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Samoa and American Samoa, two adjacent South Pacific island groups, had high circulating filarial antigen (Ag) prevalence (4.5% and 16.5% respectively) in 1999, when baseline surveys were conducted through the Pacific Programme to Eliminate Lymphatic Filariasis (LF). After 6-7 rounds of mass drug administration (MDA) with diethylcarbamazine (DEC) and albendazole from 1999-2006 with reported adequate population coverage, Ag prevalence in all ages reduced to 1-2%. American Samoa passed two Transmission Assessment Surveys (TAS) of 6-7 year-old children in 2011 & 2015. Samoa conducted four additional MDA rounds during 2008-2017, and passed TAS in two of three evaluation units (EUs) in 2013, but failed TAS in all EUs in 2017. Population representative household surveys found that overall Ag prevalence had risen to 6.2% (95% CI 4.5-8.6%) in American Samoa in 2016, and 4.9% (95% CI 4.0-5.9%) in Samoa in 2018. Ag prevalence in 6-7 year-old children was 0.7% (95% CI 0.3-1.8%) and 1.5% (95% CI 1.0-2.1%) respectively, indicating ongoing transmission. Overall, 15-25% of Ag-positive (Ag+) persons were microfilaraemic, including children as young as 5 years. Ag+ persons were identified throughout American Samoa (2016) and Samoa (2018) in all EUs, but village-level Ag prevalence varied significantly, ranging from 0% to 45%. Significant household clustering of Ag+ persons was found in both Samoas. The results indicate that neither Samoa nor American Samoa had interrupted transmission by 2011-2013 despite passing TAS thresholds, and both are now experiencing resurgence. In areas with highly efficient vectors (e.g. Polynesia), programmatic guidelines may need to be revised to ensure interruption of transmission is sustained. Potential strategies include: 1) reducing Ag prevalence thresholds for stopping MDA and validating elimination; 2) because Ag prevalence increases with age, increasing the target age groups for surveillance to improve the sensitivity for detecting any residual transmission; and 3) screening household members of Ag+ persons. Both Samoas are implementing nationwide triple drug MDA (DEC, albendazole, ivermectin) in 2018-2019.

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ANNUAL VERSUS SEMI-ANNUAL MASS DRUG ADMINISTRATION WITH DIETHYLCARBAMAZINE PLUS ALBENDAZOLE FOR ELIMINATION OF LYMPHATIC FILARIASIS IN EAST SEPIK PROVINCE, PAPUA NEW GUINEA

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Papua New Guinea (PNG) has over 5.4 million people at risk of lymphatic filariasis (LF) with some of the highest infection rates in the world. Modeling studies based on data from Ghana and India suggest that semi-annual mass drug administration (MDA) could accelerate LF elimination. The aim of this study was to compare the impact of annual and semi-annual MDA for clearance of microfilaremia (Mf) and circulating filarial antigen (CFA) in highly endemic areas in PNG. Repeated annual cross-sectional surveys were conducted in 8 sentinel villages (~300-400 individuals/site) in the Dreikikir District, East Sepik Province; 4 sentinel sites in communities received semi-annual MDA with DEC plus albendazole (ALB) at 6 month intervals for 3 years (total of 5 rounds), and 4 sentinel sites received 3 rounds of annual MDA with the same medications. Filarial test strips (FTS) evaluated the presence and levels of CFA and Mf was assessed by microscopic examination of 60 µl night blood smears. Approximately 1,400 persons were surveyed for each treatment area each year. Baseline Mf and CFA prevalence were similar in annual and semi-annual MDA communities (26% Mf+ and 51% CFA+ vs. 26% Mf+ and 53% CFA+). Clearance of Mf and CFA was assessed annually for 3 years after baseline. Mf prevalence decreased dramatically over 3 years from 26% to 0% after annual MDA and from 26% to 0.3% after semi-annual MDA. Declines in CFA prevalence were also comparable (from 51% to 29% after annual MDA, and 53% to 35% after semi-annual MDA). In conclusion, MDA with DEC + ALB was highly effective for clearing microfilaremia from communities but less effective for clearing CFA. Additional work is needed to understand the significance of persistently high CFA prevalence in these communities. Semi-annual MDA was not superior to annual MDA. We recommend that LF elimination programs conserve resources by focusing on delivery of a single round of high quality MDA per year.

