

Burundi Coverage Survey 2017

Measuring *treatment coverage* for schistosomiasis and soil transmitted helminths 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 Burundi during the 2017/18 financial year. Baseline mapping was conducted in 2007 by the Ministry of Public Health which has informed the strategy for the implementation of the preventive chemotherapy (PC) programme for schistosomiasis (SCH) and soil transmitted helminth infections (STH). In 2014 and 2016, a country-wide reassessment mapping exercise was carried out, and a new strategy has now been implemented. The aim of this coverage survey is to evaluate the effectiveness of the PC in reaching the target population.

Background to the Coverage Survey

SCH or Bilharzia is a parasitic disease caused by infection with the trematode blood-flukes schistosomes. In sub-Saharan Africa, two major forms of human SCH occur: intestinal SCH caused by mainly *Schistosoma mansoni* infection and urinary SCH due to *Schistosoma haematobium* infection. STH 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 SCH 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 (SAC) who are at risk of morbidity from SCH 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 WHO (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).

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.

SCH and STH in Burundi

The Burundi national programme is now entering its 10th year of annual treatment with PZQ and ALB. Since 2007, and every year except in 2013, all SAC in selected SCH endemic communes and all STH endemic districts have been treated with PZQ and ALB through the Mother and Child Health week. In addition, pre-SAC and pregnant women in their 2nd and 3rd trimester also receive ALB during those Mother and Child Health weeks.

Recent re-mapping of the country with circulating cathodic antigen (CCA) urine assay and Kato-Katz diagnostic tests have shown that infection is still widespread yet the average intensity of infection is low (Table 1, Figures 1 and 2). To note, there is no *S. haematobium* in Burundi. The NTD master plan in Burundi is one of elimination with the aim of reaching the 2020 goals.

	<i>S. mansoni</i> by Kato-Katz	<i>S. mansoni</i> by CCA - trace negative	<i>S. mansoni</i> by CCA - trace positive	Any STH	<i>Ascaris</i> by Kato- Katz	Hookworms by Kato-Katz	<i>Trichuris</i> by Kato-Katz
N mapping units	46	46	46	46	46	46	46
N schools	255	409	409	255	255	255	255
N pupils with data	12,735	20,371	20,371	12,735	12,735	12,735	12,732
Prevalence (and 95% CI)	1.3% (0.6% - 2.5%)	12.9% (10.5% - 15.8%)	41.8% (37.3% - 46.4%)	22.0% (18.4% - 26%)	14.8% (11.4% - 18.9%)	5.2% (4.1% - 6.4%)	4.9% (3.7% - 6.6%)
Proportion of mapping units with infection	37.0%	100.0%	100.0%	100.0%	100.0%	93.5%	100.0%
Mapping unit prevalence range	0% - 11.3%	0.8% - 24.3%	9.2% - 67.4%	1.4% - 47.6%	0.3% - 43.3%	0% - 15.7%	0.3% - 21.2%

Table 1: Results from the 2014-2016 countrywide re-mapping exercise.

Burundi Mapping 2014 & 2016
S. mansoni prevalence by CCA (trace as negative)

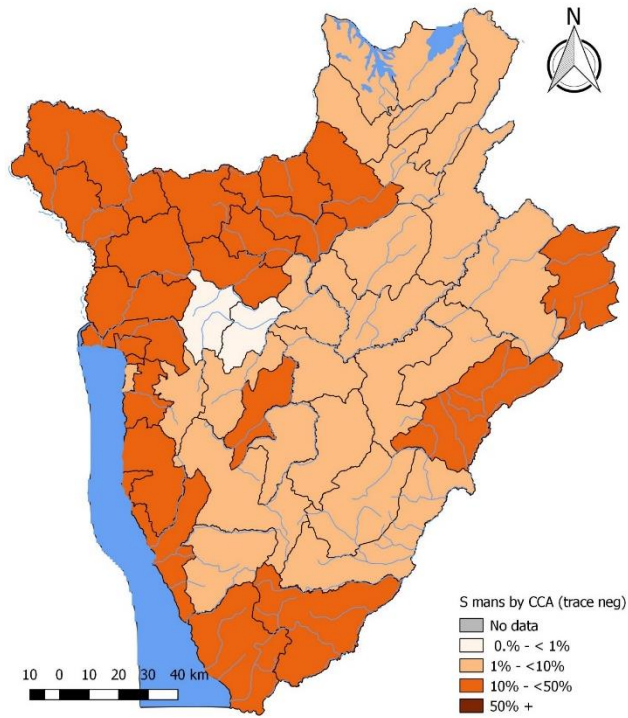


Figure 1: *S. mansoni* prevalence by CCA – considering trace as negative. Results are shown at the district level.

