Prevalence, Intensity and Associated Risk Factors of Soil Transmitted Helminths and Schistosome Infections in Kenya: A Cross-Sectional Study after Five Years of Mass Drug Administration

Year 6 (2018) Survey Analysis

Technical Report Based on Data Collected Between 29th January and 24th May 2018

28th September, 2018

Contents

Executive Summary

This report presents the findings of the year 6 survey which was an extension of the first five years (2012-2017) impact monitoring of the Kenya National School-Based Deworming Programme (KNSBDP). The survey was conducted in 20 counties of Bomet, Kericho, Narok, Bungoma, Busia, Kakamega, Vihiga, Kisumu, Homabay, Kisii, Nyamira, Migori, Kilifi, Kwale, Mombasa, Taita Taveta, Kitui, Makueni, Wajir and Garissa covering six regions in Kenya. The survey was funded by Evidence Action a non-governmental organization committed to alleviate poverty through evidence based research.

The survey revealed that Wajir and Garissa counties have zero prevalence of both STH and schistosome infections. In overall, the MDA programme has driven both STH and schistosome infections prevalence to relatively low levels however not to a point where they are no longer a public health problem.

The analysis of individual, household and school level factors associated with either STH or schistosome infections revealed that soil eating behaviour, not wearing shoes, household occupancy of more than five members and living in households with earthen floors were significant predisposing factors to these infections especially for any STH infection. Additionally, ECD children showed higher odds of any of the infections.

From the findings the programme should conduct a breaking transmission assessment in the northern counties of Kenya with the aim to declaring them free from helminthic infections. Since counties have showed heterogeneity in infection levels, different treatment frequency based on the WHO guidelines should be adopted for the counties. To sustain the chemotherapeutic gains of MDA, incorporation of integrated control approaches emphasizing on health education and WASH interventions to the communities and schools should be adopted.

Introduction

From the year 2012, the ministries of health and of education in Kenya started to deworm all school –age children who live in 66 districts (now sub counties) identified as having a high prevalence for STH and schistosome infections to warrant mass drug administration (MDA). The impact of the Kenya's school-based deworming programme was monitored for five years (2012-2017) with the support from Childrens' Investment Fund Foundation (CIFF), a charitable organization based in the United Kingdom (UK).

At the end of the five-year period, new additional funding for year 6 surveys was provided by the Evidence Action with the specific objectives of monitoring and evaluating parasitological outcomes in sites that had routine parasitological monitoring for five years and those sites that have not had routine parasitological monitoring since baseline.

This report therefore presents the year 6 survey results from 100 schools in 20 counties. The year 6 results were also compared to previous surveys since baseline. Additionally, the study provided the risk factors associated with STH and schistosome infections.

Methods

The year 6 survey utilized cross-sectional design in a representative, stratified, two-stage sample of school children across regions in Kenya. A sample size of 100 schools (5 schools per county) with approximately 108 children per school was determined to be adequate to detect a 5% change in prevalence and intensity of infection, assuming power of 80% and test size of 5%, and considering the anticipated variance in prevalence. The schools were selected based on their year 5 infection endemicity prior to the study. In each school, 18 children (9 girls and 9 boys) were sampled randomly from each of the six classes; one early childhood development (ECD) class and classes 2 − 6 using random number tables, for a total of approximately 108 children per school.

Data collection

The year 6 data was collected in two phases between 29th January to 17th February, 2018 and 8th to 24th May, 2018 approximately 12 months prior to the year 6 MDA across 20 counties in across Western, Nyanza, Rift Valley, Eastern and North Eastern regions. Both survey questionnaires and laboratory reporting form were programmed onto android-based smart phones and used to capture data electronically into the Open Data Kit (ODK) system that incorporated in-built data quality checks to prevent data entry errors.

Statistical analysis

Infection prevalence and average intensity of infections were calculated for STH and schistosome infections and the 95% confidence intervals (CIs) determined using binomial and negative binomial regression models respectively, taking into account clustering by schools. Infection intensities were classified into light, moderate and heavy infections according to WHO guidelines (Supplementary: Table S1) and the prevalence of light to heavy infections together with 95%CIs obtained using binomial regression model taking into account clustering by schools.

Overall, cross-county analysis of the factors associated with STH or schistosome infections was analyzed, first using univariable analysis and described as odds ratio (OR) using mixed effects logistic regression model at two levels; pupils nested within schools selected within counties. To select minimum adequate variables for multivariable analysis, an inclusion criteria of p-value < 0.1 was pre-specified in a forward step-wise variable selection method which selected covariates meeting the set criterion. Adjusted OR (aOR) were obtained by mutually adjusting all minimum generated variables using multivariable mixed effects logistic regression model at 95%CI taking into account hierarchical nature of the data.

All the statistical analyses were carried out using STATA version 14.1 (STATA Corporation, College Station, TX, USA).

Results

Overall, 100 schools (9,801 children) with the median age of 10 years (1 − 21 years) were surveyed across 20 counties in Western, Nyanza, Rift Valley, Coast, Eastern and North Eastern regions prior to the year 6 MDA. 50.2% of the children were males. Five schools with a total of 108 children per school were surveyed from each county. Table 1 provides the number of schools and children examined by county as well as the range of school-level prevalence for both STH and schistosome infections.

STH infections

The overall prevalence for any STH infection was 12.9% (95%CI: 10.4-16.1) with specific species prevalence of 9.7% (95%CI: 7.5-12.6) for *Ascaris lumbricoides*, 3.6% (95%CI: 2.2-5.8) for *Trichuris trichiura* and 1.0% (95%CI: 0.6-1.5) for hookworms. Similarly, the overall mean intensity for any STH infection was 762 epg (95%CI: 554-1048) with A. lumbricoides having the highest mean intensity of infection followed by T. trichiura and then hookworms (Table 2).

Figure 1 provides the STH prevalence distribution in all the surveyed counties after five years of MDA. The figure showed that pocket schools mainly in the western part of Kenya had prevalence of any STH above 20%. All schools in Eastern and North Eastern regions had STH prevalence below 1%.

The STH combined prevalence had reduced by 61.7% (p<0.001) from Y1 baseline of 33.6%, similarly, specific species indicated significant declines over the period. Hookworm reduced by 93.6% (p<0.001) from a baseline prevalence of 15.2%, *A. lumbricoides* reduced by 52.9% (P<0.001) from baseline prevalence of 20.7% and *T. trichiura* reduced by 42.7% (p<0.001) from initial prevalence of 6.3%. Similar declines were observed for mean intensity of infections, Table 2.

County specific STH prevalence showed that there is no infection in Garissa and Wajir counties, while three counties (Kitui, Makueni and Taita Taveta) had their prevalence below 1%, six counties; Bungoma, Kilifi, Kisumu, Kwale, Migori, and Mombasa had their prevalence between 1% and 10%, only Kericho County had its prevalence between 10% and 20%, and the remaining eight counties had their prevalence between 20% and 50% (Table 3). County specific mean intensities of infection is shown in Table 4.

Stratification of the STH prevalence according to the six regions showed that overall STH infections were more prevalent in Rift Valley region (21.8%) with species specific prevalence of 17.4% for *A. lumbricoides*, 5.5% for *T. trichiura* and 0.1% for hookworms, followed by Western region (20.9%) with species specific prevalence of 15.8% for *A. lumbricoides*, 7.7% for *T. trichiura* and 1.3% for hookworms. Least infections were observed in Eastern region where only hookworm was present at 0.5%. However, no STH infection was observed in all the surveyed schools of North Eastern region.