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ONCHOCERCIASIS ELIMINATION IN LOW-ENDEMIC SETTINGS: MATHEMATICAL MODELLING TO ASSESS THE REQUIRED DURATION OF MASS DRUG ADMINISTRATION OF IVERMECTIN

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Onchocerciasis is targeted for elimination in Africa by mass drug administration (MDA) of ivermectin. Many low-endemic areas have not yet been treated, as MDA programmes historically focussed only on meso- and hyperendemic areas for morbidity control. We used the ONCHOSIM simulation model to assess how many rounds of MDA are needed to eliminate onchocerciasis from low-endemic areas. We simulated annual MDA for settings with 0%-40% baseline microfilaria (mf) prevalence and varying local transmission conditions (annual biting rate, inter-individual variation in exposure to flies, and rate of infection importation from other areas). The number of MDA rounds to bring mf prevalence below 1.4% (the assumed critical threshold) depends on baseline endemicity, coverage, trends in infection importation, and the stability of transmission without importation. If importation rates remain constant until the start of MDA, it would take 5, 11, 14 and 15 annual MDA rounds, respectively, to reduce mf prevalence to <1.4% in areas with 0-10%, 10-20%, 20-30% and 30-40% baseline mf prevalence. Shorter durations are expected if the importation rates start declining before introducing MDA, thanks to treatment in surrounding areas. In some areas, infection transmission can only persist thanks to importation from surrounding higher-endemic areas. Treating the surrounding areas - leading to reduced importation - is then sufficient for elimination, although elimination can be accelerated by also treating the low-endemic area. In conclusion, the number of MDA rounds required to eliminate onchocerciasis from hypo-endemic areas varies strongly. Under some conditions as many as 15 annual MDA rounds may be required to bring mf prevalence below the assumed <1.4% threshold, and acceleration strategies may have to be considered (e.g. treating biannually). The assumed 1.4% threshold is subject to uncertainty. The actual threshold depends on local transmission conditions, and further work is needed to understand where more lenient threshold can be used or more stringent threshold are needed.

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FEASIBILITY OF ONCHOCERCIASIS ELIMINATION USING A "TEST-AND-NOT-TREAT" STRATEGY IN *LOA LOA* CO-ENDEMIC AREAS

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Mass drug administration (MDA) with ivermectin is the main strategy for onchocerciasis elimination. Ivermectin is generally safe, but has been associated with serious adverse events in persons with high microfilarial densities (MFD) of *Loa loa.* Therefore, ivermectin MDA is not recommended in areas where onchocerciasis is hypoendemic and *L. loa* is co-endemic. To eliminate onchocerciasis in those areas, a test-and-not-treat (TaNT) strategy has been proposed. Using the Loascope, a mobile video-microscope, people with high *L. loa* MFD can be identified and excluded from ivermectin treatment. While TaNT was successfully piloted in Cameroon, it remains unclear whether onchocerciasis elimination is possible using this strategy. We used the established individual-based model ONCHOSIM to assess whether onchocerciasis can be eliminated using TaNT in *L. loa* co-endemic areas and what the required duration until elimination would entail in comparison to MDA. We simulated pre-control onchocerciasis microfilarial prevalence (MFP) levels ranging from 1-50%. The impact of TaNT was simulated under varying levels of participation rate, systematic non-participation and exclusion from ivermectin due to high *L. loa* MFD. We predict that in areas with a pre-control MFP of 30-40% it normally takes around 10 and 14 years to bring onchocerciasis MFP below 1.4% using MDA, if the participation rate is 80% and 65%, respectively. These durations would increase with about 1 year, if 2.5% of the population is randomly excluded from ivermectin treatment due to TaNT. This increase can be up to about 5 years if systematic non-participation is assumed, and if participation rates are lower and pre-control MFP higher. Although the chosen elimination threshold is provisional, our model predicts a high probability of achieving true elimination after reaching this threshold. In conclusion, onchocerciasis can be eliminated using TaNT in areas co-endemic for *L. loa*. The required treatment duration of TaNT until elimination is only slightly longer than in areas with MDA, if participation is good.

