

Liberia Coverage Evaluation Survey 2018

Measuring *treatment coverage* for schistosomiasis with preventive chemotherapy



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Introduction

This survey protocol describes the background and implementation design for the coverage survey that will be conducted in Liberia during 2018. Mapping was conducted in 2012 by the Ministry of Health which has informed the strategy for the implementation of the preventive chemotherapy (PC) programme for schistosomiasis (SCH) and soil transmitted helminth infections (STH). The aim of this coverage survey is to evaluate the effectiveness of the PC in reaching the target population.

Background to the Coverage Survey

Schistosomiasis or Bilharzia is a parasitic disease caused by infection with the trematode blood-flukes schistosomes. In sub-Saharan Africa, two major forms of human schistosomiasis occur: intestinal schistosomiasis caused by mainly *Schistosoma mansoni* infection and urinary schistosomiasis due to *Schistosoma haematobium* infection. Soil-transmitted helminthiasis is caused by infection with a group of intestinal nematode worms, most important of which within much of sub-Saharan Africa are the hookworms (both *Ancylostoma duodenale* and *Necator americanus*), the roundworm (*Ascaris lumbricoides*) and whipworm (*Trichuris trichiura*). Both schistosomiasis and STH are among the neglected tropical diseases (NTDs), which remain serious public health problems, posing unacceptable threats to human health and welfare.

The World Health Assembly resolution 54.19 urges all member states to regularly treat at least 75% of all school aged children who are at risk of morbidity from schistosomiasis and STH with Praziquantel (PZQ) and Albendazole or Mebendazole (ALB or MBD), respectively. To determine if these global goals are being reached, each national programme **routinely reports** drug coverage. This metric is calculated using the number of treatments distributed during a round of PC recorded in treatment registers and/or tally sheets for the numerator, and population figures (often obtained from routine census figures) as the denominator.

In order to monitor and support NTD programme performance, independent drug **coverage surveys** are recommended by the World Health Organisation (WHO 2006). These coverage surveys should be carried out across all areas given PC, particularly at crucial time points during the programmes i.e. in the first year of the programme, in cases where coverage might be suspiciously high or low, to ensure any corrective actions where needed. In areas where routinely reported coverage is low, additional methods i.e. Key Informant Interviews and Focus Group Discussion are recommended to assess the causes of low coverage (WHO, 2005; WHO, 2010).

The Schistosomiasis Control Initiative (SCI) currently uses cluster-sample surveys similar to those widely used by the Expanded Programme in Immunisation (EPI) and in other NTD programmes (WHO 1991; WHO 2005; Worrell and Mathieu 2012; Cromwell *et. al.* 2013; Baker *et. al.* 2013). The accuracy of routinely reported coverage estimates can be assessed by comparing these with survey-derived coverage estimates and their 95% confidence intervals. In addition to identifying over and under-reporting, in routinely collected data, these coverage surveys also provide data to assess other issues such as, MDA delivery strategies, biases in treatment coverage for example by gender, school enrolment, and examination of possible reasons for coverage failure. This information assists in the identification for recommended actions to improve programme delivery.

Schistosomiasis and STH in Liberia

The Liberian schistosomiasis control programme is part of the integrated national Neglected Tropical Disease (NTD) programme at the Ministry of Health and Social Welfare. The NTD programme aims to reduce the burden of NTDs to a level where it is no longer a public health problem. The table below shows the SCH and STH prevalence categories of each county based on the data collected in the 2012 baseline survey, which was carried out prior to the first MDA in Liberia. Due to the ebola outbreak in 2014 and 2015 there was a gap between the 2nd and 3rd treatment rounds, leading to a large gap in monitoring and evaluation of SCH and STH in Liberia.

Table 1: SCH and STH prevalence categories by county in Liberia

County Name	SCH Category	WHO PC recommendation SCH for SACs	STH Category	WHO PC recommendation STH for SACs
BOMI	Low	Twice during primary school	Moderate	Annual
GBARPOLU	Low	Twice during primary school	No risk	No PC
GRAND BASSA	Low	Twice during primary school	Moderate	Annual
GRAND GEDEH	Moderate	Bi-ennial	No risk	No PC
RIVER GEE	Low	Twice during primary school	Moderate	Annual
RIVERCESS	No Risk	No PC	Moderate	Annual
BONG	High	Annual	Moderate	Annual
LOFA	Moderate	Bi-ennial	No risk	No PC

MARGIBI	Low	Twice during primary school	No risk	No PCT
NIMBA	Moderate	Bi-ennial	Moderate	Annual
GRAND CAPE MOUNT	Low	Twice during primary school	Moderate	Annual
GRAND KRU	No Risk	No PC	High	Bi-Annual
MARYLAND	High	Annual	High	Bi-Annual
MONTSERRADO	Low	Twice during primary school	No risk	No PC
SINOE	Low	Twice during primary school	High	Bi-Annual

This will be the second coverage survey conducted in Liberia, with the last one taking place in May 2017 in Gharpolu, Maryland and Grand Gedah counties. The results of the first coverage survey demonstrated programmatic coverage above the 75% target among school aged children in two out of three counties; Gharpolu and Grand Gedah. In Maryland, reported coverage was lower than the surveyed coverage due to incomplete treatment registers. In Gbarpolu and Maryland, coverage for children who attend school was higher than for those who do not. In Grand Gedeh there was no statistical difference in coverage between attending and non-attending school aged children (SAC).

Details of the MDA in Liberia, June 2018

The Ministry of Health conducted community-based MDA in late June 2018 in three counties: Bong, Lofa and Nimba. This follows the MDA that took place in the counties of Grand Bassa, Grand Cape Mount, Monsterrado and River Gee between December 2017 and February 2018. Planning, implementation and training were done by the Ministry of Health at national, country and district level. Praziquantel was administered through community based distribution to school aged children (5-14 years) and high-risk adults in all districts of these counties. Bong has high prevalence of schistosomiasis, and Lofa and Nimba both have moderate prevalence. Bong county fulfils the WHO criteria for annual treatment with Benzimidazoles, but did not receive these as part of the June MDA.

Coverage targets for MDA in June 2018

The aim of the MDA is to target both school aged children (SAC) and adults with praziquantel as follows:

	Praziquantel (PZQ)
Pre-SAC	Not targeted
SAC attending school	> 75% therapeutic coverage
SAC not attending school	> 75% therapeutic coverage
At-risk adults	> 75% therapeutic coverage

With the following definitions:

- Pre-SAC: 1 to 4 years
- SAC: 5 to 14 years
- Child attending primary school: which is defined as ‘attendance at some point during the school year’. This based on the parents’ or guardians’ report as to whether the child is currently at school or, if not, whether the child attended school at some time during the school year. If the answer to either question is “yes”, the child is considered to have attended in the reference school year, even if currently absent or out of school.¹
- At-risk adults: individuals \geq 15 years in the implementation unit.

Reported coverage from the MDA

Table 2: Reported coverage from the MDA, provided by the MoH

County	Target population	Treatments	Coverage
Bong	245,663	194,516	79%
Lofa	298,476	278,351	93%
Nimba	642,797	427,436	66%
Overall	1,186,936	900,303	76%

¹ UNESCO definition Children Out Of School: Measuring Exclusion From Primary Education
<http://www.uis.unesco.org/Library/Documents/oosc05-en.pdf>

Study Aim

This survey protocol is designed to monitor the treatment coverage of PC with PZQ for the MDA campaign in June 2018.

