Burundi 3rd Follow-Up Impact Survey 2017
Recommendations Report

SCI Schistosomiasis Control Initiative
Imperial College London

1 Programmatic recommendations

This report reviews the 3rd Follow-Up (FU3) impact survey which was conducted in Burundi, in 2017 following from 7 to 9 round(s) of mass preventive chemotherapy (PC) for schistosomiasis (SCH) and soil-transmitted helminths (STH). Baseline is pre-treatment data from 2007/08, FU1 are data collected in 2009; FU2 are data collected in 2011 and FU3 from data collected in 2017. The following programmatic recommendations are:

Table 1: Observations and corrective from the impact survey

Finding or observation	Interpretation	Programmatic action
Schistosoma mansoni and *Ascaris lumbricoides* prevalence decreased significantly from baseline. It went from 19% to 4.5% and from just under 10% to 3%, respectively.	PC is reaching target population and reducing infection.	Ministry of Health (MoH) control programme works to maintain these gains.
Increase in prevalence of *S. mansoni* and moderate and heavy intensity infection in a number of schools from 2011* despite overall reduction in both.	Spikes in results from school level information could be due to low treatment coverage in particular schools, poor sanitation or other environmental factors.	MoH and SCI to review the reported treatment coverage in all the sentinel site schools and monitor closely those that are having 2+ years of increasing prevalence. MoH and SCI continue to monitor any changes, particularly any increase in heavy intensity in all age groups.
Hookworm infection has reduced conisderably, while *Trichuris trichiura* infections have remained at a low level despite a peak in 2009. In both cases infections are only of light intensity by 2017.	PC is reaching target population in these areas and having an impact on infection.	MoH control programme works to maintain these gains.
Prevalence is similar over time in both boys and girls.	Equitable reach, acceptance and impact of treatment in boys and girls for both SCH and STH.	MoH control programme works to maintain these gains.

Heterogeneity in the prevalence of *S. mansoni* between schools. Increases in both prevalence and intensity are observed in Maramvya and Nyamibu schools. The trend is not the same across the other schools in Rumonge (Kizuga, Mudende, and Rukinga).	Schistosomiasis has focal distribution in Burundi.	MoH and SCI continue to monitor sentinel sites annually/biennially.
Prevalence of *S.mansoni* using the rapid urine based Circulating Cathodic Antigen (CCA) diagnotics is higher than with stool-based Kato-Katz diagnostic in each school. When considering CCA with trace as positive, the prevalence is more than 50% for 3 districts (Nyambu, Nyamusasa and Rukinga).	CCA technique seems to be more effective than Kato-Katz for the diagnosis of *S.mansoni* if the prevalence is low in the district due to a higher sensitivity of the CCA test.	MoH to continue the use of CCA technique to assess the burden of *S.mansoni*, inform treatment strategy in those areas and determine the applicability of the CCA as a programmatic monitoring tool.

*Following the Schistosomiasis Consortium for Operational Research and Evaluation (SCORE) and SCI mapping of Burundi in 2014, plans and protocols were developed for testing the implementation of a SCH elimination study in Burundi. This cluster-randomised control study study included MDA, plus other SCH-related interventions and evaluation of the impact. However, due to civil unrest breaking out in April 2015, all programmatic activities were put on hold with remote support provided for the implementation of MDAs. In December 2016, MER activities were resumed.

2 Methods

All methods described in associated protocol:

In English : https://imperiallondon.sharepoint.com/:w:/r/sites/fom/schisto/mer/2_Country_M%26E/BDI/Impact/FY_1718/1_Protocol_%26_pre-survey/BDI_Impact_Survey_Protocol_2017_EN.docx?d=wf9844a2effac416ab18771efa0c0fd8a&csf=1&e=CIKdyf

In French : https://imperiallondon.sharepoint.com/:w:/r/sites/fom/schisto/mer/2_Country_M%26E/BDI/Impact/FY_1718/1_Protocol_%26_pre-survey/BDI_Impact_Survey_Protocol_2017_FR.docx?d=w792870bd33e44b5e86da175e5171f0b5&csf=1&e=hZttdC

2.1 Field methods

- Nothing was specified in the MoH field survey report or emails from the MoH staff.

2.2 Deviations from protocol

- Kato-Katz test on the second day is missing for 24 children (11 in Buterere, 4 in Nyamibu, 1 in Kizuga, and 8 in Mudenge).
- Only 5-14 year olds stated in the survey protocol to be sampled, however, data contains 41 cases of children aged 15 to 17 years old.

2.3 Ethical approval

Ethical approval wasn't necessary for the survey as the activities of surveillance were part of the Ministry of Health's attributions. Ethical approval was granted by Imperial College Research Committee ICREC_8_2_2.

