Cote d'Ivoire, Phase I *Follow-Up 1* & Phase II *Baseline* Impact Survey 2016 Recommendations Report

SCI Schistosomiasis Control Initiative
Imperial College London

1 Programmatic recommendations

This reports reviews the Phase I (PI) Follow-Up 1 (FU1) & Phase II (PII) baseline validation survey which were conducted in Cote d'Ivoire in 2016 following 1 round (PI FU1) and no rounds (PII) of mass preventive chemotherapy (PC) for schistosomiasis (SCH) and soil-transmitted helminths (STH). The PI FU1 schools were visited in February and October 2016 and all PII baseline schools were visited in February 2016.

Table 1: Observations and corrective programmatic action from the impact survey for PI FU1

PI FU1		
Finding or observation	**Interpretation**	**Programmatic action**
There was an insignificant increase in overall prevalence of *S. mansoni* infections. However, there were big differences between schools. The biggest increase in *S. mansoni* prevalence was registered for schools 2 (+8.9%), 9 (+9.3%), and 20 (+11.5%).	At the time of the survey for FU1 one round of MDA had taken place in either November 2013 or May 2014. However, due to the time lapse between the 2013/4 treatments and the FU1 i.e. 2 to 2.5 years, it is plausible that parasite bounce-back has led to pre-intervention levls of baseline infection.* In addition to insufficient PC to sustain lower levels of *S. mansoni* infection, other spatial and temporal trends in environmental factors may have contributed to changes in prevalence of infection.	Work to make sure PC plan is followed and rounds of treatment happened as planned accordingly. Ensure everone in MoH team and their partners are aware of the consequence of disruptons to the programme impmenation whether they be political, financial or drug logistics related. In FU2 analysis, determine if same schools are continuing to increase in prevalence.
The overall prevalence in *S. haematobium* increased insignificantly although there were big differences between schools. The biggest increase was registered at the schools 3 (+13.1%), and 11 (+11.3%).	See above interpretation for *S. mansoni* for interpretation of results.	Continue to monitor any changes, particularly any increase in heavy intensity in all age groups.
Overall prevalence of heavy *S. haematobium* infections increased slightly from 1.9% to 2.1% and was mostly due to an increase at school 3 by 5.7%	See above interpretation for *S. mansoni* for interpretation of results.	See above programmatic actions

PII Baseline		
Finding or observation	**Interpretation**	**Programmatic action**
There was large heterogeneity in the prevalence of *S. haematobium* between schools. Schools 28 and 35 had the highest prevalence of *S. haematobium* 50.0% and 63.3%, respectively, and a prevalence of heavy *S. haematobium* infections of 20.8% and 14.2% respectively.	Schistosomiasis has focal distribution in Cote d'Ivoire.	Continue to monitor sentinel sites annually/biennially.

*Initially, the MDA was scheduled for November 2015 preceded by the impact survey in October 2015. A combination of contractual issues and coordination of activities between the ongoing SCORE project research (Swiss Tropical Institute) aligned with the national MDA carried out by the MoH triggered a 6 month delay due to an increased workload. As a consequence, the implementation of the impact survey took place in February 2016 and MDA in March 2016.

2 Methods

All methods described in associated protocol:

English Version*:* https://imperiallondon.sharepoint.com/:w:/r/sites/fom/schisto/mer/2_Country_M%26E/CIV/Impact/FY_1617/1_Protocol_%26_pre-survey/CIV-Sentinels%20Sites%20Protocol%202016-EN-Final-19.09.2016.docx?d=w78e00e3230414d288b12b852750e00dd&csf=1&e=z8Q8Z7

French Version: https://imperiallondon.sharepoint.com/:w:/r/sites/fom/schisto/mer/2_Country_M%26E/CIV/Impact/FY_1617/1_Protocol_%26_pre-survey/CIV-Sentinel%20Sites%20Protocol%20October%202016-FR-Final-13.09.2016.docx?d=w945729feea70404eb0931ae06f2a07ea&csf=1&e=59fKBi

2.1 Field methods

For each school, 10% of slides were randomly selected for data quality control by a technician not involved in the first readings.
To reach the necessary number of children at school EPP NAHOBANKAHA (PI, Katiola district, school code 12), pupils from EPP LOUGBONOU 1 were also recruited.