Intensity of STH infections were predominantly of light infections; 5.8% for *A. lumbricoides*, 5.2% for *T. trichiura* and 2.8% for hookworms. Prevalence of heavy infections were observed for *A. lumbricoides* only at 1.9% with the rest of the infections showing zero prevalence for heavy infections. The prevalence of moderate to heavy infections for any STH infections was 6.0% with majority of the moderate to heavy infections being for *A. lumbricoides* (Table 5).

Schistosome infections

The overall prevalence for schistosome infections was 2.2% (95%CI: 1.2-4.3) for *S. mansoni* and 0.3% (95%CI: 0.1-1.0) for *S. haematobium*, with respective mean intensity of infections of 12 epg (95%CI: 5-31) and 0 epg (95%CI: 0-1).

Figure 2 provides the schistosome prevalence distribution in all the surveyed counties after five years of MDA. The figure showed that nearly all the surveyed schools had both *S. mansoni* and *S. haematobium* prevalence below 1%. However, a pocket of schools mainly in the western part of Kenya had prevalence of *S. mansoni* above 10%.

Only *S. mansoni* prevalence significantly reduced by 98.5% (p<0.001) from Y1 baseline of 18.0%. *S. haematobium* showed insignificant reduction of 7.9% (p=0.779) from initial prevalence of 2.4%. Similar decline patterns were observed for mean intensity of infections, Table 2.

County specific schistosomiasis prevalence showed that there is no *S. mansoni* infection in ten counties, below 1% prevalence in four counties, between 1% and 10% in five counties and above 10% in only Busia County. Similarly, *S. haematobium* prevalence was zero in Makueni, Wajir and Taita Taveta counties, below 1% in Garissa and Kilifi counties, and between 1% and 10% in Kwale and Mombasa (Table 3). County specific mean intensities of infection is shown in Table 4.

Region specific schistosmiasis prevalence showed that *S. mansoni* infection was most prevalent in Western (6.3%), followed by Eastern (2.4%), Nyanza (1.9%) and Coast region (0.3%), however no *S. mansoni* infection was observed in North Eastern and Rift Valley regions. Additionally, *S. haematobium* infection was only observed in Coast (0.4%) and North Eastern (0.3%), with no observed infection in Eastern region.

Analysis of the intensity of schistosome infections showed that majority of *S. mansoni* infections were of heavy intensity (2.5%) while those for *S. haematobium* infection were of light intensity (65.2%). The prevalence of moderate to heavy infections for any schistosome infections was 3.2% with majority of the moderate to heavy infections being for *S. mansoni* (Table 5).

Individual, household and school WASH characteristics

All the 9,801 children surveyed from 100 schools were administered with a questionnaire to outline their water, sanitation and hygiene (WASH) practices and behaviours both at school and home levels. Table 6 gives the WASH characteristics in overall and as stratified by regions.

The overall reported average number of household occupants was 6.8 people (SD = 2.6 people). At the time of the interview, majority (84.5%) of the pupils were wearing shoes, and geophagy was not common at only 27.1% of the pupils. Nearly half (49.7%) of the pupils reported use of improved water source for drinking at household level. Reported latrine coverage at household level was high (97.3%), however, fewer pupils reported always having a handwashing facility equipped with water and soap (14.5%), or tissues/water for anal cleansing (54.0%) available in their households.

School WASH conditions varied considerably by region as well as by county (Table 6). The average number of pupils per school was 526.7 (SD = 376.8). Improved water sources were observed in 40.0% of the schools. Nearly all of the schools had at least one latrine block (99.0%). However, only 45.5% of the latrines were of VIP type. Fewer schools had handwashing facility equipped with water and soap (3.0%), or tissue/water always available for anal cleansing (10.2%). The pupils per latrine ratio was 55:1 with only 27.0% of the schools meeting the Government of Kenya (GoK) standard of 30 pupils per latrine. Additionally, on the day of the visit the following latrines had excessive smell (32.5%), visible feces outside or around (14.0%), excessive flies (24.7%), good cleanliness (88.7%), and in good structural integrity (86.0%).

Figure 3 provides the distribution of school and household water and sanitation conditions. Poor pupil to latrine ratio (i.e. >90) was observed in all schools in the North Eastern Region and part of schools in Western and Coastal regions. Most schools across all the regions had unimproved water source. Most children in western part of Kenya reported low availability of improved water source at home (<25%).

Reported latrine availability at household level was good (latrine coverage was above 75%) among all the interviewed pupils in all the regions.

Univariable analysis of factors associated with STH and schistosome infections

Univariable analysis of individual, household and school levels WASH factors revealed significant associations between STH infections and many of the covariates of interest as shown in table 7. For any of the STH infections, the individual and household-level factors like soil-eating behaviour (OR = 1.16, p = 0.030), not wearing shoes (OR = 1.42, p = 0.002), higher households membership i.e. > 5 members (OR = 1.21, p = 0.016), household head having no or only primary level of education (OR = 1.28, p = 0.008) and households with floors made of earth/sand (OR = 1.21, p = 0.023) increased the odds of STH infections. Additionally, ECD children (OR = 1.68, p < 0.001) and those below five years (OR = 4.57, p = 0.009) were associated with higher significant risk of the infections. However, availability of tissue/newspaper/water at home for anal cleansing was associated with lower odds of the infections prevalence (OR = 0.74, p = 0.001). School abseentism was associated with higher odds of the infections (OR = 1.36, p = 0.035).

Multivariable analysis of factors associated with STH infections

Table 8 gives the multivariable associations between individual, household or school WASH conditions and STH infections. ECD children (aOR = 1.79, p < 0.001) were associated with higher odds of any STH infections. Not wearing shoes was associated with higher odds of all the three STH infections and significantly associated with higher *A. lumbricoides* infection (aOR = 1.51, p = 0.002). High household membership (i.e. more than 5 members per household) was associated with associated higher odds of any STH infections and specifically was significant for *A. lumbricoides* (aOR = 1.30, p = 0.003). School abseentism was associated with higher odds of SSTH infections (aOR = 1.37, p = 0.035). Additionally, children who reported not taking anthelminthic drugs during the last MDA were associated with higher odds of all the three STH infections, however, this was not significant.

School level factors like availability of handwashing facility equipped with soap and water, availability of tissue/newspaper/water for anal cleansing, and always use of school latrine/toilet for defecation were associated with lower odds of all the three STH infections, though these were not significant.

Multivariable analysis of factors associated with schistosome infections

Table 9 gives the multivariable associations between individual, household or school WASH conditions with *S. mansoni* and *S. haematobium* infections. However, most of the covariates did not show significant associations probably due to the low number of observations in each covariate. Male children were associated with higher odds of both the infections. Children who reported not wearing shoes as well as those who did not receive treatment during the last MDA were associated with higher odds of the infections.

Conclusion

The results showed low levels of both STH and schistosome infections after five years of treatment. However, *A. lumbricoides* is still the leading STH infection followed by *T. trichuira* and hookworms among the surveyed populations.

The northern counties; Wajir and Garissa showed zero prevalence for STH and schistosome infections, an indication that there is no probable ongoing biological transmission of the infections in the region.

There was observed heterogeneity in infection levels within counties and following WHO recommendation on treatment frequency after five years of MDA; Garissa, Wajir, Kitui, Makueni and Taita Taveta counties would not require MDA, while Bungoma, Kilifi, Kisumu, Kwale, Migori and Mombasa would require MDA once after every two years, and the remaining nine counties would require MDA once every year.