3 Survey Recommendations

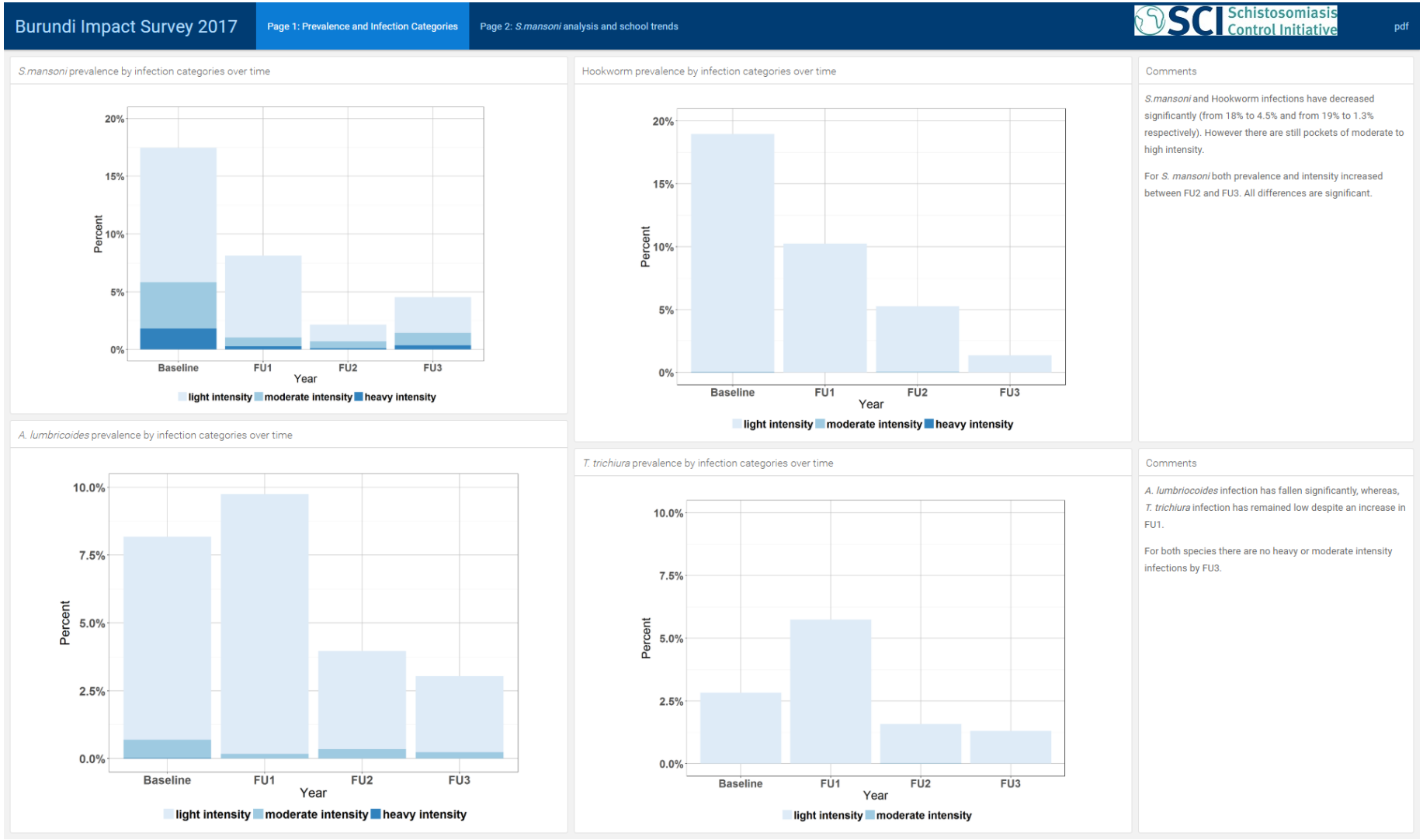
Table 2: Observations and corrective measures for the survey process itself

Finding or observation	Interpretation	Corrective action
In 4 schools, data for KK was missing for 24 children on Day 2 (see 2.2).	Children not providing a second day of stool.	MoH and SCI to determine root of issue with the 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 understand the importance of providing a stool on Day 2.

