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Reducing poverty in Africa with implementation science for NTD control

Programme of implementation research to inform the effective and sustainable scaling-up of integrated Neglected Tropical Disease (NTD) control initiatives

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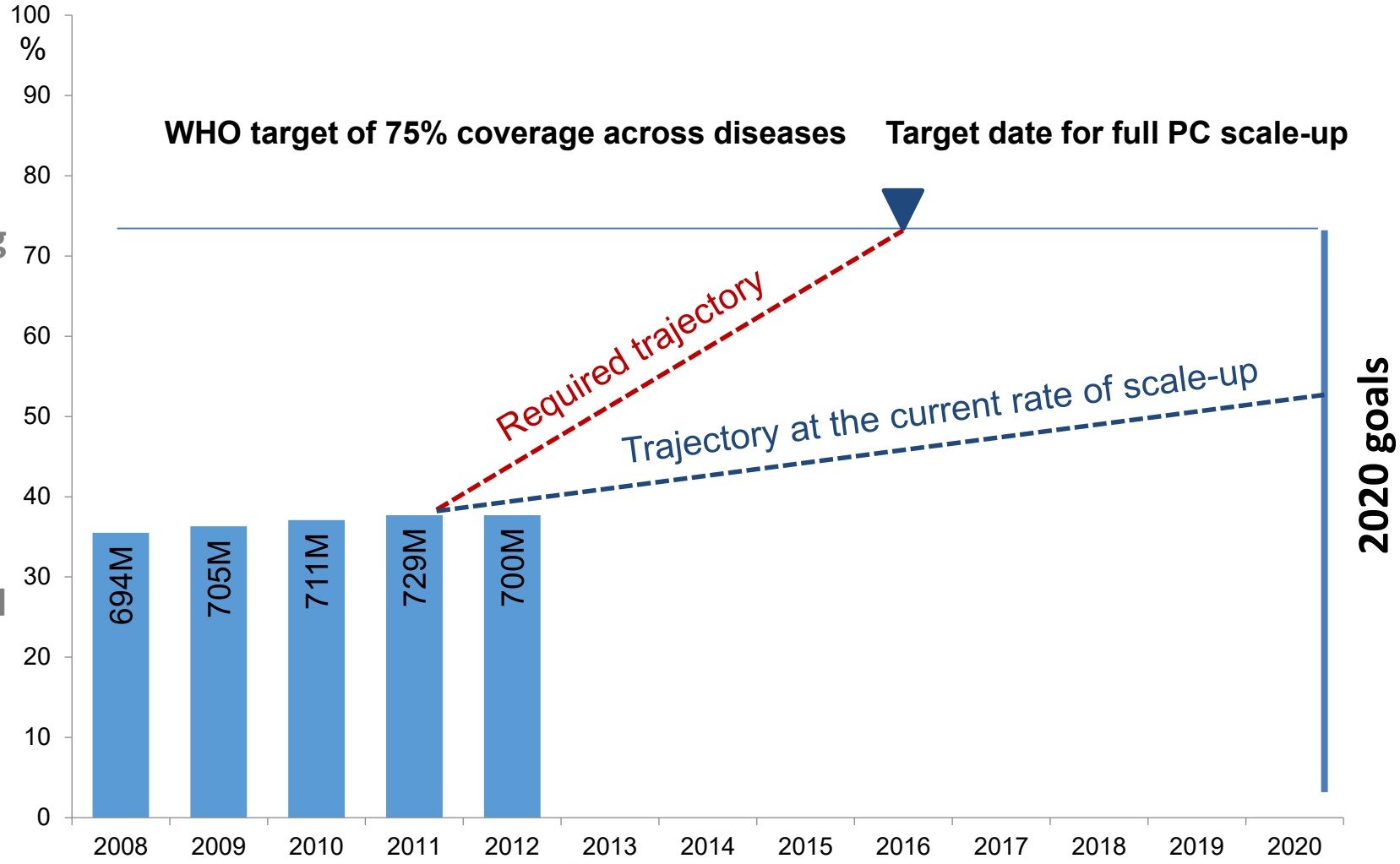
The COU**NTD**OWN project is a research programme funded by

The Research and Evidence Division (RED) of The Department for International Development (DFID)

WHO identify scale-up of future PC to reach 2020 targets

Projected % of people receiving PC for at least one disease (including LF, ONCH, SCH and STH) out of total number that require PC



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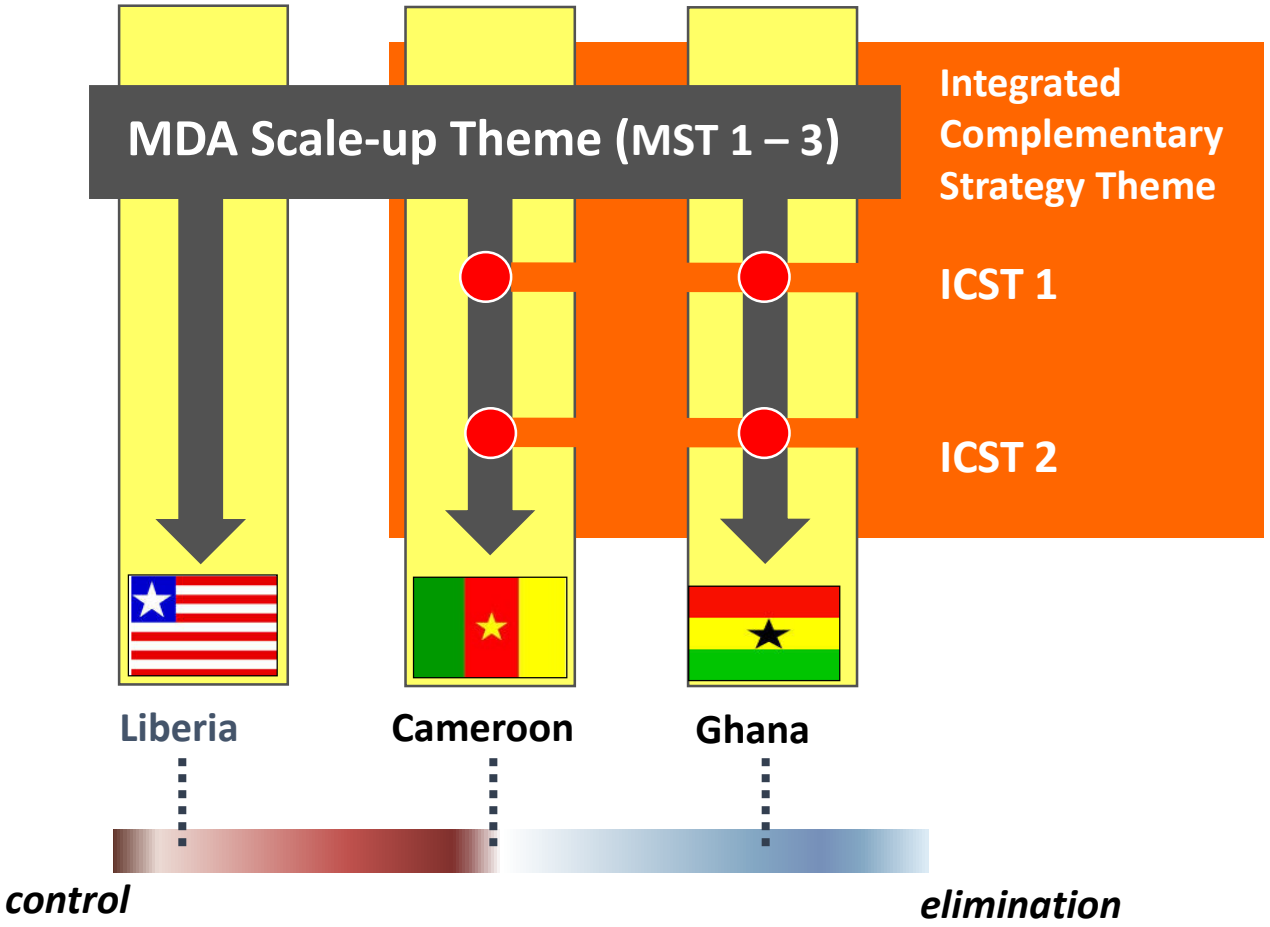
- **Urgent need to address bottlenecks in scale-up of PC**
- *and*
- **to accelerate towards WHO 2020 targets**