Ethical approval

Ethics approval was provided by the University of Liberia Pacific Institute for Research and Evaluation (UL-PIRE) for the coverage survey in May 2017 (Protocol #: 16-09-017). This approval was extended by UL-PIRE to midnight on August 20, 2019. The IRB approval letter is saved here:

https://imperiallondon.sharepoint.com/sites/fom/schisto/mer/2_Country_M&E/LBR/Coverage/FY1718/1_Protocol_&_pre-survey/LBR_IRB_Ethics_Approval_Coverage_Survey_2018.pdf?csf=1&e=AgzNW2.

Coverage surveys have been granted ethical approval by Imperial College Research Ethics Committee (ref: ICREC_8_2_2).

Study Objectives

The objectives of the coverage survey are:

Survey Objective

SO 1. To measure validated treatment coverage of PZQ in SAC and adults relative to coverage targets

SO 2. To compare reported and validated coverage of PZQ for SAC and adults

SO 3. To assess coverage in SAC and adults disaggregated by gender

SO 4. To assess coverage in SAC disaggregated by school attendance

SO 5. Collect information on why targeted eligible individuals did not receive or accept treatment

Where validated coverage rate is defined as:

$$\frac{\text{Total number of interviewed individuals that ingested the target drug}}{\text{Total number of interviewed individuals}} * 100 \%$$

Note that people interviewed but with missing information on whether they ingested the drug will be assumed to have **not** taken the drug for the purposes of calculating validated coverage.

Study Design

Overview

The coverage survey will take place in several implementation units (IUs), with the IU being defined as the county in Liberia. Each IU will be considered separately. Within each IU, the survey will be household (HH) based in randomly selected villages. See Appendix D for a detailed explanation of the statistical approach to the coverage survey.

Survey team

Interviewers must not have been involved in any previous activities related to the NTD programme, specifically the MDA, to ensure that they remain unbiased.

The survey team will consist of three groups – each assigned to a county; Bong, Lofa and Nimba. Within each group, there will be two enumerators and one supervisor. Each enumerator will be selected by UL-PIRE, who have a database that they can select appropriate researchers from. Working on the assumption that one community/village is sampled in one day, the survey will be completed in 14 days.

See Appendix A 'Field Team Planning Manual' for more details of the survey teams and logistics.

Timing of survey

Coverage surveys should ideally take place as soon as possible following treatment (especially in areas with frequent MDAs) to minimise recall bias².

The survey should also take place during the day, and preferably not during school holidays³.

In Liberia the coverage survey will take place in early September 2018 which is 2-3 months following the MDA. It is not possible to conduct the survey earlier than this, as school holidays are in August 2018. The survey will take place during the day and will not be during the school holidays.

Implementation unit selection

The number of IUs selected for a coverage survey is generally dependent on budget and logistics of the survey. Typically, at least 10% of the eligible IUs should be surveyed. See Appendix D for more information on approaches to IU selection.

In Liberia the IU is the county. The coverage survey will take place in 3 IUs. However, due to the large extension of the counties, a cluster approach was used where two/three districts within a county

² Several recent studies demonstrate that recall bias may not affect accurate reporting of treatment in populations receiving integrated MDA (Knipes *et. al.* 2014; Budge *et. al.* 2016)

³ Several SCI coverage surveys conducted during school holidays revealed that the same populations of SAC that received treatment were not available during the school holidays.

were clustered together. A cluster is then randomly selected within each selected IU. This method reduces costs incurred through long travelling distances whilst maintaining the random cluster sampling methodology. Each implementation unit will be treated independently in the analysis.

Table 3. Districts selected for the coverage evaluation survey

County	District clustered randomly selected
Bong	Fuamah
	Sanoyea
Lofa	Foya
	Voinjama
Nimba	Sanniquillie-Mah
	Gbehlay-Geh

Number of villages and households to survey within each IU

Sample size calculations indicated that 14 villages per IU, and 15 HHs per village are required to obtain 10% precision on the coverage of SAC and adults within each IU. As the MDA was community-wide, two adults and two children will be randomly sampled within each HH. See Appendix D for full details of sample size calculations.

Selection of villages to survey within each IU

The selection of villages was completed by an SCI biostatistician from the village inventory. The village inventory will include a list of all villages within each IU to be visited to ensure that all villages have the opportunity to be selected.

As population information was not available for one county (Bong), sampling of villages was by simple random selection where all villages were equally likely to be selected. Adjustment for population size will be carried out during the analyses. See Appendix D for further details of the sampling methodology.

A short list of ‘reserve villages’ will be provided, such that if a selected village cannot be visited for security or other unpredictable reasons, it can be replaced with another in the same district. See Appendix B: Coverage Survey Interviewer Manual for more details.

Table 4. Selected and reserve villages for the 2018 coverage survey

Project	County	District	Community	Type
North West	BONG	FUAMAH	CEPHAS TOWN	SELECTED
North West	BONG	FUAMAH	KORLEKPORLEH	SELECTED
North West	BONG	FUAMAH	KPALAMUE	SELECTED
North West	BONG	FUAMAH	KWEEH	SELECTED
North West	BONG	FUAMAH	NEPOLORKOLLIETA	SELECTED

Project	County	District	Community	Type
North West	BONG	FUAMAH	SANGBATA	SELECTED
North West	BONG	FUAMAH	SINGBAH-YOHKUTA	SELECTED
North West	BONG	FUAMAH	SINGBEH YOU-TA COMMUNITY	SELECTED
North West	BONG	SANOYEA	BELEMUE	SELECTED
North West	BONG	SANOYEA	BOYEA	SELECTED
North West	BONG	SANOYEA	GHAIN	SELECTED
North West	BONG	SANOYEA	LOMA-TA	SELECTED
North West	BONG	SANOYEA	NAOPUYEAMAH	SELECTED
North West	BONG	SANOYEA	TAYAMA	SELECTED
North West	LOFA	FOYA	KAMBOIMA	SELECTED
North West	LOFA	FOYA	KELIDU YEONIN NGORKUMA	SELECTED
North West	LOFA	FOYA	KELIMA	SELECTED
North West	LOFA	FOYA	KISSIUO	SELECTED
North West	LOFA	FOYA	KOLDU KONJOE	SELECTED
North West	LOFA	FOYA	KPEMALOE	SELECTED
North West	LOFA	FOYA	KPONGAIN	SELECTED
North West	LOFA	FOYA	OWEAH	SELECTED
North West	LOFA	FOYA	SAKPAWAH	SELECTED
North West	LOFA	VOINJAMA	Belle Quarter	SELECTED
North West	LOFA	VOINJAMA	City View	SELECTED
North West	LOFA	VOINJAMA	Galama	SELECTED
North West	LOFA	VOINJAMA	Obeyanmai Town	SELECTED
North West	LOFA	VOINJAMA	Seekemai	SELECTED
North West	NIMBA	GBEHLAY- GEH	DUAHNPLAY	SELECTED
North West	NIMBA	GBEHLAY- GEH	Ganaglay	SELECTED
North West	NIMBA	GBEHLAY- GEH	GEIPA	SELECTED
North West	NIMBA	GBEHLAY- GEH	Nyoanplay #1	SELECTED
North West	NIMBA	GBEHLAY- GEH	Tahnplay	SELECTED
North West	NIMBA	GBEHLAY- GEH	Zeanlay #1	SELECTED
North West	NIMBA	SANNIQUILLIE-MAH	AIRFIELD	SELECTED
North West	NIMBA	SANNIQUILLIE-MAH	BOE COMMUNITY	SELECTED
North West	NIMBA	SANNIQUILLIE-MAH	BOLOLEWEE	SELECTED
North West	NIMBA	SANNIQUILLIE-MAH	CAMP 4	SELECTED
North West	NIMBA	SANNIQUILLIE-MAH	DOMAH TOWN	SELECTED
North West	NIMBA	SANNIQUILLIE-MAH	GARBLEIN	SELECTED
North West	NIMBA	SANNIQUILLIE-MAH	KITOMA	SELECTED
North West	NIMBA	SANNIQUILLIE-MAH	TONDIN	SELECTED
North West	BONG	FUAMAH	HAINDII COMMUNITY	RESERVE
North West	BONG	SANOYEA	BOYORMAH	RESERVE
North West	BONG	SANOYEA	FELEKALA	RESERVE
North West	BONG	SANOYEA	KPOTOLOMA	RESERVE
North West	LOFA	FOYA	GBONEBODU	RESERVE
North West	LOFA	VOINJAMA	Lawalazu Road	RESERVE