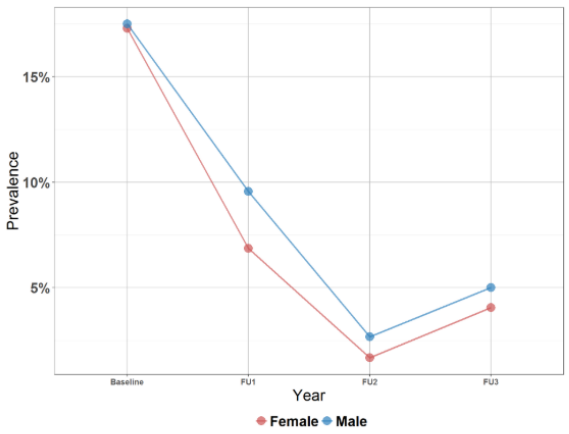
Protocol guidelines were not adhered to as older children were sampled during data collection(see 2.2).	Not many children were outside the range, thus it was decided they should be kept in the analysis to keep the sample size established in the protocol.	MoH to review the training material of the field technicians by September 2018. MoH to provide stronger supervision during data collection for the upcoming impact survey scheduled in November 2018. Ensuring adequate sample sizes are being achieved during the survey scheduled for November 2018 through electronic data capture, if possible, or daily phone/SMS checks with team leaders. SCI to include further checks in electronic data capture to improve the data quality including real-time data uploading to ensure checks and feedback to enumeration teams in the field.

4 Results

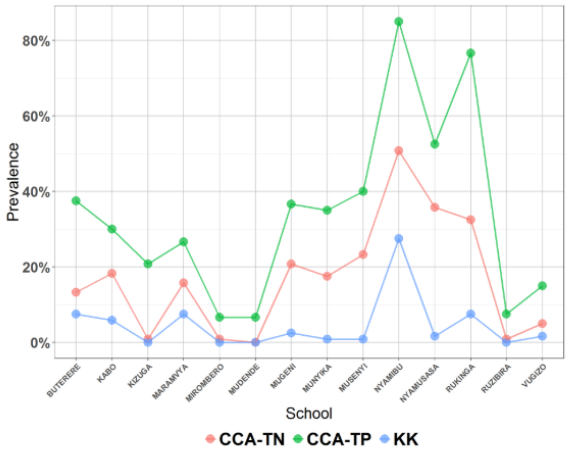
4.1 Dashboard



Prevalence of *S.mansoni* over time by gender



Prevalence of *S.mansoni* by detection methodology in FY3



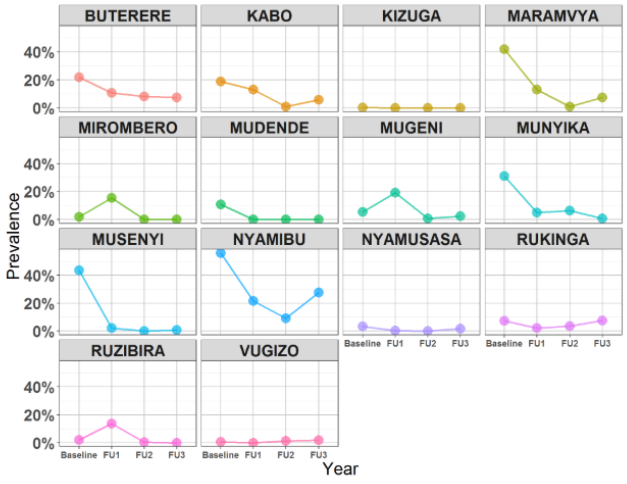
Comments

Disaggregating prevalence rates over time by gender shows that the trend in *S.mansoni* infections (decrease in the first two follow-up years, increase from FU2 to FU3) is constant across the gender of the pupils. The same is true for the prevalence of STH infections (not shown here; information available in the report tables).

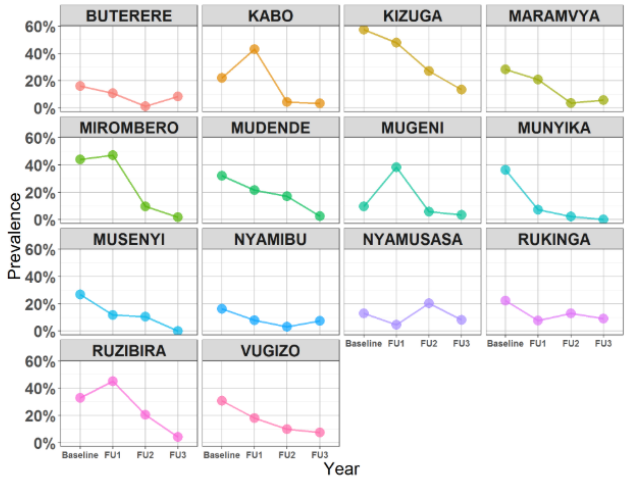
The top right graph demonstrates the prevalence of S. mansoni in all schools in FU3 using two diagnostics (Kato-Katz (KK) and Circulating Cathodic Antigen (CCA)). The CCA data have been analysed to show prevalence of infection when trace is considered positive and when considered as negative.