How we will do it: country & context-specific settings of MDA



MST 1: Evidence synthesis

Paul Garner and Cochrane group

MST 2: Applied social science

Sally Theobald and Margaret Gyapong

MST 3: Health economics

Louis Niessen

ICST 1: 'Hotspots' and SAEs

Mark Taylor, Lisa Riemer/Jo Turner
Nana Biritwum and Samuel Wanji

ICST 2: Access to MDA and CLTS

Russ Stothard, Emily Adams, Kamal Kar
Louis Tchuem-Tchuente and Mike Osei

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Research on Alternative strategies for the Acceleration of the Elimination of Onchocerciasis in Cameroon

Case study in the Meme River Basin

South west Cameroon

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The COU**NTD**OWN project is a research programme funded by

The Research and Evidence Division (RED) of The Department for International Development (DFID)

Wanji *et al. Parasites & Vectors* (2015) 8:202
DOI 10.1186/s13071-015-0817-2

Parasites & Vectors

RESEARCH Open Access

Situation analysis of parasitological and entomological indices of onchocerciasis transmission in three drainage basins of the rain forest of South West Cameroon after a decade of ivermectin treatment

Samuel Wanji[1,2*], Jonas A Kengne-Ouafo[1,2†], Mathias E Esum[1,2†], Patrick W N Chounna[1,2], Nicholas Tendongfor[1,2], Bridget F Adzemye[1,2], Joan E E Eyong[2,5], Isaac Jato[3], Fabrice R Datchoua-Poutcheu[1,2], Elvis Kah[1,4], Peter Enyong[1,3] and David W Taylor[6]

Nodule Prevalence in the River drainages (2012)

