

# SCHISTOSOMIASIS PRACTICAL AND PRECISION ASSESSMENTS

A manual for impact assessments

Version 3

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<sup>1</sup> <https://www.cor-ntd.org/resources/schistosomiasis-oversampling-study-survey-strategy-selection-meeting-report>

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## Acronyms

IU – implementation unit

KK – Kato-Katz

MDA – mass drug administration

PC – preventive chemotherapy

PSU – primary sampling unit

SAC – school-aged children

SCH – schistosomiasis

UF – urine filtration

## Glossary

**Impact assessment** – a survey conducted after at least 5-6 rounds of effective mass drug administration to determine whether the frequency of treatment should change or remain the same within a unit of implementation.

**Implementation unit (IU)** - The administrative unit in a country that is used as the basis for making decisions about implementing MDA; typically corresponds to a district, county, woreda, cercles, zone de santé, commune etc

**Practical assessments** - district-level (IU) impact assessments designed to determine if the prevalence of schistosomiasis in the district is sufficiently homogenous, such that the same treatment decision would be appropriate for all sub-districts (sub-IUs).

**Precision assessments** - sub-district-level (sub-IU) impact assessments appropriate in areas where the prevalence is heterogeneous around the 10% threshold and are designed to classify the prevalence in the sub-district as above or below 10%.

**Primary sampling unit** – the geographic unit that is selected first during sampling; in this manual, the primary sampling unit will be either a school or community.

**Purposive sampling** – a non-probability sampling technique where the survey planner selects sites to meet a survey goal; in this manual, purposive sampling refers to selecting sites that are expected to have the greatest prevalence of schistosomiasis; in this manual, purposive sampling is used to select sites for the Precision Assessment.

**Sub-IU** – a smaller administrative area within an implementation unit; typically corresponds to a sub- district, ward, kebele, colline, commune, sector, aire de santé etc.

**Systematic sampling** - a probability sampling method in which a random sample, with a fixed periodic interval, is selected from a larger population; in this manual, systematic sampling is used to select sites for the Practical Assessment and to select children in both the Practical and Precision Assessments.

# Background

Schistosomiasis (SCH), or bilharzia, is a parasitic disease caused by infection with the trematode blood- flukes schistosomes (Colley *et al.*, 2014). The World Health Assembly resolution 54.19 urges all member states to regularly treat at least 75% of all school-aged children (SAC) who are at risk of morbidity from SCH (WHO 2012). The current control strategy, for the majority of the African Region, recommended by the World Health Organization (WHO) is to first control the morbidity caused by these parasitic infections and then eliminate as a public health problem through preventive chemotherapy (PC) with praziquantel targeting all age groups over two years old (WHO 2011; WHO 2013; WHO 2020). Table 1 shows treatment recommendations for SCH stratified by prevalence category.

**Table 1. WHO guidelines for treatment of schistosomiasis (WHO 2022)**

Category	Prevalence	Action
High-Moderate Risk	≥10%	Treat all age groups age 2+
Low-risk	<10%	(i) where there has been a programme of regular PC, to continue the intervention at the same or reduced frequency towards interruption of transmission; or (ii) where there has not been a programme of regular PC, to use a clinical approach of test-and-treat, instead of PC

The majority of SCH-endemic countries throughout sub-Saharan Africa have successfully scaled up PC with praziquantel through either school or community platforms in districts with moderate and high schistosomiasis infection prevalence. As a result, the epidemiological profile of schistosomiasis infection is expected to have changed considerably and it is important to reassess the prevalence of schistosomiasis post-treatment to inform subsequent intervention strategies. The Expanded Special Project for Elimination of NTDs (ESPEN) recommends that SCH programmes that have conducted at least 5 rounds of effective PC (i.e., ≥75% coverage) conduct impact assessments to determine whether the frequency of treatment should change or remain the same. It is important to point out that in this context, **the purpose of an impact assessment is to classify the prevalence of SCH in a unit, relative to the target threshold of 10% prevalence**; the purpose is not to measure a change in prevalence.

In many settings SCH programmes have historically used administrative or health districts as the unit of implementation. Given the focal nature of SCH transmission, there is now a desire to shift from implementing PC at the district level to a sub-district level, so that treatment is better targeted to only those requiring treatment – thus minimizing over and undertreatment. Consequently, impact assessment surveys need to be able to efficiently and accurately classify endemic sub-districts, while being feasible for SCH programmes to implement. This includes ensuring that planning, implementing, and analysis and interpretation is aligned to existing technical capacity and skills.

To address this programmatic gap, a multi-country study entitled, “*The Schistosomiasis Oversampling Study*” (SOS) was conducted from 2021-2022. The goal of the SOS was to identify the optimal survey sampling method for conducting impact assessments that is feasible for country programmes, cost- effective and results in

accurate treatment classifications of sub-districts. In May of 2023, the SOS study teams, regional SCH programme managers, international SCH experts, NGO partners, donors, and WHO gathered together in Nairobi, Kenya to review the results of the SOS. The SCH programme managers and experts from the African region reviewed the different survey sampling strategies and ultimately agreed on a single impact assessment strategy, referred to as “*Schistosomiasis Practical and Precision Assessments*” (SPPA) and it was agreed that it be piloted in a number of countries.

This manual describes the resulting SPPA approach, and includes discussion of the underlying concepts, factors to consider when determining what approach is appropriate, and how to interpret the collected data. There is an accompanying protocol template appropriate for submission for ethical review.

## Rationale for a two-stage approach

Most SCH programmes are transitioning from implementing control interventions for SCH from the IU to sub-IU level to improve targeting and minimize under- and over-treatment. Following conventional methods, this would require a survey in every sub-IU to determine the appropriate treatment strategy for that sub-IU based on observed prevalence. In settings where there are many sub-IU per IU, or many IU, this quickly becomes logistically and financially infeasible. Results from the SOS study and other granular (precision) assessment surveys have highlighted that in many settings, the large majority of communities across entire IUs are either all above, or all below, the decision threshold of 10% prevalence. In such settings, all sub-IUs within the IU should receive the same treatment classification. In other settings where transmission is more focal and there is more variation around the 10% prevalence threshold, different treatment classifications should be assigned to sub-IUs within the IU. This manual describes a two-stage data collection approach that explicitly addresses these different scenarios, whilst ensuring sufficient data can be collected to efficiently classify all sub-IUs to a treatment decision.

## Overview of the SPPA methodology

The SPPA methodology described in this manual serves as a valid approach for conducting programmatic impact assessments for SCH. The **SPPA approach is not considered research; the results generated can be used, by the health ministry leading the assessments, to make decisions** about the frequency and geographic area at which to provide SCH treatment and other interventions. The manual describes *how* to conduct Practical and Precision Assessments, and also includes optional questionnaires designed to assess the feasibility of this approach. This protocol is currently being implemented in several countries across sub-Saharan Africa as a pilot, with the aim of understanding whether the guidance described here is clear, feasible and cost-effective for SCH programmes to implement. Subsequently, following any adaptations based on this pilot, the Practical and Precision Assessment approach and supporting tools will be updated and made accessible to all national programmes for conducting impact assessments by the WHO / ESPEN and will be available through the [ESPEN webpage on Schistosomiasis Practical & Precision Assessment tool \(SPPA\)](#).

## Goal

The goal of the SPPA assessment strategy is to classify sub-IUs (e.g. sub-districts, wards, aire de santé) as being above or below the 10% SCH prevalence threshold, to support ongoing PC treatment decisions.

## Overview of the approach

Practical and Precision Assessments comprise a two-stage approach to conducting an impact assessment for schistosomiasis. This two-stage approach is designed to accurately and efficiently classify the prevalence of SCH among SAC at the sub-district (sub-IU) level as  $\geq 10\%$  or  $< 10\%$  to drive appropriate treatment decisions.

**A note on terminology:** through-out this manual, small SCH implementation units (sub-IUs) are referred to as **sub-districts**. Depending on the setting, these may be wards, sub-districts, aire de santé, or other small administrative units nested within the larger implementation units (IUs) used by other NTD control programmes.

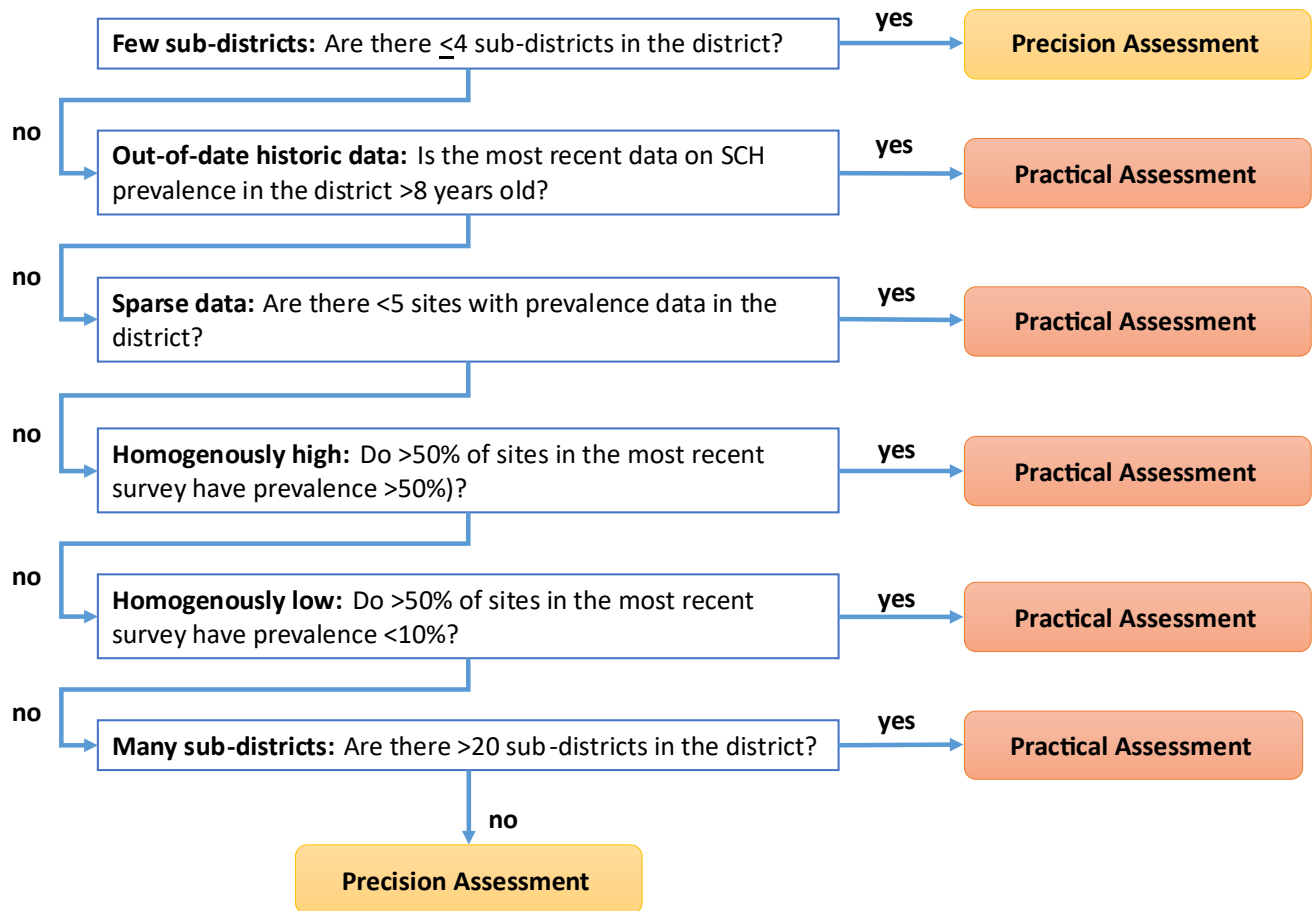
**Practical Assessments** comprise the first stage of sampling and are conducted at the district (IU) level as a test for heterogeneity. The purpose of Practical Assessments is to determine if the prevalence of SCH within a district is sufficiently similar (or *homogenous*), such that the same treatment decision would be appropriate for all sub-districts within the district. The Practical Assessment is a **15 site x 20 SAC survey**, resulting in a total sample size of **300 SAC per district**.

**Precision Assessments** are appropriate for making SCH treatment decisions at the sub-district level in districts where the prevalence of SCH is heterogeneous around the 10% threshold. Typically, Precision Assessments would be conducted following a Practical Assessment where the results indicate that SCH is too heterogeneous for the same treatment decision to be applied across all sub-districts. The Precision Assessment is a **4 site x 20 SAC** survey, resulting in a total sample size of **80 SAC per sub-district**.

**It is recommended that these surveys take place at least 6 months after the previous round of preventive chemotherapy.**

## Determining which assessment type is appropriate

For any given district that is eligible for an impact assessment – at least five rounds of effective ( $\geq 75\%$  PC coverage in SAC) - an important first step is to determine whether it is appropriate to start with a Practical Assessment at the district-level or proceed directly to a Precision Assessment in each of the sub-districts. The answer to this question needs to be determined by the national programme, based on a careful review of the programmatic data and local knowledge. Figure 1 is intended to help capture some of the questions and reasoning that national programmes may wish to use in making this decision.



**Figure 1** Questions to guide programmes in determining whether to start with a practical assessment or proceed directly to a precision assessment for a given district.