2.2 *Deviations from protocol*

All selected schools were visited with the execption of

District	Comments
Phase 2	
Touba	There are two baseline visits for EPP Koro 1, one in February and one in October 2016. The data from the first visit in February 2016 was used for the analysis.

For every school code 120 pupils were recruited with the exception of these PI schools

School Code	No. of pupil
5	109
7	119
10	119
18	101

For 88% of all PI schools and 64% of all PII schools less than 120 KK slides were recorded for Day 2 (D2). Below, the number of missing values are listed for each school code:

SchoolCode	SchoolName	N	Phase	Number of missing values for *S. mans*. D1 slide A	Number of missing values for *S. mans*. D1 slide B	Number of missing values for STH D1 slide A	Number of missing values for STH D1 slide B	Number of missing values for *S. mans*. D2 slide A	Number of missing values for *S. mans*. D2 slide B	Number of missing values for STH D2 slide A	Number of missing values for STH D2 slide B
1	EPP KOHOUROU 1	120	PI FU1	0	0	0	0	24	24	24	24
2	EPP SOUBRE	120	PI FU1	1	0	0	1	1	1	1	1
3	EPP ZIKI-DIES 2	120	PI FU1	0	0	0	0	8	8	8	8
4	EPP KAGBE 1	120	PI FU1	3	3	3	3	13	13	13	13
5	EPC ALFAWZOU AL-AZIN	109	PI FU1	0	0	0	0	8	8	8	8
6	EPP LOGOBIA 1	120	PI FU1	0	0	0	0	13	13	13	13

SchoolCode	SchoolName	N	Phase	Number of missing values for *S. mans*. D1 slide A	Number of missing values for *S. mans*. D1 slide B	Number of missing values for STH D1 slide A	Number of missing values for STH D1 slide B	Number of missing values for *S. mans*. D2 slide A	Number of missing values for *S. mans*. D2 slide B	Number of missing values for STH D2 slide A	Number of missing values for STH D2 slide B
7	EPP BOBIA 1	119	PI FU1	2	2	2	2	28	29	28	30
8	GS RESIDENTIEL	120	PI FU1	7	7	7	7	12	12	12	12
9	EPP SKG BODOUYO BLOC	120	PI FU1	1	1	2	1	9	9	9	10
10	EPP KOSSOYO	119	PI FU1	8	7	7	7	5	5	5	5
13	EPP GUIGUEDOU 2	120	PI FU1	3	1	3	1	5	8	5	9
15	EPP TOUMODI-SAKASSOU 2	120	PI FU1	0	0	0	0	13	13	13	13
16	EPP KONAN-MOUKRO	120	PI FU1	1	0	0	0	2	0	0	0
17	EPP KOUAMEKRO	120	PI FU1	1	1	1	1	4	4	4	4
18	EPP KEITADOUGOU	101	PI FU1	0	1	0	1	5	5	5	5
19	EPP GANIDA 1	120	PI FU1	1	1	1	1	25	25	25	25
20	EPP YABAYO 1	120	PI FU1	5	4	4	4	10	10	10	10
21	EPP GALLEA 1A	120	PI FU1	1	1	1	1	5	5	5	5
22	EPP MAYO-GUEYO	120	PI FU1	1	1	1	1	8	9	8	8
23	EPP BONDOUKOU	120	PI FU1	0	0	0	0	1	1	1	1
24	EPP MAMADOU KOFFI 2	120	PI FU1	0	0	0	0	1	1	1	1
25	EPP LABOKRO 1	120	PI FU1	0	0	0	0	8	8	8	8
26	EPP KOSSOU 1	120	PI FU1	0	0	0	0	43	43	43	43
27	EPP KORO 1	120	PII baseline	0	1	0	0	4	4	4	4
28	EPP KONGOHILA	120	PII baseline	0	0	0	0	2	1	1	1
30	EPP YAKASSE I	120	PII baseline	1	0	0	0	89	90	89	89
32	EPP EST 1 DIMBOKRO	120	PII baseline	2	2	2	2	8	6	8	6
33	EPP PLATEAU 2	120	PII baseline	0	0	0	0	8	8	8	8
35	EPP BEDARA	120	PII baseline	1	1	1	1	1	1	2	1
36	EPP ZEGBAN 2	120	PII baseline	0	0	0	0	6	5	5	5