Project	County	District	Community	Type
North West	LOFA	VOINJAMA	Selega Road	<i>RESERVE</i>
North West	LOFA	VOINJAMA	Selega Town	<i>RESERVE</i>
North West	NIMBA	GBEHLAY- GEH	Sarkorlay	<i>RESERVE</i>
North West	NIMBA	SANNIQUILLIE-MAH	DUO-GORTON	<i>RESERVE</i>
North West	NIMBA	SANNIQUILLIE-MAH	MENGENYEE	<i>RESERVE</i>
North West	NIMBA	SANNIQUILLIE-MAH	SUAKOZUE	<i>RESERVE</i>

Selection of households to survey within each village

Household (HH) selection will be performed on site. Selection will be random, with the methodology dependent on whether HHs lists are available, see Appendix A ‘Field Team Planning Manual’.

Although ideally the survey would include nomadic populations and transient communities, because this is a HH-based survey, those without a fixed residence at the site selected for the coverage survey will not be included in the survey target population.

Selection of individuals to survey within each household

The head of household or another responsible individual will be interviewed to obtain the HH information. Two adults and two children within each HH will be randomly selected for individual interviews. See Appendix C for more details of individual interview procedures.

Study Participant Recruitment

Consent: The village chief will be notified about the study at least a week prior to the survey by the team leader, survey coordinator, or through other channels. Upon arrival in the village, there will be a meeting with the village chief where the survey is explained and verbal permission to perform the survey in the village is obtained before any HH is visited.

Informed consent from each selected HH head or other responsible adult within the HH will be obtained at arrival and before the team enters the house for the interview, see Appendix C for ‘Household Consent Form’.

Data collection and analysis

Data will be collected by mobile devices by survey teams in the field (see Appendix C for all forms). Data will be entered on phones and will be uploaded to a remote server each evening, or whenever internet connection allows. Throughout the survey SCI will review the data collected at the end of each day to allow feedback to the team and make any adjustments to interviewer technique or the protocol.

Analysis of the data will include calculation of validated coverage and associated 95% confidence intervals using appropriate analytical tools that account for clustering in the data (i.e. interviewees

clustered in HHs and villages, and IU if appropriate). Sub-group analysis (e.g. using multi-level logistic regression) will be used to test how coverage in SAC varies according to school attendance and gender, and in adults by gender. All analyses will be fully shared with collaborating partners in country.

APPENDIX A: Field team planning manual

Survey team composition

The survey team will consist of researchers from the database, selected by the UL-PIRE. There will be three teams consisting of one team leader, two interviewers and a driver. The survey is estimated to be completed in 14 days, including travelling to and returning from the counties.

Survey team training

SCI Liberia Programme Advisor (PA) will conduct the training for the coverage survey with assistance from a senior member of UL-PIRE staff and the MoH NTD Programme Manager. Training will consist of presentations, mock interviews and a pilot survey in a nearby village, all of which will take place over two days at ULPIRE offices. SCI PA will remain in the field for 4 days with one of the teams.

The training will cover the following aspects:

- Rationale and background for conducting the survey
- Essential aspects to maintain unbiased data collection
- HH selection methodology
- Conducting the interview of targeted population
 - Each team will be provided with the same dose pole that was used during each distribution (MDA), samples of each of the drugs that were provided and examples of the posters and leaflets used during social mobilization. These will act as visual cues to the individuals in each HH.
- Recording the answers in the mobile phones
- Mock interviews

Questionnaires do not need to be translated as English is the national language of Liberia, but each team will have a local guide from the respective village during the survey, who will be able to translate.

Key training documents can be accessed from the below locations. Printed copies will also be provided to each interviewer

1. Training Agenda

https://imperiallondon.sharepoint.com/:w:/r/sites/fom/schisto/mer/2_Country_M%26E/LBR/Coverage/FY_1718/1_Protocol_%26_pre-survey/Training_material/LBR_Coverage%20Survey%20Training%20Agenda_2018_EN_DRAFT.docx?d=w1e15e37c18994ac8b5c49a1b1cbba5af&csf=1&e=LTGUAp

2. Practice Household Scenarios

https://imperiallondon.sharepoint.com/:w:/r/sites/fom/schisto/mer/2_Country_M%26E/LBR/Coverage/FY_1718/1_Protocol_%26_pre-survey/Training_material/LBR_2018_Coverage%20Survey%20Training%20Practice%20Household%20Scenarios_EN.docx?d=w911a38916b3d40c3b5b4ae0f617cefa8&csf=1&e=nqq5p2

3. Training presentation

https://imperiallondon.sharepoint.com/:p:/r/sites/fom/schisto/mer/2_Country_M%26E/LBR/Coverage/FY_1718/1_Protocol_%26_pre-survey/Training_material/LBR_Training_Data_Collection_for_CS_2018_EN.pptx?d=wcf827b18b2f246fba1cdcd133b06fc81&csf=1&e=LJGMmd

4. SurveyCTO cheat sheet

https://imperiallondon.sharepoint.com/:w:/r/sites/fom/schisto/mer/2_Country_M%26E/LBR/Coverage/FY_1718/1_Protocol_%26_pre-survey/Training_material/LBR_Coverage_SurveyCTO_Cheat_Sheet_EN.docx?d=w9eada5e1d36449abbf1fa146880808ff&csf=1&e=6Vxhf5

Timetable of activities

Timeline	Responsibility	Description of activity	Who is involved
Days 1 - 2	SCI Programme Advisor/Field Survey Advisor	Two day training of ULPIRE offices with 6 enumerators and 3 supervisors	SCI PA UL-PIRE & survey teams National Schistosomiasis & STH Coordinator
	SCI Programme Advisor/Field Survey Advisor	Entire team visits one community in a treatment county (TBC) for field testing	All
Day 3	Team leaders	Three teams travel to respective counties	UL-PIRE & survey teams
Day 4-15	Team leaders	Teams carry out survey in respective counties (14 villages over 12 days), uploading completed surveys every evening/when internet available	UL-PIRE & survey teams
Day 16	Team leaders	Travel back to Monrovia	UL-PIRE & survey teams
Day 20	UL-PIRE Coordinator	Phones sent back to SCI	UL-PIRE coordinator