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ENVIRONMENTAL FACTORS ASSOCIATED WITH CONTRASTING GEOGRAPHICAL DISTRIBUTIONS AND HOTSPOTS OF ONCHOCERCIASIS AND LOIASIS IN KONGO-CENTRAL, DEMOCRATIC REPUBLIC OF CONGO

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Onchocerciasis and loiasis are important filarial diseases in the Democratic Republic of Congo (DRC), and the Kongo-Central region has shown to have contrasting geographical distributions, which may be driven by the ecological niche of the *Simulium* and *Chrysops* vectors. To better understand environmental factors associated with geographical patterns and potential hotspots, REMO and RAPLOA survey data from 335 villages available from the ESPEN portal were examined. Maps were developed using ArcGIS 10.5.1 and prevalence distributions examined for spatial clustering using the Getis Ord Gi* statistic. Environmental factors including annual mean temperature (°C), annual precipitation (mm), elevation (m), tree canopy coverage (%) and tree canopy height (m) were obtained from publicly available sources, and data extracted for each village and analysed using statistical methods with a significance level of $P < 0.05$. Overall, mean environmental measures for both diseases were similar (temperature 31.6-32.1°C; precipitation 1287-1290mm, elevation 23.5-23.7m, canopy coverage 30.2-32.7%, canopy height 7.3-11.3m). Prevalences were found to be positively correlated with temperature, and negatively with precipitation. However, onchocerciasis prevalence was significantly negatively correlated with canopy coverage (r=-0.30) and canopy height (r=-0.16), whereas loiasis was significantly positively correlated with coverage (r=0.50) and height (r=0.26). For onchocerciasis, 86 villages were identified as hotspots and clustered near the Congo River with mean temperature 28.2°C; precipitation 1184mm, elevation 22.0m, canopy coverage 16.4%, and canopy height 5.6m. In contrast for loiasis, 57 villages were identified as hotspots and clustered in the forested region with mean temperature 24.7°C; precipitation 1165mm, elevation 18.5m, canopy coverage 63.6%, and height 13.4m. This study provides insights into the environmental parameters of transmission, which may help to delineate high and low risk, and target intervention strategies for filariasis control and elimination.

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EVALUATION OF RESPONDENT-DRIVEN SAMPLING TO ESTIMATE LYMPHATIC FILARIASIS MORBIDITY BURDEN IN HAITI

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More than 36 million people suffer from lymphatic filariasis (LF)-related limb swelling (lymphedema) or urogenital swelling (hydrocele). The World Health Organization requires LF-endemic countries to document the number of lymphedema and hydrocele cases in all historically endemic districts, yet there is no agreed methodology for assessing morbidity burden. Case reporting is hindered by the social stigma and isolation associated with LF. Respondent driven sampling (RDS) is a method developed for accessing hidden populations through recruitment of a limited number of starting 'seeds' followed by successive waves of participant referral. We evaluated the feasibility of RDS for estimating LF morbidity burden in four districts in Haiti classified as high, medium or low burden based on baseline antigen prevalence at mapping in 2001 (range: 1%—44%). We compared RDS burden estimates with those derived from recent cross-sectional household surveys (HHS) conducted in the same areas. From July 2018-January 2019, approximately 20-25 individuals per condition (lymphedema or hydrocele) identified from local health facility records were enrolled as seeds and asked to refer others in the community with the same condition. A total of 179 confirmed lymphedema cases (52% male) and 238 hydrocele cases (100% male) were enrolled through RDS across four districts. The number of referral waves directly correlated with antigen prevalence classification for both lymphedema (r^2=0.88) and hydrocele (r^2=0.97). Surprisingly, a greater number of waves were achieved for hydrocele than for lymphedema in every district. District-level RDS prevalence estimates calculated with successive sampling - population size estimation (SS-PSE) and a flat prior ranged from 0.2% (95% CI: 0.15%—0.21%) to 1.4% (95% CI: 0.4%—2.1%) for lymphedema and from 0.4% (95% CI: 0.20%—0.50) to 1.5% (95% CI: 0.7%—1.9%) for hydrocele. The 95% confidence intervals for RDS and HHS overlapped in three of four districts for hydrocele, but only one or four districts for lymphedema. Results suggest that RDS may offer a viable option to efficiently obtain LF morbidity burden data.

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HEALTH CARE PROVIDERS AND CAREGIVERS' VIEWS ON THE FEASIBILITY, USABILITY AND ACCEPTABILITY OF LUNG ULTRASOUND FOR DIAGNOSING PEDIATRIC PNEUMONIA IN MANHIÇA DISTRICT, MOZAMBIQUE

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In Mozambique, pneumonia is a leading cause of death among children under 5 years of age, yet its diagnosis remains a challenge. Although chest radiography (CXR) remains the recommended diagnostic method, existing evidence from other suggests that CXR it is often unavailable, costly and

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