The next sections of the manual describe the sampling methodology for the Practical Assessment and the Precision Assessment separately. The reader will note that the Practical and Precision Assessments utilize the same primary sampling unit, target population and diagnostic tests. Where these two approaches differ is in the survey area (district vs. sub-district) and the methodology for selecting the primary sampling unit, the number of SAC sampled per site, and the interpretation of the results.

# Schistosomiasis Practical & Precision Assessments Decision Tree

**IU** = implementation unit; typically corresponds to a district, county, woreda, cercles, zone de santé, commune etc  
**sub-IU** – a smaller administrative area within an implementation unit, the new unit for schistosomiasis preventive chemotherapy

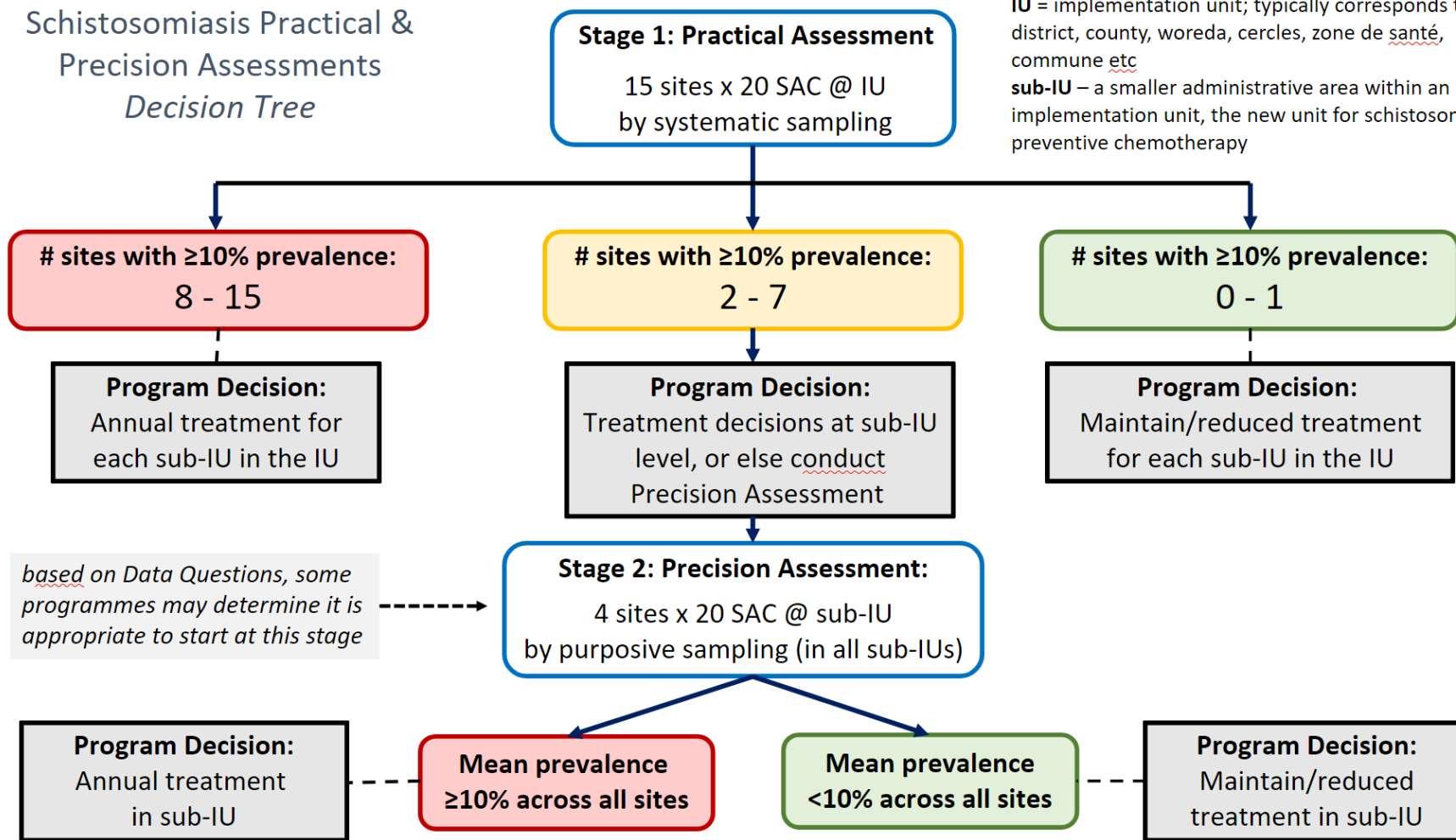


Figure 2 Decision tree for the practical assessment and precision assessment approach

# Assessment Methodology - Sampling

## Sampling for Practical Assessments

### Survey Area

The Practical Assessment should be conducted at the district (IU) level.

### Primary Sampling Unit

The preferred primary sampling unit (PSU) is the school; however, implementers may determine that the community is a more appropriate PSU if: (i) school is not in session at the time of the survey, (ii) the programme is worried that low school attendance may bias the results of the survey, or (iii) there is a desire to collect concurrent samples from adults. Either schools or communities are valid choices for the PSU. For sampling, it is necessary to have sub-district information available for all PSU.

### Selecting PSUs for Inclusion

Practical Assessments require sampling in 15 PSUs using systematic sampling. A two-step sampling process is required to select these 15 PSUs. To do this, it is necessary to obtain a list of all the PSUs ordered by sub-district. It is not necessary to include the population of each PSU.

**Step 1: Determine the number of PSU per sub-district.** The first step is to conduct systematic sampling of sub-districts to ensure that each sub-district has an equal opportunity of selection; it also helps to provide good geographic representation across the district and sub-districts. To aid programmes in determining the number of PSU per sub-district, a simple Excel tool has been built, called the *“Practical Assessment Systematic Sampling Tool”* which can be downloaded from the [ESPEN webpage on Schistosomiasis Practical & Precision Assessment tool \(SPPA\)](#). Simply enter the total number of sub-districts within a given district and their names and the tool will return the number of PSU that should be selected from each sub-district.

**Step 2: Randomly select the PSU.** For each sub-district that had  $\geq 1$  PSU selected in Step 1, it is necessary to randomly select this number of PSU. This can be done by numbering each PSU within the sub-district and then randomly drawing a number from the hat. This process should be repeated for all the sub-districts selected in Step 1 until all 15 PSU have been identified.

### Target Population

The target population for the Practical Assessments is **older school-aged children, ages 10 – 14 years**.

### Sample Size

The Practical Assessment is a 15 site x 20 SAC survey, resulting in a total sample size of 300 SAC per district. This sample size is based on the results of thousands of simulations conducted across SCH archetypes in six different countries and was found to maximize the number of times the district was correctly classified as part of the SOS study [Survey Strategy Selection Meeting Report](#). **Remember:** because the results of a Practical Assessment are interpreted according to the number of sites with site-level prevalence  $>10\%$ , standard sample size calculations do not apply.

## Selecting Children for Inclusion

The **sample size of 20 SAC** per PSU represents **the number of children targeted who return a valid specimen** (urine and/or stool). To account for children who chose not to or cannot provide a sample, we recommend inviting an additional 2 SAC to participate in each PSU. Therefore, in each PSU, **22 SAC (11 girls and 11 boys)** should be randomly selected for testing. The following steps can be followed to randomly select 22 SAC from within a primary school.

1. **Determine the number of girls and boys to sample per class (restrict to classes with children aged 10 to 14 years).** Divide 22 by the number of classes in the primary school that are likely to have kids of the target age (10 to 14 years). *For example, if there are 4 classes in the school that are likely to have children of the target age, then the number of children to sample from each class is:  $22 / 4 = 5.5$ .* Note: round up to the nearest even whole number; in this example, the number of children per class would round up to 6. To ensure gender balance, this would mean 3 girls and 3 boys.
2. **Assemble all students from these classes.** All students within these classes should be separated into class groups and assembled in separate lines – one line of boys and one line of girls.

**Exclusion criteria:** Any child in the selected classes who is outside the target age-group (10- 14 years) should not take part in the survey. Similarly, any child who is unwell (e.g. fever) should not take part and should be referred instead to the school health teacher. Any child whose parents have refused their child's participation in the survey should also not be included. All excluded children should be asked to step out of the line.

3. **Determine the sampling interval and select the students.** The steps to take for sampling pupils when there are more than boys or girls present than are required for the survey:
  - a. Count the total number of students in the class-and-gender-group line.
  - b. For each class-and-gender-group line, calculate the sampling interval ( $h$ ) by dividing the number of children in the line by the number of girls/boys to sample per class (calculated in Step 1). If the resulting sampling interval for that class is a decimal, round down to the nearest whole number. *For example, if there are 23 girls in a line for class 4, and we know that 3 girls are needed from each class from Step 1, the sampling interval for girls in that line is  $23 / 3 = 7.6$ , which we then round down to 7. In this case, every 7<sup>th</sup> girl from this class should be selected.*
  - c. Select the first child by randomly selecting a number between 1 and  $h$ . Random number selection can be done at the school by writing numbers on pieces of paper, folding them up, placing them in a container and mixing before drawing one out at random, and then selecting the child that is in this place in line. *For this example, the sampling interval is 7, so a random number between 1-7 should be chosen. Suppose the randomly selected number is 2. This means the 2<sup>nd</sup> child in line is the first one to be selected.*
  - d. The second child to sample should be the initial number +  $h$ . *In this case, the second child to sample will be the child that corresponds to the initial number (2) + sampling interval (7) = 9<sup>th</sup> child in line.*
  - e. Sampling should then proceed in this manner with every  $h^{\text{th}}$  child being sampled. *The next child to sample will be the 16<sup>th</sup> child in line (e.g.,  $9 + 7$ ).*
  - f. The selected children should be asked to leave the line to provide stool and/or urine samples.
  - g. If the target sample size for that class-gender is not reached due to some of the selected students

being unable or unwilling to provide samples, additional children should be randomly selected until the target number of stool and urine samples for that class-gender has been reached.

A list of the students selected to be in the survey and provide samples should be given to the school for their records.

## Sampling for Precision Assessments

### Survey Area

The Precision Assessments should be conducted at the sub-district (sub-IU) level.

### Primary Sampling Unit

The preferred primary sampling unit (PSU) is the school; however, the SCH programme may determine that the community is a more appropriate PSU if: (i) school is not in session at the time of the survey, (ii) the programme is worried that low school attendance may bias the results of the survey, or (iii) there is a desire to collect concurrent samples from adults. Either schools or communities are valid choices for the PSU.

### Selecting PSUs for Inclusion

Precision assessments require the purposeful selection of 4 PSUs per sub-district, based on sites that are 32 expected to have the greatest risk of schistosomiasis. **High baseline prevalence, poor programme coverage, proximity to infested water sources, high-risk occupations and migration from high-risk areas may all be used to select the highest-risk PSU.** The SCH programme is encouraged to sit with the district teams to review programme data and discuss local risk factors to make the determination of which PSU to include. In the event that some sub-districts do not have 4 PSUs (e.g., some smaller sub-districts may not have four different primary schools), it is possible to merge two or more sub-districts.

### Target Population

The target population for the Precision Assessments is **older school age children, ages 10 – 14 years.**

### Sample Size

Precision Assessments require sampling 4 sites x 20 SAC per site, for a total sample size of 80 SAC per sub-district. This sample size is based on the results of thousands of simulations conducted across archetypes in six different countries [Survey Strategy Selection Meeting Report](#). This sample size results in  $\pm 6.5\%$  precision for measuring the target threshold of 10%.

### Selecting Children for Inclusion

The **sample size of 20 SAC** per PSU represents **the number of children targeted who return a valid specimen** (urine and/or stool). To account for children who chose not to or cannot provide a sample, we recommend inviting an additional 2 SAC to participate in each PSU. Therefore, in each PSU, **22 SAC (11 girls and 11 boys)** should be randomly selected for testing. The following steps can be followed to randomly select 22 SAC from within a primary school.

1. **Determine the number of girls and boys to sample per class (restrict to classes with children aged 10 to 14 years).** Divide 22 by the number of classes in the primary school that are likely to have kids of the target age (10 to 14 years). *For example, if there are 4 classes in the school that are likely to have children of the target age, then the number of children to sample from each class is:  $22 / 4 = 5.5$ .* Note: the answer should be rounded up to the nearest **even** whole number; in this example, the number of children per class would round up to 6. To ensure gender balance, this would mean 3 girls and 3 boys.
  
2. **Assemble all students from these classes.** All students within these classes should be separated into class groups and assembled in separate lines – one line of boys and one line of girls for each age.

**Exclusion criteria:** Any child in the selected classes who is outside the target age-group (10- 14 years) should not take part in the survey. Similarly, any child who is unwell (e.g. fever) should not take part and should be referred instead to the school health teacher. Any child whose parents have refused their child’s participation in the survey should also not be included. All excluded children should be asked to step out of the line.