Roles and responsibilities

The survey team will include the following main members:

Survey Coordinator

The lead research assistant from UL-PIRE will be the survey coordinator. The primary duties of the survey coordinator are:

- Together with the SCI program advisor and biostatistician, adapt and finalise the survey protocol, including the questionnaire
- If necessary, arrange translation and back translation of questionnaire in local languages
- Together with the SCI program advisor, identify the survey team
- Together with the SCI program advisor, organise the survey logistics
- Together with the SCI program advisor, train the survey team
- Together with the SCI program advisor, oversee the data entry (paper or mobile-based).
- Lead one of the teams

SCI Program Advisor

The primary duties of the SCI program advisor are to:

- Obtain necessary ethical approvals (with the Ministry of Health)
- Adapt and finalise the survey protocol, including the questionnaire (with survey coordinator and SCI biostatistician)
- Obtain SCI sign-off of protocol
- Together with survey coordinator, identify the survey team
- Together with survey coordinator, organise survey logistics
- Together with survey coordinator, train and supervise the survey team
- Together with survey coordinator, oversee the data entry
- Together with survey coordinator, write the final survey report

Team Leader

A team leader should be identified for each field team. The primary duties of the team leader are to:

- Contact local authorities in the survey area to advise them about the study
- Lead the selection of HHs within a village
- Ensure strict adherence to the survey protocol
- Provide the survey teams with necessary materials for daily activities
- Review surveys for accuracy and completeness after each village is done.
- Review collected data (and eventual upload of data if mobile-based) at the end of each day
- Manage daily logistics
- Lead a daily debrief with the team

- Provide the field report

Interviewers

The primary duties of the interviewers are to:

- Conduct interviews according to protocol and entering data (paper or mobile-based)
- Report any issues or concerns to the team leader as they occur

The team members must have the following competencies:

- **Understanding of the sampling protocol and the necessity of protocol compliance**
- S/he does not need specific skills besides those that should be acquired during the survey training. If such a person is not available at the district level, he/she can be recruited from the national or regional level. In such cases, this person can administer surveys throughout the country as part of a national survey team.
- **Proficiency in the local language as well as general knowledge of the district**
If possible, the team members should have some experience interviewing people.

Local Guide

Often, in each selected village, the team will be accompanied by a local guide. The local guide can help familiarize surveyors with the selected cluster (i.e. identifying village boundaries or included HHs), and introduce the survey team to local authorities and HH members if necessary. However, the local guide should not be involved with the HH selection or interview process. The local guide should not have been involved in the drug distribution.

Drivers

Due to the nature of cluster surveys, drivers play a vital role in the success of the survey by helping the survey team navigate between clusters. Preferably, drivers should be familiar with the survey area. The number of drivers needed will vary based on the local situation.

SCI Biostatistician

The primary duties of the SCI biostatistician are to:

- Together with the survey coordinator and SCI program advisor, adapt and finalise the survey protocol, including the questionnaire
- Determine the sampling strategy and number of villages and HHs to sample
- Select the villages to sample
- Clean the data
- Analyse the data and produce graphs and tables with SCI PM
- Write the data cleaning notes in the report

APPENDIX B: Liberia 2018 Coverage Survey Interviewer Manual

Before arriving at the village

- The team leader should ensure that the village leader is notified of the study at least one week before the survey. The district coordinator may be able to help with this.
- The village leader should be asked if they can provide a list of all households in the village when the team arrives

Arriving at the village

- It is important to be at the village when people are available. This means interviewers should be in the village and ready to start at 8am every day.
- The first thing the team should do when arriving at the village is to seek out the head of the village:
 1. Introduce the team and ask for permission to survey
 2. Ask the head of the village for a list of houses in the village
 3. If a list of houses is available, select households using the 'village list' method
 4. If a list of households is not available, select households using the 'modified random walk' method
- The team leader will be responsible for completing the village questionnaire by interviewing the village leader:
 - The **GPS co-ordinates** of the village will be calculated as part of the questionnaire on the mobile phone devices

What to do if a village cannot be visited

If a selected village cannot be visited for security or other unpredictable reasons, replace the village with the first reserve village in the same IU that hasn't yet been visited.

Selected villages should only be replaced with those on the reserve list in extreme circumstances where it is impossible to survey that village, and not for reasons of distance, access difficulty and so on. It is important to document in the field report any villages that have been replaced and the reason for this replacement, as this could be a reason for biased coverage results.

Selecting households to interview

15 households will be randomly selected per village.

Definition of a household

We define a HH to be "a group of persons who normally live and eat their meals together in the household, and did so during the time of the survey". These people may or may not be related by

blood, but make common provision for food or essentials for living and they have only one person whom they all regard as head of the household”

If the HH comprises of one man with more than one wife then all wives and any children should be classified as one HH.

In some villages, several HHs, normally within the extended family, share the same compound. At the selected compound, if there are a number of HHs which could be selected, one HH should be randomly selected from the HHs in the compound (selection should not take the most senior, but be done by numbering the HHs and randomly selecting pieces of papers with the respective numbers written on them).

Selecting households method 1: Village lists

The village list selection of HHs is the preferred selection method. At village level, the village chief or equivalent administrative leader will be approached for a list of all HHs in the village. Team leaders must ensure that this HH list is fully up to date and captures all HHs within the area.

Sampling using the village list is when every h HHs in the village are sampled with the initial HH being a random number between 1 and h , where h is the sampling fraction as detailed below.

The steps to take for sampling using the village list are:

1. Find the total number of HHs in the village from the village list
2. Calculate the sampling fraction (h) using the equation below. Non-whole numbers should be rounded down.

$$h = \frac{\textit{Total number of households in village}}{\textit{Number of households to survey}}$$

3. Select the first HH by randomly selecting a number between 1 and h . Random number selection can be done in the field 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 HH that is on this row in the village list.
4. The second HH to sample should be the initial number + h .
5. Sampling should then proceed in this manner with every h^{th} HH being sampled.

Example of selection of HHs with a village list:

1. The protocol is to sample 12 HHs in the village.
2. The village list shows that there are 200 HHs in the village.
3. Therefore $h = 200 / 12 = 16.66$, which is rounded down to 16

4. The numbers 1 – 16 are written on pieces of paper, folded up and placed in a container and mixed up. The random piece of paper drawn out is 5.
5. The HH on the 5th row of the village list is identified.
6. The second HH to select for interviews is $5 + 16 = 21$. The HH on the 21st row of the village list is identified.
7. Sampling then continues to HHs 37 ($= 21 + 16$), 53, 69, 85, 101, 117, 133, 149, 165, 181 and 197 giving 12 HHs sampled in total.