Burundi Mapping 2014 & 2016
Any STH prevalence by KK

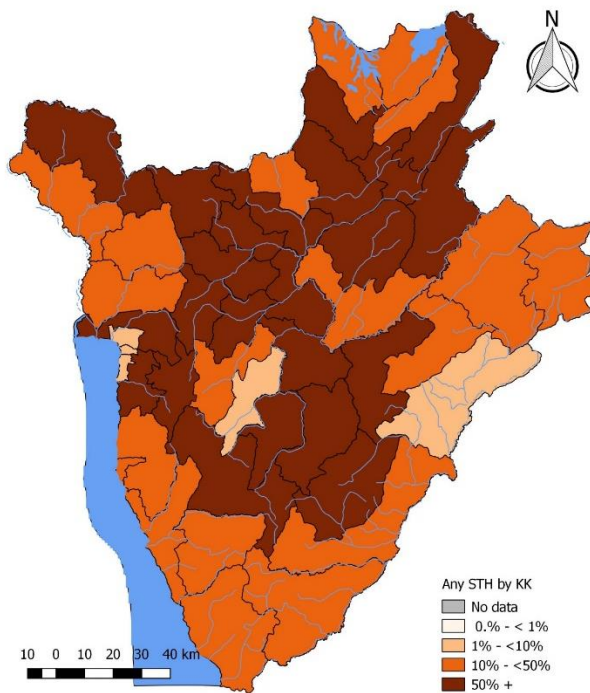


Figure 2: Any STH by Kato-Katz. Results shown at the district level.

For implementation purposes, the Ministry of Public Health in Burundi have considered results when CCA trace was considered negative. Historically, Burundi have treated at the commune level, using district level mapping data. This was revisited when the results of the recent re-mapping (2014/2016) were made available. In line with WHO guidelines, BDI is now treating district-wide.

The last coverage survey undertaken in Burundi was in 2012, which assessed the performance of the Mother and Child Health week programme (delivery of measles vaccine, vitamin A supplementation, ALB and PZQ). Since then, there has been 4 rounds of annual treatments for SCH and STH, with possibly an additional 4 rounds of treatment for some districts having a prevalence >50% for STH. The survey is planned for February 2018, two months after the MDA.

Details of the MDA in Burundi 2017

Originally planned in June 2017, the MDA for SCH had to be pushed back to December 2017, due to supply logistics (drugs did not arrive in country in time for the MDA campaign). The delayed MDA was conducted in December 2017 by the Ministry of Public Health through the Mother and Child Health Weeks in 13 districts (see Figure 3) for SCH and in all 46 districts for STH.

