Malawi Impact Survey 2015
2nd Follow Up (FU2)

Contents

[Associated spreadsheet: Malawi Impact FU2 Results 2015-09-04.xlsx]

[Associated impact protocol: MWI_FU5_Health Impact Protocol_JW]

1   Executive Summary

Malawi is endemic for both *S. haematobium* and *S. mansoni* and the soil transmitted helminths (STH). Annual mass treatment of enrolled school-age children (SAC) with praziquantel (PZQ) began in 2009 by the Malawi Government with support from the WHO and World Vision. Treatment was initially carried out in 10 districts and scaled up to 18 districts by 2011, however, treatment and geographical coverage were limited due to availability of PZQ and financial restrictions. Additional support to the National Schistosomiasis and STH)Control Programme was provided with the UK Department for International Development (DFID) and the SCI under the Integrated Control of Schistosomiasis in Sub Saharan Africa (ICOSA) project in 2011.

The health impact of the national control programme on the infection and morbidity of schistosomiasis and STH can be monitored through parasitological surveys. The baseline impact survey was carried out in March 2012 with the 1st follow (FU1) up being done in March 2014 prior to the mass drug administration in April 2014. This report summarises and discusses the results from the 2nd follow-up survey (FU2) which was carried out in the 22 sentinel schools in the districts of Balaka, Blantyre, Chiradzulu, Lilongwe, Mwanza, N. and S. Mzimba, Neno, Ntcheu and Ntchisi in March 2015. This survey year saw a switch from a longitudinal survey design to a cross-sectional design which occurred following internal SCI reviews of the data and issues arriving from field surveys. The change in survey design led to the ages of children included in the study to be altered slightly to allow for like for like comparison over time and to capture those with the highest burden of infection. The training of the technicians prior to the field visit concentrated on the change and justification for changes to the protocol as well as the field-based application of the protocol.

During the FU2 survey 2,279 SAC were sampled across the sentinel schools. Data were entered in Malawi and the databases were cleaned and analysed by the Senior Biostatistician at SCI. The analyses were performed across all ages, and also in the age groups 6 to 8 years and 11 to 12 years of age. However, to allow for a more 'like-for-like' comparison between years the 6-8 year olds data were focused on. The main results showed that: *S. mansoni* prevalence, mean intensity of infection and prevalence of heavy infection all decreased between baseline and FU2, although the difference in prevalence was non-significant and, for intensity and heavy infection, the models did not converge probably due to the very low values observed; Prevalence of *S. haematobium* significantly decreased from baseline as did the prevalence of heavy infection between baseline and FU2, reduction in mean infection intensity between baseline and FU2 was observed but was not significant; there was a large and highly significant decrease in the prevalence of haematuria between baseline and FU2; the prevalence of any STH increased from baseline in FU2 and this was determined by hookworm infection as both *Ascaris lumbricoides* and *Trichuris trichiura* were not detected.

The overall prevalence and intensity of both schistosomiasis species and the STH reported in Malawi is low, however, it remains to be discussed with the MOH, when the country should carry out a re-assessment mapping survey to determine if treatment protocols should be changed.

2   Background to the impact survey

Schistosoma mansoni, *S. haematobium* and the STH are endemic in all 28 districts in Malawi. A baseline Health Impact survey was carried out prior to the first national MDA in March 2012 in 22 sentinel schools 2,642 children sampled. In March 2014, the first follow up occurred preceding the second national MDA campaign (April – June 2014) in the same 22 schools with 1458 children followed up longitudinally and 846 new students for the cross-section in line with the original protocol. Following 2014, internal team discussions at SCI and with in-country partners led to the adaption of the original protocol. The consensus is outlined below.

Changing from cohort to cross-sectional survey design:

- Cohort studies can lead to high dropout rates as seen in Malawi and taking this into account during analysis will be extremely complicated.
- Using follow up ID's for the children can be very complicated in the field and may lead to mislabelling and misdiagnosis.
- We know the benefits of treatment to individuals, additional evidence is now needed to show the benefit to the population specific age groups and in the community.

Dropping the morbidity indicators:

- There is existing evidence showing relationships between infection and morbidity
- There are too many confounders to explain any changes we see in these indicators
- It is not ethical to take measurements and not address the issues – SCI does not have the capacity to address anaemia and under-nutrition.

Sampling by age rather than grade

- It is not too challenging to sample by age, rather than by grade, when in the field at rural schools
- Ultimately in the analysis we will be looking at children by age and not grade
- In Malawi where baseline has already been conducted they will continue to sample those aged 6, 7, 8 years to allow a direct comparison to baseline, and in order to collect information on those in the higher risk groups i.e. aged 10 - 14 years additional sampling of 11 and 12 years olds will be carried out
- In countries where baseline is yet to be conducted, as the age intensity profiles for SCH peak at 12 to 20 years of age we will sample from the older grades of children. The sample of 120 will be done by age from the four oldest grade in a school.

The previous report Health Impact Report and both study protocols can be found in the following folders:

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S:\SCI - post 3 June 2011\Current programmes\DFID\ICOSA\COUNTRIES\Malawi\M&E\Impact\Protocol\FY2\ MWI_FY5_Health Impact Protocol_JW