Random selection to start at house 5

Select every 16th house ($21 = 5 + 16$)

House 1	House 21	House 41	House 61	House 81
House 2	House 22	House 42	House 62	House 82
House 3	House 23	House 43	House 63	House 83
House 4	House 24	House 44	House 64	House 84
House 5	House 25	House 45	House 65	House 85
House 6	House 26	House 46	House 66	House 86
House 7	House 27	House 47	House 67	House 87
House 8	House 28	House 48	House 68	House 88
House 9	House 29	House 49	House 69	House 89
House 10	House 30	House 50	House 70	House 90
House 11	House 31	House 51	House 71	House 91
House 12	House 32	House 52	House 72	House 92
House 13	House 33	House 53	House 73	House 93
House 14	House 34	House 54	House 74	House 94
House 15	House 35	House 55	House 75	House 95
House 16	House 36	House 56	House 76	House 96
House 17	House 37	House 57	House 77	House 97
House 18	House 38	House 58	House 78	House 98
House 19	House 39	House 59	House 79	House 99
House 20	House 40	House 60	House 80	House 100

Selecting households method 2: Modified random walk

If there are no village lists available then the HHs can be selected using the Modified Random Walk Procedure. The first HH is determined using the traditional spin the bottle method.

The steps for carrying out a random walk are:

1. Identify a central point (i.e. central meeting place, house of the village chief) within the village.
2. Spin a bottle/pen at this central point to randomly select a direction. If there is no road in the direction indicated by the bottle, move the bottle clockwise until a road is encountered.
3. Count all HHs along the direction indicated by the bottle between the central point and the village boundary. **Do NOT count empty/destroyed houses, businesses, or administrative buildings.** It is important to remember which HHs were included in the counting. A map indicating the HHs and their numbers should be drawn up.
4. The sampling fraction h should then be calculated using the equation below. Non whole numbers should be rounded down.

$$h = \frac{\textit{Total number of households counted}}{\textit{Number of households to survey}}$$

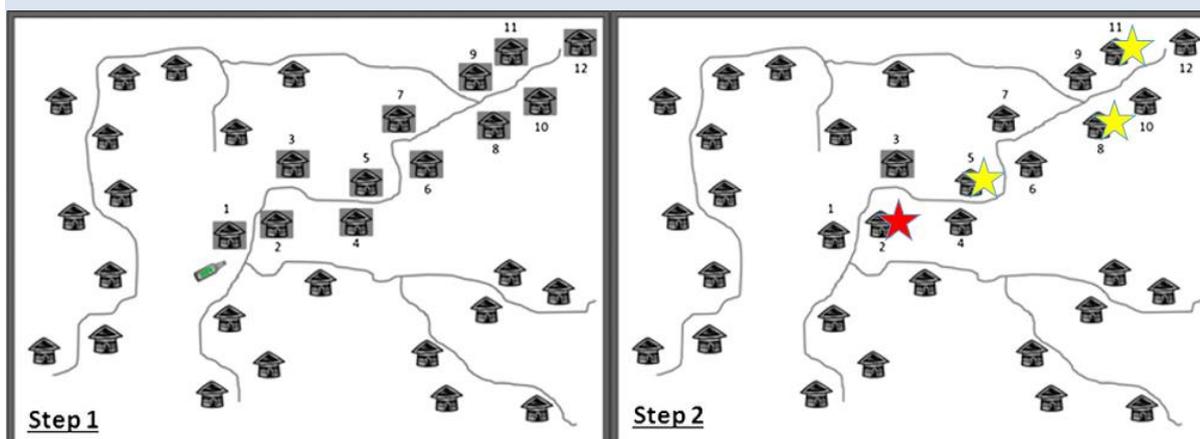
5. Find the first HH to sample by randomly selecting a number between 1 and h . Random number selection can be done in the field by writing numbers on pieces of paper, folding them up, placing them in a container and mixing before drawing one out at random, and then selecting the HH that is on this row in the village list.
6. The second HH to sample should be the initial number + h
7. Sampling should then proceed in this manner with every h^{th} HH being sampled.

Example of selection of houses with a random walk (Worrell and Mathieu 2012):

Step 1

1. The protocol is to sample 4 HHs to in the village.
2. The central point of the village has been found (see diagram below).
3. The bottle has been spun and the direction of survey determined.
4. A total of 12 HHs have been found between the direction of the bottle and the village boundary (see step 1 in the diagram below).
5. Therefore $h = 12 / 4 = 3$.

Diagram illustrating a random walk with 12 HHs and 4 HHs to be interviewed



Step 2

6. The first HH to be surveyed is randomly selected between numbers 1 – 4 and is number 2. HH number 2 is identified, and is shown with a red star on the diagram above.
7. The second HH to sample is $HH\ 2 + 3 = 5$. This is shown with a yellow star on the diagram above.
8. Sampling then continues to HHs $8 (=5+3)$ and 11 giving 4 HHs sampled in total.

Obtaining household permission to survey

Once the HH has been selected for interviews, the survey team should approach the house in a friendly and respectful manner and follow the below steps:

- Ask to speak with the head of the HH or the most senior person present.
- Introduce yourself to the head of the HH
- Explain the purpose of your visit and obtain consent from the head of the HH. Ensure the introduction is factual and does not influence or bias the HH's responses
- See below for example introduction:

Hello, my name is <name>. I am here on behalf of the Ministry of Health of Liberia, and we are here to conduct a household survey about an activity that has taken place in the village during the past months.

We would like to speak to some members of your households; and if you agree, the survey will only take a few minutes. Your answers will be treated anonymously.

The results will the Ministry of Health improve the programme.

It is your choice to take part, or not to take part, in this survey. If you do not wish to participate, it will not have any consequences for you.

Would you like to take part in our survey?

Answer: **Yes** or **No**.

- If the head of the HH provides consent, ask them to complete the household consent form (appendix C). If the person is not literate, read out the consent form in the local language, and obtain consent by thumb print.
- If the head of the HH **DOES NOT** provide consent for the survey; thank them for their time and continue to the next HH.

What to do if a household cannot be interviewed

If people in the selected home refuse to participate, try to encourage participation. If they still refuse, indicate this on the survey form, and count this HH as one of the HHs visited, indicate this on the survey form. **DO NOT replace the house with another HH.**

If no-one is at home in the selected HH, return later in the day. If, again, nobody is at home, indicate this on the survey form in the “Household questions” section, and count this HH as one of the HHs visited. **DO NOT replace the HH with another one⁴.**

If there are no eligible individuals for interview in the HH (e.g. no SAC live at the address, or all HH members moved in after the drug distribution), note this on the survey form, do not ask the questions, **but replace the HH with the next HH in the direction of travel with any eligible interviewee.**

Selecting individuals within a household

- If the head of the HH agrees to participate, proceed with the interview.
- Two adults and two school-aged children (SAC) within each HH will be randomly selected for interview.
- SAC are all children aged 5 -14 years
- Adults are all people aged 15 or over

⁴ If this happens for many households (e.g. frequently >2 households/village) in several villages, the supervisors should discuss with the study co-ordinator to consider increasing the number of households to randomly select per village.

The steps to take for interviewing SAC within a HH are:

1. Write the name of each SAC (i.e. all children aged 5 -14) in the HH on a separate piece of paper. **Include all SAC living in the HH, even if they are not in the HH at the time.**
2. Fold up the pieces of paper and put into a container
3. Pick out two pieces of paper
4. Interview the children whose names are on the paper
5. If a selected individual cannot be interviewed, please see below.

The steps to take for interviewing adults within a HH are:

1. Write the name of each adult (i.e. all individuals 15 or over) in the HH on a separate piece of paper. **Include all adults living in the HH, even if they are not in the HH at the time.**
2. Fold up the pieces of paper and put into a container
3. Pick out two pieces of paper
4. Interview the adults whose names are on the paper
5. If a selected individual cannot be interviewed, please see below

What to do if an individual cannot be interviewed

- If an individual (SAC or adult) cannot be interviewed then return later to try to interview them.
- If an individual is away from the house (e.g. at school), go to try to find them if permission from the head of the HH has been obtained.
- **If they still cannot be interviewed then DO NOT replace them with another individual.** Record them on the survey form as not being interviewed and the reason why.