Burundi - Districts treated for SCH in December 2017

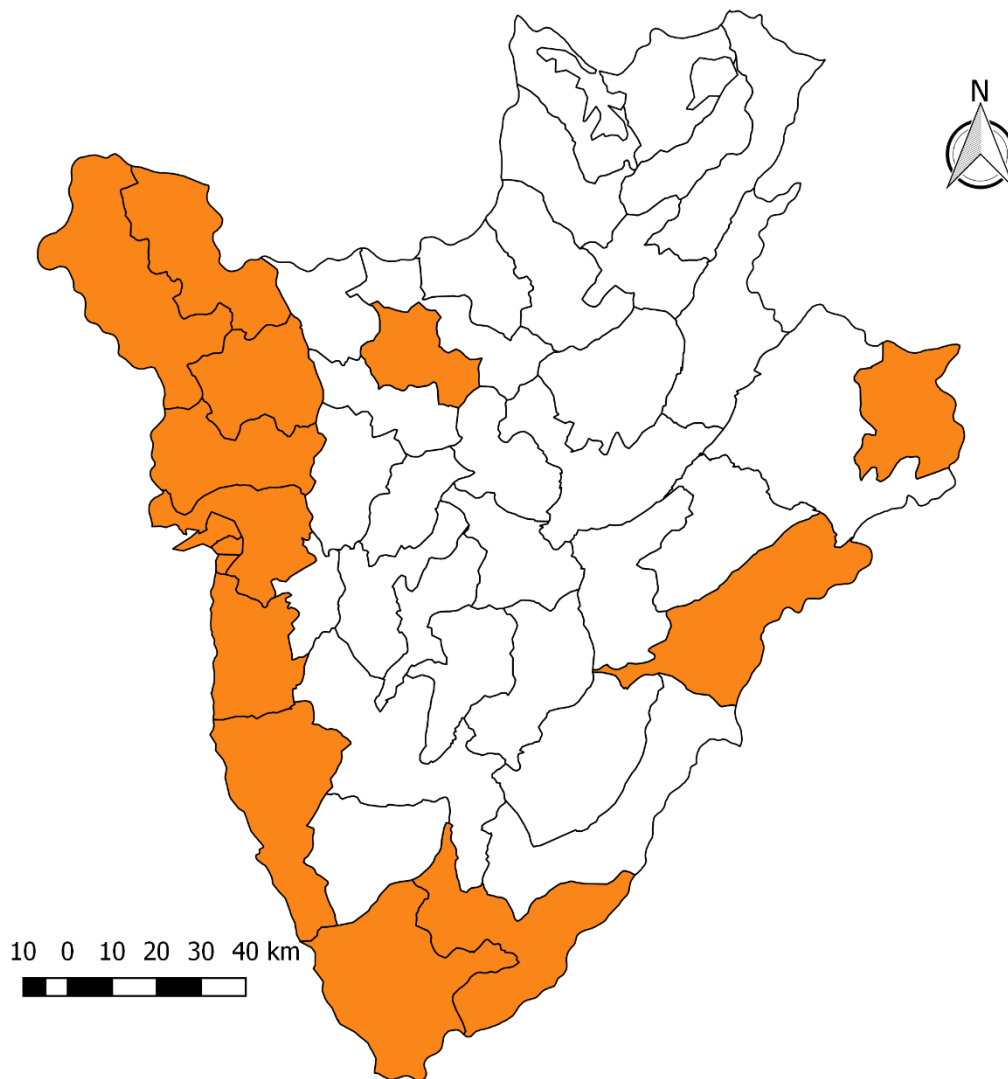


Figure 3: Districts which have received treatment for SCH¹. Please note that all 46 districts have received treatment for STH.

Training of drug distributors was ensured through cascade training starting at the district level as part of the Mother and Child Health week preparations. PZQ and ALB were distributed against SCH and STHs, to all SAC regardless of their enrolment status in those selected districts. In addition, children aged between 1 and 4 years old and pregnant women in their 2nd and 3rd trimester were given ALB.

Coverage targets for MDA in 2017

The aim of the MDA was to target the following age groups:

¹ Country doesn't have the updated shapefiles. Bujumbura has been split into 3 districts instead of 1, hence the discrepancy between the number of districts treated and those marked.

	Praziquantel (PZQ)	Benzimidazoles (ALB)
Pre-SAC	Not targeted	> 75%
SAC attending school	> 75%	> 75%
SAC not attending school	> 75%	> 75%
At-risk adults	Not targeted	> 75%*

*Only expecting mothers in their 2nd and 3rd trimester are treated with ALB during the Mother and Child Health weeks.

With the following definitions:

- SAC: typically 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.²
- At-risk adults: pregnant women in their 2nd and 3rd trimester at the implementation unit

Reported coverage from the MDA

At the time of writing this protocol, reported coverage of the December MDA was unknown. Selection of the districts to be surveyed in this protocol will be based on randomly selecting two districts from either high or medium level prevalence districts.

Study Aim

This survey protocol is designed to monitor the treatment coverage of PC with PZQ and ALB for the MDA campaign in 2017.

Ethical approval

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

² UNESCO definition Children Out Of School: Measuring Exclusion From Primary Education
<http://www.uis.unesco.org/Library/Documents/oosc05-en.pdf>

Study Objectives

The objectives of the coverage survey are:

Survey Objective (SO) 1. To measure validated treatment coverage of PZQ and ALB in SAC, and female adults for ALB relative to coverage targets

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

SO 3. To assess coverage in SAC, 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). Each IU will be considered separately. Within each IU, the survey will be household (HH) based in randomly selected collines. 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 be composed of surveyors from the l'Institut des Statistiques du Burundi, led under the supervision of Dr Gustave Nshimirimana. There will be 2 teams of 3 individuals per team who will conduct the survey. The survey is estimated to take no more than 19 days, including travel.