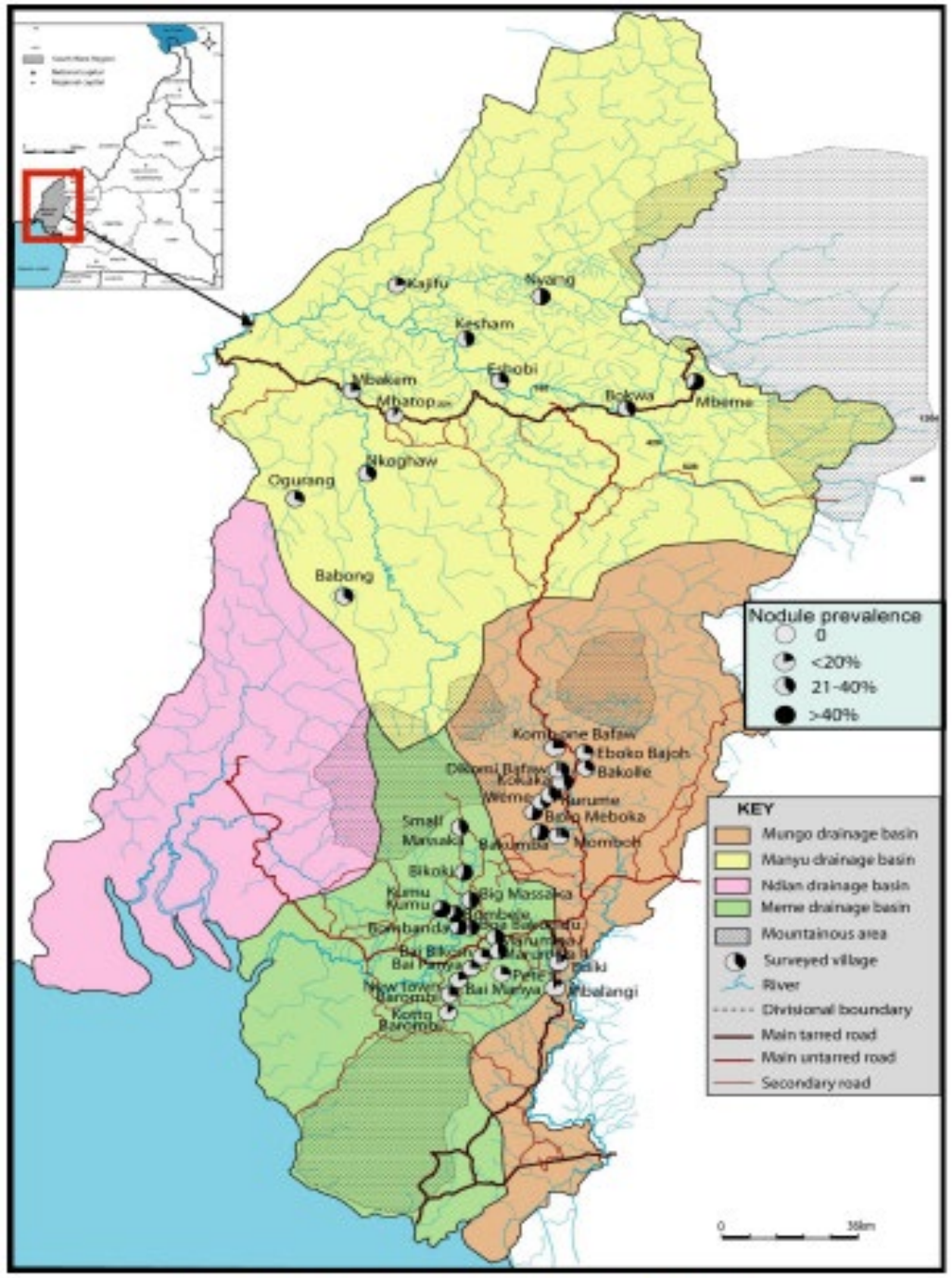

Figure 2: Nodule prevalence in the three drainage basins

Microfilariae Prevalence in the River drainages (2012)

Figure3: Mf prevalence in the three drainage basins

Entomological Indicators in the River Drainages (2012)

Drainage basin	Manyu			Mungo			Meme		
Entomological indices	Kajifu	Babong		Bolo	Bakumba		Big Massaka	Bombele	Marumba I
Females captured	4051	5683		2106	4068		1917	3119	1015
Daily biting rate	1012.8	1623.7		421.2	813.6		383.4	623.8	203
Monthly biting rate	30382.5	48711		12636	24408		11502	18714	6090
Females dissected	4051	4040		2106	3961		1862	3119	1015
Parous females	428	519		588	1058		767	908	493
Infected females (L1,L2,L3)	57	19		49	114		112	117	21
% infected females	13.3	3.7		8.3	10.8		14.6	12.9	4.3
Females with L3 in head	12	9		16	64		49	48	10
% infective females	2.8	1.7		2.7	6.0		6.4	5.3	2.0
L3/infective female	3.2	2.88		2.9	3.2		4.2	3.9	1.5
L3 in head/1000 parous	88.8	60.7		79.9	190.9		271.2	207	30.4
MTP	285	313.5		282	1180.1		1211.7	1128	90

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END POINTS FOR ELIMINATIONS OF ONCHOCERCIASIS

Indicators	ONCHOSIM/WHO-APOC thresholds
Prevalence of *O. volvulus* mf	< 5% (all surveyed communities) OR < 1% (90% of surveyed communities)
Prevalence of mf in Children	< 0.1%
Simulium Infective rate (%)	< 0.05

Wanji *et al. Parasites & Vectors* (2015) 8:667
DOI 10.1186/s13071-015-1283-6

Parasites & Vectors

RESEARCH Open Access

Relationship between oral declaration on adherence to ivermectin treatment and parasitological indicators of onchocerciasis in an area of persistent transmission despite a decade of mass drug administration in Cameroon

Samuel Wanji[1,2*], Jonas A. Kengne-Ouafo[1,2], Mathias E. Esum[1,2], Patrick W. N. Chounna[1,2], Bridget F. Adzemye[1,2], Joan E. E. Eyong[2,4], Isaac Jato[3], Fabrice R. Datchoua-Poutcheu[1,2], Raphael A. Abong[1,2], Peter Enyong[1,3] and David W. Taylor[5]

Relationship Between Ivermectin Intake and *O. volvulus* Prevalence in the study population