3. **Determine the sampling interval and select the students.** The steps to take for sampling pupils when there are more than the target number (from Step 1) in any class-gender group:
  - a. Count the total number of students in the class-and-gender-group line
  - b. For each class-and-gender-group line, calculate the sampling interval ( $h$ ) by dividing the number of children in the line by the number of girls/boys to sample per class (calculated in Step 1). The answer should be rounded down to the nearest whole number. *For example, if there are 17 girls in the Class 2 line, the sampling interval for girls in that line is  $17 / 3 = 5.6$  (round down to 5). In this case, every 5<sup>th</sup> girl from this class should be selected.*
  - c. Select the first child by randomly selecting a number between 1 and  $h$ . Random number selection can be done at the school by writing numbers on pieces of paper, folding them up, placing them in a container and mixing before drawing one out at random, and then selecting the child that is in this place in line. *In this example,  $h = 5$ , so a random number between 1-5 should be chosen. Suppose that random number is 5. This means the 5<sup>th</sup> child in line is the first to be selected.*
  - d. The second child to sample should be the initial number +  $h$ . *In this example, the next child selected will be spot of the previous child (5<sup>th</sup>) + sampling interval (5) = 10<sup>th</sup> child.*
  - e. Sampling should then proceed in this manner with every  $h^{\text{th}}$  child being sampled.
  - f. The selected children should be asked to leave the line to provide stool and/or urine samples.
  - g. If the target sample size for that class-gender is not reached due to some of the selected students being unable or unwilling to provide samples, additional children should be randomly selected until the target number of stool and urine samples for that class-gender has been reached.

A list of the students selected to be in the survey and provide a sample should be given to the school for their records.

## Assessment Methodology – Survey procedures

**Once PSU have been selected, survey procedures are the same for both Practical and Precision Assessments – the only difference being the number of SAC sampled per PSU.**

All selected PSU (schools or villages) should be informed in advance of the survey team’s visit to ensure that the date and time of arrival are conducive to conducting the survey and collecting samples from the children and permission is granted. It is important to pick a time of year when children are most likely to be in school (or when they are most likely to be at home, in the event of a community-based survey).

Upon arrival in a selected PSU, the survey team should introduce themselves to the headmaster of the school (or village chief in the event of a community-based survey) and explain the purpose of the team’s visit. The local procedures described for seeking consent should be followed. Once consent from the headmaster or village chief is obtained, the survey team should complete the Site Level Form ([Appendix 1](#)) including recording of the site’s geographical location using a hand-held global positioning system (GPS) e.g. a smartphone.

The survey team should then follow the steps outlined in the sampling methodology section “[Selecting Children for Inclusion](#)” to randomly select target-age children to enrol in the survey under the supervision of the headteacher or school staff member, such as the health teacher. These children should then be enrolled in the survey using the Participant Data Entry Form ([Appendix 1](#)) and given instructions for providing a urine and/or stool sample on the day of the survey. The samples will be processed that same day on site, or at a nearby location by the survey (parasitological) team.

### Laboratory procedures

Every sample collected should be labelled with a unique identification (ID) number (see [Data Management](#) section). Stool and urine samples should be examined as per the egg detection and urine dipstick standard operating procedures (SOPs) ([Appendices 3 -5](#)) and the intensity of each infection expressed as eggs per slide and eggs per 10ml. To maintain confidentiality, the laboratory technicians will test samples and record results using participant IDs and associated sample numbers.

### Survey outcomes

The following outcomes should be measured:

- ***Schistosoma haematobium***: eggs per 10ml of urine using urine filtration method (1 slide)
- **Microhaematuria**: Number of children with micro haematuria as detected with a reagent dipstick
- ***Schistosoma mansoni***: eggs per gram of faeces using the Kato-Katz method (2 slides, A & B read on day 1)
- **Hookworm** (*Ancylostoma duodenale*, *Necator americanus*): eggs per gram of faeces using the Kato-Katz method (2 slides, A & B read on day 1)
- ***Ascaris lumbricoides***: eggs per gram of faeces using the Kato-Katz (2 slides, A & B read on day 1)
- ***Trichuris trichiura***: eggs per gram of faeces using the Kato-Katz method (2 slides, A & B read on day 1)
- **Demographic composition** (age and sex) of the selected individuals.
- **Water contact behaviours** of the selected individuals.
- **School information**

## Sample Collection, diagnostic tests and processing

### Urine collection

In settings where *S. haematobium* is endemic, all children enrolled should be asked to provide a urine sample. This sample will be tested using urine dipsticks (hemastix) and urine filtration. See [Appendix 3](#) and [Appendix 4](#) for SOP on urine diagnostic tests.

### Stool collection

In settings where *S. mansoni* is endemic, stool specimens should be collected for parasitological testing via Kato-Katz. See [Appendix 5](#) for SOP on Kato-Katz.

### Sample collection process

1. Each selected student should be asked for verbal consent to provide urine and stool samples ([Appendix 2](#)).
- 2. Urine samples should be collected between 10am and 2pm.**
3. Give the selected students empty urine and stool containers and instruct them how to collect sufficient amounts of urine and stool for testing.
4. When the student has their sample, they should be enrolled at the registration desk and assigned an ID (see Data Management section) their sample pots will each be labelled with the ID and using the same ID, the child's personal details will be collected on the Participant Data Entry Form ([Appendix 1](#)).
5. A team member or the student submits the samples to the sample processing area where the technicians are processing the urine and stool and reading for eggs.
- 6. All urine samples should be tested for micro-haematuria first and then filtered to be examined for eggs, following the SOP without deviation. Urine filtration should be done on all urine samples and not just those positive for micro-haematuria. Urine filtration should be done on all urine samples even if less than 10ml of urine has been provided, record the volume (ml) of urine filtered on the Urine Form**
7. All stool samples should be examined for eggs following the SOP without deviation.

## Recommended Supply List for Data Collection Teams

Data Entry & Ancillary Supplies	Waste Disposal
Smartphones/Tablets	Bucket(s) for urine disposal
Chargers	1% hypochlorite solution (domestic bleach)
Backpack to carry supplies	Methylated spirits
Clipboard	Bin bags
Consent forms (if paper-based is required)	Paper towels
Pens and Pencils	Toilet paper
Participant Register (ID sheets)	Medicated soap
Notepad	Rubber washing gloves
Calculator	Disinfectant wipes OR tissues and 70% Ethanol
Permanent marker	Waste containers (containing disinfectant)

## Recommended Supply List for Laboratory Teams

(see SOPs for specifications)

General	Urine Filtration
Microscope	Hemastix
Generator (unless lab site has power)	Urine cup with lid
Hand tally counter(s)	Urine filter holder
Permanent marker	10cc syringes
Gloves	Membrane filters
Laboratory coat	Lugol's Iodine (5% solution)
Adequate shoes	<b>Kato-Katz</b>
Surgical mask	Kato-Katz kit or individual elements:
Hand sanitizer	Cellophane sheets (hydrophilic, 30 - 50µm thick)
Forceps	Metal sieve
Microscope slides	Wooden or plastic spatulas/ applicators
Slide boxes	Kato-Katz plastic template
Newspaper	Glycerol/dye (Malachite Green or Methylene Blue)
Scissors	Stool container
Data entry form	

## Electronic Data Collection via ESPEN Collect

The recommended platform for electronic data collection is ESPEN Collect. ESPEN Collect has the SPPA standardized school form, individual enrollment form, and diagnostic results form (see Appendix 1). To initiate support from the ESPEN Collect system, the principal investigator should do the following:

1. Register with ESPEN Collect here: <https://espen.afro.who.int/espen-collect-survey-registration>

2. Submit both the protocol and IRB approval, or an official letter stating that IRB approval is not required, at the time of registration
3. The progress of the registration/setup/implementation can be tracked here: <https://espen.afro.who.int/tools-resources/espen-collect/registration-summary>

## Data Management

The ability to correctly link participant enrollment forms with their corresponding lab results (e.g. urine filtration, hemastix and Kato-Katz) is an essential aspect of data management. This requires the careful assigning and use of unique IDs for every individual. To maximize the chances that lab results and participant enrollment forms can be matched at a 1:1 basis, it is recommended that survey teams adhere to the following steps:

1. Upon enumerating children and selecting the SAC to participate in the survey, provide each child with a stool (and urine) container and instruct them to go collect a sample.
2. When the children return with their sample(s), send them to the enrollment station, where each child will be assigned a unique ID according to the order they appear using DISTRICT CODE \_PSU CODE \_CHILD NUMBER. For example, suppose the district code is 36 and the PSU code is 002 and this is the first child to arrive with their sample. This child would be assigned the unique ID: 36\_002\_01. This unique ID should be clearly written on the child's sample containers using permanent marker, and in the paper [Participant Register](#).
3. Once the unique ID has been assigned, the data recorder should complete the participant form for that child using the ESPEN Collect platform on the smartphone or tablet. The data recorder will need to use double entry to record unique ID for the child to reduce the chances of typing errors. It is a good best practice for the data recorder to check each time to ensure the unique ID they are entering into the device matches what is on the paper Participant Register.
4. Note: if an error is made when entering data into ESPEN Collect, best practice is to record the error in a Participant Register notes column (e.g., "for participant 36\_002\_17 gender was mistakenly entered as 'male' when the correct response should have been 'female'"). At the end of the day Participant Register notes sheet should be shared (via photo text or email) with the Data Manager so that the error can be immediately corrected within the database.

After collection, data will be downloaded and automatically transferred via an encrypted connection to a secure ESPEN Collect server if there is a mobile network available in the area. If a mobile network is not available, the data is stored on the phone until it can be transmitted via a Wi-Fi connection to the same secure server. Access to the secure server will be limited to essential personnel within specified user roles. The Data Manager will perform quality control checks daily (or as near to daily as can be achieved) to ensure quality and accuracy of data uploaded to the server.

Data will be stored electronically in the file formats specified above on a secure server. These data belong to the national NTD programme and are intended for making programmatic decisions. It is expected that the NTD programme will share the site-level deidentified data with ESPEN as part of the routine Epidemiological Reporting Form (EPIRF) and the Joint Application Package (JAP) process.

## Common challenges

*What to do if a PSU cannot be visited?*

If one or more of the selected PSU cannot be visited, a replacement PSU should be randomly selected from the same sub-district. If there are no unsampled PSU in the sub-district that are safe to access, a replacement PSU may be randomly selected from a neighbouring sub-district.

*What to do if a PSU has less than 32 (practical) / 22 (precision) target-age children?*

If the PSU has fewer than the sample size of target-age SAC (10 to 14 years), sampling can stop when all target-age SAC available have been enrolled; there is no need to go to a neighbouring site to reach the sample size.

*What to do if fewer than 32 (practical) / 22 (precision) target-age children return a urine and/or stool specimen?*

One would expect some children not to produce a urine or stool specimen, which is why two additional children are factored into the sampling interval. If the target sample size of children do not produce a viable urine and/or stool sample, the team may select additional children until the target size is reached.

## Assessment Methodology – Data analysis and interpretation

**General consideration:** Before using the survey results to guide programming or decision-making, it is important to assess both the validity of the results and potential threats to their interpretation. This involves evaluating whether the survey was conducted as planned and identifying any issues that may have impacted the findings.

Some key considerations include determining whether the required sample size was met at each site and if all intended sites were surveyed. Additionally, it is important to review any issues with data collection, deviations from the planned survey procedures, and how well these procedures were monitored throughout the survey process. For example, assess whether laboratory procedures were executed as planned. Another factor is evaluating whether the survey population aligns with the intended target population. For instance, is school attendance sufficiently high to reasonably assume that the prevalence measured among the school-attending children applies to the entire school-age population in the community? Finally, assess whether the results aligned with initial expectations. If there are discrepancies, consider what might explain them.

Reviewing and documenting these considerations will help evaluate how survey limitations could affect the validity of the results and guide any necessary adjustments in interpretation.

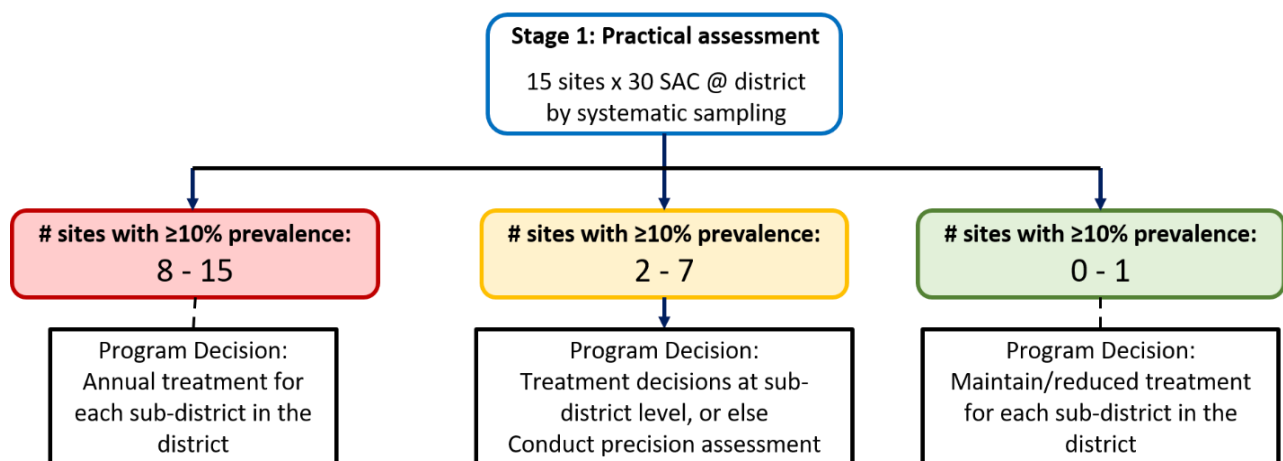
### Analysis and Interpretation for Practical Assessment

**For the Practical Assessment, the key unit of analysis is the PSU-prevalence,** and not the overall survey mean prevalence. Once all 15 PSU in a district have been visited and the data have been cleaned, the first step in

the analysis is to summarize the data **by PSU** (i.e. school/community). To do this, the Data Manager should calculate the prevalence of SCH within each PSU as follows:

$$\text{PSU prevalence} = \frac{\text{\# SAC testing positive for SCH in the PSU}}{\text{Total \# SAC with a valid test result in the PSU}}$$

Note that if there are more than one species of SCH present in the district, the results may be combined, such that a child **testing positive for either *S. haematobium* or *S. mansoni* would be counted as “positive for SCH”** and should appear once in both the numerator and denominator. Once the prevalence of SCH has been calculated for each PSU, the PSU results should be entered into the [SPPA Results Entry Form](#) (Table 2), an Excel file of this can be downloaded from the [ESPEN webpage on Schistosomiasis Practical & Precision Assessment tool \(SPPA\)](#) and the team should refer to the Decision Tree (Figure 1, recopied below) to identify the appropriate programmatic response.