The interaction with the MoH staff will be limited to:

- Attendance to the training sessions,
- Ensure that the logistics for the survey are sorted prior to the start of the survey.

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 bias³.

The survey should also take place during the day, and preferably not during school holidays⁴.

In Burundi the coverage survey will take place in February 2018, which is 2 months following the MDA. 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 logistical reasons. Typically, at least 10% of the eligible IUs should be surveyed. See Appendix D for more information on approaches to IU selection.

In Burundi the IU is the district. The coverage survey will take place in two IUs. Each implementation unit will be treated independently in the analysis.

The two districts were randomly selected from the list of districts that were classified as having either a high or medium prevalence. The districts which will be surveyed are Nyanza-lac and Bubanza.

Number of collines and households to survey within each IU

Sample size calculations indicated that 17 collines per IU, and 15 HHs per colline are required to obtain 9% precision on the coverage of SAC within each district. Two children will be randomly sampled within each HH.

In addition, all women in the selected HH will be asked to answer specific questions to assess whether they were pregnant at the time of the MDA, which would make them eligible for receiving ALB during the MDA.

See Appendix D for full details of sample size calculations.

Selection of collines to survey within each IU

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

As population information is available, sampling of collines will be proportional to size (PPS) to enable people in large collines to be equally likely to be surveyed as people in small collines. See Appendix D for further details of the sampling methodology.

A short list of 'reserve collines' will be provided, such that if a selected colline 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.

³ 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)

⁴ 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.

Selection of households to survey within each colline

HH selection will be performed on site. Selection will be random, with the methodology dependent on whether HHs lists are available (see data collection protocol).

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 HH or another responsible individual will be interviewed to obtain the HH information. All adult females of the HH and two children randomly selected within each HH will be interviewed. See Appendix C for more details of individual interview procedures.

Study Participant Recruitment

Consent: The colline 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 colline, there will be a meeting with the colline chief where the survey is explained and verbal permission to perform the survey in the colline is obtained before any household (HH) is visited.

Informed consent from each selected HH head will be obtained at arrival and before the team enters the house for the interview, see Annex 5 'Household Consent Form'.

Data collection and analysis

Data will be collected on paper forms and entered in-country. Once data has been double entered and cleaned in-country, a copy should be sent to the SCI biostatistician whereupon it will be analysed in conjunction with the in-country stats or technical team, for the specific indicators listed above. If capacity building is required in-country to increase skills in data management and analysis, SCI will tailor a training package based on requests by the MoH.

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 collines, 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. In addition, there would be some information on the coverage of ALB for female adults. All analyses will be fully shared with collaborating partners in country.

APPENDIX A: Field team planning manual

Survey team composition

There will be 2 teams of 3 individuals in each.

Survey team training

Considering the current political situation in-country, SCI staff cannot travel to Burundi. A skype training meeting between SCI PM, national NTD coordinator and the team conducting the survey will take place prior to the activity (February 2018).

- The training will consist of a combination of presentations, group and individual tasks, mock interviews, over 1 day;
- The teams will collectively with the MoH translate the questions in the local language.

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 on the paper forms
- Mock interviews

Timetable of activities

Timeline	Responsibility	Description of activity	Who is involved
22.01.2018	SCI MER Director	Sign-off protocol by SCI ME&R Director	SCI MER Team and SCI MER Director
22.01.2018	SCI PMO	Arrange for translation of the protocol	SCI PMO and SCI PM
29.01.2018	External contractor	Protocol translated into French	External contractor
22.01.2018	MoH Burundi	Survey team identified	MoH Burundi
29.01.2018	SCI PM	Protocol shared with in-country team	SCI PM
	SCI Finance Director	Funds are received in-country	SCI Finance Director, JRO, SCI PM
14.02.2018	MoH Burundi	Questionnaire is translated into local language	MoH Burundi