3 Impact survey data collection methods
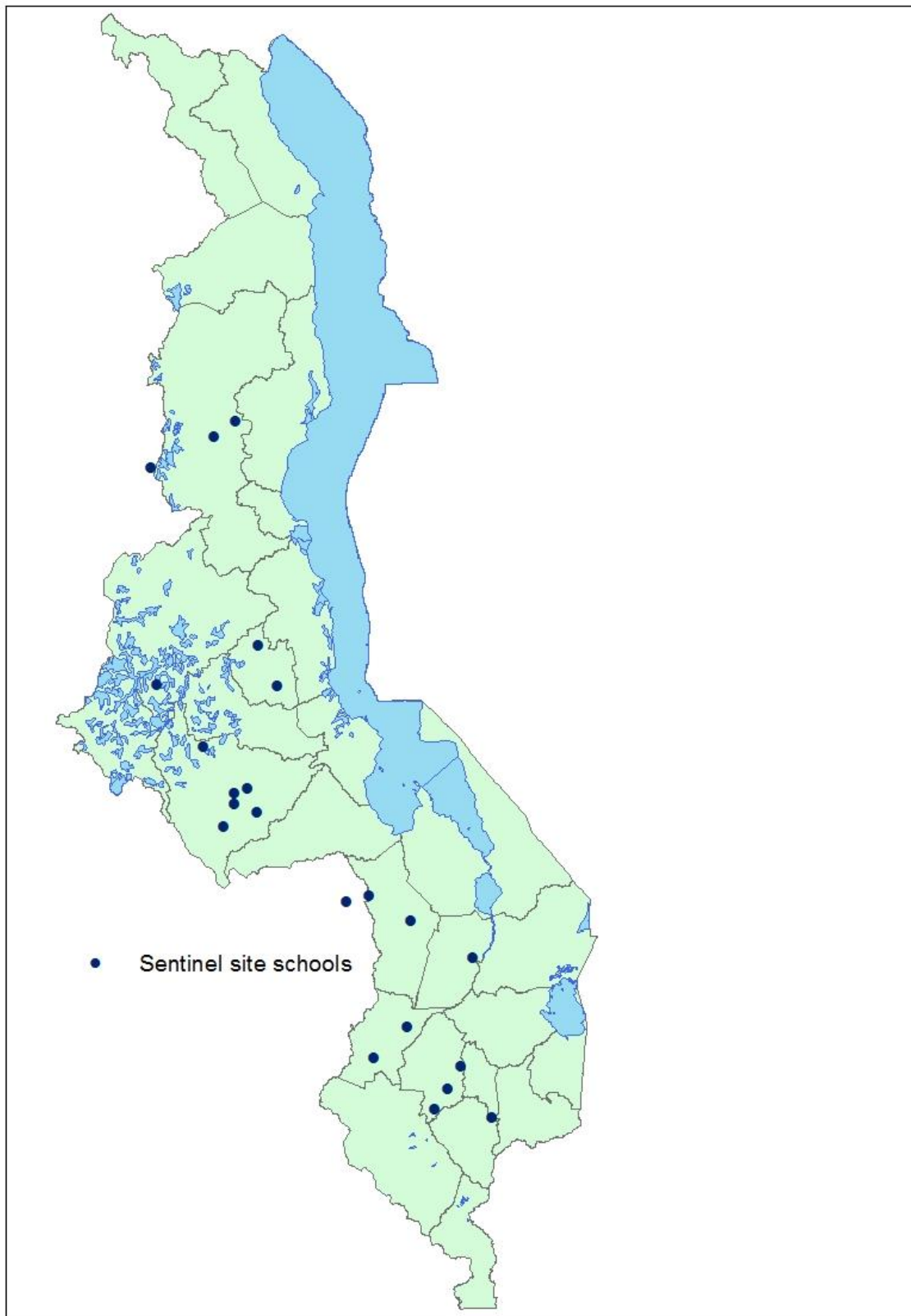
3.1 School selection

Selection of schools is unchanged from baseline as sentinel sites do not change throughout the life of the study. See baseline protocol for study site selection

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3.1.1 Map of study sites

Sentinel site schools

3.2 Field methodology

All of the technicians involved in this FU2 survey were involved in FU1 data collection. For this reason training was focussed on changes to protocol and previous errors on data recording in the field. In particular how to record the volume of urine.

Additional points that came out of the training:

- Technicians believe the children will not run away as we are not taking blood this year
- Previously children were only registered when they brought the samples back – this is not the case this year. Children will be registered when the bottles are handed out
- How to record if a sample was not delivered compared to negative so that the data entry staff can easily understand
- The school that was reportedly 'closed' last year will be available.
- A few schools will have problems with access due to the recent flooding however they will make arrangements for those schools.

Teams were made up of the following individuals.

Team *Mansoni*	Team *Haematobium*
January Gausi	Susan Ngambi
Alfred Elias	Eddie Chipinga
Gervase Gamadzi	Veronica Zumani
Maxwell Phiri	James Kaphiryo
Stephen Kaluzi	

The change in protocol from cohort to cross-sectional data collection between years FU1 and FU2 led to changes in the ages of pupils sampled each year (see table 1). The protocol in FU2 was for children aged between 6 to 8 years and 11 to 12 years to be sampled. The 6 to 8 year olds enables a like-for-like comparison with the data collected at baseline, while the older children enable a comparison between the age groups in FU2. In addition, as mentioned in section 2, we are no longer collecting anthropometrics height and weight and anaemia. Previous protocols are located in the M&E impact folder. Unless stated methods remain the same as previous years.

Study Year	Supplementary cross-sectional study	Age in longitudinal/cross-sectional study		
Baseline		6	7	8
FU1	6	7	8	9
FU2	11-12	6	7	8
FU3	11-12	6	7	8
FU4	11-12	6	7	8

Table 1: Age distribution of children to sample from the protocol

Table 2**Error! Reference source not found.** shows the distribution of children sampled in each year. At baseline, the majority (78%) of children were between 6 and 8, whereas in FU1 difficulties in following-up children meant that the age distribution was somewhat different from that expected, and here only 38% of children were aged between 6 and 8. In FU2 71% of the children were between ages 6-8 and 28% of the children were between 11 &12. Sampling children in these older age groups enables us to determine if there were differences in prevalence and intensity between the age groups but makes comparison between years more complicated.

