALE INFECTED (P %) | GMI FEMALE MF/ML | GMI MALE MF/ML |
|---|---|---|---|---|---|---|
| **>20** | 23 | 7 (30.43) | 9 | 1 (11.11) | 3.38 | 3.00 |
| **21-30** | 5 | 2 (40 .00) | 3 | 0 (0.00) | 3.87 | 0.00 |
| **31-40** | 8 | 3 (37.50) | 4 | 1 (25.00) | 3.17 | 3.00 |
| **41-50** | 5 | 2 (40.00) | 4 | 0.(0.00) | 3.87 | 0.00 |
| **51-60** | 2 | 0(.0.00) | 2 | 0. (0.00) | 0.00 | 0.00 |
| **<61** | 3 | 1 (33.33) | 1 | 1 (100) | 5.00 | 2.00 |
| **TOTAL** | 46 | 15 (32.61) | 23 | 3 (13.04) | 19.3 | 8.0 |

**Table 6:** Prevalence of infection using microscopy in Alapoti community

| ALAPOTI AGE DISTRIBUTION | FEMALE SAMPLED | FEMALE INFECTED (P %) | MALE SAMPLED | MALE INFECTED (P %) | GMI FEMALE MF/ML | GMI MALE MF/ML |
|---|---|---|---|---|---|---|
| **>20** | 4 | 1 (25) | 6 | 4 (66.67 | 3.00 | 2.91 |
| **21-30** | 5 | 3 (60) | 5 | 2 (40) | 2.62 | 2.00 |
| **31-40** | 4 | 2 (50) | 1 | 2 (50) | 2.45 | 3.46 |
| **41-50** | 15 | - (0) | 5 | - (0) | 0.00 | 0.00 |
| **51-60** | 8 | 3 (37.5) | 5 | - (0) | 2.96 | 0.00 |
| **<61** | 2 | - (0( | 4 | 1 (25) | 0.00 | 2.00 |
| **UNCLASSIFIED** | 1 | - (0) | 1 | - (0) | 0.00 | 0.00 |
| **TOTAL** | 38 | 9 (23.68) | 26 | 9 (34.62) | 11.01 | 10.4 |

**Table 7:** Prevalence of infection using microscopy in Eredo community

| EREDO AGE DISTRIBUTION | FEMALE SAMPLED | FEMALE INFECTED (P %) | MALE SAMPLED | MALE INFECTED (P %) | GMI FEMALE MF/ML | GMI MALE MF/ML |
|---|---|---|---|---|---|---|
| **>20** | 26 | 8 (30.77) | 21 | 5 (23.81) | 4.9 | 4.13 |
| **21-30** | 8 | 0 (00) | 6 | 2 (33.33) | 0.00 | 2.45 |
| **31-40** | 9 | 7 (77.78) | 1 | 1 (100) | 2.99 | 11.00 |
| **41-50** | 7 | 3 (42.86) | 2 | 2 (100) | 2.29 | 2.00 |
| **51-60** | 3 | 1 (33.33) | 2 | 2 (100) | 3.00 | 4.31 |
| **<61** | 9 | 4 (44.44) | 4 | 1 (25) | 2.91 | 3.00 |
| **TOTAL** | 63 | 23 (36.51) | 36 | 13 (36.11) | 16.09 | 15.59 |

**Table 8:** Prevalence of infection using microscopy in Ketu-Adiewe community

| KETU ADIEWE AGE DISTRIBUTION | FEMALE SAMPLED | FEMALE INFECTED (P %) | MALE SAMPLED | MALE INFECTED (P %) | GMI FEMALE MF/ML | GMI MALE MF/ML |
|---|---|---|---|---|---|---|
| **>20** | 4 | 3 (75) | 14 | 1 (7.14) | 3.35 | 2.00 |
| **21-30** | 8 | 8(100) | 12 | 0 (0) | 6.85 | 0.00 |
| **31-40** | 20 | 6 (30) | 18 | 4 (22.22) | 3.84 | 2.38 |
| **41-50** | 8 | 4 (50) | 8 | 5 (62.5) | 3.31 | 5.14 |
| **51-60** | 10 | 5 (50) | 9 | 4 (44.44) | 4.85 | 3.46 |
| **<61** | 4 | 0 (0) | 9 | 3 (33.33) | 0.00 | 1.88 |
| **TOTAL** | 54 | 26 (48.15) | 70 | 17 (24.29) | 22.20 | 14.86 |

**Discussion**

This study assessed the status of lymphatic filariasis and Onchocerciasis prevalence in certain communities in Ogun State that have been undergoing Mass Drug Administration of Medicines (MAM) since 2007 to determine readiness to meet the GPELF goal in year 2022. Treatment was administered through MAM by single treatment therapy of 400mg/kg albendazole and 200mcg/kg ivermectin.

The prevalence of infection using the Oncho/LF IgG4 biplex strip test was below threshold level of 1% in most of the communities including Ajilete (0.00%), Ketu Adie-Owe (0.00%), Oke-Ella (0.00%) but above threshold level in Eredo (1.03%), Alapoti (3.13%) and Igbesa (4.34%). Overall prevalence of 1.03% using Oncho/LF IgG4 biplex strip test was however above the WHO threshold. This means that the whole community will have to undergo Mass Drug of Medicines.

Microscopic findings in all the six communities indicated prevalence rates higher than the threshold level which also aligned with the rate determined using the test strip. In contrast to previous research, the prevalence by microscopy was higher than the Oncho/LF IgG4 biplex strip test. According to previous reports, this could happen when the adult worms in the blood cannot be expressed by the biplex because of its long stay in the circulating blood of patients. There are indications that certain MDA drugs can prevent the vector- borne transmission of adult worms for several months by killing the microfilariae and inducing a temporary sterilization of adult worms, but since adult worms continue to live in the body they eventually produce new microfilaria. It has also been reported in previous literature that patients with active filarial infections typically have IgG4 in the blood which can be detected using routine assays, but people with passive filarial infection could still be picked by microscopy especially the adult stages.

Using both assays, the prevalence of infection was higher in females than in males. This is because they were the ones predisposed to the vector due to their bush farming which is in line with previous research work in these areas. It was also observed that prevalence of infection was highest among the stratified ages of 21-50 years who are majorly the working population. This was also in line with previous findings.

It was observed that even though prevalence has reduced in the last five years, there is still a need to administer MAM in such a way that it elicits the cooperation of participants. There is a need to deal with the ignorance of the people in these communities by sensitization in the cause, available tools of diagnosis, creating awareness through jingles,

all forms of available effective communication and networking in their language.

Substantial advances have been made towards the elimination of onchocerciasis and LF in SSA [5, 6]. Despite prolonged control activities however, many endemic areas are still experiencing ongoing transmission. Taken together with the risk of loiasis-related SAEs, issues of efficacy and appropriateness for existing treatment strategies remains of major concern. The work presented here highlights settings suitable for innovative MDA regimens and integrated control, which may help to address these concerns. Further work is required to test new strategies in programmatic settings, providing the empirical evidence needed to guide efforts towards the 2020 goals and beyond.esnais CB, Takougang I, Paguele M, Pion SD, Boussinesq M. Excess mortality associated with loiasis: a retrospective population-based cohort study. Lancet Infect Dis. 2017;17(1):108–16.

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