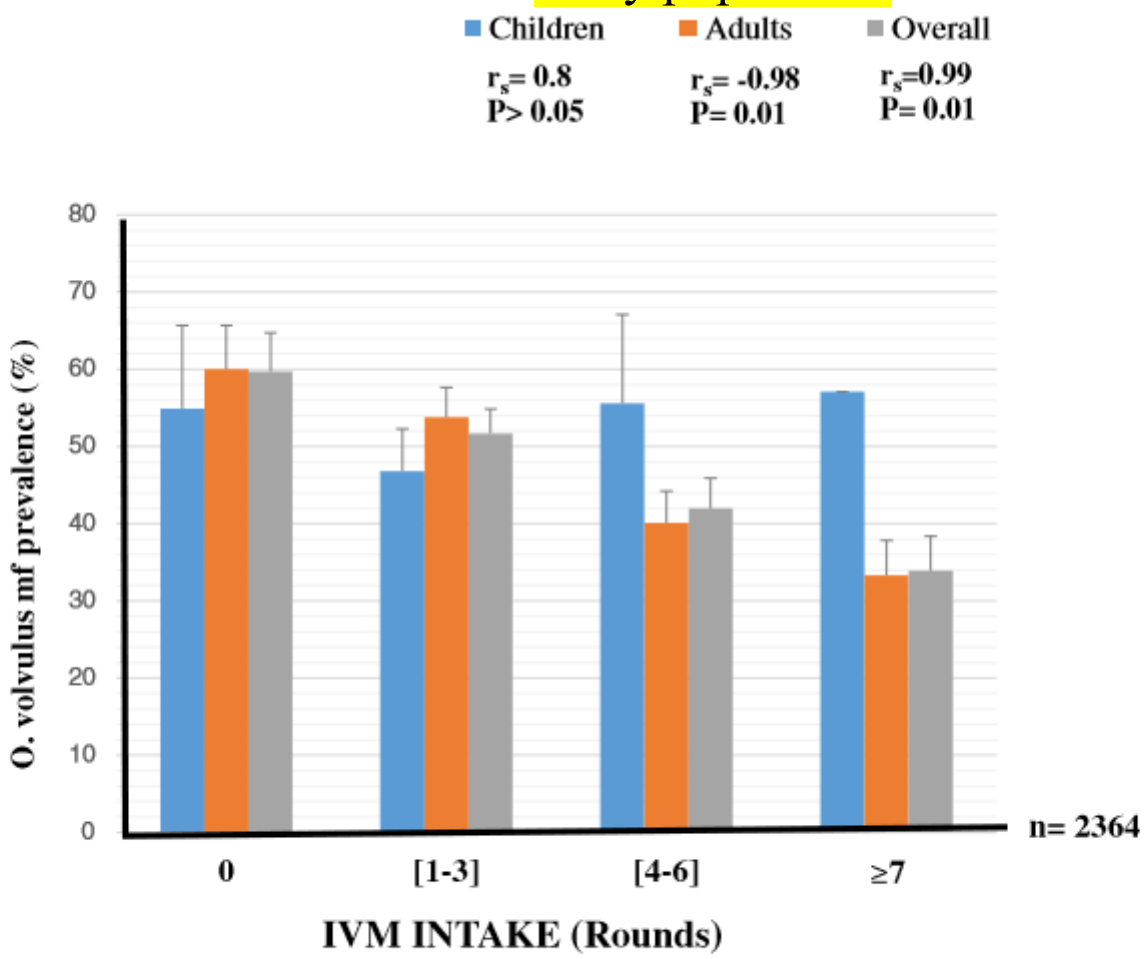

Fig. 1 Effect of ivermectin treatment on *O. volvulus* mf prevalence in the study population. (Number of people examined per IVM intake groups written in the order children, adults (overall): [0 time] = 82, 285 (367); [1-3 times] = 316, 640 (956); [4-6 times] = 72, 543 (615); [≥7 times] = 7, 419 (426). Bars represent the 95 % margin of error. Significance level set at 5 %

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Changes in the proportions of the study population in defined mf load groups in Relation to IVM intake profile

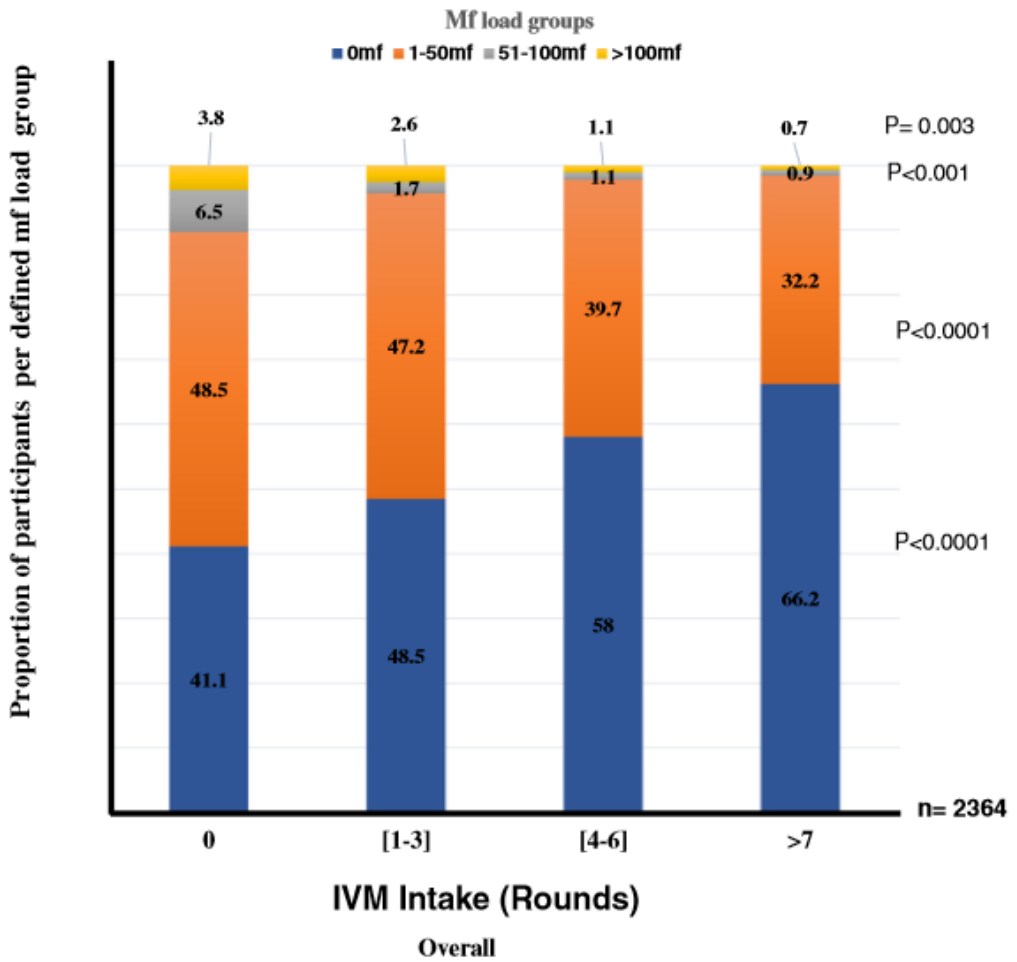

Fig. 6 Changes in the proportions of study population in defined mf load groups in relation to IVM intake profile. (Number of people examined per IVM intake groups: [0 time] = 367; [1-3 times] = 956; [4-6 times] =615; [≥7 times] =426). P-value given for each defined mf load group and significance level set at 5 %

PLOS | NEGLECTED TROPICAL DISEASES

RESEARCH ARTICLE

Programmatic factors associated with the limited impact of Community-Directed Treatment with Ivermectin to control Onchocerciasis in three drainage basins of South West Cameroon

Christian Tetteh Duamor[1,2], Fabrice Roberto Datchoua-Poutcheu[3], Winston Patrick Chounna Ndongmo[3], Aldof Tah Yoah[1], Ernest Njukang[1], Emmanuel Kah[1], Mary Sheena Maingeh[1], Jonas Arnaud Kengne-Ouaffo[1,3], Dizzle Bita Tayong[1,3], Peter A. Enyong[1,3], Samuel Wanji[1,3]*

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Fig 1. Organogram of CDTI establishment. Adapted from (APOC/WHO, 1998).