Our assessment of the individual, household and school WASH practices and behaviour on STH and schistosome infections suggested mixed impacts. WASH risk factors differed across individual worm species; this is expected given the different mechanisms of infections. The results revealed no clear trend of the relative importance of school or household-level WASH factors, however factors like soil eating, not wearing shoes, high number of household occupants, and living in households with earthen floors increased the odds of STH and schistosome infections.

Recommendations

Based on the survey findings, we recommend the following:

1. The programme should conduct a breaking transmission assessment in the northern counties of Kenya with the aim to declaring them free from helminthic infections.
2. The programme should adopt at county-level different treatment frequency based on the WHO guidelines.
3. To sustain the chemotherapeutic gains of MDA, incorporation of integrated control approaches emphasizing on health education and WASH interventions to the communities and schools should be adopted.

References

1. Mwandawiro CS, Nikolay B, Kihara JH, Ozier O, Mukoko DA, Mwanje MT, et al. Monitoring and evaluating the impact of national school-based deworming in Kenya: study design and baseline results. Parasit. Vectors [Internet]. 2013;6:1. Available from: http://www.parasitesandvectors.com/content/6/1/198

Appendices

List of Tables

Table 1: Number of schools and children examined by county as well as school prevalence range (min - max) among school children in Kenya

County	Schools (children)	Median age (min-max)	School range STH prevalence (min-max)	School range *S. mansoni* prevalence (min-max)	School range *S. haematobium* prevalence (min-max)
Bomet	5 (541)	10.0 (3-18)	13.0-39.8	0-0	0-0
Bungoma	5 (519)	9.5 (4-15)	0.9-9.3	0-0	0-0
Busia	5 (540)	11.0 (4-17)	0.9-56.5	0-41.7	0-0
Garissa	5 (197)	10.0 (4-14)	0-0	0-0	0-3.4
Homa Bay	5 (535)	10.0 (5-15)	16.7-35.2	0-15.3	0-0
Kakamega	5 (539)	10.0 (5-16)	17.6-38.9	0-31.5	0-0
Kericho	5 (540)	9.0 (1-16)	13.0-22.2	0-0	0-0
Kilifi	5 (507)	10.0 (4-17)	1.0-19.3	0-0	0-0.9
Kisii	5 (532)	9.0 (4-16)	9.3-37.0	0-0	0-0
Kisumu	5 (540)	10.0 (5-16)	0-8.3	0-13.9	0-0
Kitui	5 (540)	10.0 (2-18)	0-0.9	0-2.8	0-0
Kwale	5 (522)	9.0 (4-16)	0.9-11.1	0-1.9	0-5.7
Makueni	5 (522)	10.0 (4-14)	0-1.9	0-13.9	0-0
Wajir	5 (112)	9.5 (3-14)	0-0	0-0	0-0
Migori	5 (539)	10.0 (4-19)	0.9-4.6	0-0	0-0
Mombasa	5 (526)	10.0 (4-16)	0-5.6	0-0.9	0-0.9
Narok	5 (516)	10.0 (4-21)	12.0-33.7	0-0	0-0
Nyamira	5 (511)	10.0 (3-14)	0-39.8	0-0	0-0
Taita Taveta	5 (491)	9.0 (3-15)	0-0.9	0-0.9	0-0
Vihiga	5 (532)	10.0 (1-14)	12.1-49.5	0-1.9	0-0
Total	**100 (9,801)**	**10.0 (1-21)**	**0-56.5**	**0-41.7**	**0-5.7**

Table 2: Overall prevalence % (95%CI), average intensity epg (95%CI) of infections and relative reductions (RR) % (p-value) among school children in Kenya

Survey	STH Combined	Hookworm	*A. lumbricoides*	*T. trichiura*	*S. mansoni*	*S. haematobium*
Prevalence, % (95%CI)						
Y1 Baseline*	33.6 (31.2-36.2)	15.2 (13.2-17.4)	20.7 (18.3-23.5)	6.3 (5.0-8.0)	2.4 (1.5-4.1)	18.0 (13.0-24.9)
Y3 Midterm*	18.6 (16.4-21.0)	2.4 (1.8-3.2)	13.8 (12.0-15.9)	5.0 (3.7-6.8)	1.7 (0.8-3.6)	7.9 (3.8-16.2)
Y5 Endline*	15.2 (13.1-17.6)	1.3 (1.0-1.6)	11.1 (9.3-13.2)	4.6 (3.4-6.1)	2.0 (1.2-3.2)	3.9 (1.7-9.0)
Y6 Evaluation[$]	12.9 (10.4-16.1)	1.0 (0.6-1.5)	9.7 (7.5-12.6)	3.6 (2.2-5.8)	2.2 (1.2-4.3)	0.3 (0.1-1.0)

RR (Y1Baseline – Y6Evaluation)	61.7 (p<0.001)	93.6 (p<0.001)	52.9 (p<0.001)	42.7 (p=0.006)	7.9 (p=0.779)	98.5 (p<0.001)
Average Intensity, epg (95%CI)						
Y1 Baseline*	2012 (1698-2385)	62 (48-78)	1914 (1601-2288)	36 (11-122)	14 (5-41)	20 (11-39)
Y3 Midterm*	1141 (962-1352)	9 (5-16)	1113 (936-1324)	19 (12-30)	6 (2-16)	7 (3-16)
Y5 Endline*	1088 (898-1318)	11 (5-21)	1059 (872-1286)	18 (11-29)	5 (3-10)	4 (1-12)
Y6 Evaluation$	762 (554-1048)	6 (2-16)	741 (535-1027)	15 (8-27)	12 (5-31)	0 (0-1)
RR (Y1Baseline – Y6Evaluation)	62.0 (p<0.001)	90.7 (p<0.001)	61.1 (p<0.001)	58.3 (p=0.201)	13.4 (p=0821)	99.3 (p<0.001)

*Indicates surveys done under the CIFF funding and included 172 schools in four regions
$Indicates surveys done under Evidence Action funding and included 100 schools in six regions

Table 3: Overall and county prevalence % (95%I) for STH and schistosome infections among school children in Kenya