2.3 Ethical approval

Ethical approval was granted by the National Ethical Committee of Research as well as by Imperial College Research Committee ICREC_8_2_2. (https://imperiallondon.sharepoint.com/:b:/r/sites/fom/schisto/mer/2_Country_M%26E/CIV/Impact/FY_1617/1_Protocol_%26_pre-survey/CIV-Ethical%20approval%20Sentinel%20Sites.pdf?csf=1&e=Y3S4so)

3 Survey Recommendations

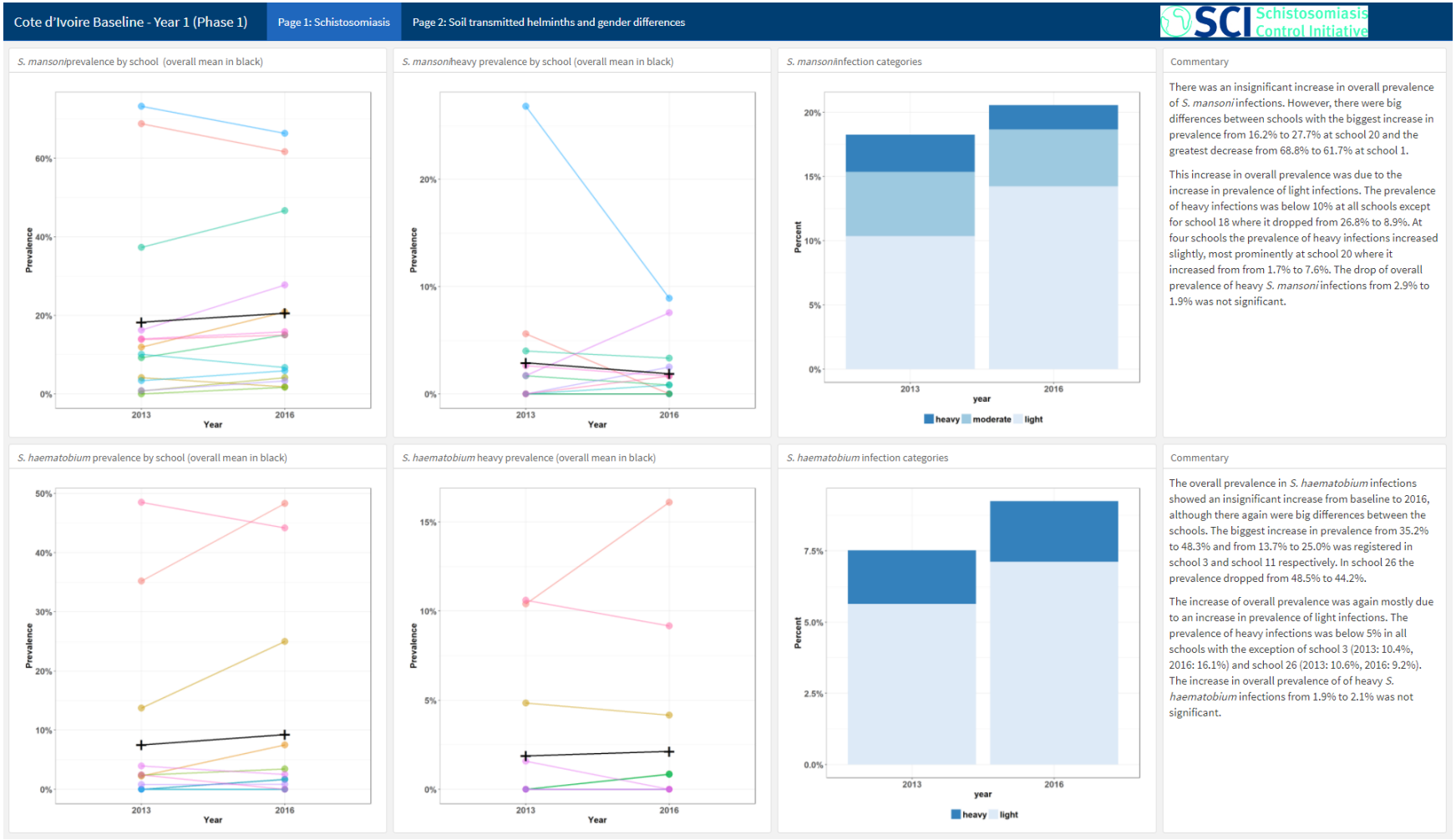
Table 2: Observations and corrective measures for the survey process itself