https://doi.org/10.1371/journal.pntd.0005966.g001

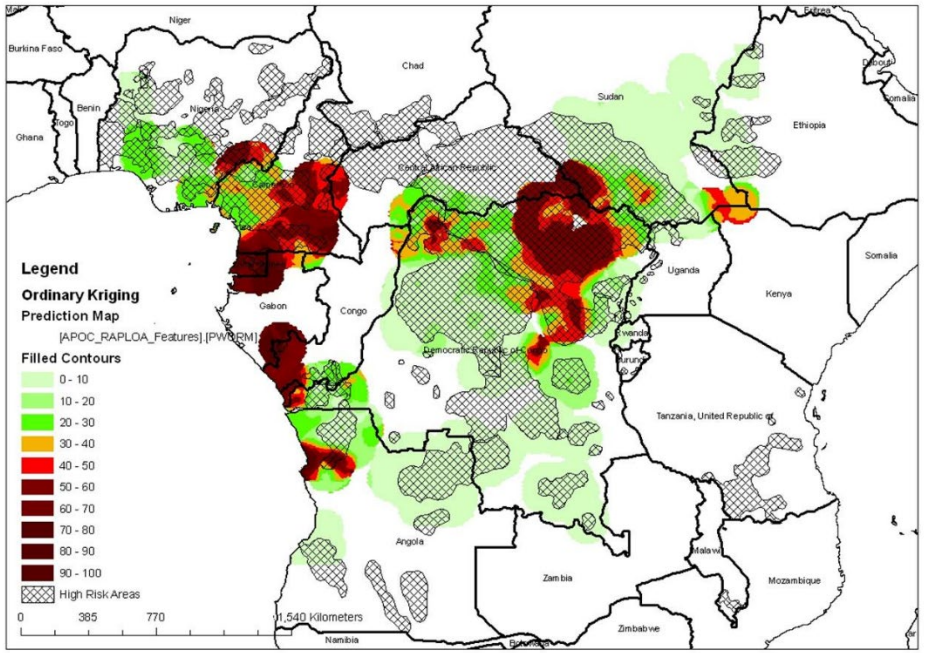
Conclusion

Certain critical weaknesses existed in the implementation process of CDTI in our study area. This included weak community participation towards planning of CDTI activities, sensitization of community members, resource mobilization and monitoring of the process. This may have actually led to low adherence to Ivermectin treatment among community members.

Also, inadequate staff at the frontline health facilities, funding issues and transportation challenges derailed efforts of the health service towards implementing adequate training, supervision and monitoring of the process.

Co-endemicity *Loa loa* and *Onchocerca volvulus*

***Onchocerciasis** (grey) and Loiasis (coloured) high risk areas (Source: APOC)*



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Force of Transmission and Timing of Drug Distribution

-High Intensity of Transmission Coupled to not suitable timing of Ivermectin Distribution

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Numerous fast Flowing Rivers in the South west region

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Need of Alternative Strategies

To Accelerate the Elimination of Onchocerciasis in this forested area, there is a need to use new strategies for tackling the parasite in human and the vector population in the rivers at the same time

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Alternative Strategies

- **Strategy 1**

The recent adoption of Doxycycline as an alternative complementary strategy by African and American onchocerciasis programmes (APOC and OEPA) highlights the need for implementation research to evaluate, in a regional and country-wide programmatic context, how to integrate new macrofilaricidal drugs to complement existing MDA strategies

Alternative Strategies

- **Strategy 2**

Themephos is an environmental friendly insecticide that is highly effective against Simulium vector larvae and has been used successfully for the control of onchocerciasis in different scenario

Study area and Design

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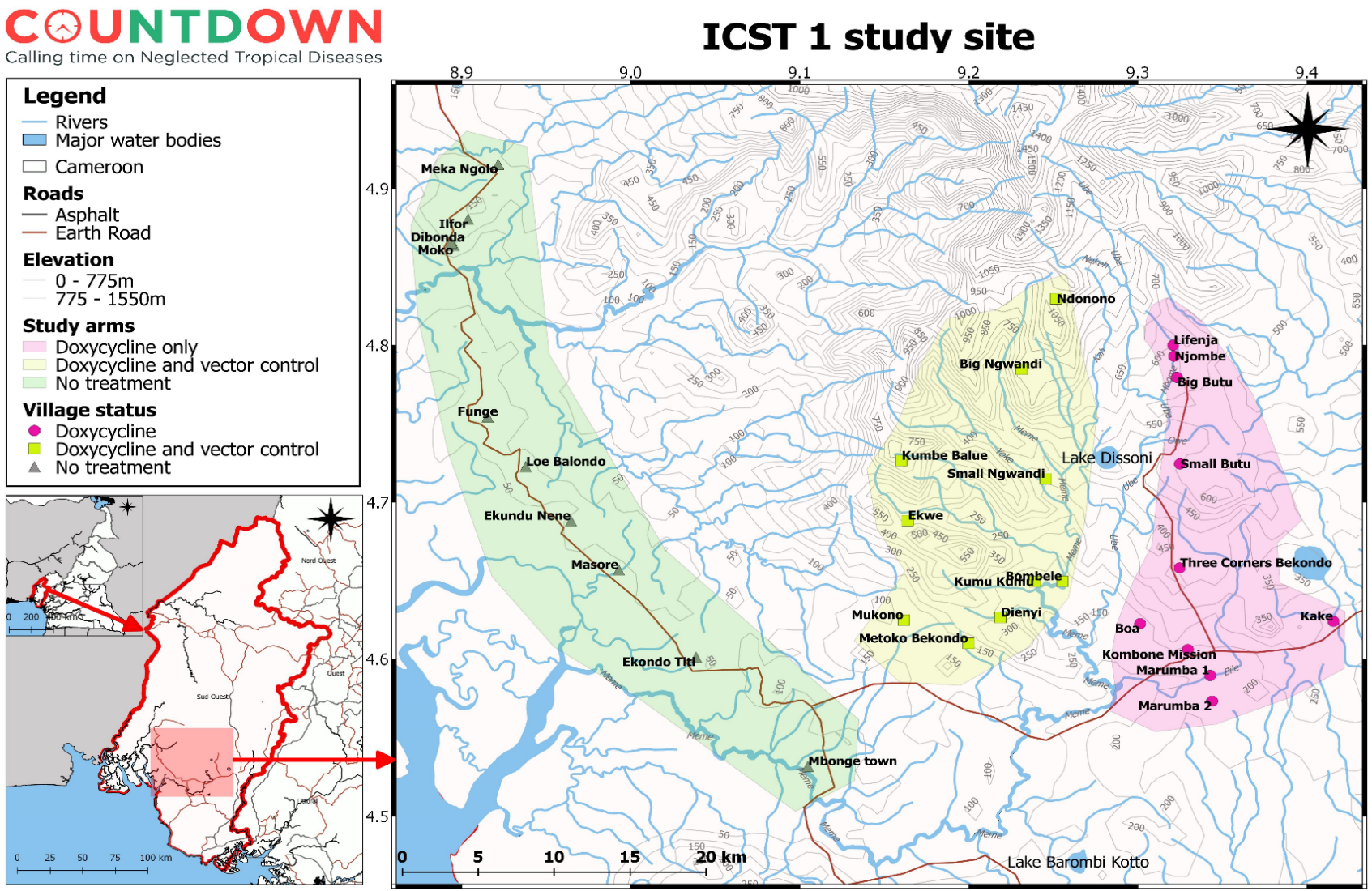