**Table 2 Practical assessment results entry form**

District Name	Number of sites with $\geq 10\%$ SCH	Number of sites with $< 10\%$ SCH	Programme Decision:
e.g. Murkonna	9	6	Annual preventive chemotherapy to all age groups $> 2$ years of age

### Interpretation

**Districts with eight or more PSU that have a SCH prevalence  $\geq 10\%$  (RED category):** The majority of the sites sampled are above the target threshold for MDA, indicating that SCH is likely to be widespread.

Consequently, it is most appropriate to continue to deliver annual MDA to all the sub-districts within the district. Sub-district level assessments are not needed at this time. The programme may want to consider viewing the results on a map to see if any spatial patterns emerge that may help drive specific programme action. For example, if parts of the district have a PSU prevalence that is very high (e.g.  $> 50\%$ ), the programme may want to determine whether this is most likely due to high rates of reinfection or poor participation in the MDA.

**Districts with no more than one PSU with a prevalence  $\geq 10\%$  (GREEN category):** These districts can be considered to have consistently low SCH prevalence and therefore it would be appropriate to consider reducing the frequency of treatment (e.g., decreasing from annual to biennial MDA, or triennial). If one PSU was found to have  $\geq 10\%$  SCH prevalence, the SCH programme may want to deliver targeted annual treatment to that PSU.

**Districts with between two and seven communities that have a SCH prevalence  $\geq 10\%$  (YELLOW category):**

The national SCH programme is encouraged to critically review the results for districts that fall within this yellow category, as the most appropriate programmatic response may depend on the local situation. The prevalence of SCH in these districts is mixed, meaning that it varies with some sites above 10% and others below, and not enough in either category to make a single treatment decision for the entire district; applying the same treatment decision across all sub-districts may result in over- treating some areas, while under-treating others.

The SCH programme must review the data from the Practical Assessment and decide if:

- a) there is enough information to make a treatment decision in one or more of the sub-districts (e.g., in sub-districts that were sampled at least once during the Practical Assessment, the programme may decide to use the mean prevalence in the sub-district, to make a treatment decision); or,
- b) there is not enough information to make a treatment decision within one or more sub-districts, in which case the programme should proceed to conduct a **Precision Assessment** in each of the indeterminate sub-districts (note: the programme may proceed directly to the Precision Assessments if resources allow; however, the programme may determine that it is preferable to deliver the next round of MDA and conduct the Precision Assessments in the next fiscal year, at least 6 months after the MDA).

When making these determinations, programmes are strongly encouraged to view the PSU results on a map, ideally one that includes the sub-district boundaries. This may help to identify spatial patterns in the distribution of SCH that could help the SCH programme decide whether it is possible to make treatment decisions at the sub-district level without the need for further assessments.

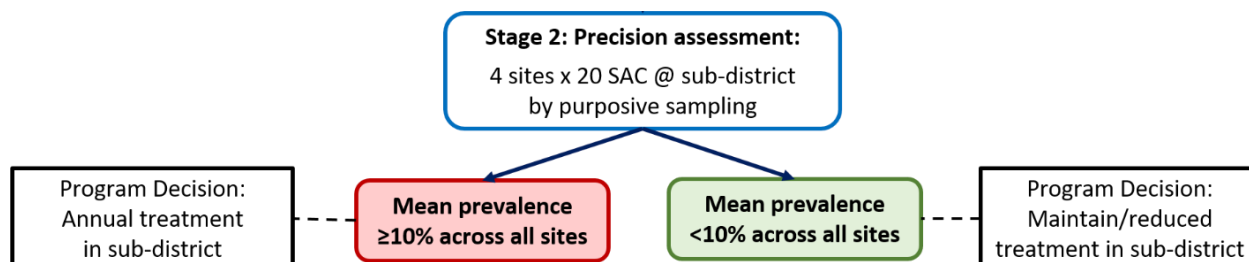
## Analysis and Interpretation for Precision Assessments

**For Precision Assessments, the key unit of analysis is the sub-district mean prevalence of SCH.** Once the data have been collected and cleaned for a given sub-district, the Data Manager should calculate the mean prevalence for the sub-district by combining the data from all 4 PSU sampled within the sub- district as follows:

$$\text{Mean sub-district prevalence} = \frac{\text{Total number of children testing positive for SCH across all 4 PSU}}{\text{Total number of children with valid samples across all 4 PSU}}$$

Note that if there are more than one species of SCH present in the sub-district, the results may be combined, such that a child testing positive for *either* *S. haematobium* or *S. mansoni* would be counted as “positive for SCH” and should appear once in both the numerator and denominator. Once the mean prevalence of SCH has been calculated across all PSU for the sub-district, the results should be entered into the [SPPA Results Entry Form](#) (Table 3), an Excel file of this can be downloaded from the [ESPEN webpage on Schistosomiasis Practical & Precision Assessment tool \(SPPA\)](#) and the team should refer to the Decision Tree (Figure 1, recopied below) to identify the appropriate programmatic response.

If the mean sub-district prevalence is  $\geq 10\%$  (**RED category**) then the recommended programme action is to continue to deliver annual MDA. If the mean sub-district prevalence is  $< 10\%$  (**GREEN category**), then it would be appropriate to consider reducing the frequency of treatment (e.g., decreasing from annual to biennial or triennial MDA).



**Table 3 Precision assessment results entry form**

Sub-district Name	Mean Prevalence $\geq 10\%$ SCH	Mean Prevalence $< 10\%$ SCH	Programme Decision:
e.g. Murkina B	Yes	-	Annual preventive chemotherapy to all age groups $> 2$ years of age

## Training Materials

Training materials in English and French to support the implementation of the SPPA approach have been developed and are available on the same [ESPEN webpage on Schistosomiasis Practical & Precision Assessment tool \(SPPA\)](#) as the other tools linked to the manual and where any updates to this manual will also be available.

SPPA Introduction Slides	Roles, Responsibilities and Team Composition
Practical Assessment Sampling Design	Creating unique IDs for individual participants
Precision Assessment Sampling Design	Ethics and consent
Stool Collection	Practical Assessment pre/post test (and answers)
Stool Processing & Diagnostics	Precision Assessment pre/post test (and answers)
Urine Collection & Diagnostics	

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## Appendix 1: Survey Forms (for use in ESPEN Collect system)

The ESPEN data team have copies of all of the electronic forms.

### Site Level (School or Community) Form

No.	Variable	Label	Entered Value
1	w_survey_date	Date of survey	Automatically entered
2	w_recorder_id	Recorder ID	From pre-populated list
3	w_district	Select the county	From pre-populated list
4	w_sub-district	Select the sub-district	From pre-populated list
5	w_school_name	Select the school name	From pre-populated list
6	w_school_community	Community school is in	Free text field
6	w_gps	Collect GPS Coordinates	Automatically entered
7	w_headteacher	Name of head teacher	Free text field
8	w_headteacher_phone	Contact number of head teacher	Numeric field
9	w_treatment	How long ago did pupils in your school last receive deworming treatment (PZQ or ALB/MBD or both)?	Never Don't know 1 month 2 - 6 months 6 – 12 months 12-24 moths Over two years ago
10	w_enrolment	How many children were enrolled at the time of deworming	Numeric field
11	w_treated	How many children were treated?	Numeric field
12	w_treated_logiccheck	<i>IF the number (treated/enrolment) is &lt;20% or &gt;100%, check both 10 &amp; 11.</i>	
13	w_remarks	Any additional notes:	

# Participant Register (paper)

School name: \_\_\_\_\_ Date: \_\_\_\_\_

District code: \_\_\_\_\_ Subdistrict code: \_\_\_\_\_

#	Name	Sex	Age	Class	Stool (Y/N)	Urine (Y/N)	Notes
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							

## Participant Data Entry Form (electronic)

No.	Variable	Label	Entered Value
1	<b>p_survey_date</b>	Date of survey	Automatically entered
2	<b>p_recorder_id</b>	Recorder ID	From pre-populated list
3	<b>p_district</b>	Select the district	From pre-populated list
4	<b>p_subdistrict</b>	Select the sub-district	From pre-populated list
5	<b>p_school_name</b>	Select the school name	From pre-populated list
6	<b>p_consent</b>	Did parent or guardian or head teacher consent?	Yes / No
	<b>p_assent</b>	Did the child give assent?	Yes / No
7	<b>p_name</b>	Name of pupil	
8	<b>p_participant_ID</b>	Enter participant's ID	Restricted numeric 1-32
9	<b>p_participant_ID2</b>	Re-enter the ID	Restricted numeric 1-32
10	<b>p_age_yrs</b>	Enter the age in years	Restricted numeric 10-14
11	<b>p_sex</b>	Select the sex	Male / Female
12	<b>p_stoolsucces</b>	Was a stool sample successfully collected from this person?	Yes / No
13	<b>p_urinesucces</b>	Was a urine sample successfully collected from this person?	Yes / No
14	<b>p_child_treat</b>	Have you ever been treated with PZQ? (show tablet, or photo of tablet)	Yes/No/Don't remember
15	<b>p_always_lived</b>	Have you always lived here, in this community?	Yes / No
	<b>P_long_lived</b>	<i>If no, when did you move here?</i>	In the last year / more than one year ago / can't remember
16	<b>p_water_play</b>	Did you bathe, swim or play in nearby rivers, streams or ponds in the last week?	Yes/No
17	<b>p_water_fish</b>	Did you go fishing in nearby rivers, streams or ponds in the last week?	Yes/No
18	<b>p_remarks</b>	Additional comment	

# Urine tally sheet (paper)

PSU name: \_\_\_\_\_ Date: \_\_\_\_\_

District code: \_\_\_\_\_ PSU code: \_\_\_\_\_

page \_\_\_\_ of \_\_\_\_

Slides (circle): **A / B** Reader (name) \_\_\_\_\_ Date / / **202**

#	UNIQUE ID District code_PSU code_Child Number	Dipstick result 0 = None 1 = Trace non- haemolysed 2 = Trace haemolysed 3 = + 4 = ++ 5 = +++	mls urine	Number of eggs	Notes
1	_ _ _ _ _ _ _ _ _				
2	_ _ _ _ _ _ _ _ _				
3	_ _ _ _ _ _ _ _ _				
4	_ _ _ _ _ _ _ _ _				
5	_ _ _ _ _ _ _ _ _				
6	_ _ _ _ _ _ _ _ _				
7	_ _ _ _ _ _ _ _ _				
8	_ _ _ _ _ _ _ _ _				
9	_ _ _ _ _ _ _ _ _				
10	_ _ _ _ _ _ _ _ _				
11	_ _ _ _ _ _ _ _ _				
12	_ _ _ _ _ _ _ _ _				
13	_ _ _ _ _ _ _ _ _				
14	_ _ _ _ _ _ _ _ _				

15	_ _ _ _ _ _ _ _ _				
16	_ _ _ _ _ _ _ _ _				
17	_ _ _ _ _ _ _ _ _				
18	_ _ _ _ _ _ _ _ _				
19	_ _ _ _ _ _ _ _ _				
20	_ _ _ _ _ _ _ _ _				
21	_ _ _ _ _ _ _ _ _				
22	_ _ _ _ _ _ _ _ _				

# Stool tally sheet (paper)

PSU name: \_\_\_\_\_ Date: \_\_\_\_\_

District code: \_\_\_\_\_ PSU code: \_\_\_\_\_

page \_\_\_ of \_\_\_

Slides (circle): **A / B** Reader (name) \_\_\_\_\_ Date / / **202**

#	UNIQUE ID	AS	HK	TR	SM	Notes
1	_ _ _ _ _ _ _ _ _					
2	_ _ _ _ _ _ _ _ _					
3	_ _ _ _ _ _ _ _ _					
4	_ _ _ _ _ _ _ _ _					
5	_ _ _ _ _ _ _ _ _					
6	_ _ _ _ _ _ _ _ _					
7	_ _ _ _ _ _ _ _ _					
8	_ _ _ _ _ _ _ _ _					
9	_ _ _ _ _ _ _ _ _					
10	_ _ _ _ _ _ _ _ _					
11	_ _ _ _ _ _ _ _ _					
12	_ _ _ _ _ _ _ _ _					
13	_ _ _ _ _ _ _ _ _					
14	_ _ _ _ _ _ _ _ _					
15	_ _ _ _ _ _ _ _ _					
16	_ _ _ _ _ _ _ _ _					
17	_ _ _ _ _ _ _ _ _					