County	STH Combined	Hookworms	*A. lumbricoides*	*T. trichiura*	*S. mansoni*	*S. haematobium*
Bomet	24.0 (16.5-34.8)	0	23.4 (15.8-34.6)	1.1 (0.3-4.1)	0	-
Bungoma	5.1 (2.5-10.4)	0.2 (0-1.4)	4.9 (2.5-9.8)	0	0	-
Busia	23.4 (9.1-6.0)	1.1 (0.2-7.9)	4.8 (2.0-11.6)	21.2 (7.4-60.5)	17.6 (6.7-46.0)	-
Garissa	0	0	0	0	0	0.5 (0.1-4.8)
Homa Bay	23.0 (17.4-30.4)	5.6 (2.7-11.6)	16.5 (10.3-26.4)	4.9 (2.6-9.1)	4.9 (1.4-16.6)	-
Kakamega	23.9 (17.3-33.2)	2.8 (2.3-3.4)	22.8 (15.9-32.6)	1.3 (0.9-1.9)	6.7 (1.1-41.6)	-
Kericho	16.9 (13.8-20.9)	0.4 (0.1-2.7)	16.0 (13.1-19.6)	1.3 (0.6-2.7)	0	-
Kilifi	4.8 (1.4-16.6)	0.6 (0.1-2.4)	0.4 (0.1-1.3)	4.0 (0.9-17.1)	0	0.2 (0-1.4)
Kisii	21.6 (13.8-33.9)	0.4 (0.1-1.3)	20.8 (13.3-32.7)	1.5 (0.6-4.1)	0	-
Kisumu	3.2 (1.3-7.6)	0.2 (0-1.3)	1.1 (0.6-2.1)	2.0 (0.8-5.5)	4.6 (1.5-13.9)	-
Kitui	0.4 (0.1-1.2)	0.4 (0.1-1.2)	0	0	1.1 (0.3-3.7)	0
Kwale	6.3 (3.5-11.3)	2.8 (1.3-5.8)	0	3.9 (1.4-11.3)	0.4 (0.1-2.8)	1.1 (0.2-8.1)
Makueni	0.6 (0.2-2.1)	0.6 (0.2-2.1)	0	0	3.7 (0.9-15.8)	0
Wajir	0	0	0	0	0	0
Migori	2.4 (1.4-4.3)	0.7 (0.3-1.9)	1.3 (0.6-3.0)	0.6 (0.2-2.1)	0	-
Mombasa	2.2 (0.8-6.0)	0.8 (0.1-5.5)	0.4 (0-3.3)	1.0 (0.3-3.3)	0.2 (0-1.4)	1.9 (0-1.3)
Narok	24.5 (17.4-34.5)	0	12.4 (6.1-25.3)	14.4 (7.3-28.1)	0	-
Nyamira	22.9 (13.3-39.3)	0.4 (0.1-2.9)	22.1 (13.1-37.1)	0.8 (0.2-3.4)	0	-
Taita Taveta	0.2 (0-1.4)	0	0.2 (0-1.4)	0	0.4 (0.1-1.3)	0
Vihiga	30.7 (19.2-49.1)	0.9 (0.5-1.8)	30.3 (18.7-49.0)	7.8 (3.5-17.0)	0.4 (0.1-2.7)	-
Total	**12.9 (10.4-16.1)**	**1.0 (0.6-1.5)**	**9.7 (7.5-12.6)**	**3.6 (2.2-5.8)**	**2.2 (1.2-4.3)**	**0.3 (0.1-1.0)**

Table 4: Overall and county mean intensity epg (95%CI) for STH and schistosome infections among school children in Kenya

County	STH combined	Hookworms	A. lumbricoides	T. trichiura	S. mansoni	S. haematobium
Bomet	1357 (905-2033)	0	1353 (901-2033)	3 (1-11)	0	-
Bungoma	131 (60-286)	0	131 (60-286)	0	0	-
Busia	383 (166-885)	1 (0-6)	296 (113-777)	87 (28-269)	142 (50-397)	-
Garissa	0	0	0	0	0	0
Homa Bay	794 (544-1158)	41 (7-251)	749 (487-1152)	3 (2-7)	6 (1-31)	-
Kakamega	1930 (1418-2625)	4 (3-6)	1924 (1415-2617)	1 (0-3)	53 (8-368)	-
Kericho	913 (696-1197)	1 (0-4)	911 (695-1194)	1 (1-3)	0	-
Kilifi	43 (8-237)	0 (0-1)	0	43 (8-239)	0	0 (0-1)
Kisii	1867 (853-4089)	1 (0-7)	1864 (851-4086)	2 (0-5)	0	-
Kisumu	157 (93-265)	0 (0-3)	155 (92-263)	1 (0-3)	5 (1-21)	-
Kitui	0	0	0	0	2 (0-5)	0
Kwale	26 (13-56)	11 (5-26)	0	15 (7-35)	3 (0-19)	1 (0-6)
Makueni	1 (0-3)	1 (0-3)	0	0	6 (1-31)	0
Wajir	0	0	0	0	0	0
Migori	32 (8-134)	2 (1-6)	16 (4-60)	14 (2-93)	0	-
Mombasa	307 (39-2415)	1 (0-8)	303 (37-2459)	3 (1-8)	0 (0-1)	0
Narok	866 (325-2308)	0	789 (259-2404)	78 (30-201)	0	-
Nyamira	1661 (807-3420)	42 (6-305)	1610 (787-3295)	9 (1-62)	0	-
Taita Taveta	29 (4-200)	0	29 (4-200)	0	2 (0-8)	0
Vihiga	3441 (1918-6173)	2 (1-4)	3422 (1909-6133)	17 (7-42)	0 (0-3)	-
Total	**762 (554-1048)**	**6 (2-16)**	**741 (535-1027)**	**15 (8-27)**	**12 (5-31)**	**0 (0-1)**

Table 5: Prevalence % (95%CI) of light, moderate and heavy intensity of infections among school children in Kenya

Infections	Light infections	Moderate infections	Heavy infections	Moderate-heavy infections
STH infections:				
STH combined	8.6 (6.9-10.8); n=843	4.0 (2.9-5.4); n=392	2.0 (0.9-4.2); n=192	6.0 (4.4-8.2); n=584
A. lumbricoides	5.8 (4.5-7.5); n=561	3.9 (2.8-5.3); n=371	1.9 (0.9-4.2); n=188	5.7 (4.1-7.9); n=559
Hookworms	2.8 (1.6-4.8); n=276	0	0 (0-0.1); n=3	0 (0-0.1); n=3
T. trichiura	5.2 (3.5-7.8); n=507	0.2 (0.1-0.5); n=23	0 (0-0.1); n=1	0.2 (0.1-0.5); n=24
Schistosome infections:				
Any schistosome	63.7 (55.0-73.7); n=6242	0.8 (0.4-1.6); n=74	2.5 (1.3-4.7); n=243	3.2 (1.9-5.6); n=317
S. mansoni	0.9 (0.5-1.5); n=85	0.8 (0.4-1.6); n=74	2.5 (1.3-4.6); n=240	3.2 (1.8-5.6); n=314
S. haematobium	65.2 (56.3-75.5); n=6390	-	0.1 (0-0.4); n=3	0.1 (0-0.4); n=3

Table 6: Pupil, household and school WASH characteristics overall and stratified by region, Kenya