15.02.2018	MoH Burundi	Forms are printed and stapled in preparation of the survey	SCI PM, SCI Biostatistician, MoH Burundi
12.02.2018	MoH Burundi	Logistics of the survey are sorted	SCI PM and MoH Burundi
16.02.2018	SCI PM	1 day training over skype	SCI PM and National SCH Coordinator
19.02-09.03	External surveyors	Undertake field survey	External surveyors in Burundi
16.03.2018	External surveyors	Field report from survey team leaders written and shared with SCI PM	External surveyors in Burundi
09.04.2018	SCI MER team	Data analysis	SCI Biostatistician
23.04.2018	SCI PM	Report from survey shared with in-country team	SCI PM and SCI MER Team

Roles and responsibilities

The survey team will include the following main members:

Survey Coordinator

The NTD focal point (or other relevant national NTD control programme staff) will be the survey coordinator. The primary duties of the survey coordinator are:

- Together with the SCI program manager 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 manager, identify the survey team
- Together with the SCI program manager, organise the survey logistics
- Together with the SCI program manager, train the survey team
- Together with the SCI program manager, 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 colline
- 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 colline 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 colline, the team will be accompanied by a local guide. The local guide can help familiarize surveyors with the selected cluster (i.e. identifying colline 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.

Data Entry Personnel

The data entry personnel must be knowledgeable of data management and data entry.

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 collines and HHs to sample
- Select the collines 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: Burundi 2017 Coverage survey interviewer manual

Before arriving at the colline

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

Arriving at the colline

- It is important to be at the colline when people are available. This means interviewers should be in the colline and ready to start at 8am every day.
- The first thing the team should do when arriving at the colline is to seek out the head of the colline:
 1. Introduce the team and ask for permission to survey
 2. Ask the head of the colline for a list of houses in the colline
 3. If a list of houses is available, select households using the 'colline 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 colline questionnaire by interviewing the colline leader:
 - The **GPS co-ordinates** of the colline should be entered on **arrival and departure** if the data is being collected on paper forms

What to do if a colline cannot be visited

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

Selected collines should only be replaced with those on the reserve list in extreme circumstances where it is impossible to survey that colline, and not for reasons of distance, access difficulty and so on. It is important to document in the field report any collines 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 colline.

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 collines, 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: Colline lists

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

Sampling using the colline list is when every h HHs in the colline 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 colline list are:

1. Find the total number of HHs in the colline from the colline 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 colline 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 colline list:

1. The protocol is to sample 12 HHs in the colline.
2. The colline list shows that there are 200 HHs in the colline.
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 colline list is identified.
6. The second HH to select for interviews is $5 + 16 = 21$. The HH on the 21st row of the colline 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 colline 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 colline chief) within the colline.
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 colline 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.

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

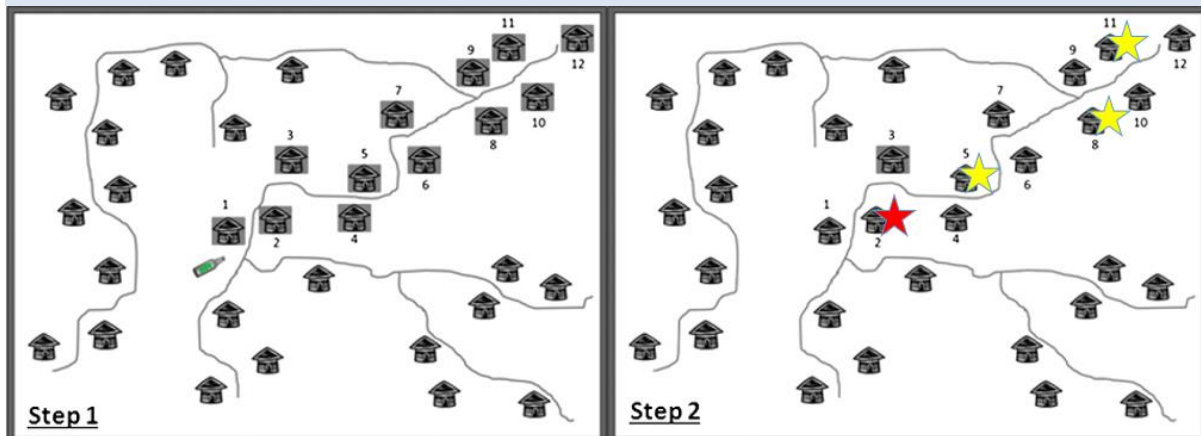
- Find the first HH to sample by randomly selecting a number between 1 and h . Random number selection can be done in the field by writing numbers on pieces of paper, folding them up, placing them in a container and mixing before drawing one out at random, and then selecting the HH that is on this row in the colline list.
- The second HH to sample should be the initial number + h
- 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