Age	Baseline		FU1		FU2	
	N	%	N	%	N	%
4	0	0%	10	0%	0	0%
5	20	1%	110	5%	0	0%
6	400	15%	279	12%	606	27%
7	471	18%	252	11%	519	23%
8	1190	45%	357	15%	491	22%
9	360	14%	283	12%	1	0%
10	146	6%	713	30%	3	0%
11	14	1%	198	8%	554	24%
12	4	0%	84	4%	81	4%
13	0	0%	33	1%	0	0%
14	0	0%	17	1%	0	0%
15	0	0%	3	0%	0	0%
missing	25	1%	14	1%	24	1%

Table 2: Age distribution of sampled children within each year

Deviations from the protocol:
Technicians were asked to record exact amounts of volume received from the students and if no urine was provided to draw a line through the field to highlight that it wasn't provided. If any volume of urine was provided technicians were to record the total volume filtered. It appears this was done in the initial few days, however, consistent high levels of 10ml of urine recorded raises the question whether it was continued throughout the survey.

In some instances more than the 120 children were sampled this was to allow for a proportion of children to be lost when returning the samples. However, in a few schools more than the required 120 retuned with full containers.

Apart from these, there were no exceptional deviations to protocol and more details of the field methodology can be found here:

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3.3 Ethical considerations

Ethical approval for the survey was obtained from the National Health Sciences Research Committee (NHSRC) in Malawi.

Head teachers were asked to give written consent for the children and the children themselves were free to refuse to participate at any time.

4 Data cleaning

4.1 Data cleaning summary

Data was cleaned and analysed by the SCI Senior Biostatistician (Michelle Clements). The data was provided to SCI in two files – the school and pupil file and was broadly of a good quality.

There seemed to be a very low number of instances where urine volume was recorded as being less than 10ml, and the SCI Program Manager asked the Malawi Data Officer to check the paper forms for all instances where urine volume was less than 10ml which created an additional file.

4.2 Deviations from protocol

Full details of data cleaning can be found in '*Malawi Impact FU2 data cleaning notes.xlsx*', and a summary of the data is provided below:

- The protocol was for 120 children to be sampled per school. The number of pupils recorded in each school ranged from 85 to 131, with the average being 106.
- The protocol was for 50% of the children sampled in each school to be boys and 50% to be girls. All schools sampled between 41% and 52% boys, except school 007.021 which is an all-boys school and sampled 100% boys, and school 003.022 which sampled 38% boys. There was a total of 14 pupils for which gender was missing. There was one instance where gender was recorded as 0, and one instance were gender was recorded as 6 – in both instances we made the gender missing.
- The protocol was for ages 6, 7, 8, & 11 to be sampled in each school. All schools sampled at least 80% of pupils in the protocol age groups, and there were 21 pupils where age was missing. There were one instance where age was recorded as 1 and two instances where age was recorded as 2 – in all three cases we made age missing.
- There was one school for which the district code did not match the district name. School 021.023 is recorded as being in district code 12 but district name Neucheu. This discrepancy has been consistently recorded throughout the data collection. As the named district is likely to be correct it will be recorded as this in the future. Also verified by GPS.
- There were 15 pupils where the school codes created from the pupil ID did not match any other school codes. We used the interview dates and interviewer initials in order to determine the correct school and changed the pupil ID accordingly.
- There was one instance where Kato-Katz data was collected in a non-Kato-Katz school, and we removed all Kato-Katz data associated with this pupil.
- There were 45 instances, from 4 schools, where pupil ID was duplicated. In school 012.021 there were 38 instances where pupil ID was duplicated, and further inspection showed that all associated data was also duplicated. Consequently, we removed one instance of each duplicated row. For the remaining 7 duplications, there were 4 duplications where one row

had no data associated with it and so we removed the rows without any data, and there were 3 duplications that had the same data recorded twice and so we removed one row each time.

- There was one instance where the urine volume file recorded a different urine volume than the pupil file and here we took the urine volume file to be correct. There was also 16 pupils where volume of urine was recorded but egg count was missing and here we took the egg count to be zero. There was three instances where there was no urine volume recorded all with zero egg counts, and 3 instances where both urine volume and egg count were zero; in all six cases we took the urine volume to be 10ml and egg count to be zero.

5   Results

The variables analysed were:

1. *S. mansoni* assessed using Kato-Katz
2. *S. haematobium* assessed using urine filtration
3. Haematuria assessed by haemastix dipstick
4. Any STH assessed using infection status data from the three STH's, as described below
5. *Ascaris* assessed using KK
6. Hookworm assessed using KK
7. *Trichuris* assessed using KK
8. See **Appendix II** for full details of the statistical methodology.

5.1   Summary table of descriptive statistics

Table 3 shows parasitological variables in each year for different age groups. The first set of columns show the parasitological variables in each year using all available data, whereas the second set uses only data collected on 6-8 year olds, the age group where the majority of data was collected in FU1 & FU2. We examined the trends evident in these two sets of data and found that they were broadly the same across time. Consequently, we focus below on the 6-8 year olds only as this allows for a more 'like-for-like' comparison between years. The final set of columns shows the parasitological variables collected in FU2 only, split by age group. The older age groups were also sampled in FU2 to allow us to determine if there were any large differences between younger and older ages in FU2. Results from FU2 split by age group are discussed in more detail in the separate results by species and are presented in the associated spread sheet.