Characteristics	Overall (N=9,801) n (%) or mean (SD)	Coast (n=2,046) n (%) or mean (SD)	Nyanza (n=2,657) n (%) or mean (SD)	Western (n=2,130) n (%) or mean (SD)	Rift valley (n=1,597) n (%) or mean (SD)	Eastern (n=1,062) n (%) or mean (SD)	N. Eastern (n=309) n (%) or mean (SD)
STH infections							
Any STH infection	1,242 (12.9%)	68 (3.4%)	381 (14.5%)	442 (20.9%)	346 (21.8%)	5 (0.5%)	0
Hookworm prevalence	94 (1.0%)	21 (1.1%)	39 (1.5%)	27 (1.3%)	2 (0.1%)	5 (0.5%)	0
Hookworm intensity$	5.8	3.2	17.2	1.8	0.2	0.3	0
A. lumbricoides prevalence	935 (9.7%)	5 (0.3%)	321 (12.2%)	333 (15.8)	276 (17.4%)	0	0
A. lumbricoides intensity$	741	82.5	864.6	1450.7	1020.9	0	0
T. trichiura prevalence	346 (3.6%)	45 (2.3%)	52 (2.0%)	162 (7.7%)	87 (5.5%)	0	0
T. trichiura intensity$	15.0	15.2	5.7	26.7	26.7	0	0
Schistosome infections							
S. mansoni prevalence	214 (2.2%)	5 (0.3%)	51 (1.9%)	133 (6.3%)	0	25 (2.4%)	0
S. mansoni intensity$	12.2	1.1	2.2	49.8	0	3.7	0
S. haematobium prevalence	9 (0.3%)	8 (0.4%)	-	-	-	0	1 (0.3%)
S. haematobium intensity$	0.2	0.2	-	-	-	0	0
Individual and household characteristics							
Boys	4,771 (49.8%)	987 (49.9%)	1,318 (50.5%)	1,054 (50.6%)	776 (49.8%)	518 (49.3%)	161 (53.7%)
Age	9.6 (2.4)	9.5 (2.2)	9.4 (2.5)	9.7 (2.3)	9.6 (2.5)	9.9 (2.3)	9.4 (2.1)
Number of household occupants	6.8 (2.6)	6.8 (2.5)	6.6 (3.0)	6.8 (2.0)	7.2 (2.8)	6.6 (2.1)	6.6 (1.9)
Shoe-wearing	8,101 (84.5%)	1,516 (76.6%)	2,523 (96.6%)	1,400 (67.2%)	1,530 (98.2%)	857 (81.5%)	275 (91.7%)
Soil-eating behaviour	2,596 (27.1%)	78 (3.9%)	1,121 (42.9%)	982 (47.1%)	72 (4.6%)	332 (31.6%)	11 (3.7%)
Improved water source*	4,866 (49.7%)	1,857 (90.8%)	907 (34.1%)	601 (28.2%)	763 (47.8%)	540 (50.9%)	198 (64.1%)
Toilet/latrine available	9,329 (97.3%)	1,907 (96.3%)	2,497 (95.6%)	2,070 (99.3%)	1,548 (99.4%)	1,012 (96.3%)	295 (98.3%)
Handwashing facility with soap and water always available	1,422 (14.5%)	229 (11.2%)	748 (28.2%)	65 (3.1%)	361 (22.6%)	18 (1.7%)	1 (0.3%)
Tissue/water for anal cleansing always available	5,174 (54.0%)	1,217 (61.5%)	1,596 (61.1%)	510 (24.5%)	1,498 (96.2%)	288 (27.4%)	65 (21.7%)
School characteristics	Overall (n=100)	Coast (n=20)	Nyanza (n=25)	Western (n=20)	Rift valley (n=15)	Eastern (n=10)	N. Eastern (n=10)
Number of children in school	526.7 (316.8)	645.7 (446.4)	482.6 (260.6)	758.7 (247.4)	359.3 (154.5)	326.4 (186.1)	386.3 (176.8)
Improved water source*	40 (40.0%)	9 (45.0%)	6 (24.0%)	7 (35.0%)	9 (60.0%)	3 (30.0%)	6 (60.0%)
Latrine/toilet available	99 (99.0%)	19 (95.0%)	25 (100%)	20 (100%)	15 (100%)	10 (100%)	10 (100%)
Pupils per latrine [median (IQR)]	54.9 (94.2)	54.9 (100)	54.4 (93.2)	98.4 (128.9)	37.3 (32.8)	37.8 (35.5)	113.9 (128.7)
Handwashing facility with soap and water always available	3 (3.0%)	0	3 (12.0%)	0	0	0	0
Drinking water always available	36 (48.0%)	0	14 (56.0%)	4 (26.7%)	11 (73.3)	5 (50.0%)	2 (20.0%)

Number of months without water	4.6 (5.9)	4.0 (2.6)	2.3 (2.3)	3.9 (4.2)	3.7 (3.3)	6.2 (4.3)	12.4 (14.3)
Tissue/water for anal cleansing always available	10 (10.2%)	14 (14.0%)	15 (14.8%)	9 (8.9%)	3 (3.1%)	4 (4.2%)	12 (11.7%)

$^{\$}$Infection intensity was measured using egg per gram and displayed as arithmetic mean

*Improved water source was defined as the proportion of population with access to tap water, boreholes, protected wells or springs, and rain water collection

Table 7: Univariable associations between WASH conditions and STH infections among school children in Kenya

Factors	STH combined (n=1,242)		A. lumbricoides (n=935)		Hookworms (n=94)		T. trichiura (n=346)	
	OR (95%CI)	p-value	OR (95%CI)	p-value	OR (95%CI)	p-value	OR (95%CI)	p-value
Individual factors:								
Male children	1.07 (0.94-1.22)	0.314	1.05 (0.90-1.22)	0.534	1.43 (0.94-2.17)	0.098	1.08 (0.85-1.38)	0.518
ECD children	1.68 (1.43-1.99)	<0.001**	1.86 (1.55-2.23)	<0.001**	0.89 (0.50-1.59)	0.691	1.28 (0.94-1.74)	0.121
Soil-eating behavior	1.16 (1.01-1.32)	0.030**	1.67 (1.45-1.93)	<0.001**	0.64 (0.38-1.07)	0.088	0.41 (0.30-0.56)	<0.001**
Not wearing shoes	1.42 (1.14-1.77)	0.002**	1.53 (1.18-1.97)	0.001**	1.45 (0.80-2.61)	0.219	1.18 (0.81-1.73)	0.390
Age group								
< 5 years vs > 14 years	4.57 (1.46-14.2)	0.009**	3.78 (1.09-13.1)	0.036**	Insufficient obs		1.92 (0.11-35.5)	0.662
5-14 years vs > 14 years	3.21 (1.24-8.32)	0.016**	1.85 (0.65-5.29)	0.252	0.90 (0.12-6.87)	0.918	9.41 (1.22-72.4)	0.031**
Did not receive treatment during last MDA	1.20 (0.93-1.53)	0.159	1.29 (0.97-1.71)	0.080	1.07 (0.53-2.15)	0.856	0.88 (0.55-1.41)	0.599
Household factors:								
Household members:								
More than 5 members vs 1-5 members	1.21 (1.04-1.41)	0.016**	1.24 (1.04-1.47)	0.014**	1.37 (0.82-2.29)	0.224	1.16 (0.87-1.56)	0.321
Household head level of education:								
No formal education vs Secondary and above	1.23 (1.00-1.52)	0.054	1.45 (1.15-1.83)	0.002**	0.58 (0.29-1.16)	0.121	0.91 (0.59-1.40)	0.656
Primary education vs Secondary and above	1.28 (1.07-1.54)	0.008**	1.32 (1.07-1.62)	0.009**	0.85 (0.50-1.46)	0.566	1.05 (0.72-1.53)	0.797
Roof materials:								
Iron sheets vs tiles	0.68 0.34-1.40	0.297	1.03 (0.40-2.68)	0.948	0.66 (0.12-3.55)	0.627	0.56 (0.18-1.75)	0.318
Grass/thatch/makuti vs tiles	0.72 0.35-1.49	0.375	1.10 (0.42-2.94)	0.842	0.50 (0.09-2.93)	0.444	0.59 (0.19-1.88)	0.374
Floor materials:								
Wooden vs cement/tiles	1.05 (0.36-3.04)	0.924	0.99 (0.31-3.13)	0.981	Insufficient obs		0.81 (0.08-7.84)	0.855
Earth/sand vs cement/tiles	1.21 (1.03-1.43)	0.023**	1.19 (0.99-1.44)	0.061	1.32 (0.77-2.27)	0.318	1.33 (0.96-1.85)	0.090
Wall materials:								
Clay/mud vs stone/bricks/cement	1.21 (1.00-1.47)	0.055	1.19 (0.95-1.49)	0.130	1.50 (0.79-2.83)	0.212	1.27 (0.89-1.82)	0.183
Wood vs stone/bricks/cement	1.15 (0.75-1.75)	0.518	1.13 (0.73-1.76)	0.587	Insufficient obs		0.94 (0.29-3.02)	0.914
Iron sheets vs stone/bricks/cement	0.99 (0.65-1.51)	0.952	1.07 (0.68-1.69)	0.782	1.03 (0.25-4.17)	0.971	0.88 (0.34-2.28)	0.794
Household possessions:								