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

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



Step 2

- 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.
- The second HH to sample is HH 2 + 3 = 5. This is shown with a yellow star on the diagram above.
- 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 <country>, and we are here to conduct a household survey about an activity that has taken place in the Colline 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 one**⁵.

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 school-aged children (SAC) and all adult females within each HH will be randomly selected for interview.
- SAC is all children aged 5 -14 years
- All female adult, person aged 15-45 years old⁶

⁵ If this happens for many households (e.g. frequently >2 households/colline) in several collines, the supervisors should discuss with the study co-ordinator to consider increasing the number of households to randomly select per colline.

⁶ “Mother’s mean age at first birth” is 21.3 years. Life expectancy for women is 62.7 years (https://www.indexmundi.com/burundi/demographics_profile.html) . Based on this, women to be interviewed in each HH should be between 15-45 years old.

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.

For interviewing the female adults in the HH:

1. Write the name of each female adult aged between 15-45 years old.
2. Include all female adults living in the HH (within this age range), even if there are not in the HH at the time.
3. Interview all the women that fit this criteria.
4. If the eligible female adult cannot be interviewed, please see below.

What to do if an individual cannot be interviewed

- If an individual (SAC or female 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 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 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 - Colline Questionnaire <i>To be answered by the interviewee</i>		
1	Date (DD/MM/YYYY)	
2	Interviewer Name	
3	GPS South on Arrival	
4	GPS East on Arrival	
5	District name (of implementation unit)	
6	Commune name	
7	Colline name	
8	What is the position in the colline of the person being interviewed? (ENTER CODE)	
9	What is the total population of the colline?	
10	What is the number of households in the colline (<i>interviewee to estimate if not known</i>)	
11	Source of population data? (ENTER CODE)	
12	When was the mass treatment for schistosomiasis and soil-transmitted helminths carried out? (month/year)	
13	How was the mass treatment provided in the colline? (ENTER CODE)	
14	If the treatment was community based, how was treatment in the colline carried out? (ENTER CODE)	
<i>To be answered by the interviewer</i>		
15	Method of random sampling of households	<input type="checkbox"/> Random selection from household list <input type="checkbox"/> Bottle spinning method
16	Notes about colline interview	
17	GPS South on Departure	
18	GPS East on Departure	

Answer codes for colline questions

8. Interviewee position? 1. Colline chief 2. Colline deputy chief 3. School head teacher	11. Source of population data 1. Colline register 2. Election register 3. LF register 4. Malaria register 5. Onchocerciasis register 6. General health register 7. Other (please specify)
13. How was the MDA treatment provided in the colline? 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	14. If treatment was community based, how was treatment in the colline carried out? 1. Door to door 2. At the house of the colline head 3. Central point in the colline 4. Local health centre 5. At the colline school 6. Other 7. Do not know

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

H4. Commune name	
H5. Colline name	
H6. Head of household name	

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

7	What number house is this for you in the colline? <i>(Enter one number)</i>	
8a	Was this house interviewed? <i>(Tick one box)</i>	<input type="checkbox"/> No <input type="checkbox"/> Yes on first visit <input type="checkbox"/> Yes on second visit
8b	<i>If household not interviewed:</i> Reason why household not interviewed <i>(Tick one box)</i>	<input type="checkbox"/> Nobody home <input type="checkbox"/> Refused to participate <input type="checkbox"/> Household not found or destroyed <input type="checkbox"/> Other
8c	<i>If household not interviewed and reason 'other'</i> Reason not interviewed: other <i>(Enter reason)</i>	
9	<i>If household interviewed:</i> Consent form signed by Head of House? <i>(Tick one box)</i>	<input type="checkbox"/> No: <i>stop interview</i> <input type="checkbox"/> Yes