18	_ _ _ _ _ _ _ _ _					
19	_ _ _ _ _ _ _ _ _					
20	_ _ _ _ _ _ _ _ _					
21	_ _ _ _ _ _ _ _ _					
22	_ _ _ _ _ _ _ _ _					

## Urine Form (electronic)

Question	Variable	Label	Entered Value
1	<b>u_microscopist_id</b>	Microscopist ID	From pre-populated list
2	<b>u_district</b>	Select the district	From pre-populated list
3	<b>u_subdistrict</b>	Select the sub-district	From pre-populated list
4	<b>u_school_name</b>	Select the school name	From pre-populated list
5	<b>U_samples_batch</b>	How many samples were collected in this school?	Restricted numeric 1-32
<b><i>Open loop so that there are responses for n samples</i></b>			
5	<b>u_participant_ID</b>	Enter participant's ID	Restricted numeric 1-n
6	<b>u_participant_ID2</b>	Re-enter the unique ID	Restricted numeric 1-n
7	<b>u_dipstick</b>	Dipstick result (micro-haematuria)	0 = None 1 = Trace non-haemolysed 2 = Trace haemolysed 3 = + 4 = ++ 5 = +++
8	<b>u_ml_urine</b>	Volume (ml) of urine filtered Do not discard samples less than 10ml	
9	<b>u_sh_egg_ml</b>	Number of eggs recorded	
10	<b>u_remarks</b>	Additional comment	

## Kato-Katz Form (electronic)

Question	Variable	Label	Entered Value
1	k_microscopist_id	Microscopist ID	From pre-populated list
2	k_district	Select the district	From pre-populated list
3	k_subdistrict	Select the sub-district	From pre-populated list
4	k_school_name	Select the school name	From pre-populated list
	k_samples_batch	How many samples were collected in this school?	Restricted numeric 1-32
<b>Open loop so that there are responses for n samples</b>			
5	k_participant_ID	Enter participant's ID	Restricted numeric 1-n
6	k_participant_ID2	Re-enter the ID	Restricted numeric 1-n
7	k_sch_man_sa	Schistosoma mansoni (eggs) – Slide A	
8	k_sch_man_sb	Schistosoma mansoni (eggs) – Slide B	
9	k_ascaris_lumb_sa	Ascaris lumbricoides (eggs) – Slide A	
10	k_ascaris_lumb_sb	Ascaris lumbricoides (eggs) – Slide B	
11	k_hookworm_sa	Hookworm (eggs)– Slide A	
12	k_hookworm_sb	Hookworm (eggs)– Slide B	
13	k_trichuris_sa	Trichuris trichiura (eggs) – Slide A	
14	k_trichuris_sb	Trichuris trichiura (eggs) – Slide B	
15	k_other_name_1	Other (name 1)	
16	k_other_quantity_1a	Other Quantity 1 – Slide A	
17	k_other_quantity_1b	Other Quantity 1 – Slide B	
18	k_other_name_2	Other (name 2)	
19	k_remarks	Additional comment	

## Appendix 2: Information and Consent Forms

### Informed consent process

1. The survey team should inform district-level health and education officials of the survey in advance and obtain the contact details of the head teachers of the schools selected for the survey.
2. The team should contact the relevant head-teachers to inform them of their involvement in the survey at least one week in advance. Then, head-teachers should be asked to organise an information session with parents the day before the date scheduled for data-collection, or further in advance of the survey day.
3. The enumerators' team should arrive at the selected school the day prior to data-collection and do the following:
  - i. Provide the head-teacher with the corresponding information sheet ([Form B.1.](#)) and obtain his/her consent to implement the survey ([Form B.2.](#)).
  - ii. Provide the head teacher with the information sheet for parents of the selected classes ([Form A.1.](#)).
  - iii. Request a list of enrolled children for each of the classes eligible for the survey.
  - iv. Support the teachers of those classes selected for the survey to explain the activity to children and ([Form A.1](#)).
  - v. Support the meeting with parents to address questions and any concerns.
4. Head teachers should provide a copy of the parents' information sheet to the teachers in charge of the classes eligible for the survey. Teachers should read out the forms to the students and hand over a copy. If possible, enumerators should support class teachers to address any questions or doubts.
5. At the time of the school meeting with parents, head teachers are expected to explain the survey activities drawing on the information sheets provided by the team. They are also expected to provide copies of the information sheets to the parents present.
6. The enumerators' team should try to attain signed consent from the head teacher at the school meeting and use the list of enrolled children for each selected class to keep track of the students with permission to provide samples.
7. On the day of data-collection, the survey team should check that children from the selected class have a signed consent form provided by the head teacher. Using the list of children enrolled in each class, they should confirm who has the head teacher's consent form.
8. On the day of data-collection, the random selection process for students **must only consider those for whom a signed consent form was provided the day before** during the school meeting.
9. For all those classes, the team should gather assent from them. Attain verbal assent using the corresponding information sheet (C.1.). Ensure that verbal assent is recorded and that two enumerators witness the process.
10. The enumerators' team should try to complete the preparations listed above early in the morning of the day of data collection. It is expected they will leave the survey site for the school to be visited by the survey team the next day to repeat the same consent process described above.

## Schistosomiasis Practical and Precisions Assessments: Information Sheet – Parents (form A.1)

### Measuring prevalence of schistosomiasis and soil transmitted helminths in <country>

Your child is invited to participate in a public health study conducted by the <relevant ministry>. Participating in this activity is entirely up to you. Please take as much time as you need to go over the information sheet. You will be given a copy of this form.

#### What is the survey about?

'Local term for bilharzia or schistosomiasis' and other 'local term for intestinal worms' are endemic through large parts of <country> and pose a major public health threat. To address this, the <relevant ministry> has conducted mass drug administration activities for schistosomiasis and other worms in recent years. To assess how effective these treatment campaigns have been, we are asking children of both sexes (ages 10-14) to take part in a survey to enable us to estimate how many children in your community remain affected by those parasites.

#### Why has your child's school been selected to take part?

The school that your child attends was selected from a <relevant ministry> list of schools located in communities at risk for 'local term for bilharzia or schistosomiasis'. A total of xxx have been selected in <country> to ensure we can obtain a representative estimate of the proportion of children in the country who require treatment.

Children of both sexes between 10 to 14 years of age that attend the selected schools are eligible to participate in this study. This selection of participants reflects the population groups targeted by treatment activities, following the guidance of the World Health Organization (WHO).

#### What will happen if my child takes part in this survey?

On the day of the survey, we will be inviting xx girls and xx boys from your child's school to take part. These children will be selected at random (by lottery) from those children that have consent to take part. If you provide consent, we cannot say in advance whether your child will be selected.

#### *If selected:*

- Your child will be asked to provide one urine sample and one stool sample over the course of a day. Sample pots will be provided to your child at the school at the time of data-collection.
- These samples will be examined by laboratory technicians to identify parasitic material, and their results recorded electronically.
- The enumerators may also ask your child for her/his name, age, sex and some questions on school attendance and sanitation procedures. Each participating class will be called in turns to participate in the study so that any disruption of normal school activities will be kept to a minimum.
- Technicians will examine your child's urine and stool samples in the laboratory using diagnostic tests to detect the presence of worms in the body. If we find that your child is infected with <local term for schistosomiasis>, the Ministry of Health will be informed of the need for treatment activities in this community.
- Your child will be offered treatment for this infection as part of the deworming programme done by the Ministry after the survey has finished.

### **Are there any risks involved?**

We do not anticipate any physical risks for your child's participation. Some children may be embarrassed by the activity or have concerns about their hygiene. To facilitate the process, your child will receive an empty stool and urine containers and instructions about how to safely collect the required urine and stool samples. However, if at any time your child feels uncomfortable with the process, s/he will be free to stop her / his participation. S/he also has the right to avoid answering any questions at any time.

### **Are there any benefits in my taking part?**

Your household is in a community that has been identified as being at risk of contracting 'local term for bilharzia or schistosomiasis'. This study will help to determine how effective treatment activities have been in the area and which treatment strategies may best help to further reduce the presence of 'local term for bilharzia or schistosomiasis' in this region. Reducing the prevalence of the disease in the area is expected to improve children's long-term health.

In case of a positive diagnosis, treatment will be offered as part of the district wide deworming programme done by the <relevant ministry>, once the survey has been completed. Treatment can improve your child's general health status, including less stomach problems/pain while urinating less fatigue and weakness and better nutritional uptake.

### **Will my children's participation be confidential?**

All personal information and diagnostics results will be recorded on electronic forms, which will be kept private. Only a small number of people from the survey team will be allowed to look at information about your child such as their name. After the survey is finished, your child's name will be removed from the data, and the remaining data will be kept in an online data store. No person will be able to link test results to you or your child. The data will be made available to other researchers worldwide for research and to improve medical knowledge. However, your personal information will not be included and there is no way that you can be identified.

### **What happens if I change my mind?**

Your child's participation in the study is voluntary. There are no consequences if you decide s/he should not take part. S/he can stop participation at any time without saying why and refuse answering any questions s/he is not comfortable with.

### **What happens if something goes wrong?**

If you have any questions or concerns about the data collected during the survey, please feel comfortable to stop and talk to us about it.

If at a later stage you may like to withdraw your child's information, or if you later have some concerns about this survey, you may contact us at any time by using the information on the card provided, which includes:

**Safeguarding officer:** xxx

<Any other relevant Ministry or Ethics Board Staff for your country>

## Schistosomiasis Practical and Precisions Assessments: Information Sheet – Head-Teacher (form B.1)

### Measuring prevalence of schistosomiasis and soil transmitted helminths in <country>

Students from the school you direct are invited to participate in a public health study conducted by the <relevant ministry>. Please take as much time as you need to go over the information sheet. You will be given a copy of this form.

#### What is the survey about?

'Local term for bilharzia or schistosomiasis' and other 'local term for intestinal worms' are endemic through large parts of <country> and pose a major public health threat. To address this, the <relevant ministry> has conducted mass drug administration activities for schistosomiasis and other worms in recent years. To assess how effective these treatment campaigns have been, we are asking children of both sexes (10-14) to take part in a survey to enable us to estimate how many children in your community remain affected by those parasites.

#### Why have your school been selected to take part?

Your school was selected from a <relevant ministry> list of schools located in communities at risk for 'local term for bilharzia or schistosomiasis'. A total of xxx have been selected in <country> to ensure we can obtain a representative estimate of the proportion of children in the country who require treatment.

Children of both sexes between 10 to 14 years of age that attend the selected schools are eligible to participate in this study. This selection of participants reflects the population groups targeted by treatment activities, following the guidance of the World Health Organization (WHO). Children will be selected at random (by lottery) on the day of the survey.

#### What will happen if my pupils take part in this survey?

- Pupils will be asked to provide one urine sample and one stool sample over a day. Sample pots will be provided to your pupils at the school at the time of data-collection.
- These samples will be examined by laboratory technicians to identify parasitic material, and their results recorded electronically.
- The enumerators may also ask pupils for he/his name, age, sex and some questions on school attendance and sanitation procedures.
- Each participating class will be called in turns to participate in the study so that any disruption of normal school activities will be kept to the minimum.
- Technicians will examine your child's urine and stool samples in the laboratory using diagnostic tests to detect the presence of worms in the body.
- In the case that pupils are infected with 'local term for schistosomiasis' the Ministry of Health will be informed of the need for treatment activities in this community. Pupils will be offered treatment for this infection as part of the deworming programme done by the Ministry after the survey has finished.

#### Are there any risks involved?

We do not anticipate any physical risks for your pupils' participation. Some children may be embarrassed by the activity or have concerns about their hygiene. To facilitate the process, pupils will receive empty stool and urine containers and instructions about how to safely collect the required samples. However, if at any time pupils feel uncomfortable with the process, s/he will be free to stop her / his participation. S/he also has the right to avoid answering any questions at any time.

### **Are there any benefits in my taking part?**

Your household is in a community that has been identified as being at risk of contracting 'local term for bilharzia or schistosomiasis'. This study will help to determine how effective treatment activities have been in the area and which treatment strategies may best help to further reduce the presence of 'local term for bilharzia or schistosomiasis' in this region. Reducing the prevalence of the disease in the area is expected to improve children's long-term health.

In case of a positive diagnosis, treatment will be offered as part of the district-wide deworming programme done by the <relevant ministry>, once the survey has been completed. Treatment can improve your child's general health status, including less stomach problems/pain while urinating less fatigue and weakness and better nutritional uptake.

### **Will my pupils' participation be confidential?**

All personal information and diagnostics results will be recorded on electronic forms, which will be kept private. Only a small number of people from the survey team will be allowed to look at information about your pupils such as their names. After the survey is finished, your pupils' names will be removed from the data, and the remaining data will be kept in an online data store. No person will be able to link test results to your pupils. The data will be made available to other researchers worldwide for research and to improve medical knowledge. However, their personal information will not be included and there is no way that they can be identified.