Prevalence with CCA is always higher (or equal if 0) than with KK. Prevalence using CCA with trace positive is between 3 and nearly 50 times larger than with KK.

S.mansoni prevalence over time by school



Prevalence of any STH over time by school



Comments

The uptick in *S.mansoni* infections has not occurred over all schools but is located at specific centres. The increase in S. mansoni in FU3 was greatest in schools of Maramvya (Isale) and Nyamibu (Rumonge). The trend is not the same across the other schools in Rumonge (Kizuga, Mudende, and Rukinga).

STH infections have reduced accross all schools.

4.2 Results tables

Table 3. Impact survey results

Infection	Characteristics			Prevalence				Prevalence of heavy infections				Mean Intensity (epg / ep10ml)			
	Year*	No. Schools	No. Pupils	Prevalence	prevalence percentiles† across all schools	% - point reduction from baseline	p-value of difference from baseline	Prevalence of heavy infections	prevalence of heavy infections percentiles† across all schools	% - point 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	4211	17.5%	2.4% 9.0% 28.8%	n/a	n/a	1.8%	0.1% 0.8% 1.7%	n/a	n/a	28.3	2.5 10.8 31.3	n/a	n/a
	FU1	14	5316	8.1%	0.7% 7.8% 13.4%	9.3	< 0.01	0.3%	0.0% 0.0% 0.2%	1.5	< 0.01	5.9	0.6 3.3 7.4	22.4	< 0.01
	FU2	14	5926	2.1%	0.0% 0.9% 3.0%	15.3	< 0.01	0.1%	0.0% 0.0% 0.0%	1.7	< 0.01	2.5	0.0 0.8 1.9	25.8	< 0.01
	FU3	14	1680	4.5%	0.2% 1.7% 7.1%	12.9	< 0.01	0.4%	0.0% 0.0% 0.0%	1.4	< 0.01	5.4	0.0 0.5 4.7	23.0	< 0.01
Any STH	baseline	14	4208	27.7%	17.8% 27.5% 32.7%	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	FU1	14	5313	24.3%	8.6% 19.4% 42.0%	3.3	< 0.01	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	FU2	14	5926	10.4%	3.8% 9.8% 16.0%	17.2	< 0.01	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
	FU3	14	1680	5.4%	2.7% 5.0% 8.1%	22.3	< 0.01	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
A. lumbricoides	baseline	14	4210	8.2%	3.5% 4.5% 6.5%	n/a	n/a	0.0%	0.0% 0.0% 0.0%	n/a	n/a	155.5	5.5 14.1 38.5	n/a	n/a
	FU1	14	5316	9.7%	1.8% 3.8% 12.3%	-1.6	0.04	0.0%	0.0% 0.0% 0.0%	0.0	n/a‡	40.6	1.2 8.4 18.3	114.9	< 0.01

Infection	Characteristics			Prevalence				Prevalence of heavy infections				Mean Intensity (epg / ep10ml)			
	Year*	No. Schools	No. Pupils	Prevalence	prevalence percentiles† across all schools	% - point reduction from baseline	p-value of difference from baseline	Prevalence of heavy infections	prevalence of heavy infections percentiles† across all schools	% - point 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
	FU2	14	5926	4.0%	0.7% 2.3% 4.3%	4.2	< 0.01	0.0%	0.0% 0.0% 0.0%	0.0	n/a‡	48.2	1.5 3.6 11.1	107.3	< 0.01
	FU3	14	1680	3.0%	0.8% 2.1% 4.2%	5.1	< 0.01	0.0%	0.0% 0.0% 0.0%	0.0	n/a‡	53.8	0.7 3.8 38.7	101.7	< 0.01
Hookworm	baseline	14	4211	19.0%	12.1% 16.2% 26.1%	n/a	n/a	0.0%	0.0% 0.0% 0.0%	n/a	n/a	19.6	10.4 13.9 23.9	n/a	n/a
	FU1	14	5315	10.3%	5.9% 8.1% 16.9%	8.7	< 0.01	0.0%	0.0% 0.0% 0.0%	0.0	n/a‡	8.0	4.7 8.6 10.5	11.5	< 0.01
	FU2	14	5926	5.3%	2.2% 3.2% 8.1%	13.7	< 0.01	0.0%	0.0% 0.0% 0.0%	0.0	n/a‡	7.2	1.6 3.2 9.3	12.4	< 0.01
	FU3	14	1680	1.4%	0.0% 0.8% 2.3%	17.6	< 0.01	0.0%	0.0% 0.0% 0.0%	0.0	n/a‡	1.8	0.0 0.3 1.4	17.8	< 0.01
T. trichiura	baseline	14	4209	2.8%	1.4% 2.2% 4.3%	n/a	n/a	0.0%	0.0% 0.0% 0.0%	n/a	n/a	1.7	0.7 1.1 2.2	n/a	n/a
	FU1	14	5314	5.7%	1.2% 4.6% 11.4%	-2.9	< 0.01	0.0%	0.0% 0.0% 0.0%	0.0	n/a‡	3.7	0.9 3.2 6.4	-2.0	< 0.01
	FU2	14	5927	1.6%	0.6% 1.4% 2.4%	1.2	< 0.01	0.0%	0.0% 0.0% 0.0%	0.0	n/a‡	1.3	0.3 0.8 2.3	0.4	< 0.01
	FU3	14	1680	1.3%	0.0% 0.8% 1.7%	1.5	< 0.01	0.0%	0.0% 0.0% 0.0%	0.0	n/a‡	0.8	0.0 0.1 0.3	0.9	< 0.01