Group	Everybody			6-8 year olds only			FU2 Age	
	Baseline	FU1	FU2	Baseline	FU1	FU2	6 to 8	11 to 12
N Sm	1091	613	772	534	182	530	530	237
Prev Sm	1.9%	0.2%	1.6%	2.2%	0.0%	1.5%	1.5%	1.7%
Mean Sm (epg)	1.9	0.1	0.7	2.1	0.0	0.6	0.6	0.9
Prev Sm heavy	0.1%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%
Prev Sm mod	0.3%	0.0%	0.3%	0.2%	0.0%	0.2%	0.2%	0.4%
Prev Sm light	1.6%	0.2%	1.3%	1.9%	0.0%	1.3%	1.3%	1.3%
N Sh	2628	2171	2115	2060	835	1499	1499	599
Prev Sh	9.9%	5.9%	4.9%	9.2%	5.9%	4.3%	4.3%	6.3%
Mean Sh (ep10ml)	4.3	1.7	1.1	3.6	1.4	1.0	1.0	1.2
Prev Sh heavy	1.9%	0.8%	0.6%	1.6%	0.6%	0.6%	0.6%	0.7%
Prev Sh light	7.9%	5.2%	4.3%	7.6%	5.3%	3.7%	3.7%	5.7%
N Haem	2630	2353	2135	2061	888	1515	1515	603
Prev Haem	10.0%	13.4%	0.3%	9.4%	11.6%	0.2%	0.2%	0.7%
N AnySTH	1091	611	768	534	182	527	527	236
Prev Any STH	0.3%	0.8%	1.8%	0.0%	1.1%	2.1%	2.1%	1.3%
N Asc	1091	611	771	534	182	529	529	237
Prev Asc	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Mean Asc (epg)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prev Asc heavy	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Prev Asc mod	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Prev Asc light	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
N Hkw	1091	612	771	534	182	529	529	237
Prev Hkw	0.2%	0.8%	1.8%	0.0%	1.1%	2.1%	2.1%	1.3%
Mean Hkw (epg)	0.3	0.3	0.6	0.0	0.5	0.8	0.8	0.2
Prev Hkw heavy	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Prev Hkw mod	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Prev Hkw light	0.2%	0.8%	1.8%	0.0%	1.1%	2.1%	2.1%	1.3%
N Tri	1091	610	768	534	182	527	527	236
Prev Tri	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Mean Tri (epg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Prev Tri heavy	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Prev Tri mod	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Prev Tri light	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 3: Parasitological variables for different age groups in each year.
Abbreviations: Sm = S. mansoni; Sh = S. haematobium; Asc = Ascaris; Hkw = hookworms; Tri = Trichuris; AnySTH = any of Ascaris, hookwoms or Trichuris; N = number of children sampled; Prev = prevalence (proportion of children positive for focal parasite); Mean = arithmetic mean infection intensity; epg = eggs per gram; ep10ml = eggs per 10 millilitre; Prev heavy/mod/light = proportion of children in each infection category according to WHO guidelines

5.2 Parasitological results by species

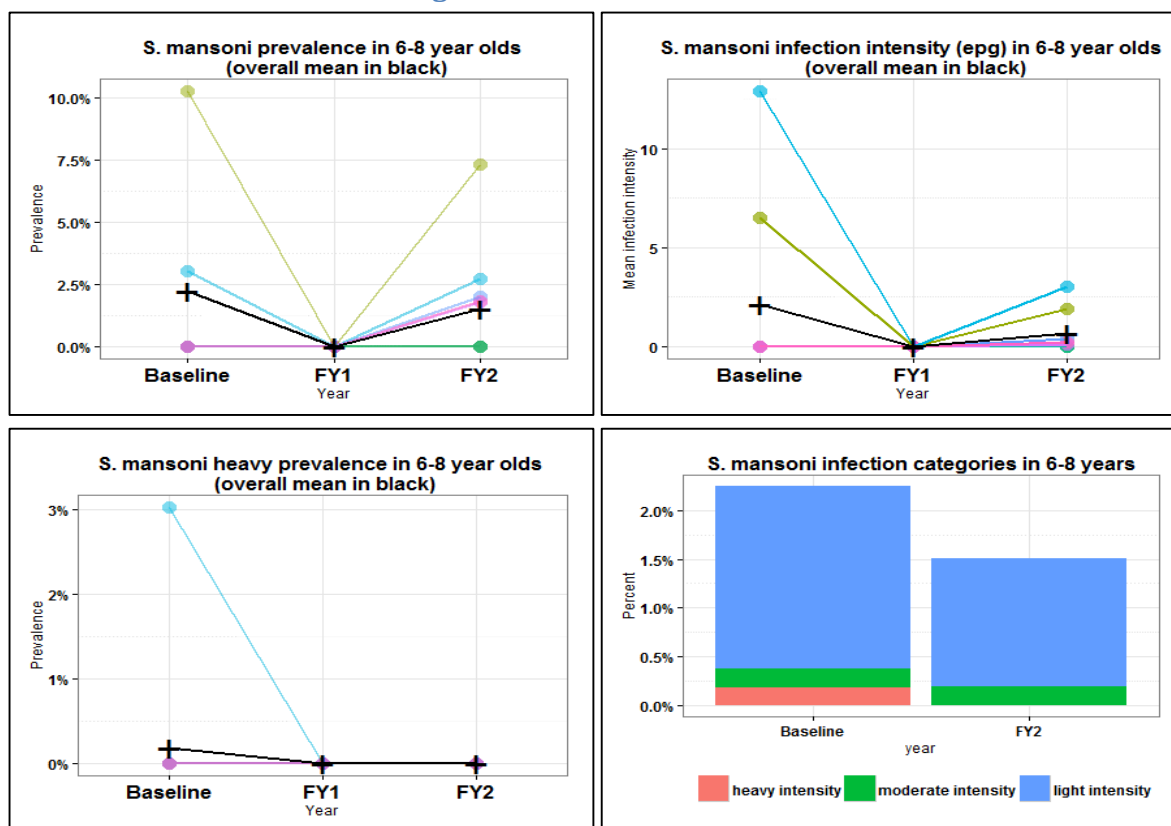### 5.2.1 *S. mansoni* assessed using Kato-Katz

Figure 1: S. mansoni over time in 6 – 8 year olds. Each coloured line represents a single school and the black line represents the overall mean.