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Public Engagement

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Community Engagement

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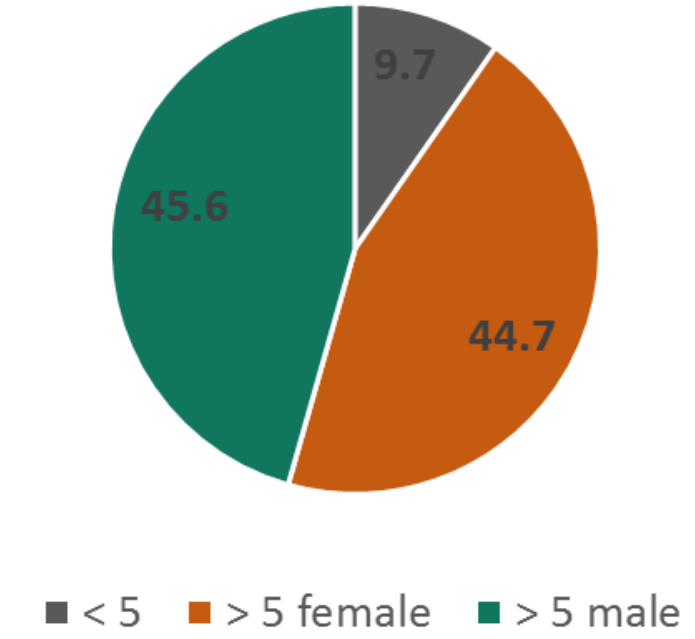
CENSUS RESULTS

Census results in 20 intervention communities:

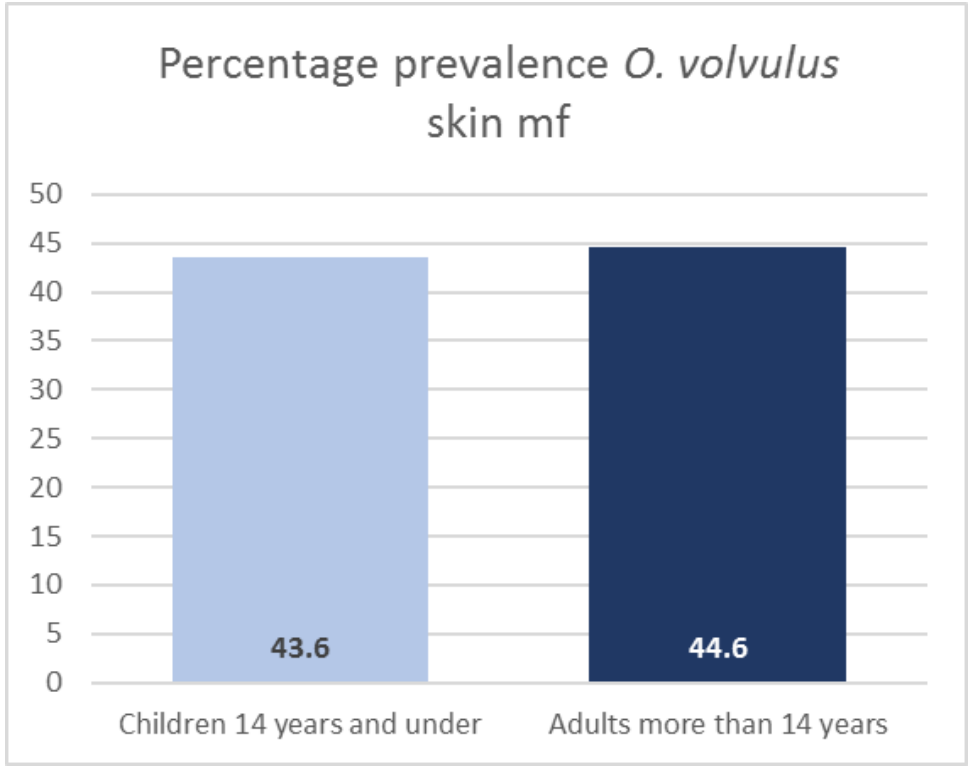
Community Name	Census	Under 5 years	5 years and above		
			Female	Male	Total
Nake	1415	138	622	654	1276
Metoko Bekondo	991	111	393	482	875
Dienyi	1352	147	568	634	1202
Kumu Kumu	307	50	116	141	257
Bombele	955	105	413	433	846
Bombanda	777	85	331	358	689
Kombone	1974	174	905	894	1799
Boa Bakundu	2140	174	916	1046	1962
Big Butu	1029	111	459	456	915
Lifenja	332	29	153	149	302
Njombe	441	49	182	210	392
Big Massaka	829	51	399	378	777
Small Butu	509	45	220	244	464
Bikoki	354	28	166	158	324
Bakumba	1291	122	584	585	1169
Big Ngwandi	2095	245	965	882	1847
Betenge	327	29	156	132	288
Small Massaka	797	84	379	333	712
Lokando	391	48	172	171	343
Kwa Kwa	1657	110	804	735	1539
Total	19963	1935	8903	9075	17978



In total, 9.7% of the population were less than 5 years of age and not eligible for screening

Parasitological screening

	Individuals that took part in the parasitological screening		individuals screened with Ov microfilaridermia		
Community Name	Number Screenned	Screening coverage (%)	Parasitology screening for 5 years and above Ov mf Negative	Ov mf Positive	Prevalence (%)
Nake	496	38,9	309	187	37,7
Metoko B.	428	48,9	222	206	48,1
Dienyi	731	60,8	339	392	53,6
Kumu Kumu	92	35,8	35	57	62
Bombele	377	44,5	257	120	31,8
Bombanda	343	49,7	238	105	30,6
Kombone	806	44,8	503	303	37,6
Boa Bakundu	1255	64	798	457	36,4
Big Butu	547	59,7	331	216	39,5
Lifenja	123	40,7	52	71	57,7
Njombe	221	56,4	93	128	57,9
Big Massaka	586	75,3	240	346	59
Small Butu	249	53,7	61	188	75,5
Bikoki	219	67,6	66	153	69,9
Bakumba	548	46,9	253	295	53,8
Big Ngwandi	1007	54,5	647	360	35,7
Betenge	221	76,7	102	119	53,8
Small Mas.	342	48	225	117	34,2
Lokando	131	38,2	54	77	58,8
Kwa Kwa	792	51,4	461	331	41,8
Total	9514	52,9	5286	4228	44,4