Finding or observation	Interpretation	Corrective action
For 23 PI and 7 PII schools, stool sample records from Day 2 were incomplete (see 2.2).	Lower number of recorded egg counts for *S. mansoni* and STH for Day 2 slides. Children not providing a second day of stool.	Determine root of problem with survey team and in future surveys implement daily data checks (paper or phone) to enable corrective action. Contact school before visit to ensure visit does not coincide with school activity or social event. Ensure students and teachers understanding the importance of proving a stool on Day 2.
No GPS coordinates were recorded for the PII schools with school code 31 (EPP OUELE-PLATEAU I), 34 (EPP GROUMANIA), and 35 (EPP BEDARA)	GPS coordinates are missing.	Ensure practicing correct recording of the GPS coordinates during the training. Survey team leader to ensure GPS coordinates are checked before departing school.

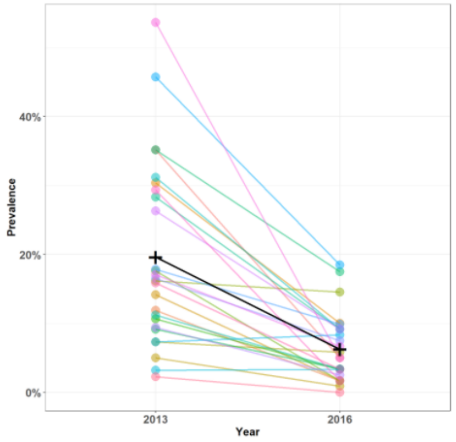
4 Results

4.1 Dashboard

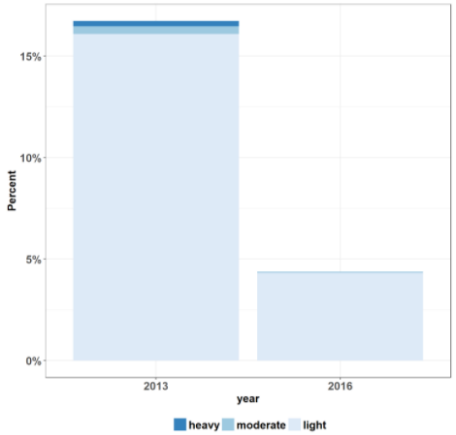
4.1.1 PI FU1



Any STH prevalence (overall mean in black)



Hookworm infection categories

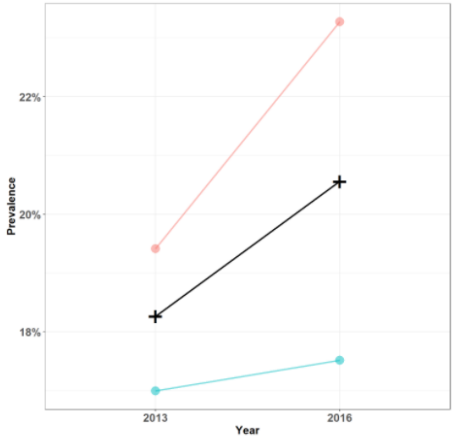


Commentary

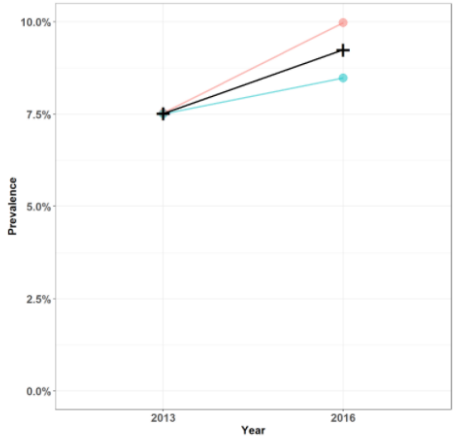
Prevalence of infections of any STH decreased significantly from 19.6% to 6.3%. While Ascaris and Trichuris infections were below 4% in both years the prevalence of Hookworm dropped from 16.7% to 4.4%.

There were no heavy STH infections in 2016. The prevalence of moderate STH infections was below 1% in both years for all types of infections.