	aOR (95%CI)	p-value	aOR (95%CI)	p-value	aOR (95%CI)	p-value	aOR (95%CI)	p-value
Radio	0.91 (0.77-1.09)	0.297	0.83 (0.68-1.02)	0.073	0.85 (0.51-1.41)	0.533	1.08 (0.78-1.49)	0.649
Television	0.73 (0.61-0.88)	0.001**	0.64 (0.52-0.80)	<0.001**	0.65 (0.36-1.17)	0.151	0.88 (0.64-1.20)	0.421
Mobile phone	0.96 (0.71-1.29)	0.784	0.94 (0.66-1.33)	0.716	0.67 (0.31-1.42)	0.292	0.96 (0.60-1.53)	0.864
Sofa set	0.84 (0.71-1.00)	0.047**	0.85 (0.70-1.04)	0.110	0.84 (0.50-1.42)	0.516	0.83 (0.61-1.14)	0.252
Bicycle	1.03 (0.88-1.21)	0.701	1.02 (0.86-1.23)	0.791	1.58 (1.00-2.50)	0.048**	1.14 (0.86-1.50)	0.365
Motorcycle	0.90 (0.74-1.10)	0.294	0.88 (0.70-1.11)	0.281	1.00 (0.59-1.71)	0.993	0.90 (0.64-1.27)	0.548
Electricity	0.72 (0.61-0.86)	<0.001**	0.68 (0.56-0.84)	<0.001**	0.74 (0.43-1.27)	0.277	0.96 (0.71-1.31)	0.807
Car	0.76 (0.50-1.18)	0.220	0.71 (0.42-1.18)	0.184	1.73 (0.66-4.54)	0.262	0.60 (0.26-1.38)	0.232
Toilet/latrine available	1.42 (0.84-2.38)	0.189	1.00 (0.53-1.87)	0.999	2.66 (0.80-8.85)	0.111	2.22 (0.77-6.41)	0.140
Share toilet/latrine with other households	1.04 (0.88-1.23)	0.670	1.11 (0.91-1.34)	0.297	0.89 (0.54-1.46)	0.635	0.75 (0.54-1.03)	0.072
Used toilet/latrine to defecate last time at home	1.08 (0.77-1.51)	0.645	0.96 (0.67-1.39)	0.836	3.80 (0.91-15.8)	0.067	0.97 (0.51-1.88)	0.937
Tissue/newspaper/water always available for anal cleansing	0.74 (0.62-0.88)	0.001**	0.73 (0.60-0.89)	0.001**	0.91 (0.53-1.56)	0.734	0.82 (0.56-1.21)	0.319
Handwashing facility with soap and water always available	0.84 (0.67-1.05)	0.126	0.87 (0.68-1.12)	0.284	1.14 (0.59-2.22)	0.693	0.70 (0.45-1.08)	0.107
Improved water source	1.12 (0.93-1.33)	0.227	1.11 (0.91-1.35)	0.318	1.62 (0.96-2.75)	0.072	1.06 (0.77-1.45)	0.715
School factors:								
Handwashing facility with soap and water always available	0.66 (0.25-1.75)	0.408	0.68 (0.23-2.03)	0.493	Insufficient obs		0.68 (0.09-5.32)	0.711
Tissue/newspaper/water always available for anal cleansing	0.96 (0.82-1.12)	0.604	0.96 (0.81-1.14)	0.645	0.82 (0.51-1.34)	0.438	0.84 (0.63-1.12)	0.230
Drinking water always available	0.86 (0.68-1.08)	0.197	0.85 (0.65-1.11)	0.240	1.09 (0.61-1.94)	0.775	1.02 (0.68-1.52)	0.928
Always use school latrine/toilet	0.67 (0.35-1.28)	0.224	0.90 (0.43-1.88)	0.778	Insufficient obs		0.26 (0.09-0.73)	0.010**
Days absent from school in the last one week:								
One day vs never absent	1.05 (0.88-1.25)	0.590	1.07 (0.88-1.31)	0.500	0.96 (0.54-1.70)	0.886	1.14 (0.83-1.56)	0.434
Two days vs never absent	1.35 (1.05-1.73)	0.019**	1.43 (1.09-1.89)	0.010**	0.90 (0.40-2.03)	0.808	1.67 (1.06-2.63)	0.027**
More than two days vs never absent	1.36 (1.02-1.82)	0.035**	1.38 (1.00-1.92)	0.053	1.42 (0.69-2.92)	0.342	1.61 (0.97-2.66)	0.064

**Indicates significant associations (p<0.05)

Table 8: Multivariable associations between WASH conditions and STH infections among school children in Kenya

Factors	STH combined (n=1,242)		A. lumbricoides (n=935)		Hookworms (n=94)		T. trichiura (n=346)	
	aOR (95%CI)	p-value	aOR (95%CI)	p-value	aOR (95%CI)	p-value	aOR (95%CI)	p-value
Individual and household factors								
Male children	1.04 (0.91-1.19)	0.569	1.02 (0.88-1.19)	0.803	1.38 (0.90-2.12)	0.139	1.04 (0.81-1.34)	0.734
ECD children	1.79 (1.50-2.15)	<0.001**	1.99 (1.63-2.43)	<0.001**	0.96 (0.51-1.80)	0.902	1.37 (0.98-1.92)	0.067
Soil-eating behavior	0.92 (0.76-1.13)	0.429	0.99 (0.80-1.23)	0.959	0.70 (0.37-1.33)	0.273	0.70 (0.44-1.12)	0.135
Not wearing shoes	1.41 (1.13-1.76)	0.002**	1.51 (1.17-1.96)	0.002**	1.33 (0.73-2.42)	0.355	1.18 (0.80-1.74)	0.405
Did not receive treatment during last MDA	1.10 (0.85-1.42)	0.452	1.15 (0.86-1.54)	0.352	1.06 (0.51-2.21)	0.868	0.88 (0.55-1.42)	0.603