S. mansoni prevalence, mean intensity of infection and prevalence of heavy infection all decreased between baseline and FU2, although the difference in prevalence was non-significant and, for intensity and heavy infection, the models did not converge probably due to the very low values observed (Figure 1; Table 4). Comparison between age groups in FU2 showed that both prevalence and mean intensity of infection were slightly higher in the older age group (Table 3; prevalence in 6 - 8 year olds = 1.5%, prevalence in 11 - 12 year olds = 1.7%), although these differences were not significant (see associated spread sheet). No individuals with heavy *S. mansoni* infections were sampled in FU2. All *S. mansoni* measures were higher in FU2 than in FU1, however, such a difference can be expected when cross-sectionally examining low numbers of individuals with infection.

S. mansoni: 6-8 year olds only	Baseline	FU1	FU2	% change base - FU2	p-value of difference
N tested	534	182	530	n/a	
Prevalence	2.2%	0.0%	1.5%	-33%	0.793
Mean infection intensity	2.1	0.0	0.6	-70%	d.n.c
Prevalence of heavy infection	0.2%	0.0%	0.0%	-100%	d.n.c
% moderate infection	0.2%	0.0%	0.2%	1%	n/a
% light infection	1.9%	0.0%	1.3%	-29%	

Table 4: S. mansoni over time in 6 – 8 year olds. D.n.c indicates that the model did not converge – most likely due to very low prevalence or infection intensity.

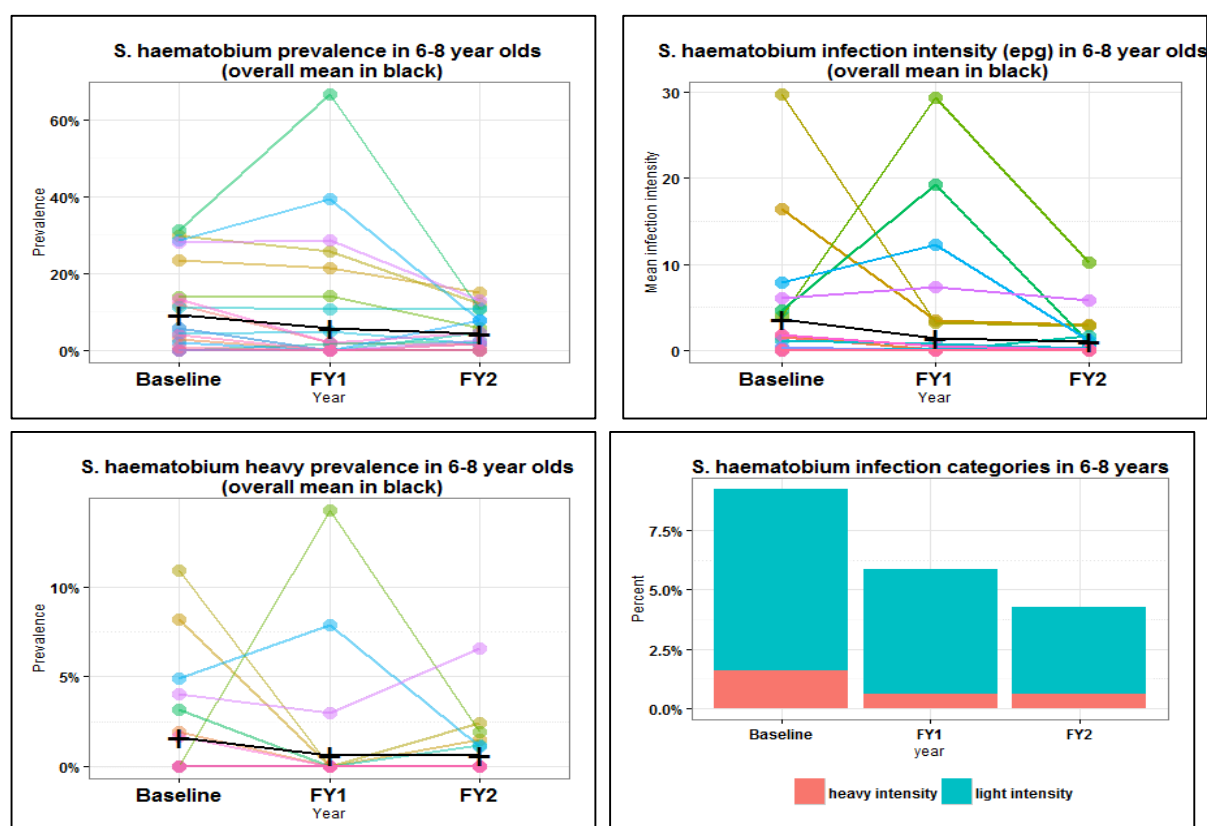## 5.2.2 *S. haematobium* assessed using Urine Filtration

Figure 2: S. haematobium over time in 6 – 8 year olds. Each coloured line represents a single school and the black line represents the overall mean.

Prevalence of *S. haematobium* significantly decreased from 9.2% at baseline to 4.3% in FU2 (Table 5, $p < 0.001$) and the prevalence of heavy infection between baseline and FU2 also showed a significant decrease ($p= 0.024$). A reduction in mean infection intensity between baseline and FU2 was also observed although the change was not significant ($p= 0.093$). In FU2, the prevalence, mean intensity of infection and prevalence of heavy infection were all slightly higher in 11 - 12 year olds than in 6 – 8 year olds (Table 3; prevalence in 6 – 8 year olds = 4.3%, prevalence in 11 - 12 year olds = 6.3%) but none of these differences were significant (see associated spreadsheet).