Prevalence of *S. mansoni* by gender



Prevalence of *S. haematobium* by gender



Commentary

There was a significant higher prevalence of *S.mansoni* infections in boys than in girls (p = 0.002). For *S. haematobium* gender was not significant (p = 0.086)

Key outputs	S. mansoni	S. haematobium	Any STH
Prevalence (%)	+2.3%	+1.73%	-13.37%
Prev. heavy inf. (%)	-1.01%	+0.25%	-
Mean epg/epcl	-18.14	-1.32	-

4.1.2 PII Baseline

Cote d'Ivoire Baseline (Phase 2) | Page 1: Schistosomiasis | Page 2: Soil transmitted helminths and gender differences

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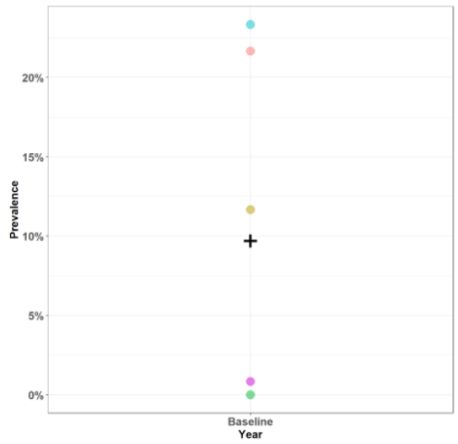
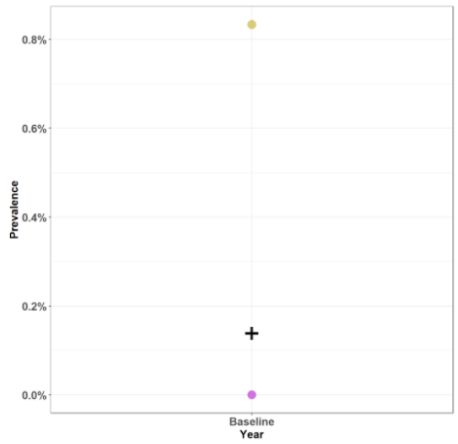
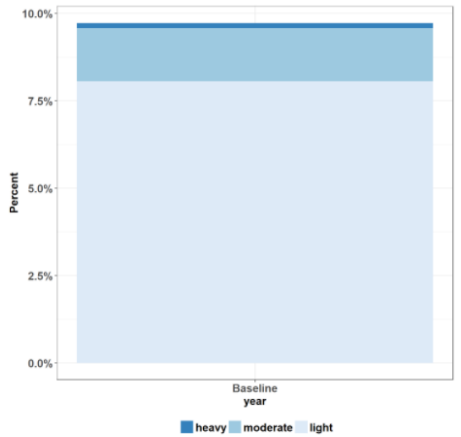
S. mansoni prevalence by school (overall mean in black)



S. mansoni heavy prevalence by school (overall mean in black)



S. mansoni infection categories

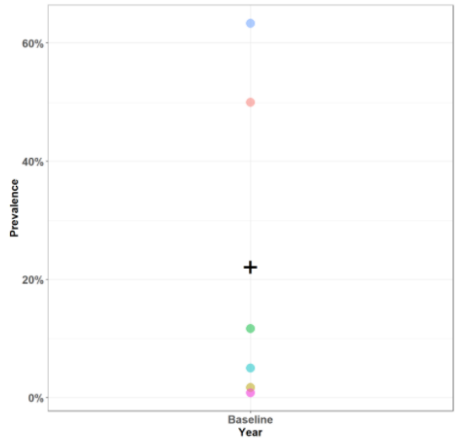


Commentary

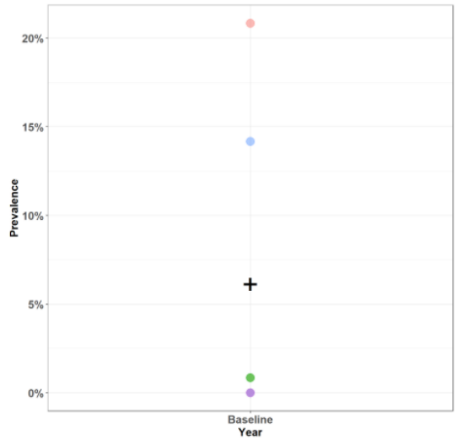
The overall prevalence of *S. mansoni* was 9.7%. Of the six sentinel schools for *S.mansoni* three schools had prevalences above 10% (school 34: 23.3%, school 27: 21.7%, school 29: 11.7%).