† 25th, 50th (median), 75th

‡ Model does not converge due to too few *positive* (i.e., infected) observations.

* Year – Baseline: 2007/08; FU1: 2009; FU2: 2011; FU3: 2017.

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	2203	2000	17.3%	17.5%	1.7%	1.9%	28.3	27.4
	FU1	14	2549	2415	6.9%	9.6%	0.0%	0.0%	4.8	7.5
	FU2	14	3112	2812	1.7%	2.7%	0.0%	0.0%	1.4	3.9
	FU3	14	840	840	4.1%	5.0%	0.0%	0.0%	5.1	5.7
Any STH	baseline	14	2202	1998	27.2%	28.2%	n/a	n/a	n/a	n/a
	FU1	14	2548	2413	24.4%	25.4%	n/a	n/a	n/a	n/a
	FU2	14	3112	2812	9.9%	11.0%	n/a	n/a	n/a	n/a
	FU3	14	840	840	5.0%	5.7%	n/a	n/a	n/a	n/a
A. lumbricoides	baseline	14	2203	1999	8.0%	8.4%	0.0%	0.0%	180.0	129.0
	FU1	14	2549	2415	10.4%	10.1%	0.0%	0.0%	40.0	47.0
	FU2	14	3112	2812	3.8%	4.1%	0.0%	0.0%	41.9	55.2
	FU3	14	840	840	3.2%	2.9%	0.0%	0.0%	39.4	68.2
Hookworm	baseline	14	2203	2000	18.6%	19.4%	0.0%	0.0%	16.8	22.6
	FU1	14	2549	2414	9.8%	10.7%	0.0%	0.0%	8.5	11.3
	FU2	14	3112	2812	4.8%	5.8%	0.0%	0.0%	6.0	8.5
	FU3	14	840	840	0.8%	1.9%	0.0%	0.0%	0.4	3.1
T. trichiura	baseline	14	2202	1999	2.7%	3.0%	0.0%	0.0%	1.7	1.7
	FU1	14	2548	2414	5.4%	6.3%	0.0%	0.0%	3.8	3.9
	FU2	14	3113	2812	1.6%	1.6%	0.0%	0.0%	1.1	1.5
	FU3	14	840	840	1.3%	1.3%	0.0%	0.0%	0.5	1.2

† Numbers of pupils may differ from Table 3 as there are pupils with epidemiological results but no gender information.

* Year – Baseline: 2007/08; FU1: 2009; FU2: 2011; FU3: 2017.

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

Table 5. *S.mansoni* prevalence by diagnostic

School	Prevalence measured by Kato-Katz	CCA - Trace positive	CCA - Trace negative
Buterere	7.5%	37.5%	13.3%
Kabo	5.8%	30.0%	18.3%
Kizuga	0.0%	20.8%	0.8%
Maramvya	7.5%	26.7%	15.8%
Mirombero	0.0%	6.7%	0.8%
Mudende	0.0%	6.7%	0.0%
Mugeni	2.5%	36.7%	20.8%
Munyika	0.8%	35.0%	17.5%
Musenyi	0.8%	40.0%	23.3%
Nyamibu	27.5%	85.0%	50.8%
Nyamusasa	1.7%	52.5%	35.8%
Rukinga	7.5%	76.7%	32.5%
Ruzibira	0.0%	7.5%	0.8%
Vugizo	1.7%	15.0%	5.0%

4.3 Pdf of dashboard

BDI_IS2017_Dashboard_2018-07-09.pdf