### **What happens if I change my mind?**

Your pupils' participation in the study is voluntary. There are no consequences if you decide they should not take part. They can also stop their participation at any time without saying why and refuse to answer any questions they may not be comfortable with.

### **What happens if something goes wrong?**

If you have any questions or concerns about the data collected during the survey, please feel comfortable to stop and talk to us about it.

If at a later stage you would like to withdraw your students' information, or if you later have some concerns about this survey, you may contact us at any time by using the information on the card provided, which includes:

**Safeguarding officer:** xxx

<Any other relevant Ministry or Ethics Board Staff for your country>

## Schistosomiasis Practical and Precisions Assessments: Assent form – Schoolchildren (form C.1)

Place: \_\_\_\_\_ Date: \_\_\_\_\_

We are from the Ministry of Health in <country name>. We are doing a study to learn how many children in your school are affected by [local term for bilharzia] and other [local name for intestinal worms]. This will help us decide how best to stop children from being affected by [local term for bilharzia] in your community.

We are inviting 32 children from your school to take part in this research, and you have been selected by chance. If you don't want to take part, that's okay. If you agree to take part, we will ask you a few very short questions about where you live, and activities you've done in the past week. We will also ask you to provide a stool sample and a urine sample, which we will look at to see if you have any worm infections.

We understand that you might find this a bit embarrassing – we will give you all the material you need to do this, and explain to you how to collect the sample. If we see that you have an infection, you will be offered treatment through school. The information we collect about you might be shared with others, but your name will not be used and will be kept secret. You will not receive anything for taking part in this study.

If you decide to take part, and then change your mind or don't want to carry on, that's OK. We have also asked your parents for permission to take part, and we're only speaking to you about this because they have agreed. Even if your parents say 'yes' you can still decide not to take part. You may ask me any questions about the study. You can call us at any time on the phone number XXXXX.

	yes	no
Do you understand why we are doing the research?		
Are you happy to talk to me?		
Do you understand that you can stop me at any time? And that you don't have to answer questions that you don't want to?		
Are you happy to provide us with a urine sample and a stool sample?		
Are you happy that the information you give may be shared with others?		

---

Printed name of child

Signature/mark of participant

Date

**If child cannot read the form themselves, a witness must sign here:** I was present while the benefits, risks and procedures were read to the child. All questions were answered, and the volunteer has agreed to take part in the research.

---

Printed name of witness

Signature/mark of witness

Date

Tick box if participant refuses to have witness present.

I attest that, I have explained the study information accurately in \_\_\_\_\_ and was understood to the best of my knowledge by the participant and that they have freely given their consent to participate in the presence of the above named impartial witness (where applicable).

---

Printed name of person obtaining  
consent

Signature of p. obtaining consent

Date

## Schistosomiasis Practical and Precisions Assessments: Consent Form – Head Teacher (form B.2)

### Measuring prevalence of schistosomiasis and soil transmitted helminths in <country>

Place: \_\_\_\_\_ Date: \_\_\_\_\_

To show that you understand the information we gave you and that you are happy with your pupils to participate of the survey, we will ask you to confirm that you agree with the following statements by adding your initials to each statement below:

	Person's initials
I have read and understood the information provided about the study and had the opportunity to ask questions to my satisfaction.	
I agree that my pupils take part in this survey and provide the required samples for examination by laboratory technicians.	
I understand that my pupils' real name will not be stored or disclosed to others, that their results will be stored electronically in a secure location, and that after the survey that these results may be shared with other researchers, and that they will not be identifiable from this information.	
I understand that my pupils' participation is voluntary and that they can withdraw at any time without having to provide a reason.	
I confirm that I was provided with alternatives to contact the research team after the survey had taken place to ask further questions, raise concerns or withdraw your participation.	

After confirming you agree with all the statements above, please provide a mark or your signature.

School's name:

Headteachers' name: \_

*[STAMP THE SIGNED FORM, IF ANY SCHOOL STAMP AVAILABLE]*

## Appendix 3: Hemastix SOP

*Diagnosis of: Schistosoma haematobium.*



All manufactured kits come with instructions on how to use them. It is very important to follow the instructions to ensure the quality of the results.

### Equipment for Hemastix test

- Fresh urine sample
- Hemastix test strips
- Scissors
- Colour chart (separate or on test strip container)



Video demonstration: click on the icon **haemastix.MPG**

Steps for Reagent Strips	Images
Step 1: Collect a fresh urine specimen in a clean plastic container. Ensure that the urine is tested in the field within <b>2 hours</b> of collection. If there is a delay, refrigerate the specimen if possible.	
Step 2: Remove one strip from its bottle (you can cut the strip in two to save resources) and label the strips with the patient identification.	
Step 3: Completely immerse the reagent areas of the strip into the urine specimen for a few seconds.	
Step 4: When removing the strip, run its edge against the rim of the container to remove any excess urine.	
Step 5: Put the strip horizontally on the table or on top of the urine cup so that the chemicals do not mix together.	
Step 6: Read the strip between <b>1 and 2 minutes after it has been dipped</b> in the urine specimen.	

Step 7: Match the colour of the strip with the colour chart on the bottle label and record the results in the form. The order of readings on the chart will match the order of results to enter (see below).

Record

“0” if the result is negative.

1= trace non-haemolysed

2 = trace haemolysed

3 = +

4 = ++

5 = +++



**Important Note:**

- DO NOT LAY THE STRIP ON THE COLOUR CHART AS THIS WILL SOIL THE CHART
- It is extremely important to read the strip 1-2mins after it has been dipped in the urine sample. Any colour changes that occur after 2 minutes are of no diagnostic value and should be ignored.

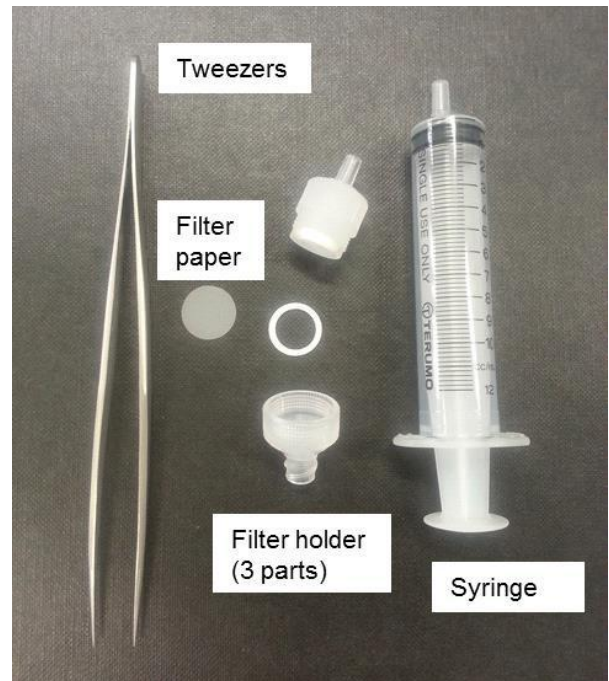
## Appendix 4: Urine Filtration SOP

### *Diagnosis of: Schistosoma haematobium*

All manufactured kits come with instructions on how to use them. It is very important to follow the instructions to ensure the quality of the results.

#### **Safety precautions**

- The urine should be considered potentially infectious.
- Wear gloves and lab coats whenever handling urine samples.
- Benches, instruments and equipment should be routinely decontaminated with disinfectants after use.
- Materials contaminated with infectious waste should be disinfected before disposal.
- Drinking or eating during laboratory procedures is prohibited.
- Appropriate disinfectant(s) should be used for disposal of contaminated specimen containers and for cleaning of workbenches.
- Used specimen containers must be disinfected before washing



#### **Equipment for Urine Filtration:**



- Urine pots (250ml), reusable, with fresh urine sample
- Swinnex Filter Holder, reusable
- Tweezers/Forceps, reusable
- Syringe, plastic, 10ml, reusable
- Nuclepore Membrane Filter, 13mm diameter and pore size 12 $\mu$ m - 25 $\mu$ m
- Microscope glass slides, reusable
- Lugol's Iodine (5% solution)
- Potentially: cellophane strips, hydrophilic 30-50 $\mu$ m thick, soaked in glycerol

**Sample collection:**

The number of eggs in the urine varies throughout the day, with the highest between 10am and 2pm. The specimen should be taken between these times and consist of a single urine sample. Since eggs are more often found at the end of a urine flow, at least 10ml should be collected at the end of urination

(the terminal urine). The easiest way to ensure a terminal urine sample is to ask individuals to ‘try to fill’ a large pot, e.g. 250ml. Note that some children, particularly those who are heavily infected with schistosomiasis, may not be able to provide 10ml of urine. **Do not discard these smaller samples, but note the volume (ml) of urine provided.** Specimens should be examined as soon as possible after collection as the eggs may hatch and then become invisible, or crystals may form, making a correct diagnosis more difficult. If specimens cannot be examined on the same day, keep them in a fridge.

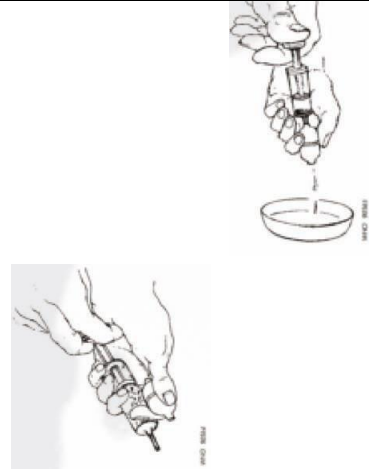
**IMPORTANT NOTE:** To increase the volume of urine provided during sample collection, it would be advisable to promote fluid intake and physical exercise prior to micturition (e.g. provide the children with 2 glasses of water, one hour before urine collection, and request the children to participate in 10 minutes of exercise) (Doehring *et al.* 1983).

Steps for Urine Filtration	Images
<p>Step 1: Ensure the filter holders and syringes are well cleaned and dry. Unscrew the filter holder and insert a nuclepore filter between the two parts of the filter holder. Make sure it is correctly held in place before screwing the unit together again.</p>	
<p>Step 2: Mix the urine specimen (shaking or pulling up and down with the syringe) before drawing 10ml of urine into the syringe. Then attach the filter unit (filter holder with filter inside).</p> <p><b>If less than 10ml urine sample is available, withdraw all urine in the sample pot and note the quantity of urine (ml) on the laboratory form next to the ID number. Do not discard the urine sample if it is less than 10ml.</b></p>	

Step 3: Keeping the syringe and the unit in a vertical position, press the plunger down to push all the urine through the filter and out into a bucket.



Step 4: Carefully detach the syringe from the filter unit. Draw air into the syringe, reattach the syringe to the filter unit and expel the air again. This is important as it removes any excess urine and ensures that the eggs are firmly attached to the filter.

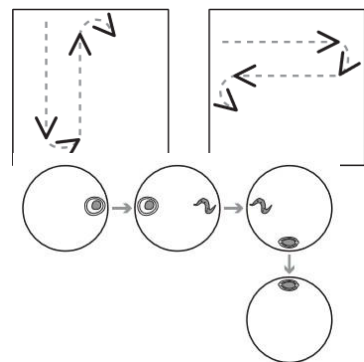


Step 5: Unscrew the filter holder and use a pair of tweezers to remove the filter and place it onto the glass microscope slide labelled with a unique identification number. The top side of the filter, where the eggs were captured, should be face-up on the slide.

DO NOT DISCARD THE FILTER HOLDER OR SYRINGE.



Step 6: Add one drop of Lugol's iodine and wait 15 seconds for the stain to penetrate the eggs. This makes the eggs more easily visible.



Step 7: Immediately examine the whole filter under a microscope. Starting in one corner of the sample, systematically scan the **WHOLE** sample in a 'zig zag' scheme. When moving to a new row, keep a small microscopic field overlap: an object in the corner of the field is chosen and is brought towards the opposite side of the field. Then, the second field is examined. Count **ALL** eggs on the filter using a hand tally counter. Schistosome eggs can be seen clearly because they stain orange.

Step 8: Record the total number of eggs on the filter. When no eggs are seen, record "0".

<p>Step 9: If the slides are kept for QC, cover the stained filter with a <b>glycerol soaked cellophane strip</b> (NO methylene blue or malachite green). Potentially add 4% formalin or SAF-solution for longer storage. If the slides are to be stored, keep them in the fridge to avoid hatching of eggs.</p>	
<p>Step 9: At the end of the day, wash all reusable equipment (forceps, filter holders, syringes, urine containers, glass slides) in 1%</p>	
<p>hypochlorite solution (domestic bleach) for use next day, discard used filters and clean the workbench.</p>	
<p><b>IMPORTANT: Read the slide within an hour of the urine sample being taken otherwise the eggs may be non-viable and become translucent. Do not leave the samples exposed to the sun. If samples can't be read immediately, store them in the fridge.</b></p>	

**Note:**

10% of all slides need to be randomly selected and re-examined by a more experienced technician. Results are considered discrepant if egg count differences are:

- For counts below 50 eggs: more than  $\pm 5$  eggs
- For counts >50 eggs: more than 10% of eggs
- Differing between egg-positive and egg-negative

Discrepant slides are re-read once more by a third technician and final decision on results are made based on all three readings. If more than 50% of QC slides are discrepant on several days, the lead technician should conduct re-training and discuss with the survey team lead about suitable consequences.