Only one pupil at school 29 was heavily infected. All other infections were moderate (1.5%) or light (8.1%) infections

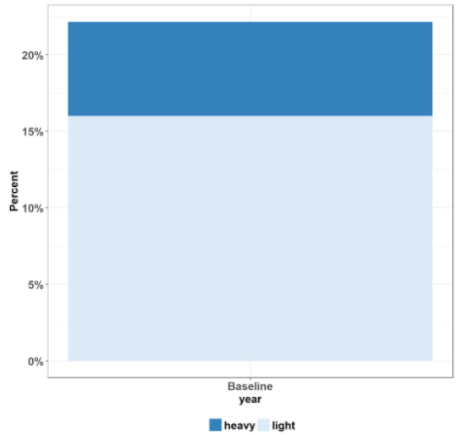
S. haematobium prevalence by school (overall mean in black)



S. haematobium heavy prevalence (overall mean in black)



S. haematobium infection categories



Commentary

The overall prevalence of *S. haematobium* was 22.1% with large variations between schools. Of the six sentinel school for *S. haematobium* two schools had prevalences above 50% (school 28: 50.0%, school 35: 63.3%) while the prevalence at the schools 31, 33, 37 was 5% or less.

The overall prevalence of heavy infections was 6.1% and of light infections 16.0%. The prevalence of heavy infections at school level was below 1% at all schools except at school 28 (20.8%) and school 35 (14.2%)

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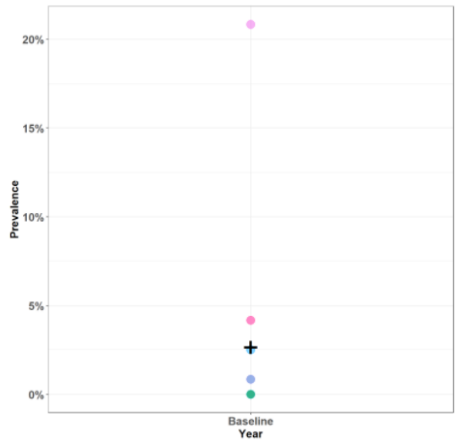
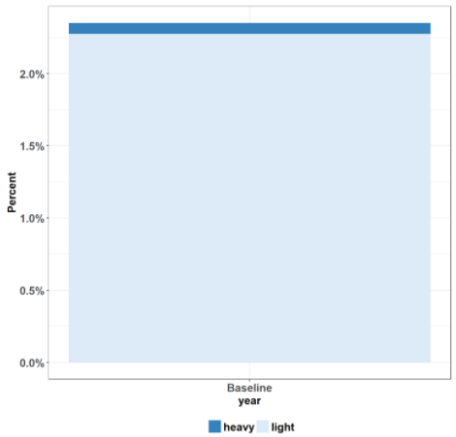
Any STH prevalence (overall mean in black)



Hookworm infection categories

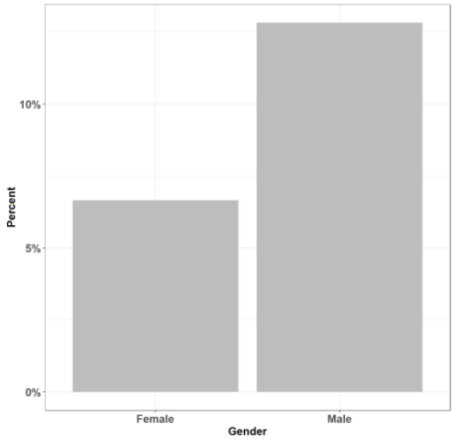


Commentary

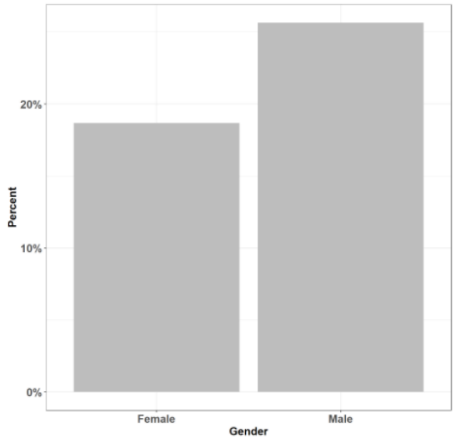
The overall prevalence of any STH was 2.7% which was largely due to Hookworm infections. 2.4% of all pupils was infected with Hookworms, 0.1% were heavily infected. The prevalences of Ascaris and Trichuris were below 1%, for both infections no heavy infections were recorded.