S. haematobium: 6-8 year olds only	Baseline	FU1	FU2	% change base - FU2	p-value of difference
N tested	2060	835	1499	n/a	
Prevalence	9.2%	5.9%	4.3%	-54%	< 0.001
Mean infection intensity	3.6	1.4	1.0	-71%	0.093
Prevalence of heavy infection	1.6%	0.6%	0.6%	-63%	0.024
% light infection	7.6%	5.3%	3.7%	-52%	n/a

Table 5: S. haematobium over time in 6 – 8 year olds

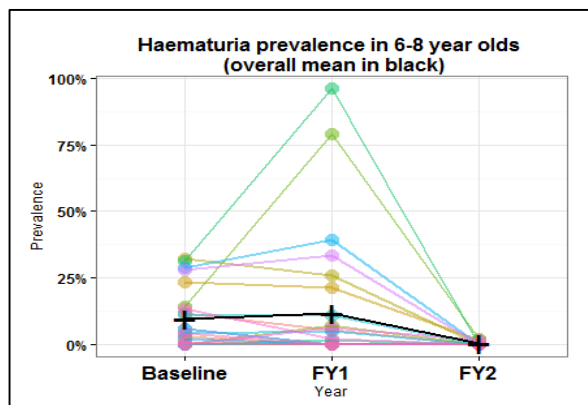### 5.2.3 Haematuria assessed using haemastix dipstick

Figure 3: Prevalence of haematuria measured using dipstick in 6 – 8 year olds over time. Each coloured line represents a single school and the black line represents the overall mean.

There was a large and highly significant decrease in the prevalence of haematuria between baseline and FU2, from 9.4% at baseline to 0.2% at FU2 (Figure 3; Table 6). There were two schools (006-021 & 006-023) where large increases in haematuria were observed between baseline and FU1 before decreasing substantially in FU2. We have investigated this further and these same patterns are still evident when data from all sampled children within the school is used, rather than just data from 6-8 year olds ('Tables by school' tab of associated spread sheet). Prevalence of haematuria was overall slightly higher in 11 - 12 year olds than in 6 – 8 year olds (Table 3; prevalence in 6-8 = 0.2%, prevalence in 11-12 = 0.7%) but this difference was not significant (see associated spread sheet).

Haematuria: 6-8 year olds only	Baseline	FU1	FU2	% change base - FU2	p-value of difference
N tested	2061	888	1515	n/a	
Prevalence	9.4%	11.6%	0.2%	-98%	< 0.001

Table 6: Prevalence of haematuria measured using dipstick in 6 – 8 year olds over time
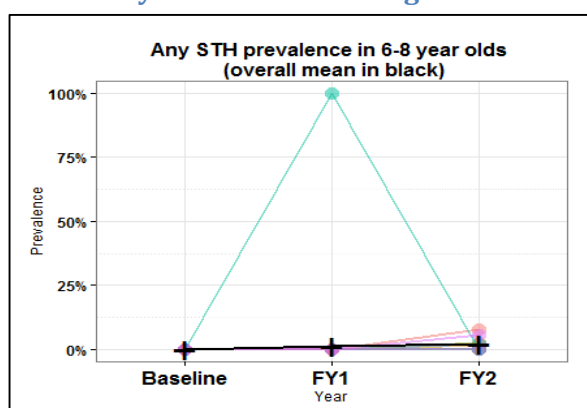
5.2.4 Any STH assessed using Kato-Katz

Figure 4: Prevalence of any STH in 6 – 8 year olds over time. Each coloured line represents a single school and the black line represents the overall mean.

The prevalence of any STH in 6 – 8 year olds increased from 0% in baseline to 2.1% in FU2 (Figure 4; Table 7). The model assessing significance of this difference did not converge, most likely due to the very small numbers of positive children observed. There was one school (006-021) where 100% of the children sampled in FU1 had at least one STH. However, further inspection revealed that there were only two children sampled in this school during FU1 (due to the protocol being to only sample those children also sampled at baseline and difficulties with follow-up) and consequently this result should be treated with caution. It is reassuring to see that none of the 49 6 - 8 year olds in FU2 in this school tested positive for any STH ('tables by school' in associated spread sheet).

Any STH: 6-8 year olds only	Baseline	FU1	FU2	% change base - FU2	p-value of difference
N tested	534	182	527	n/a	
Prevalence	0.0%	1.1%	2.1%	#DIV/0!	d.n.c

Table 7: Prevalence of any STH in 6 – 8 year olds over time. D.n.c indicats the model did not converage, most likely due to the low prevalence observed.

5.2.5 *A. lumbricoides* assessed using Kato-Katz

No *A. lumbricoides* infections were detected in 6 - 8 year olds in any year of the study (Table 8). Additionally, no *A. lumbricoides* infections were detected in FU2 in either age group.

A. lumbricoides: 6-8 year olds only	Baseline	FU1	FU2	% change base - FU2	p-value of difference
N tested	534	182	529		
Prevalence	0.0%	0.0%	0.0%		
Mean infection intensity	0.0	0.0	0.0		
Prevalence of heavy infection	0.0%	0.0%	0.0%	n/a	
% moderate infection	0.0%	0.0%	0.0%		
% light infection	0.0%	0.0%	0.0%		