To be answered by the interviewee *Household head or other adult*

10	How many people live in this household? <i>(Enter one number)</i>	
11	How many adult males live in this house (15 or older)? <i>(Enter one number)</i>	
12	How many adult females live in this house (15 or older)? <i>(Enter one number)</i>	
13	How many boys live in this house (5-14 years old)? <i>(Enter one number)</i>	
14	How many girls live in this house (5-14 years old)? <i>(Enter one number)</i>	
15	Notes about household interview <i>Answered by interviewer</i>	

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

H4. Commune name	
H5. Colline name	
H6. Head of household name	

Coverage Survey Individual Child Questionnaire – to be answered by interviewer

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

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

H4. Commune name	
H5. Colline name	
H6. Head of household name	

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

		Child 1	Child 2
23a	Have you attended school in the last school year: January 2017 to December 2017? <i>(Tick one box)</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
23b	<i>If attended school in last school year:</i> What type of school do you attend? (ENTER CODE)		
24a	How did you hear about the mass treatment? (ENTER CODE)		
24b	<i>If heard about mass treatment is 'other':</i> How did you hear about the mass treatment - other? <i>(Write answer)</i>		
25	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"/> ALB <input type="checkbox"/> Dose pole <input type="checkbox"/> None of above	<input type="checkbox"/> Schisto <input type="checkbox"/> PZQ <input type="checkbox"/> ALB <input type="checkbox"/> Dose pole <input type="checkbox"/> None of above
26a	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	<input type="checkbox"/> Yes <input type="checkbox"/> No
26b	<i>If did not swallow PZQ:</i> Reasons for not swallowing PZQ (ENTER CODE)		
26c	<i>If did not swallow PZQ, and other reason for not swallowing PZQ:</i> Other reasons for not swallowing PZQ <i>(Write answer)</i>		
26d	<i>If swallowed PZQ:</i> Where did you take the PZQ? (ENTER CODE)		

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

H4. Commune name	
H5. Colline name	
H6. Head of household name	

		Child 1	Child 2
27a	Did you swallow ALB at the mass treatment (show tablet)? (Tick one box)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
27b	If did not swallow ALB: Reasons for not swallowing ALB (ENTER CODE)		
27c	If did not swallow ALB, and other reason for not swallowing ALB: Other reasons for not swallowing ALB (write answer)		
27d	If swallowed ALB: Where did you take the ALB? (ENTER CODE)		
28	If swallowed PZQ or ALB: How did you take the PZQ and ALB tablets? (ENTER CODE)		
29	If swallowed PZQ or ALB: Was the distributor present when you swallowed the tablets? (Tick one box)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
30	If swallowed PZQ or ALB: Had you eaten in the two hours before you took the tablets? (Tick one box)	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
31a	Who decided whether you took the treatment or not? (ENTER CODE)		
31b	If who decided is other: 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)		

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

H4. Commune name	
H5. Colline name	
H6. Head of household name	

Answer codes for Household and Individual Child questions

23b. What type of school do you attend?

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

24a. How did you hear about the drug distribution?

- | |
|------------------------------|
| 1. Teacher |
| 2. Colline 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) |

26b: Reasons for not swallowing PZQ

27b: Reasons for not swalling ALB

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

26d: Where did you take PZQ?

27d: Where did you take ALB?

- | |
|---------------------------------|
| 1. School |
| 2. Home (door-to-door) |
| 3. House of the colline head |
| 4. Central point in the colline |
| 5. Local health center |
| 6. District Clinic |
| 7. Other |
| 8. Does not know |

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

H4. Commune name	
H5. Colline name	
H6. Head of household name	

28: How did you swallow PZQ and/or ALB?

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

31a. Who decided whether you took the treatment or not?

1.Me
2.Father
3.Mother
4.Other family member
5.School teacher
6.Colline head
7.Traditional healer
8.Health worker or drug distributor
9.Other (please specify)
10.Did not know about the distribution

32. Did you know beforehand when and where the MDA took place?

1.Did not know when or where
2.Knew when only
3.Knew where only
4.Knew when and where