19.2% of all pupils in school 36 were infected with hookworm, 0.8% were heavily infected. There were no other heavy STH infections in any of the other 10 schools.

Prevalence of *S. mansoni* by gender



Prevalence of *S. haematobium* by gender



Commentary

The prevalence of both infections was significantly higher for boys then for girls (*S. mansoni*: p=0.002, *S.haematobium*: p=0.004).

Key outputs	S. mansoni	S. haematobium	Any STH
Prevalence (%)	9.7%	22.1%	2.7%
Prev. heavy inf. (%)	0.1%	6.1%	-
Mean epg/epcl	6.78	15.16	-

4.2 Results tables

4.2.1 PI FU1 Schools

Table 3. Impact survey results

Infection	Characteristics			Prevalence				Prevalence of heavy infections				Mean Intensity (epg / ep10ml)			
	Year[a]	No. Schools	No. Pupils	Prevalence	prevalence percentiles† across all schools	% reduction from baseline	p-value of difference from baseline	Prevalence of heavy infections	prev. heavy infections percentiles† across all schools	% reduction from baseline	p-value of difference from baseline	Mean Intensity (epg / ep10ml)	mean intensity percentiles† across all schools	% reduction from baseline	p-value of difference from baseline
S. mansoni	Baseline	14	1621	18.3%	3.6% 11% 15.7%	n/a	n/a	2.9%	0% 0% 2.4%	n/a	n/a	46.01	2.24 7.01 40.39	n/a	n/a
	FU1	14	1644	20.6%	4.6% 15% 26%	+ 2.3%	0.19	1.9%	0% 0.8% 2.3%	-1.0%	0.079	27.86	3.76 15.51 42.38	-39.4%	
S. haematobium	baseline	15	1863	7.5%	0% 0.8% 3.2%	n/a	n/a	1.9%	0% 0% 0.8%	n/a	n/a	5.98	0 0.03 4.63	n/a	n/a
	FU1	15	1785	9.2%	0.4% 1.7% 5.5%	1.7%	0.14	2.1%	0% 0% 0.9%	0.3%	0.64	4.66	0.01 0.26 0.93	- 22.1%	
Any STH	baseline	26	3138	19.6%	9.7% 16.4% 29.1%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	FU1	26	3081	6.3%	2.7% 5% 9.2%	-13.4%	<0.001	n/a	n/a	n/a	n/a	n/a	n/a	n/a	
Ascaris	baseline	26	3138	3.2%	0% 1.1% 3.3%	n/a	n/a	0.0%	0.0%, 0.0%, 0.0%	n/a	n/a	146.67	0 0.62 52.17	n/a	n/a
	FU1	26	3081	1.2%	0% 0% 0.8%	-2.0%	<0.001	0.0%	0.0%, 0.0%, 0.0%	0.0%	(*)	26.02	0 0 7.91	-82.3%	
Hookworm	baseline	26	3138	16.7%	7.3% 10.7% 26.7%	n/a	n/a	0.3%	0.0%, 0.0%, 0.5%	n/a	n/a	57.22	9.88 27.51 67.22	n/a	n/a
	FU1	26	3081	4.4%	1.7% 3.4% 5.7%	-12.3%	<0.001	0.0%	0.0%, 0.0%, 0.0%	-0.3%	(*)	7.88	1.41 3.67 9.0		

Trichuris	baseline	26	3138	1.1%	0% 0.4% 1.4%	n/a	n/a	0.0%	0.0%, 0.0%, 0.0%	n/a	n/a	21.41	0 0.02 3.74	n/a	n/a
	FU1	26	3081	1.0%	0% 0% 0.8%	-0.1%	0.29	0.0%	0.0%, 0.0%, 0.0%	0.0%	(*)	6.69	0 0 0.41		

[a]Baseline Oct/Nov-13; FU1 Feb-16 and Sep-16

† 25th, 50th (median), 75th

(*) p-value not available as the model did not converge.