Table 8: A. lumbricoides over time in 6 – 8 year olds

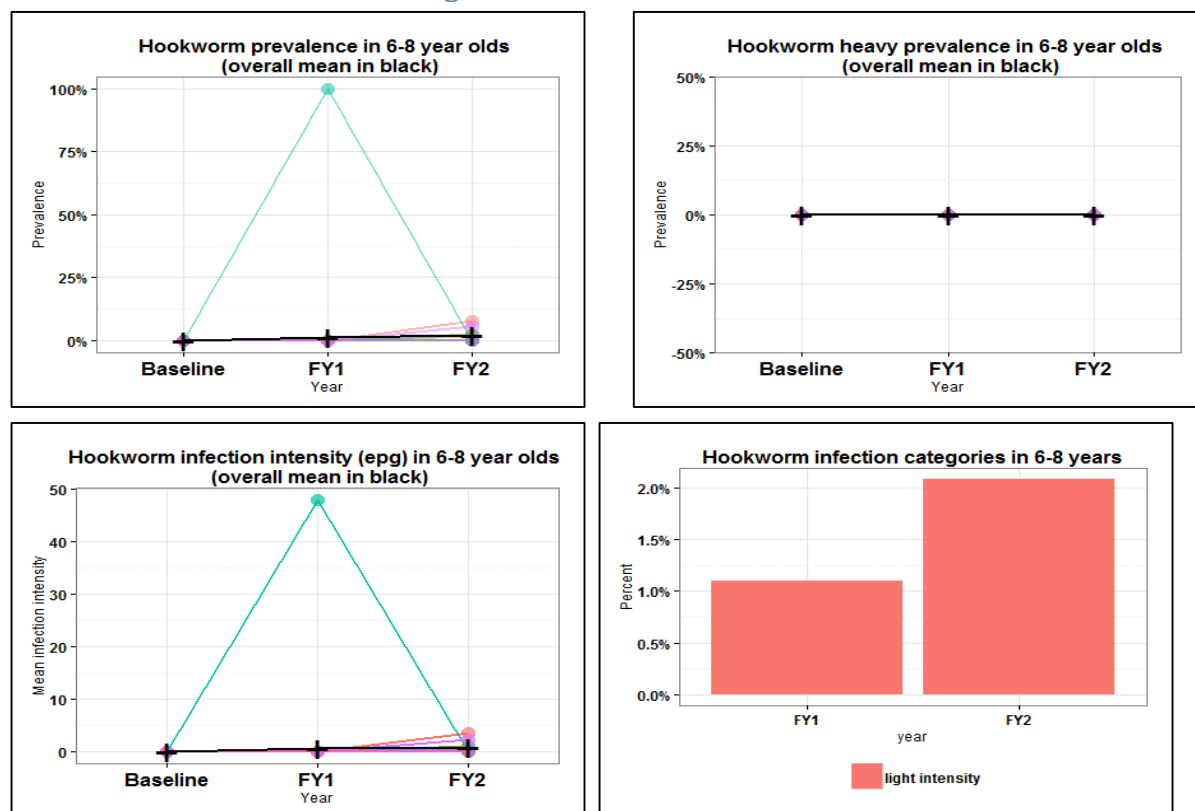## 5.2.6   Hookworm assessed using Kato-Katz

Figure 5: Hookworm over time in 6 – 8 year olds. Each coloured line represents a single school and the black line represents the overall mean.

Hookworm prevalence in 6 – 8 year olds increased from 0% at baseline to 2.1% at FU2 (Figure 5), although this difference was not significant (Table 9 nu). Correspondingly, there was also an increase in mean intensity of infection between baseline and FU2, although the model assessing the significance of this difference did not converge. No 6 – 8 year olds were found to have heavy infections during any year of the study. Prevalence and mean intensity of infection in FU2 was slightly lower in the 11 -12 year olds than in the 6 – 8 year olds but this difference was not significant. There was one school (006-021) where 100% of the children sampled in FU1 tested positive for hookworm. However, further inspection revealed that there were only two children sampled in this school during FU1 (believed to be due to large numbers of children dropping out of the study between baseline and FU1 in this this school) and consequently this result should be treated with caution. None of the 49 6 - 8 year olds in FU2 in this school tested positive for hookworm ('tables by school' in associated spread sheet).

Hookworm: 6-8 year olds only	Baseline	FU1	FU2	% change base - FU2	p-value of difference
N tested	534	182	529	n/a	
Prevalence	0.0%	1.1%	2.1%	#DIV/0!	0.810
Mean infection intensity	0.0	0.5	0.8	#DIV/0!	d.n.c
Prevalence of heavy infection	0.0%	0.0%	0.0%	#DIV/0!	n/a
% moderate infection	0.0%	0.0%	0.0%	#DIV/0!	n/a
% light infection	0.0%	1.1%	2.1%	#DIV/0!	

Table 9: Hookworm over time in 6 – 8 year olds. d.n.c indicates the model did not converge, most likely due to the low intensity observed.

5.2.7 *T. trichiura* assessed using Kato-Katz

No *T. trichiura* infections were detected in 6 - year olds in any year of the study (Table 89). Additionally, no *T. trichiura* infections were detected in FU2 in either age group (Table 2).

T, trichiura: 6-8 year olds only	Baseline	FU1	FU2	% change base - FU2	p-value of difference
N tested	534	182	527		
Prevalence	0.0%	0.0%	0.0%		
Mean infection intensity	0.0	0.0	0.0	n/a	
Prevalence of heavy infection	0.0%	0.0%	0.0%		
% moderate infection	0.0%	0.0%	0.0%		
% light infection	0.0%	0.0%	0.0%		

Table 10: T. trichiura over time in 6 – 8 year olds

6 Discussion

6.1 Impact survey results

S. mansoni: Prevalence decreased to zero in FU1 but was back to being not significantly different from baseline in FU2. Due to the very low initial levels of we cannot conclude if this is a true effect or simply sampling variation due number of schools sampled. However, baseline was at a low level to begin with so we can say with confidence that the low levels of *S. mansoni* are being maintained. This should be monitored closely. FU3 will provide evidence of the impact as additional information on the older age group who appear to have higher prevalence and intensity will enable supplementary verification.

S. haematobium: Consistent reductions have been observed in each year in all metrics which is encouraging. Additionally, prevalence of haematuria dropped dramatically in FU2 which could be indicating a reduction in low intensity infections that are not detected with urine filtration. Additional supervision during FU3 data collection on recording of urine volumes will have to be carried out to ensure correct volumes are being used to calculate intensity.