33. How far was the distribution point from your home if walking?

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

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

H4. Commune name	
H5. Colline	
H6. Head of household name	

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

		Adult 1	Adult 2	Adult 3	Adult 4
34	Name of person randomly selected? <i>(Enter name)</i>				
35a	Was this person interviewed? <i>(Tick one box)</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
35b	<i>If person not interviewed:</i> Reason for no interview? <i>(Tick one box)</i>	<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
35c	<i>If person not interviewed and reason no interview 'other':</i> Other reason no interviewed? <i>(Enter reason)</i>				
36	Interview start time <i>(HH.MM)</i>				
37	Is this person being interviewed confidentially? <i>(Tick one box)</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
38	Consent received? <i>(Tick one box)</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
39	Participant age? <i>(Enter one number)</i>				
40	What is your occupation? (ENTER CODE)				
41	If occupation is other: What is your occupation other? <i>(Write answer)</i>				

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

H4. Commune name	
H5. Colline	
H6. Head of household name	

Coverage Survey Individual Adult Questionnaire – to be answered by interviewee

		Adult 1	Adult 2	Adult 3	Adult 4
42a	How did you hear about the mass treatment? (ENTER CODE)				
42b	<i>If heard about mass treatment is 'other':</i> How did you hear about the mass treatment - other? <i>(Write answer)</i>				
43	Are you pregnant? <i>(Tick one box)</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
44	<i>If pregnant:</i> In which month of pregnancy are you now? <i>(Write number)</i>				
45	<i>If not pregnant:</i> Have you given birth since the MDA (Dec 2017)? <i>(Tick a box)</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
46a	Did you swallow ALB at the mass treatment (show tablet)? <i>(Tick one box)</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
46b	<i>If did not swallow ALB:</i> Reasons for not swallowing ALB (ENTER CODE)				
46c	<i>If did not swallow ALB, and other reason for not swallowing ALB:</i> Other reasons for not swallowing ALB <i>(Write answer)</i>				
46d	<i>If swallowed ALB:</i> Where did you take the ALB? (ENTER CODE)				
47	<i>If swallowed ALB:</i> How did you take the ALB tablets? (ENTER CODE)				
48	<i>If swallowed ALB:</i> Was the distributor present when you swallowed the tablets? <i>(Tick one box)</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No

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

H4. Commune name	
H5. Colline	
H6. Head of household name	

		Adult 1	Adult 2	Adult 3	Adult 4
49	<i>If swallowed ALB:</i> Had you eaten in the two hours before you took the tablets? <i>(Tick one box)</i>	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No
50a	Who decided whether you took the treatment or not? (ENTER CODE)				
50b	<i>If who decided is other:</i> Who decided whether you took the treatment or not - other? <i>(Write answer)</i>				
51	Did you know beforehand when and where the MDA would take place? (ENTER CODE)				
52	How far was the distribution point from your home if walking? (ENTER CODE)				

Answer codes for Household and Individual Adult questions

40. What is your occupation?

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

42a. How did you hear about the drug distribution?

- | |
|------------------------------|
| 1. Teacher |
| 2. Colline 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) |

46b: Reasons for not swallowing ALB

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

	26. Medicine does not work 27. Other (please specify)
46d: Where did you take ALB? 1. School 2. Home (door-to-door) 3. House of the colline head 4. Central point in the colline 5. Local Health Centre 6. District Clinic 7. Other 8. Does not know	47: How did you take the ALB tablets? 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
50a: Who decided whether you took the treatment or not? 1. Me 2. Father 3. Mother 4. Other family member 5. School teacher 6. Colline Head 7. Traditional Healer 8. Health worker or drug distributor 9. Other (please specify) 10. Did not know about the distribution	51: Did you know beforehand when and where the MDA would take place? 1. Did not know when or where 2. Knew when only 3. Knew where only 4. Knew when and where
52: How far was the distribution point from your home if walking? 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 survey is tailored to get an 9% margin of error on the validated coverage of SACs. The survey of pregnant women is powered for quantitative analysis.

Regarding the survey of SACs there were no deviations from the general statistical approach outlined below in this protocol.

Sample size details

Values imputed to the sample size calculation were:

- # children in each implementation unit = 100,000 (taking NYANZA-LAC as a basis)
- Number of children interviewed in each household on average = 1.6
- Number of individuals targeted in each colline = 30
- Non-response rate = 20%
- Margin of error for confidence interval = 9%
- 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 collines) 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 colline) that permits two collines 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 collines that can be surveyed per day is 2, if a relatively small number of HHs are interviewed per colline.
- **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 9 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 collines longer, or reduce the number of houses visited within some collines, 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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