Table 4. Impact survey results by sex

Infection	Year	No. Schools	No. Girls	No. Boys	Prevalence Girls	Prevalence Boys	Prevalence of heavy infections Girls	Prevalence of heavy infections Boys	Mean Intensity (epg / ep10ml) Girls	Mean Intensity (epg / ep10ml) Boys
S. mansoni	Baseline	14	771	850	16.99%	19.41%	3.50%	2.35%	49.4	43.0
	FU1	14	788	855	17.51%	23.27%	0.51%	3.16%	15.3	39.4
S. haematobium	Baseline	15	933	930	7.50%	7.53%	1.82%	1.94%	4.8	7.2
	FU1	15	873	912	8.48%	9.98%	1.60%	2.63%	3.0	6.3
Any STH	baseline	26	1542	1596	15.30%	23.81%	-	-	-	-
	FU1	26	1492	1588	5.23%	7.24%	-	-	-	-
Ascaris	baseline	26	1542	1596	2.66%	3.70%	0.00%	0.06%	98.4	193.3
	FU1	26	1492	1588	1.34%	1.01%	0.00%	0.00%	35.5	17.2
Hookworm	baseline	26	1542	1596	12.19%	21.12%	0.19%	0.31%	30.9	82.7
	FU1	26	1492	1588	3.08%	5.60%	0.00%	0.00%	3.1	12.4
Trichuris	baseline	26	1542	1596	1.10%	1.13%	0.06%	0.00%	34.4	8.8
	FU1	26	1492	1588	1.07%	0.94%	0.00%	0.00%	7.6	5.8

Calculation of p-values of differences between sexes incorporated clustering at the school level. Statistical methodology is available from SCI on request.

4.2.2 PII Schools

Table 5: Impact Survey Results Baseline PII

Infection	Characteristics			Prevalence		Prevalence of heavy infections		Mean Intensity (epg / ep10ml)	
	Year	No. Schools	No. Pupils	Prevalence	prevalence percentiles† across all schools	Prevalence of heavy infections	prev. heavy infections percentiles† across all schools	Mean Intensity (epg / ep10ml)	mean intensity percentiles† across all schools
S. mansoni	baseline	6	720	9.7%	0.8% 0.8% 16.7%	0.1%	0% 0% 0%	0.1 0.1 12.9	6.8
S. haematobium	baseline	6	718	22.1%	1.3% 5.0% 30.8%	6.1%	0% 0.8% 7.5%	0.09 0.56 14.36	15.2
Any STH	baseline	11	1319	2.7%	0% 0.4% 2.9%	n/a	n/a	n/a	n/a
Ascaris	baseline	11	1319	0.4%	0% 0% 0.4%	0%	0% 0% 0%	0 0 4.65	4.5
Hookworm	baseline	11	1319	2.4%	0% 0.4% 2.5%	0.1%	0% 0% 0%	0 0.03 3.4	8.6
Trichuris	baseline	11	1319	0.2%	0% 0% 0%	0%	0% 0% 0%	0 0 0	0.0

Table 6. Impact survey results by sex, Phase 2 Baseline

Infection	Year	No. Schools	No. Girls	No. Boys	Prevalence Girls	Prevalence Boys	Prevalence of heavy infections Girls	Prevalence of heavy infections Boys	Mean Intensity (epg / ep10ml) Girls	Mean Intensity (epg / ep10ml) Boys
S. mansoni	Baseline	6	361	359	6.6%	12.8%	0%	0.3%	2.2	11.4
S. haematobium	Baseline	6	359	359	18.7%	25.6%	5.3%	7.0%	14.4	15.9
Any STH	baseline	11	661	658	2.4%	2.9%	n/a	n/a	n/a	n/a
Ascaris	baseline	11	661	658	0.6%	0.2%	0%	0%	5.8	3.1
Hookworm	baseline	11	661	658	1.8%	2.9%	0.2%	0%	9.1	8.1
Trichuris	baseline	11	661	658	0.2%	0.2%	0%	0%	0.04	0.01

4.3 Pdf of dashboard

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R:\Countries\Cote_d'Ivoire\Impact\2016_ICOSA_Year1\5_Results\CIV_Impact_Phase2_Baseline_dashboard.pdf