STH's: STH prevalence is low with hookworm being the predominant species found, we have found very little evidence of *A. lumbricoides* infections and no evidence of *T. trichiura* infection. There have been consistent increases in hookworm over the two follow-up years of the study however, infection is still at a very low level. This should be monitored closely. Low albendazole availability during treatment following baseline and FU1 data collection may be related to the increase in Hookworm prevalence. This is of particular importance as the national lymphatic filariasis elimination program, who have been treating annually with ALB, will be stopping MDA in the next few years. The national schistosomiasis control program will to monitor the prevalence of STH's through the sentinel site schools and these sites will pick up any increase in prevalence due to the cessation of the lymphatic filariasis program.

In order to enable a direct comparison to baseline and report on the true impact the participants sampled in this follow up were from the lower age groups which are reported to harbour lower

prevalence of disease overall. Data collection in subsequent years which will include samples from the 11 - 12 year olds will allow additional verification on the impact of the treatments.

Overall prevalence and intensity reported here within Malawi is low, however remains to be discussed with the MOH, when the country should carry out a re-assessment mapping survey to determine if treatment protocols should be changed.

6.2   Learnings for the future

Within Malawi it is clear that prevalence of S. *mansoni* in particular is very low. There may be other reasons for this other than solely treatment with PZQ and therefore it will be important next year to include a quality assessment on the samples to ensure the results are true.

The SCI Program Manager highlighted during training that there were consistent issues with recording urine volumes in previous years. It was hoped that this would encourage the technicians to be more vigilant in recording this information, however, patterns in the data show that after day three the majority of volumes used for filtration are 10mls, a pattern that is not seen in the chools that were supervised by the Program Manager. In future data collection if it is possible, adding in a picture section to the data collection therefore recording the visual volumes of urine will improve reliability of results.

By dropping the biometric data collection, blood samples in particular, the children were more cooperative and the sampling on the day took much less time. It took the group supervised by the PM a few days to work out the logistics of the data collection as well as how to avoid data recording errors through missing information. If left to their own devices many errors could have been made during the survey. Although technicians are provided with notebooks to record results before they are entered into the forms it is clear that this was not being done in a systematic manner and better recording sheets need to be created for each school.

6.3   Other issues

None to report.

7   Appendix I: Associated documentation

7.1   Historical documentation

S:\SCI - post 3 June 2011\Current programmes\DFID\ICOSA\COUNTRIES\Malawi\M&E\Impact

7.2   Data cleaning and analysis files

R:\Countries\Malawi\Impact

7.3   Other documentation

N/A

8 Appendix II: Statistical Methodology

Summary table

Table 3 shows:

Statistic	Description and notes
N pupils with data	The number of pupils analysed for each focal species
Prevalence of infection	The arithmetic mean prevalence across all pupils with data for each focal species.
Mean intensity of infection	The arithmetic mean intensity of infection across all pupils with data for each focal species. *S. haematobium* shows the mean eggs per 10 ml of urine, whereas *S. mansoni* and STH's show the mean eggs per gram of stool.
Prevalence of heavy infection	The arithmetic mean prevalence of heavy infections (defined by WHO) across all pupils with data for each focal species.
Prevalence of light infection	The arithmetic mean prevalence of light infections (defined by WHO) across all pupils with data for each focal species.
Prevalence of moderate infection	The arithmetic mean prevalence of moderate infections (defined by WHO) across all pupils with data for each focal species.

Assessing significance of differences in prevalence

Baseline & FU2 in 6 – 8 year olds

The significance of differences in prevalence between years was assessed using generalised linear mixed models in the lme4 package in R with family set as binomial to enable analysis of 0/1 data. School was included as a random effect to adjust for non-independence of data points collected from children within the same school and to enable conclusions to be drawn at the level of the wider population rather than just at the level of the individual schools studied.

Fixed effects were age (6, 7 & 8 as a factor), sex, and year as a factor, where baseline was the intercept. Significance of the difference between baseline and FU2 was assessed using the Wald statistics outputted as standard by lme4.

Age groups in FU2

The significance of differences between age groups in FU2 was assessed in a similar way to changes between years. A binomial glmm was used with school as a random effect, but here fixed effects were simply age group (6 -8 and 11 – 12) and sex. Significance of the difference between age groups was assessed using the Wald statistics outputted as standard by lme4.

Assessing significance of differences in infection intensity

Baseline & FU2 in 6 – 8 year olds

The significance of differences in infection intensity between years was assessed using generalised linear mixed models in the lme4 package in R with family set as Poisson to enable analysis of count data. Analysis in this manner requires that all infection intensities are whole numbers (i.e. not fractions) and consequently we rounded any fractions up to the nearest whole number so that any fractions between 0 and 1 would still be recorded as positive. For *S. mansoni* and STH's, where infection intensity is normally expressed as eggs per gram by multiplying the number of eggs by 24, we first divided the epg by 24 before rounding and submitting to analysis. We divided the epg by 24 so that the distribution became less patchy and more amenable to analysis.

As with the prevalence analysis, school was included as a random effect but we also included an additional observation level random effect to adjust for any over dispersion in the data. Fixed effects were age as a factor, sex and year as a factor, and significance of the difference between age groups was assessed using the Wald statistics outputted as standard by lme4.

Age groups in FU2

The significance of differences in infection intensity between age groups in FU2 was assessed in a similar manner to the differences in infection intensity between years. A Poisson glmm was used with the mean egg count (divided by 24 where appropriate) rounded up to the nearest whole number. School was included as a random effect with an additional observation level random effect also included. Fixed effects were simply age group (6 -8 and 11 – 12) and sex, and significance of the difference between age groups was assessed using the Wald statistics outputted as standard by lme4.