## Appendix 5: Kato Katz SOP

*Diagnosis of: S. mansoni, T. trichiura, A. lumbricoides, and hookworm (A. duodenale and N. americanus)*


**General Principle:** people infected with soil-transmitted helminths (STH) or intestinal schistosomes pass the eggs of the worms with their faeces. By examining a stool specimen under a microscope, it is possible to count the number and the type of eggs that are present.

### **Safety precautions**

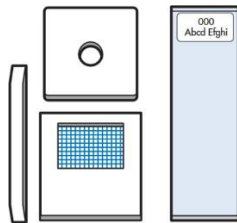
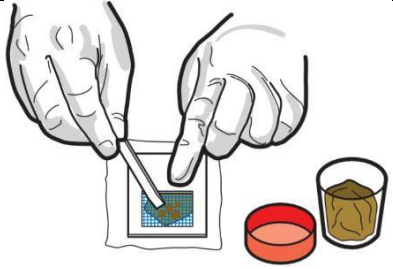
- The stool should be considered potentially infectious.
- Wear gloves and lab coats whenever handling stool samples.
- Benches, instruments and equipment should be routinely decontaminated with disinfectants after use.
- Materials contaminated with infectious waste should be disinfected before disposal.
- Drinking or eating during laboratory procedures is prohibited.
- Appropriate disinfectant(s) should be used for disposal of contaminated materials, wooden spatulas and specimen containers and for cleaning of workbenches.
- Used specimen containers must be disinfected before washing.

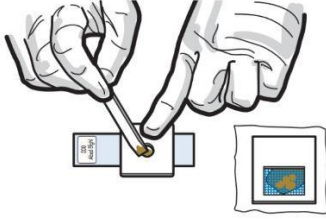

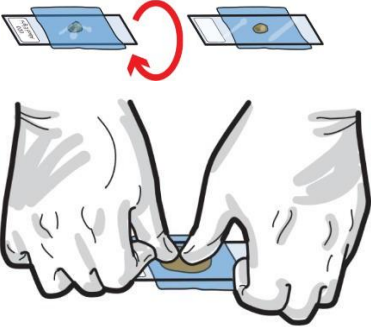
### **Equipment for Kato Katz**

- Stool sample in container (polythene squares tied with grass or plastic pot)
- Cellophane sheets (hydrophilic, 30 - 50µm thick)
- Malachite green (or methylene blue)
- Glycerol
- Metal sieve (Endecott Sieve) with 200 - 250µm mesh size OR nylon mesh with up to 300 µm mesh size
- Slide boxes
- Microscopic glass slides
- Newspapers
- Wooden or plastic spatulas/ applicators
- Forceps
- Kato-Katz plastic template with a hole of 6mm on a 1.5mm thick template (delivering 41.7mg of faeces), reusable

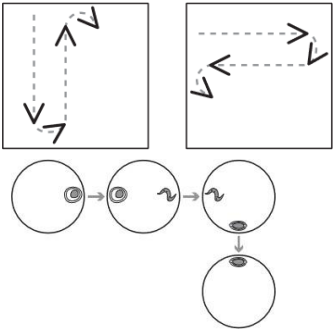
Preparation of Kato Katz Reagents	Images
Step 1: Weigh out 3g of Malachite green powder (or methylene blue).	
Step 2: Dilute it in 100ml of distilled water (this is the “ <b>stock solution</b> ”).	
Step 3: Dilute 60ml of glycerine in 40ml of distilled water*.	
Step 4: Take 1 ml of Malachite green (or methylene blue) <b>stock solution</b> and add it to 100ml of the 60% glycerol solution (this is the “ <b>working solution</b> ”).	
Step 5: Cut cellophane into 25mm x 30mm pieces and soak them overnight in the <b>working solution</b> .	 <p>Fig 2</p>

\*In reference books the ratio is 50% or greater glycerol solution (50ml glycerine and 50ml distilled water). In Uganda they have found this makes too light a solution and thus makes it difficult to read slides after some time has passed.

Kato-Katz Steps	Images
Step 1: Place <b>two</b> glass slides alongside each other and label both slides with the sample number and then place a plastic template on top of each.	
Step 2: Place a small amount of the faecal specimen on a newspaper and press through the metal sieve. Using a spatula, scrape the sieved faecal material through the sieve so that only the debris remains on the top.	

<p>Step 3: Scrape up some of the sieved faeces from the underside to fill the hole in the templates, avoiding air bubbles and levelling the faeces off to remove any excess.</p> <p>Carefully lift off the templates and place it in a bucket of water mixed with concentrated detergent so that they can be reused.</p>	
<p>Step 4: Place one piece of the cellophane, which has been soaked overnight in the malachite green (or methylene blue) working solution, over the faecal specimen.</p>	
<p>Step 5: Invert the microscope slide and firmly press the sample against the cellophane strip on another microscope slide or on a smooth hard surface to spread the faeces in a circle. If done well, it should be possible to read newspaper print through the stool smear.</p>	
<p>Step 6: Let the slide clear with the cellophane upwards for 30 minutes (less if exposed to sunlight).</p> <p>If hookworm is present in the area, the slide should be read within 60 minutes of processing. After that time, the hookworm eggs disappear.</p> <p>The ideal time for observing <i>S. mansoni</i> eggs is within 24 hours after preparation, however, in bright sunlight the slides clear rapidly and a 24hr delay is not necessary.</p>	

Microscopic Examination for <i>S. mansoni</i> and STH	Images
<p>Step 1: For one stool sample (slide A and B), each slide should be examined by different technicians.</p> <p>Place the slide under the microscope, use 10x objective for scanning the slide. To check individual eggs, a higher magnification can be used (40x).</p>	

<p>Step 2: Starting in one corner of the sample, systematically scan the <b>WHOLE</b> sample in a 'zig zag' scheme. When moving to a new row, keep a small microscopic field overlap: an object in the corner of the field is chosen and is brought towards the opposite side of the field. Then, the second field is examined. Count <b>ALL</b> eggs present using a hand tally counter. Make sure not to confuse counters for different species.</p>	
<p>Step 3: Record the sample number and slide on the recording form and note the <b>number</b> and the <b>type of each</b>. If no eggs are seen, record "0".</p>	
<p>Step 4: Remove the faeces and cellophane using a tissue into the waste container and place all slides used when conducting Kato-Katz into the disinfectant. These slides should be cleaned and used again for the survey. Proceed in the same way for the reusable templates and potentially the spatulas.</p>	

**Note:**

10% of slides (counting both slides A and B) are randomly selected and re-examined by a more experienced technician for quality control (QC). Results are considered discrepant if egg count differences are:

- for counts below 100 eggs: more than  $\pm 10$  eggs
- for counts  $>100$  eggs: more than  $\pm 20\%$  of eggs
- differing between egg-positive and egg-negative

Hookworm eggs will not be considered as they are known to become transparent over time. Discrepant slides are re-read once more by a third technician and final decision on results are made based on all three readings. If more than 50% of QC slides are discrepant on several days, the lead technician should conduct re-training and discuss with the survey team lead about suitable consequences.

## Appendix 6: Assessing STH prevalence during SPPA

Soil-transmitted helminth (STH) infections are caused by parasitic worms, including *Ascaris lumbricoides*, *Trichuris trichiura*, and hookworms (*Necator americanus* and *Ancylostoma duodenale*). These infections are among the most common globally and are frequently identified in communities with poor access to water, sanitation, and hygiene. STH infections can lead to anemia, malnutrition, malaise, and impaired growth and development.<sup>1</sup> Populations most at risk of morbidity include pre-school-aged children (pre-SAC), school-aged children (SAC), women of reproductive age (WRA), and adults in high-risk occupations, such as tea pickers and miners.<sup>1</sup>

To reduce infections in communities, once- or twice-yearly preventive chemotherapy (PC) with benzimidazoles is recommended in areas where the baseline infection prevalence is  $\geq 20\%$ .<sup>2,3</sup> As prevalence decreases due to effective interventions, the treatment frequency is adjusted accordingly (see Table X).<sup>2-4</sup> Deworming medications are typically provided to SAC through school-based distribution platforms and to pre-SAC and WRA through community- or healthcare-based delivery.

Through these efforts, combined with broader community initiatives such as behavior change and improved access to clean water and sanitation, WHO is leading the global effort to achieve and sustain the elimination of STH morbidity among children. This goal, termed 'elimination as a public health problem' (EHP), is defined for STH by the reduction of moderate-to-heavy-intensity infection (MHII) prevalence to  $< 2\%$  among children.<sup>5-7</sup> To monitor the success of control programs, WHO recommends periodic parasitological surveys. These surveys, typically conducted at the implementation unit (IU) level after five rounds of effective PC, provide essential data on the current epidemiology of the disease and serve two main purposes:

- To guide decisions on deworming treatment frequency within the IU; and
- To assess whether the EHP threshold ( $< 2\%$  MHII prevalence among children) has been achieved in the IU.

### **Including an STH survey during SPPA**

Conducting a Practical or Precision Assessment for schistosomiasis (SPPA) provides an opportunity to gather valuable STH information while integrating data collection efforts, reducing the need for separate surveys, and streamlining program evaluation.

A control program should consider including the evaluation of STH during a SPPA if:

- **An STH impact survey is recommended by WHO.** WHO recommends an impact survey in an IU if PC distribution has been ongoing for  $\geq 5$  years<sup>4,6,7</sup> and if effective coverage ( $\geq 75\%$  among targeted at-risk groups) has been consistently achieved during each distribution.<sup>4</sup>
- **Additional evidence on STH epidemiology is needed by the program.** STH surveys may be warranted during the SPPA if the program lacks baseline STH data, seeks updated or more robust estimates than obtained from previous surveys, or has reasons to believe new evidence is needed.

**During practical assessments:** When a practical assessment is conducted in an IU for schistosomiasis, it can also serve as an STH baseline or impact survey<sup>4</sup> (however, since impact surveys are now more common, the following text focuses on this purpose).

To provide programs with the flexibility to conduct STH impact surveys within their available resources, WHO does not recommend a specific design, but offers a general framework.<sup>4</sup> For example, for estimating the prevalence of infection, *WHO's Guide for Mapping Neglected Tropical Diseases Amenable to Preventive*

*Chemotherapy in the African Region* recommends sampling 50 students aged 10-14 years old from each of 5 sites (i.e., schools) within a district (or ecological zone when resources are limited).<sup>8</sup> To monitor progress toward achieving EPHP (<2% MHII prevalence), WHO's *2030 Targets for Soil-Transmitted Helminthiasis Control Programmes* advises sampling 250 pre-SAC and SAC in each ecologically homogeneous area.<sup>6</sup> WHO's *Compendium of Indicators for Monitoring and Evaluating Progress of the Road Map for Neglected Tropical Diseases 2021–2030* suggests data collection at the district level.<sup>7</sup>

The practical assessment, which involves randomly sampling 20 students from each of 15 sites (totaling 300 students) within the IU, closely parallels the commonly used STH impact survey approach, where 5 sites with 50 students each (totaling 250 students) are sampled within each ecological zone or IU. Both designs use a cluster sampling approach, randomly selecting sites and students within each site. With systematic random sampling used within the practical assessment approach, this ensures greater geographic representation across the IU than simple random sampling. However, compared with the often-used 5-site/50-student approach, the practical assessment exceeds WHO's recommended sample size of 250 for MHII prevalence monitoring, enhances geographic representation, and reduces the margin of error around the IU-level prevalence estimate. Therefore, the practical assessment is comparably suited to guide STH treatment decisions and monitor progress toward elimination as a public health problem in the IU.

Note that in schistosomiasis-endemic settings where Kato-Katz stool examination is not already being performed through the SPPA because the endemicity is due to *S. haematobium*, programs may wish to consider conducting stool collection at fewer sites (e.g., schools) specifically for STH estimation purposes. Currently, no evidence is available on the number of sites needed to do so reliably; however, ongoing modeling efforts are exploring whether reduced sampling (from the standard SPPA) could provide sufficient data for STH evaluations in such areas.

**During precision assessments:** While the practical assessment systematically samples sites and students across the IU, ensuring representation across the IU for STH, the precision assessment selects sites within sub-IUs using purposive sampling based on schistosomiasis risk. As a result, precision assessments do not ensure geographic representation and high-risk schistosomiasis sites may not reflect the broader STH epidemiology throughout the IU. Therefore, schistosomiasis precision assessments alone may not be suitable for guiding IU-level treatment decisions or monitoring IU-level progress toward EPHP for STH. Efforts are ongoing to determine if the precision assessment design can be modified to address this STH limitation.

Nonetheless, with 20 SAC and 4 sites sampled in each sub-IU within an IU, site-level estimates collected through precision surveys can still provide valuable STH information for the program by providing evidence on the STH burden in specific areas and contributing information to inform future geospatial modeling efforts. Collecting these data can be worthwhile, especially if stool samples and Kato-Katz are already being collected and performed for the schistosomiasis survey. With precision assessments, STH data collection should only be considered if there is a clear present or future use for the results to inform actionable decisions.