	aOR (95%CI)	p-value	aOR (95%CI)	p-value	aOR (95%CI)	p-value	aOR (95%CI)	p-value
Household members:								
More than 5 members vs 1-5 members	1.26 (1.08-1.47)	0.004**	1.30 (1.09-1.55)	0.003**	1.38 (0.82-2.32)	0.219	1.16 (0.86-1.57)	0.318
Improved water source	1.12 (0.93-1.35)	0.242	1.10 (0.89-1.36)	0.357	1.80 (1.03-3.14)	0.038**	1.08 (0.77-1.51)	0.670
Toilet/latrine available	1.50 (0.86-2.60)	0.151	1.09 (0.57-2.10)	0.787	1.74 (0.44-6.80)	0.427	2.46 (0.78-7.79)	0.127
Always use home toilet/latrine	1.24 (0.86-1.80)	0.255	1.15 (0.78-1.72)	0.478	2..91 (0.58-14.5)	0.192	0.86 (0.41-1.82)	0.696
Roof materials:								
Iron sheets vs tiles	0.57 (0.28-1.18)	0.131	0.90 (0.34-2.37)	0.827	0.60 (0.10-3.61)	0.577	0.52 (0.16-1.70)	0.280
Grass/thatch/makuti vs tiles	0.50 (0.24-1.06)	0.072	0.81 (0.29-2.23)	0.678	0.29 (0.04-2.05)	0.217	0.49 (0.14-1.67)	0.253
Floor materials:								
Wooden vs cement/tiles	0.92 (0.31-2.77)	0.889	0.77 (0.23-2.59)	0.678	Insufficient obs		0.80 (0.08-7.82)	0.845
Earth/sand vs cement/tiles	1.28 (0.97-1.71)	0.084	1.26 (0.92-1.72)	0.152	1.31 (0.58-2.96)	0.510	1.48 (0.79-2.76)	0.224
Wall materials:								
Clay/mud vs stone/bricks/cement	0.91 (0.66-1.25)	0.559	0.86 (0.60-1.22)	0.392	1.34 (0.54-3.34)	0.531	0.90 (0.46-1.78)	0.769
Wood vs stone/bricks/cement	1.04 (0.67-1.61)	0.853	0.98 (0.62-1.55)	0.932	Insufficient obs		0.95 (0.29-3.14)	0.932
Iron sheets vs stone/bricks/cement	0.86 (0.54-1.37)	0.526	0.92 (0.56-1.53)	0.753	0.84 (0.17-4.15)	0.829	0.74 (0.26-2.07)	0.563
Household possessions:								
Radio	0.93 (0.78-1.12)	0.454	0.85 (0.69-1.05)	0.140	0.88 (0.51-1.52)	0.648	1.09 (0.77-1.54)	0.641
Television	0.77 (0.63-0.95)	0.014**	0.69 (0.54-0.88)	0.002**	0.68 (0.36-1.30)	0.244	0.95 (0.67-1.34)	0.754
Mobile phone	1.15 (0.83-1.58)	0.398	1.19 (0.81-1.74)	0.382	0.65 (0.28-1.48)	0.301	0.97 (0.58-1.64)	0.920
School factors								
Handwashing facility with soap and water always available	0.63 (0.24-1.66)	0.348	0.70 (0.24-2.11)	0.531	Insufficient obs		0.69 (0.09-5.53)	0.727
Tissue/newspaper/water always available for anal cleansing	0.94 (0.80-1.11)	0.450	0.96 (0.80-1.15)	0.673	0.80 (0.47-1.37)	0.423	0.77 (0.57-1.06)	0.105
Always use school latrine/toilet	0.78 (0.40-1.54)	0.480	1.11 (0.51-2.41)	0.792	Insufficient obs		0.29 (0.10-0.85)	0.024**
Days absent from school in the last one week:								
One day vs never absent	1.03 (0.86-1.23)	0.480	1.04 (0.85-1.28)	0.699	0.91 (0.51-1.63)	0.752	1.14 (0.82-1.57)	0.435
Two days vs never absent	1.33 (1.03-1.71)	0.028**	1.42 (1.07-1.87)	0.014**	0.88 (0.39-2.00)	0.758	1.66 (1.05-2.62)	0.030**
More than two days vs never absent	1.37 (1.02-1.83)	0.035**	1.39 (1.00-1.94)	0.051	1.37 (0.66-2.86)	0.398	1.58 (0.95-2.63)	0.076

**Indicates significant associations (p<0.05)

Table 9: Multivariable associations between WASH conditions and any schistosome infections among school children in Kenya

Factors	*S. mansoni* (n=214)		*S. haematobium* (n=9)	
	aOR (95%CI)	p-value	aOR (95%CI)	p-value
ndividual and household factors				
Male children	1.09 (0.79-1.50)	0.607	1.08 (0.23-5.03)	0.923

ECD children	0.75 (0.46-1.22)	0.249	Insufficient obs	
Soil-eating behavior	0.67 (0.38-1.18)	0.169	Insufficient obs	
Not wearing shoes	1.14 (0.74-1.75)	0.558	0.83 (0.13-5.21)	0.844
Did not receive treatment during last MDA	1.14 (0.66-1.97)	0.647	Insufficient obs	
Household head education level:				
No formal education vs Secondary and above	0.93 (0.56-1.52)	0.762	3.10 (0.14-6.59)	0.470
Primary education vs Secondary and above	0.84 (0.51-1.37)	0.486	0.27 (0.04-1.84)	0.181
Improved water source	0.86 (0.59-1.25)	0.432	Insufficient obs	
Handwashing facility with soap and water always available	0.89 (0.51-1.54)	0.681	Insufficient obs	
Toilet/latrine available	0.61 (0.28-1.33)	0.215	Insufficient obs	
Tissue/newspaper/water always available for anal cleansing	0.92 (0.56-1.54)	0.735	Insufficient obs	
Roof materials:				
Iron sheets vs tiles	0.17 (0.01-2.22)	0.176	0.55 (0-***)	0.840
Grass/thatch/makuti vs tiles	0.19 (0.01-2.59)	0.211	0.78 (0-***)	0.938
Household possessions:				
Electricity	1.26 (0.87-1.82)	0.214	5.99 (0.17-20.5)	0.321
Bicycle	1.41 (1.00-1.99)	0.049**	0.28 (0.04-1.95)	0.199
Mobile phone	0.73 (00.40-1.31)	0.284	0.09 (0.01-5.61)	0.252
School factors				
Tissue/newspaper/water always available for anal cleansing	1.01 (0.67-1.53)	0.964	0.31 (0-28.19)	0.609
Drinking water always available	0.82 (0.41-1.63)	0.576	Insufficient obs	
Days absent from school in the last one week:				
One day vs never absent	1.08 (0.69-1.69)	0.728	0.51 (0.05-5.19)	0.572
Two days vs never absent	0.81 (0.33-2.02)	0.658	0.64 (0.06-6.98)	0.711
More than two days vs never absent	0.42 (0.12-1.43)	0.166	0.84 (0.11-6.62)	0.866

**Indicates significant associations (p<0.05)

Supplementary File:

Table S1 Intensity thresholds for light, moderate and heavy infections with *A. lumbricoides*, *T. trichiura*, hookworms and schistosomes

Helminth	Intensity Threshold		
	Light	Moderate	Heavy
A. lumbricoides	1 – 4999 epg	5000 – 49999 epg	≥ 50000 epg
T. trichiura	1 – 999 epg	1000 – 9999 epg	≥ 10000 epg
Hookworms	1 – 1999 epg	2000 – 3999 epg	≥ 4000 epg
S. mansoni	1 – 99 epg	100 – 399 epg	≥ 400 epg
S. haematobium	1 – 50 eggs/10ml urine		≥ 50 eggs/10ml urine