Interviewing selected individuals

- Interview the randomly selected individuals using the phones or paper forms
- Interviews should be conducted with each person privately; parents can accompany children.
- Avoid leading questions or providing the HH with information which later you will be asking them to provide to you either as an answer, or to check their responses. Use visual cues as much as possible (dose poles, drugs etc)
- **DO NOT** read the multiple-choice options to the interviewee or suggest an answer
- Wait for the interviewee to provide an answer and then choose the most appropriate option on the phone or from the codes provided with the paper forms

- If using paper forms, be very careful when answering questions with multiple parts that no contradictory answers are given – e.g. person says that they did take drugs but also give a reason why they didn't take drugs

Note: The survey can be conducted by either one (1) or both interviewers at a time. If the interviewers feel confident that they can conduct the interview alone then the other interviewer and field supervisor can proceed to the next HH according to the sampling protocol.

Finishing the survey

- After everyone selected has been interviewed and all the responses recorded on the data collection form thank everyone for their assistance and leave the HH.
- Move on to the next selected HH and repeat.

Coverage Survey - Village Questionnaire <i>To be answered by the interviewee</i>		
1	Date (DD/MM/YYYY)	
2	Interviewer Name	
3	GPS on Arrival	
5	County name (of implementation unit)	
6	District name	
7	Village name	
8	What is the position in the village of the person being interviewed? (ENTER CODE)	
9	What is the total population of the village?	
10	What is the number of households in the village (<i>interviewee to estimate if not known</i>)	
11	Source of population data? (ENTER CODE)	
12	When was the mass treatment for SCH carried out? (month/year)	
13	How was the mass treatment provided in the village? (ENTER CODE)	
14	Did this treatment include adults?	<input type="checkbox"/> Yes <input type="checkbox"/> No
15	If the treatment was community based, how was treatment in the village carried out? (ENTER CODE)	
<i>To be answered by the interviewer</i>		
16	Method of random sampling of households	<input type="checkbox"/> Random selection from household list <input type="checkbox"/> Bottle spinning method
17	Notes about village interview	

Answer codes for village questions

<p>8. Interviewee position?</p> <ol style="list-style-type: none"> 1. Village chief 2. Village deputy chief 3. School head teacher 	<p>11. Source of population data</p> <ol style="list-style-type: none"> 1. Village register 2. Election register 3. LF register 4. Malaria register 5. Onchocerciasis register 6. General health register 7. Other (please specify) 	<p>13 How was the MDA treatment provided in the village?</p> <ol style="list-style-type: none"> 1. No MDA treatment was carried out 2. School-based treatment 3. Community-based treatment 4. Both school-based and community-based treatment 5. Do not know
<p>15. If treatment was community based, how was treatment in the village carried out?</p> <ol style="list-style-type: none"> 1. Door to door 2. At the house of the village head 3. Central point in the village 4. Local health centre 5. At the village school 6. Other 7. Do not know 		

H1. Date (DD/MM/YYYY)	
H2. Interviewer Name	
H3. County name	

H4. District name	
H5. Village	
H6. Head of household name	

Coverage Survey – Household Form *To be answered by the interviewer*

1	Date (DD/MM/YYYY)	
2	Interviewer Name	
3	GPS on Arrival	
4	County name (of implementation unit)	
5	District name	
6	Village name	
7	What number house is this for you in the village? (Enter one number)	
8a	Was this house interviewed? (Tick one box)	<input type="checkbox"/> No <input type="checkbox"/> Yes on first visit <input type="checkbox"/> Yes on second visit
8b	If household not interviewed: Reason why household not interviewed (Tick one box)	<input type="checkbox"/> Nobody home <input type="checkbox"/> Refused to participate <input type="checkbox"/> Household not found or destroyed <input type="checkbox"/> Other
8c	If household not interviewed and reason 'other' Reason not interviewed: other (Enter reason)	
9	If household interviewed: Consent form signed by Head of House? (Tick one box)	<input type="checkbox"/> No: stop interview <input type="checkbox"/> Yes

To be answered by the interviewee Household head or other adult

10	How many people live in this household? (Enter one number)	
11	How many adult males live in this house (16 or older)? (Enter one number)	
12	How many adult females live in this house (16 or older)? (Enter one number)	
13	How many boys live in this house (5-15 years old)? (Enter one number)	
14	How many girls live in this house (5-15 years old)? (Enter one number)	

H1. Date (DD/MM/YYYY)	
H2. Interviewer Name	
H3. County name	

H4. District name	
H5. Village	
H6. Head of household name	

15	Notes about household interview <i>Answered by interviewer</i>	
----	--	--

The equity questionnaire below is based on the supporting file

https://imperiallondon.sharepoint.com/:x:/r/sites/fom/schisto/_layouts/15/Doc.aspx?sourcedoc=%7Bf95d291c-9d38-48e6-b5e4-0b997b55b5a3%7D&action=default&uid=%7BF95D291C-9D38-48E6-B5E4-0B997B55B5A3%7D&ListItemId=11594&ListId=%7B825796A2-CB19-4B65-97EB-1957505FED4A%7D&odsp=1&env=prod from <http://www.equitytool.org>

Equity Questionnaire – To be answered by the household head or other adult interviewee	
E1. Does your household have a generator? (Tick one box)	<input type="checkbox"/> Yes <input type="checkbox"/> No
E2. Does your household have a cupboard? (Tick one box)	<input type="checkbox"/> Yes <input type="checkbox"/> No
E3. Does your household have chairs ? (Tick one box)	<input type="checkbox"/> Yes <input type="checkbox"/> No
E4. Does your household have a television? (Tick one box)	<input type="checkbox"/> Yes <input type="checkbox"/> No
E5. Does any member of this household own a watch	<input type="checkbox"/> Yes <input type="checkbox"/> No
E6. Does any member of this household have a bank account?	<input type="checkbox"/> Yes <input type="checkbox"/> No
E7. What type of toilet do you use in your household	<input type="checkbox"/> No Facility/Bush/Field <input type="checkbox"/> Other type of toilet
E8. What is the main source of energy for lighting in this household?	<input type="checkbox"/> Electricity <input type="checkbox"/> Other lighting source
E9. What type of fuel does your household mainly use for cooking?	<input type="checkbox"/> Fire/Charcoal <input type="checkbox"/> Wood <input type="checkbox"/> Other type of fuel
E10. What is the main material of the floor in your household?	<input type="checkbox"/> Earth/Sad/Mud = <input type="checkbox"/> Wood <input type="checkbox"/> Other type of fuel
E11. What is the main material of the exterior walls in your household	<input type="checkbox"/> Mud and sticks <input type="checkbox"/> Other material