Very little difference in prevalence of onchocerciasis in children and adults

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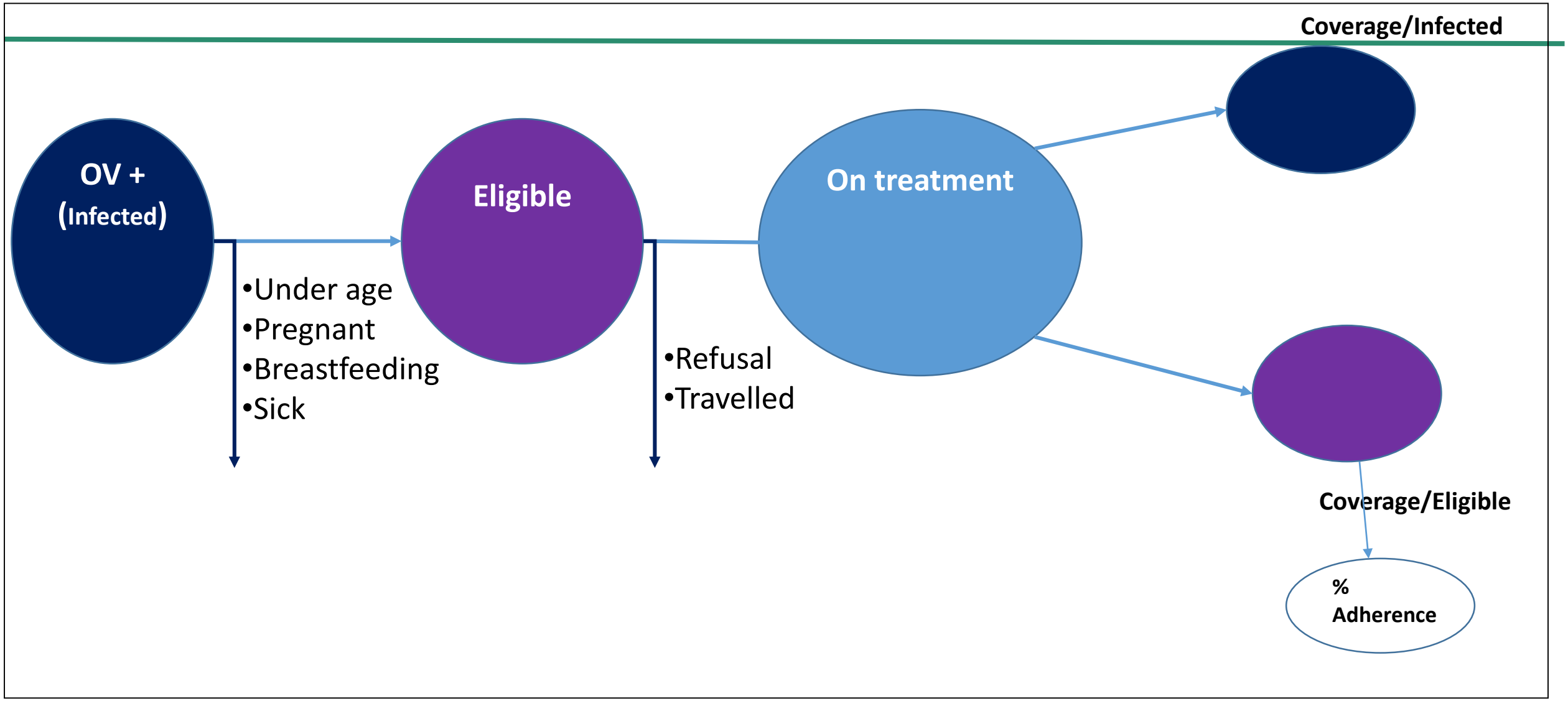
Algorithm for Coverage and Adherence determinations



Cumulative Portrait from all Communities

Doxycycline DOT by CDDs and FLHW After Morning Breakfast

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Results/Findings - Treatment

Community	Total after exclusion criteria	Number of eligible individuals that took part in the doxy treatment*			% Coverage per eligible population			Number of individuals who started and completed doxy treatment for 35 days			% adherence to doxy treatment		
		Female	Male	Total	Female	Male	Total	Female	Male	Total	Female	Male	Total
Nake	168	59	76	135	74,7	86,4	80,8	55	67	122	93,2	88,2	90,4
Metoko Bekondo	187	54	111	165	78,3	94,9	88,7	38	84	122	70,4	75,7	73,9
Dienyi	339	119	162	281	76,3	90,5	83,9	116	158	274	97,5	97,5	97,5
Kumu Kumu	53	18	25	43	85,7	89,3	87,8	16	14	30	88,9	56	69,8
Bombele	112	51	49	100	92,7	90,7	91,7	38	42	80	74,5	85,7	80
Bombanda	93	33	42	75	73,3	91,3	82,4	31	40	71	93,9	95,2	94,7
Kombone	280	81	120	201	64,3	78,4	72	81	116	197	100	96,7	98
Boa Bakundu	414	151	210	361	87,8	93,3	90,9	146	202	348	96,7	96,2	96,4
Big Butu	194	73	68	141	70,2	75,6	72,7	69	63	132	94,5	92,6	93,6
Lifenja	62	25	24	49	73,5	85,7	79	25	22	47	100	91,7	95,9
Njombe	122	36	50	86	69,2	71,4	70,5	34	47	81	94,4	94	94,2
Big Massaka	300	117	132	249	78	91	84,4	99	110	209	84,6	83,3	83,9
Small Butu	159	58	78	136	84,1	90,7	87,7	48	75	123	82,8	96,2	90,4
Bikoki	137	49	62	111	80,3	88,6	84,7	45	60	105	91,8	96,8	94,6
Bakumba	263	105	99	204	77,2	78,6	77,9	101	95	196	96,2	96	96,1
Big Ngwandi	317	130	138	268	76,9	93,2	84,5	126	136	262	96,9	98,6	97,8
Betenge	103	52	39	91	98,1	100	98,9	51	37	88	98,1	94,9	96,7
Small Massaka	94	35	34	69	63,6	87,2	73,4	35	34	69	100	100	100
Lokando	74	32	23	55	72,7	76,7	74,3	28	18	46	87,5	78,3	83,6
Kwa Kwa	299	134	131	265	86,5	91	88,6	130	124	254	97	94,7	95,8
Grand Total	3770	1412	1673	3085	78,2	87,8	83,2	1312	1544	2856	92,9	92,3	92,6