Figure 1: STH Prevalence Distribution after Five Years of Deworming
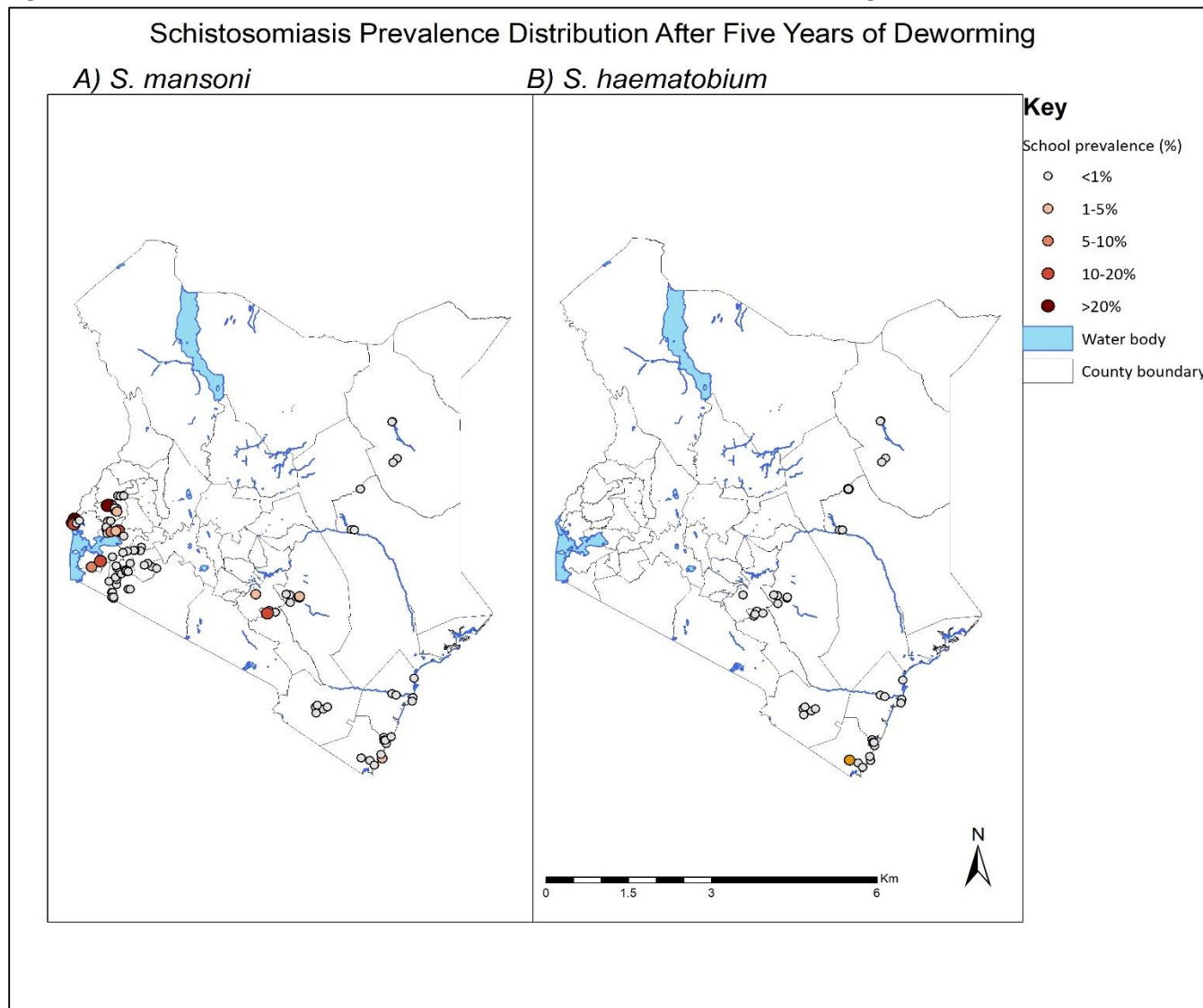

STH Prevalence Distribution After Five Years of Deworming
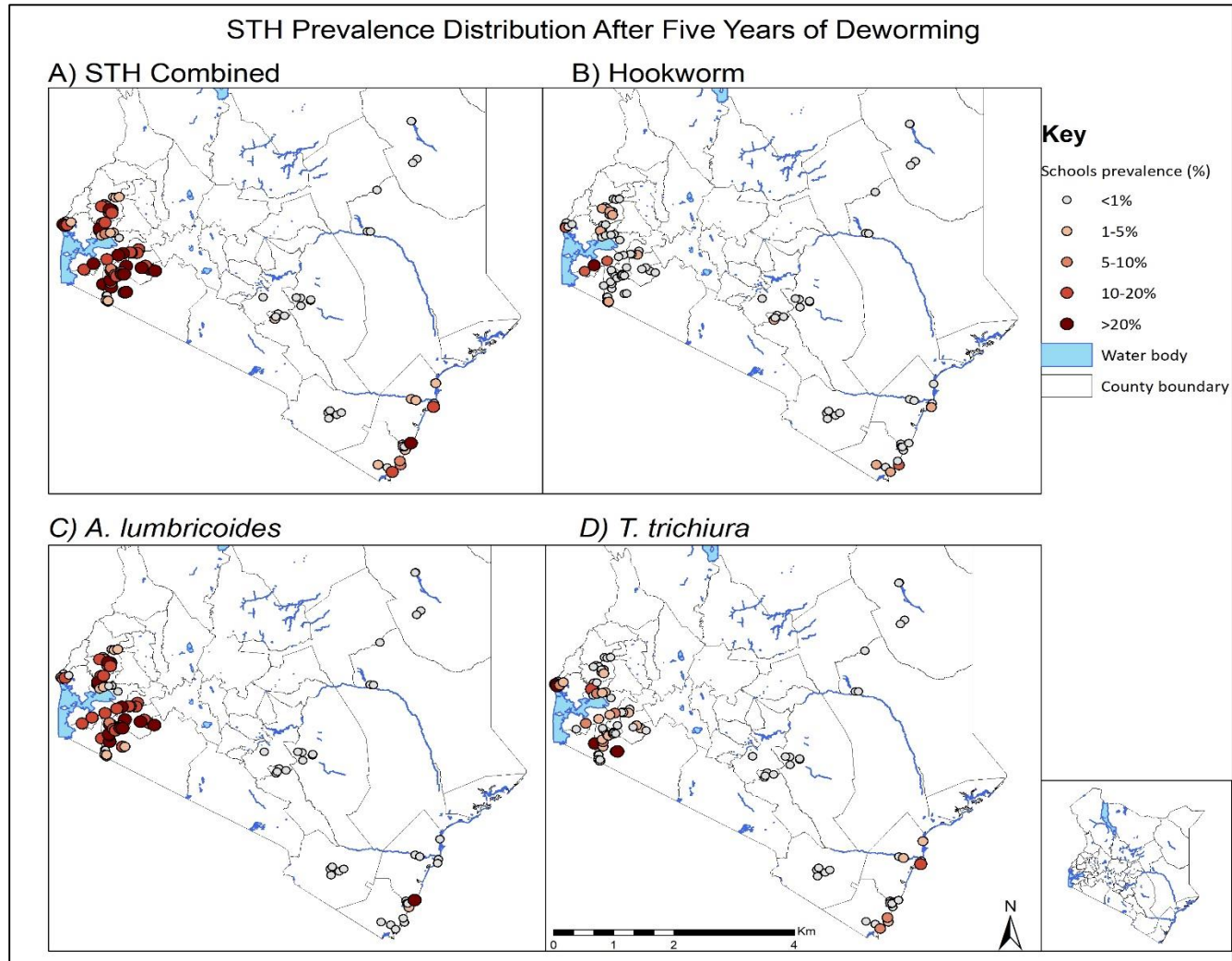
Figure 2: Schistosomiasis Prevalence Distribution after Five Years of Deworming

Schistosomiasis Prevalence Distribution After Five Years of Deworming

A) *S. mansoni*

B) *S. haematobium*

Key

School prevalence (%)

- ○ <1%
- ○ 1-5%
- ○ 5-10%
- ● 10-20%
- ● >20%
- Water body
- County boundary

Km
0   1.5   3   6

N

Figure 3: Distribution of School and Household Water and Sanitation Conditions

School and Household Water and Sanitation Conditions

A) School pupil:latrine ratio

B) School water source

C) Improved water source at home

D) Toilet/latrine availability at home

Pupil:latrine ratio
- <30
- 30-60
- 60-90
- >90

School water source
- Improved
- Unimproved

Proportion of children with improved home water source
- <25%
- 25-50%
- 50-75%
- >75%

Proportion of pupils with home toilet/latrine
- <25%
- 25-50%
- 50-75%
- >75%

N

Km
0   1   2   4