H1. Date (DD/MM/YYYY)	
H2. Interviewer Name	
H3. County name	

H4. District name	
H5. Village	
H6. Head of household name	

Coverage Survey Individual Questionnaire – *to be answered by interviewer*

		Adult 1	Adult 2	Child 1	Child 2
16	Name of person randomly selected? (Enter name)				
17a	Was this person interviewed? (Tick one box)	<input type="checkbox"/> Yes <input type="checkbox"/> No			
17b	<i>If person not interviewed:</i> Reason for no interview? (Tick one box)	<input type="checkbox"/> Absent during survey <input type="checkbox"/> Refused to participate <input type="checkbox"/> Other	<input type="checkbox"/> Absent during survey <input type="checkbox"/> Refused to participate <input type="checkbox"/> Other	<input type="checkbox"/> Absent during survey <input type="checkbox"/> Refused to participate <input type="checkbox"/> Other	<input type="checkbox"/> Absent during survey <input type="checkbox"/> Refused to participate <input type="checkbox"/> Other
17c	<i>If person not interviewed and reason no interview 'other':</i> Other reason no interviewed? (Enter reason)				
18	Interview start time (HH.MM)				
19	Is this person being interviewed confidentially? (Tick one box)	<input type="checkbox"/> Yes <input type="checkbox"/> No			
20	Consent received? (Tick one box)	<input type="checkbox"/> Yes <input type="checkbox"/> No			
21	Participant age? (Enter one number)				
22	Sex (M/F)? (Tick one box)	<input type="checkbox"/> Male <input type="checkbox"/> Female			

H1. Date (DD/MM/YYYY)	
H2. Interviewer Name	
H3. County name	

H4. District name	
H5. Village	
H6. Head of household name	

Coverage Survey Individual Questionnaire – *to be answered by interviewee*

		Adult 1	Adult 2	Child 1	Child 2
23a	<i>Adults only:</i> What is your occupation? (ENTER CODE)				
23b	<i>Adults only, if occupation is other:</i> What is your occupation - other? <i>(write answer)</i>				
23c	<i>Adult females only:</i> Were you pregnant or breastfeeding in June 2018?	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
24a	<i>Children only:</i> Have you attended school in the last school year: September 2017 to July 2018? <i>(Tick one box)</i>			<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
24b	<i>If attended school in last school year:</i> What type of school do you attend? (ENTER CODE)				
25a	Did you know about the MDA?	<input type="checkbox"/> Yes <input type="checkbox"/> No			
25b	How did you hear about the mass treatment? (ENTER CODE)				
25c	<i>If heard about mass treatment is other:</i> How did you hear about the mass treatment - other? <i>(write answer)</i>				
26	Individual knowledge of the schistosomiasis mass treatment <i>show participants props and (tick all objects recognised, or 'none' if don't recognise any)</i>	<input type="checkbox"/> Schisto <input type="checkbox"/> PZQ <input type="checkbox"/> Dose pole <input type="checkbox"/> None of above	<input type="checkbox"/> Schisto <input type="checkbox"/> PZQ <input type="checkbox"/> Dose pole <input type="checkbox"/> None of above	<input type="checkbox"/> Schisto <input type="checkbox"/> PZQ <input type="checkbox"/> Dose pole <input type="checkbox"/> None of above	<input type="checkbox"/> Schisto <input type="checkbox"/> PZQ <input type="checkbox"/> Dose pole <input type="checkbox"/> None of above
27a	Did you swallow PZQ at the mass treatment? (show dose pole/tablets) <i>(Tick one box)</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No			
27b	<i>If did not swallow PZQ:</i> Reasons for not swallowing PZQ (ENTER CODE)				

H1. Date (DD/MM/YYYY)	
H2. Interviewer Name	
H3. County name	

H4. District name	
H5. Village	
H6. Head of household name	

		Adult 1	Adult 2	Child 1	Child 2
27c	<i>If did not swallow PZQ, and other reason for not swallowing PZQ:</i> Other reasons for not swallowing PZQ (write answer)				
27d	<i>If swallowed PZQ:</i> Where did you take the PZQ? (ENTER CODE)				
28	<i>If swallowed PZQ:</i> How did you take the PZQ tablets? (ENTER CODE)				
29	<i>If swallowed PZQ:</i> Was the distributor present when you swallowed the tablets? (Tick one box)	<input type="checkbox"/> Yes <input type="checkbox"/> No			
30	<i>If swallowed PZQ:</i> Had you eaten in the two hours before you took the tablets? (Tick one box)	<input type="checkbox"/> Yes <input type="checkbox"/> No			
31a	Who decided whether you took the treatment or not? (ENTER CODE)				
31b	<i>If who decided is other:</i> Who decided whether you took the treatment or not - other? (write answer)				
32	Did you know beforehand when and where the MDA would take place? (ENTER CODE)				
33	How far was the distribution point from your home if walking? (ENTER CODE)				

Answer codes for Household and Individual questions

23a: What is your occupation?

- | |
|----------------------------|
| 1. Farmer |
| 2. Merchant |
| 3. Health worker |
| 4. Housewife |
| 5. Student |
| 6. Fisherman |
| 7. Medicines distributor |
| 8. Teacher |
| 9. Village Head |
| 10. Does not work |
| 11. Other (please specify) |

24b: What type of school do you attend?

- | |
|----------------------------------|
| 1. Primary (public or private) |
| 2. Secondary (public or private) |
| 3. Religious school |

25b. How did you hear about the drug distribution?

- | |
|------------------------------|
| 1. Teacher |
| 2. Village Meeting |
| 3. Posters / flyers |
| 4. Health professional |
| 5. Newspaper |
| 6. Radio |
| 7. TV |
| 8. Town crier (loud speaker) |
| 9. Place of worship |
| 10. Banner |
| 11. Other (please specify) |

27b: Reasons for not swallowing PZQ

- | |
|--|
| 1. Too young |
| 2. Too old |
| 3. Pregnant |
| 4. Breast feeding |
| 5. Too sick |
| 6. Feels healthy |
| 7. Fear of side effects |
| 8. Bad smell or taste |
| 9. Tablets are too large |
| 10. Rumours |
| 11. Does not know |
| 12. Drugs ran out |
| 13. Was at work |
| 14. Not living in the village at time of MDA |
| 15. Absent from school on day of MDA |
| 16. Does not attend school |
| 17. There was no MDA |
| 18. Had not heard about MDA |
| 19. Too far from distribution point |
| 20. Refused to answer |
| 21. Was not invited to MDA |
| 22. Had not eaten before MDA |
| 23. Too many tablets |
| 24. Medicine does not work |
| 25. Other (please specify) |

<p>27d: Where did you take PZQ?</p> <ol style="list-style-type: none"> 1. School 2. Home (door-to-door) 3. House of the village head 4. Central point in the village 5. Local Health Centre 6. District Clinic 7. Other 8. Does not know 	<p>28: How did you swallow PZQ?</p> <ol style="list-style-type: none"> 1. All at the same time 2. I took them all throughout the day but not all at the same time 3. I took them all but not on the same day 4. One tablet a day until they were all finished 5. I took some but not all of them 6. I was given the tablets but did not swallow them 7. Do not remember
<p>31a: Who decided whether you took the treatment or not?</p> <ol style="list-style-type: none"> 1. Me 2. Father 3. Mother 4. Other family member 5. School teacher 6. Village Head 7. Traditional Healer 8. Health worker or drug distributor 9. Other (please specify) 10. Did not know about the distribution 	<p>32: Did you know beforehand when and where the MDA would take place?</p> <ol style="list-style-type: none"> 1. Did not know when or where 2. Knew when only 3. Knew where only 4. Knew when and where
<p>33: How far was the distribution point from your home if walking?</p> <ol style="list-style-type: none"> 1. 0 - at home or in school 2. Less than 30 minutes 3. 30 to 60 minutes 4. 1 to 2 hours 5. More than 2 hours 6. Do not know 	

Appendix D: Detailed survey methodology & sample size estimation

Deviations from general statistical approach in this protocol

The implementation unit in Liberia is the county. However, the logistical costs of surveying an entire country were too high. Instead, we grouped the districts within each county into clusters of districts where travel between them was relatively simple. We sampled all three counties to survey in, and then randomly sampled a cluster of districts within each randomly selected county. Each cluster of counties will be treated as one IU during analysis. It was felt that this strategy offered the best compromise between cost considerations and geographical spread of the survey.