### **Diagnosing STH**

STH infections are diagnosed in the same manner as *S. mansoni* using microscopic examination of stool samples with the Kato-Katz technique. Diagnostics should adhere to the guidelines outlined in WHO's Bench Aids for the Diagnosis of Intestinal Parasites, Second Edition as outlined in Appendix 5: Kato Katz SOP in this manual.<sup>9</sup> While other diagnostic methods, such as PCR, are available, it is important to note that WHO treatment frequency categories and EPHP thresholds are based on Kato-Katz diagnostic.

Historically, some programs may have reported only the presence or absence of STH eggs in a stool sample. However, with the increasing importance of monitoring proxy morbidity indicators and progress toward

achieving EPHP, it is crucial to quantify and record the number of STH eggs observed in each sample to determine an individual's infection intensity. The SPPA survey forms, which are available through ESPEN Collect, include the recording of both presence and number of eggs per slide (2 slides per sample).

**Analysing and Interpreting STH results from a SPPA**

**From practical assessments:** The key difference between the 15-site/20-student SPPA practical assessment and a 5-site/50-student survey, for example, lies in the number of sites and students surveyed. Both approaches use cluster sampling and provide evidence to guide STH treatment decisions and assess whether the STH EPHP threshold has been met at the IU level.

However, while analysis of the practical assessment for schistosomiasis focuses on the number of sites above and below 10% prevalence, the STH analysis from this survey focuses on estimating the IU-level prevalence. Since the methodology of the practical assessment is similar to that of the 5-site/50-student survey, the analysis and interpretation of the practical assessment, when used as an IU-level STH impact survey, can follow the same procedures and evaluation methods as other cluster surveys for STH.<sup>2,4</sup>

Below are some suggested steps to calculate key indicators, organize the results, and use them to guide programming and evaluate progress.

**1: Calculate the site-level any intensity infection (All) prevalence of (i) hookworm, (ii) *A. lumbricoides*, (iii) *T. trichiura*, and (iv) any STH species.**

Prevalence of All for [SPECIES] infection:

$$\frac{\text{Number of students testing positive for [SPECIES] at the site}}{\text{Number of students tested at the site}}$$

Where [SPECIES] refers to hookworm, *A. lumbricoides*, *T. trichiura*, and any STH species. For the 'any STH' species infection calculation, note that some students may have multiple infections; ensure that a student with, for example, both *A. lumbricoides* and *T. trichiura* infections is counted only once in the numerator when calculating the 'any STH' infection prevalence estimate. Note that, after this step, there will be four All prevalence estimates for each site (15 sites × 4 All estimates = 60 site-level All estimates in an IU).

**2: Calculate the mean site prevalence of any STH infections of any intensity.**

Mean site All = 
$$\frac{\text{Prevalence}_{\text{All},s1} + \text{Prevalence}_{\text{All},s2} + \text{Prevalence}_{\text{All},s3} + \dots + \text{Prevalence}_{\text{All},s15}}{15}$$

where:

- Prevalence<sub>All,s1</sub> is the prevalence of All for any STH species infection for Site 1,
- Prevalence<sub>All,s2</sub> is the prevalence of All for any STH species infection for Site 2,
- and so forth, up to Prevalence<sub>All,s15</sub> for Site 15.

These values can also be calculated for species-specific means if desired i.e. Mean site hookworm prevalence =  $\frac{\text{Prevalence}_{\text{hk}w1} + \text{Prevalence}_{\text{hk}w2} + \dots + \text{Prevalence}_{\text{hk}w15}}{15}$ .

Note that, since the number of students sampled is consistent across all sites, calculating the mean site All prevalence could be done by summing the number of students testing positive for any infection across all sites and dividing by the total number of students sampled across all sites. However, the stepwise approach described above is recommended for two main reasons. First, calculating site-level estimates is essential for the analysis and illustrates heterogeneity between sites, which can provide insights into local STH epidemiology. Second, because the students were selected in a way that does not produce an equal probability of selection across the IU, selection probability weights would need to be applied to obtain true IU-level prevalence estimates. For

these reasons, calculating the mean site prevalence and referring to our IU-level measure as the "mean site prevalence" provides a clearer representation of our approach.

**3: Calculate the site-level moderate-to-heavy intensity infection (MHII) prevalence of (i) hookworm, (ii) *A. lumbricoides*, (iii) *T. trichiura*, and (iv) any STH infection.**

Prevalence of MHII for [SPECIES] infection:

$$\frac{\text{Number of SAC testing positive for an MHII for [SPECIES] at the site}}{\text{Number of students tested at the site}}$$

Where [SPECIES] refers to hookworm, , *A. lumbricoides*, *T. trichiura*, and any STH species. Ensure that the denominator includes all SAC tested, not just those testing positive. Note that some students may have multiple MHII; ensure that a child with, for example, both, *A. lumbricoides* and *T. trichiura* MHII is counted only once in the numerator when calculating the "any STH" MHII prevalence estimate. Note that, after this step, there will be four MHII prevalence estimates for each site (15 sites × 4 MHII estimates = 60 site-level estimates for MHII in an IU).

**4: Calculate the mean site prevalence of any STH infections of moderate-to-heavy intensity.**

$$\text{Mean site MHII prevalence} = \frac{\text{Prevalence}_{\text{MHII},s1} + \text{Prevalence}_{\text{MHII},s2} + \text{Prevalence}_{\text{MHII},s3} + \dots + \text{Prevalence}_{\text{MHII},s15}}{15}$$

where:

- Prevalence<sub>MHII,s1</sub> is the prevalence of MHII for any STH species infection for Site 1,
- Prevalence<sub>MHII,s2</sub> is the prevalence of MHII for any STH species infection for Site 2,
- and so forth, up to Prevalence<sub>MHII,s15</sub> for Site 15.

These values can also be calculated for species-specific means if desired i.e. Mean site *T. trichiura* prevalence = Prevalence<sub>tri1</sub> + Prevalence<sub>tri2</sub>.....+ Prevalence<sub>tri15</sub> / 15..

**5: Organize and visualize results.** With 120 site-level prevalence estimates and 8 mean site prevalence estimates generated per IU, it is important to present the results in a format that is easily understandable by stakeholders for actionable use. Tables and figures can be created in various formats to suit your needs (see example Table shell below)

**Example Table.** Estimated site prevalence and mean site STH prevalence by IU, species, and intensity of infection

	Number of 10–14-year-old students		Hookworm		Ascaris		Trichuris		Any STH infection	
	Enrolled	Surveyed	All	MHII	All	MHII	All	MHII	All	MHII
<b>IU #1</b>										
Site 1										
Site 2										
...										
Site 15										
<b>IU #2</b>										
Site 1										
Site 2										
...										
Site 15										

Abbreviations: All: Any intensity infection IU: Implementation Unite; MHII: Moderate-to-heavy intensity infection; STH: Soil-transmitted

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helminth

Within each species, values in gray-shaded cells represent the mean site prevalence in the IU, while values without shading indicate the individual site prevalence. Thick boxes highlight the values used for treatment decision recommendations (All) and for assessing whether the EPHP threshold has been met (MHII).

**6: Evaluate survey implementation and limitations.** Before using the survey results to guide programming or decision-making, it is important to assess both the validity of the results and potential threats to their interpretation. This involves evaluating whether the survey was conducted as planned and identifying any issues that may have impacted the findings.

Some key considerations include determining whether the required sample size was met at each site and if all intended sites were surveyed. Additionally, it is important to review any issues with data collection, deviations from the planned survey procedures, and how well these procedures were monitored throughout the survey process. For example, assess whether laboratory procedures were executed as planned, such as ensuring slides were read within 60 minutes of preparation for accurate hookworm evaluation. Another factor is evaluating whether the survey population aligns with the intended target population. For instance, is school attendance sufficiently high to reasonably assume that the prevalence measured among the school-attending children applies to the entire school-age population in the community? Finally, assess whether the results aligned with initial expectations. If there are discrepancies, consider what might explain them.

Reviewing and documenting these considerations will help evaluate how survey limitations could affect the validity of the results and guide any necessary adjustments in interpretation.

**7: Determine WHO’s PC frequency recommendations for each IU.** According to WHO, the mean site prevalence of any STH infection of any intensity is used to guide treatment frequency.<sup>2-4</sup> The mean site prevalence calculated through the practical assessment is a suitable proxy for the IU-level prevalence. Figure 2 of *WHO’s 2030 Targets for Soil-Transmitted Helminthiases Control Programmes* diagrams the recommended preventive chemotherapy (PC) frequency following both baseline and impact surveys. If the practical assessment is considered an impact survey, this table indicates the following recommendations:

IU prevalence of any STH infection of any intensity (All)	WHO recommended PC frequency
<2%	No PC
2-<10%	Once every two years
10-<20%	Once a year
20-<50%	Maintained at previous frequency
≥50%	Three times a year

**8: Evaluate if the EPHP target has been met in the IU.** EPHP validation is achieved at the country level, however, it is important to assess whether this target has been met in each IU for morbidity monitoring purposes and to support future EPHP validation efforts.

Based on the mean site MHII prevalence, determine whether the EPHP target has been met (<2% MHII) or not yet met (≥2% MHII) in the IU. Note that WHO guidelines specify that the EPHP indicator is measured among both pre-SAC and SAC populations.<sup>6</sup> However, surveys are often conducted solely among SAC, and conclusions are often drawn from this group.

It is important to note that the prevalence of MHII will always be equal to or lower than the prevalence of All within a particular species or within the aggregate ‘any STH’ measure. Therefore, it is possible to achieve the EPHP threshold of <2% MHII in the IU while still needing to continue PC distributions (≥2% All). The frequency of

PC will depend on the overall prevalence of AII, as outlined in the Step 7 table above.

**9: Submit Results to WHO.** Once results are available, promptly report them to WHO using the PC Epidemiological Data Reporting Form (EPIRF). This reporting is essential for tracking global progress on STH control, as well as for understanding and preparing for future donation requests.

**From precision assessments:** As previously mentioned, the sites chosen for the precision assessment are selected based on schistosomiasis risk within the sub-IU. Consequently, valid prevalence estimates for STH at the IU level cannot be confidently derived from these surveys without making strong assumptions. Despite this limitation, when STH data are collected, site-level STH prevalence estimates should still be calculated, as outlined in Steps 1 and 2 above, to provide evidence of the STH burden at the site.

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## Appendix 7: Assessing *T. solium* during SPPA

### Overview

Taeniasis is an infection caused by tapeworms of the genus *Taenia*, which can infect humans through the consumption of undercooked or contaminated meat. There are three main species that can infect humans: *Taenia solium* (from pork), *Taenia saginata* (from beef), and *Taenia asiatica* (also from pork but not of public health importance). *Taenia solium* is particularly concerning because it not only causes intestinal taeniasis but the infection with the larval stages can also lead to cysticercosis including neurocysticercosis, a severe condition where the larvae migrate to the brain, causing neurological complications. Neurocysticercosis is the main cause of acquired (and preventable) epilepsy where the parasite exists. Proper cooking and hygiene practices are essential to prevent infection by these parasites (<https://www.who.int/multi-media/details/a-one-health-approach-to-tackling-the-pork-tapeworm>).

Schistosomiasis control programs should assess the presence of *Taenia solium* because praziquantel, the drug commonly used to treat schistosomiasis, can trigger severe neurological adverse reactions in individuals unknowingly infected with *T. solium* if neurocysticercosis is present. Identifying and managing *T. solium* infections before administering praziquantel is crucial to avoid these potentially life-threatening complications (<https://www.who.int/publications/i/item/9789240068117>, <https://www.who.int/publications/i/item/9789240068131>).

### When to include an assessment of *T. solium*:

If the implementation unit is known to have free roaming pigs **AND** open defecation practices, the program is encouraged to assess the Kato-Katz slides for taeniasis, keeping in mind that *Taenia* eggs are much smaller than schistosome eggs. With free roaming pigs we refer to pigs that might have been roaming at any point in their lives, for example as piglets even if later they are kept in pens.

### Diagnosing *T. solium*:

If any of the Kato-Katz slides are found to have taeniid eggs, the **species of *Taenia* must be confirmed** because *T. solium* eggs are indistinguishable from those of other *Taenia* species such as *T. saginata* or *T. asiatica*, which do not cause a serious public health problem.

- *Taenia* species can be confirmed using molecular methods or by direct parasitological examination (identifying the positive person, medication, and collecting the proglottids and the scolex where available).
- To confirm the *Taenia* species by molecular methods, samples can be stored in ethanol (collect about 2–5 g of faeces into at least double the volume of ethanol 95%). Samples can be kept at room temperature in dark storage for up to 5–6 days before storing them in ethanol. This provides an option to do the Kato–Katz first and only store the positive samples in ethanol.

### How to interpret the *T. solium* results:

If *Taenia solium* is confirmed, this indicates that transmission is occurring. The threshold suggested for triggering a public health intervention is  $\geq 0.5\%$  *T. solium* taeniasis

(<https://www.who.int/publications/i/item/9789240060722>). If the area being assessed has already

received multiple rounds of MDA with praziquantel and *Taeniasis* is still present, a One Health approach (adding the vaccination and medication of pigs) should be strongly considered as it is more efficient than MDA alone.

An absence of taeniasis among the survey samples **cannot be interpreted** as an absence of taeniasis in the implementation unit because of the limited survey population (only school-aged children) and the fact that sites were not selected according to the presence of the key risk factors for *T. solium* (e.g., there may not have been a prerequisite that each school correspond to a village with free roaming pigs).