Vector Control: Ground Larviciding

- Baseline Entomology indicators

		PAROUS (%)		INFECTED (%)		INFECTIVE (%)		Total not Dissected	Grand Total
SITE	Total Dissected	NULLIPAROUS	PAROUS	NO	YES	NO	YES		
BERENGE	697	455 (65.3)	242 (34.7)	671 (96.3)	26 (3.7)	687 (98.6)	10 (1.4)	155	852
BETENGE	475	266 (56)	209 (44)	461 (97.1)	14 (2.9)	472 (99.4)	3 (0.6)	27	502
BIG MASSAKA	216	162 (75)	54 (25)	207 (95.8)	9 (4.2)	210 (97.2)	6 (2.8)	1076	1292
BOMBELE	1025	600 (58.5)	425 (41.5)	922 (90)	103 (10)	1003 (97.9)	22 (2.1)	3440	4465
KWAKWA	1029	579 (56.3)	450 (43.7)	977 (94.9)	52 (5.1)	1010 (98.2)	19 (1.8)	4212	5241
MARUMBA 1	353	290 (82.2)	63 (17.8)	343 (97.2)	10 (2.8)	350 (99.2)	3 (0.8)	187	540
SMALL MASSAKA	1577	795 (50.4)	782 (49.6)	1491 (94.5)	86 (5.5)	1542 (97.8)	35 (2.2)	667	2244
TOTAL	5372	3147 (58.6)	2225 (4.4)	5072 (94.4)	300 (5.6)	5274 (98.2)	98 (1.8)	9764	15136

- Sensitivity Tests

Temephos concentration mg/L	Number of larvae tested	Average raw morality % (s.d.)	Average adjusted Mortality % (s.d.)
0.5	47	100 (0)	100 (0)
0.25	84	100 (0)	100 (0)
0.1	130	100 (0)	100 (0)
0.05	203	98.73 (1.85)	98.618 (2.021)
0.025	120	95.51 (4.2)	95.007 (4.716)
0.01	355	76.62 (14.01)	79.956 (15.145)
0.005	152	58.12 (34.24)	43.927 (40.480)
0.0025	252	44.24 (24.51)	39.691 (24.781)
0.001	187	30.7 (2.05)	23.364 (8.111)
0.0005	90	12 (7.10)	7.952 (1.374)
(Control) 0	577	9.76 (4.88)	-

- **Measurement of River Parameters and Training of Community workers**

GROUND LARVICIDING

Themophos is Sprayed before the Rapids

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Simulium Larvae are killed in Breeding Sites

Before Ground Larviciding

After Ground Larviciding

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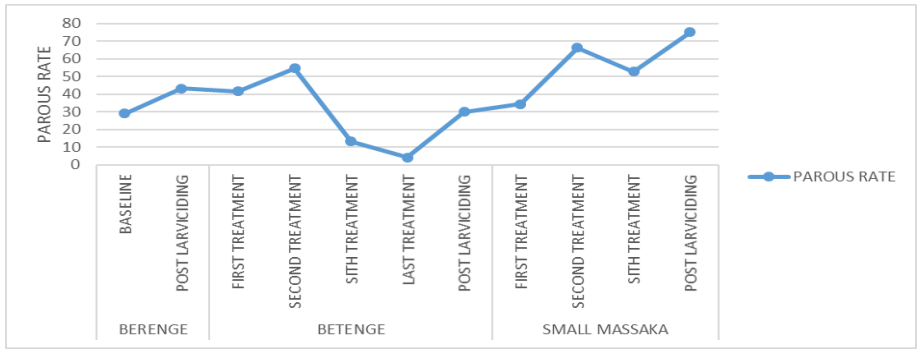
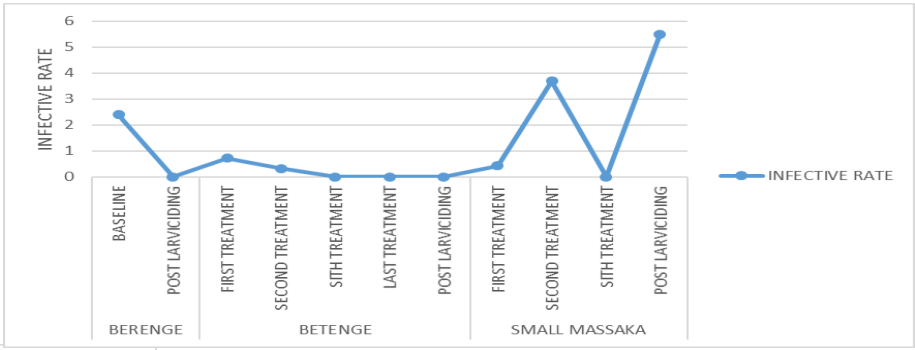
Larviciding: Translation into Reduction of Entomological indices

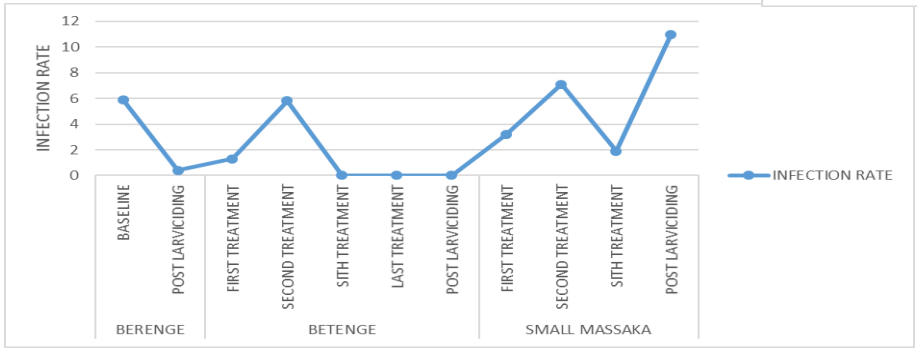


Parous rate during larviciding

Infective rate during larviciding



Infection rate during larviciding



Monthly Transmission Potential during larviciding

SITE	BASELINE	SECOND TREATMENT	SITH TREATMENT	LAST TREATMENT	POST TREATMENT
BERENGE	779,4	-	-	-	0
BETENGE	165	10	0	0	0
SMALL MASSAKA	70,1	8	4	0	2

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Evaluation in 2019

Clinical, Parasitological, Entomological

Acknowledgments

Collaborative work between scientists from

UNIVERSITY OF BUEA
UNIVERSITE DE BUEA
KNOWLEDGE WITH WISDOM

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