Sample size details

Values imputed to the sample size calculation were:

- # average population in each implementation unit = 310,378 (2008 census data)
- Number of children interviewed in each household on average = 2
- Number of individuals targeted in each village = 30
- Non-response rate = 20%
- Margin of error for confidence interval = 10%
- Expected true coverage = 50%
- Intra-class correlation coefficient = 0.1
- Confidence level of intervals = 95%

Statistical approach to coverage survey

Statistical approach to coverage survey methodology & sample size estimation

Scope

These principles are applicable for assessing treatment coverage in all MDA settings where the method of sampling is two stage cluster sampling.

Implementation units monitored

Logistical and financial constraints will almost always mean that not all implementation units will be assessed. There are two main options when choosing which implementation units to assess:

1. **Non-random selection of implementation units** where units are chosen for their particular properties. These properties may be due to reported coverage rates or other external factors (e.g. donor-support; geography). Where the implementation units are chosen for their reported coverage rates a mix of districts that have reported low and high coverage are often chosen. This is to allow comparison between districts and to

investigate if particularly low performing district may actually have performed better than expected perhaps due to the population being lower than estimated. Non-random selection is most commonly used in programs covering large areas (such as large countries) where logistical and cost constraints mean only a small number of implementation units can be visited. However, this method does not enable an estimate of coverage at the population level to be obtained.

2. **Random selection of implementation units** where the units are chosen randomly from a list of all implementation units, with or without weighting for population size. This strategy allows estimation of coverage at a program level if sufficient implementation units are visited. This strategy is most commonly used in programs that cover relatively small areas where travel distances between implementation units is not prohibitive.

Sample size calculation

The sample size calculations find the number of primary sampling units (PSUs; normally villages) required in order to have expected 95% confidence intervals of $\pm 9\%$ when true population coverage is 50%, given a specified target number of households (HHs) to survey in each PSU. It is assumed that coverage estimates of a pre-specified precision are required at an IU-level (the highest level of resolution) and that sample size calculations need not aim to achieve a pre-specified precision for any particular sub-group (e.g. enrolled vs. non-enrolled children). Thus the precision of coverage estimates for sub-groups will vary according to their frequency in the survey.

The parameters used in the calculation are:

- **True implementation unit coverage assumed = 50%**. This is chosen as it is the most conservative level and will give the largest sample size required of any assumed coverage percentage.
- **Number of HHs sampled in each primary sampling unit = variable**. This is chosen by the program management and is primarily motivated by logistical issues such as team size and expected distances between PSUs. Arguably the biggest driver of cost in coverage surveys is the staff costs (per diems) for enumerators. Therefore we try to minimise the time needed for a survey (person-hours), given a pre-specified precision. A cluster size (number of HHs per village) that permits two villages to be surveyed per day rather than just one, is preferable, and will minimise the time needed for the survey. We assume the maximum

number of villages that can be surveyed per day is 2, if a relatively small number of HHs are interviewed per village.

- **Number of individuals in the implementation unit:** The average IU population size is considered. Often this will make little difference to the estimated sample size required, though may do when IUs are small. (see below for further options when implementation units are small).
- **Differences between PSUs in coverage: Intra-class correlation coefficient = 0.1.** An intra-class correlation coefficient (*rho*) of 0.1 is assumed. This is based on a review of coverage survey data from several countries: Baker et al. (Baker, et al., 2013), suggested a design effect of approximately 6 is appropriate when designing a district-level NTD PCT coverage survey based on coverage survey results from several countries in sub-Saharan Africa. Assuming approximately 50 individuals were surveyed per district in the reviewed surveys (though this is not explicitly reported in the paper), leads to an estimate of *rho* around 0.1. In countries where IUs are smaller than a district and implementation may therefore be expected to be more homogeneous within an IU, a smaller value of *rho*/design effect may be more realistically assumed during sample size calculations.
- **Margin of error for confidence intervals.** A maximum margin of error of 10 percentage points on a 95% confidence interval for the IU coverage estimate is specified.
- **Width of confidence intervals calculated during the analysis = 95%.** This is a standard metric.
- **Number of adults and children to sample in each HH = 2.** This is generally assumed to be two as only two SAC, or two SAC and two adults, per HH should be interviewed, with the individuals being randomly selected.
- **Expected non-response rate = 20%.** The expected non-response rate is assumed to be 20% when adults are being surveyed to allow for less than two adults on average in a HHs. When only SAC are being surveyed, this may be lowered to 12%.

Sample size calculations when implementation units are small

When implementation units are small (e.g. health care centres), and comparable to PSU sizes in some larger surveys, then the sampling methodology may be altered. In this instance, we would assume the overall program to be the implementation unit and the implementation unit to be the primary sampling unit. The sample size calculation would then proceed as normal but would instead calculate the number of implementation units required to have expected 95% confidence intervals of $\pm 9\%$ when true population coverage is 50%, given a specified number of HHs to survey

in each implementation unit. This methodology will generally require HH lists to be available for random HH selection. Unbiased estimates of population coverage will then be calculable, assuming that the implementation units to be surveyed were randomly selected and a sufficient number (>15) were surveyed.

Selection of primary sampling units

Selection of primary sampling units is conducted by an SCI biostatistician. There are two main options when selecting PSUs to survey:

- 1. PSUs are selected from a list of all PSUs within the implementation unit, with no reference to population size.** In this instance, every PSU has an equal probability of being selected and consequently HHs in small PSUs are more likely to be selected than HHs in large PSUs due the same number of individuals being interviewed in each PSU. This selection method is most commonly used when population sizes of the primary sampling units are not known. Analyses of coverage rates and associated 95% confidence intervals are be performed with and without adjustment for PSU size, collected as part of the survey.
- 2. PSUs are selected from a list of all PSUs within the implementation unit, with probability proportional to population size.** In this instance, larger PSU's have a higher probability of being selected than smaller PSUs, leading to an equal probability of each individual in the implementation unit being selected. Analysis therefore does not require any adjustment for population size. Selection is performed without replacement to guard against the possibility of especially large PSUs being selected multiple times.

Sampling of individuals within a HH

Our standard protocol is for two SAC and two adults (if eligible for treatment) to be interviewed in each HH. Much of the differences in whether or not people received treatment is often between HHs rather than between individuals within a HH. If we were to interview everybody in the same HH then if particularly large HHs were surveyed the interview process could take a very long time meaning either that the teams would have to stay in the villages longer, or reduce the number of houses visited within some villages, neither of which is optimal. We believe that this method will not induce any biases as long as the protocol is followed of randomly selecting from the list of all eligible individuals in the HH.

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