Zanzibar Coverage Survey 2018

Measuring ***treatment coverage*** *for* schistosomiasis and soil transmitted helminths with preventive chemotherapy

SMZ
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Contents

Introduction

This survey protocol describes the background and implementation design for the coverage survey that will be conducted in Zanzibar, Tanzania during the 17/18 fiscal year. The aim of this coverage survey is to evaluate the effectiveness of the preventtive chemotherapy (PC) treatments 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 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.

Schistosomiasis and STH in Zanzibar

The overall aim of the National Programme for the Control of Schistosomiasis and STH in Zanzibar is to eliminate schistosomiasis as a public health problem by 2020 and falls under the department of Neglected Tropical Disease Control at the Ministry of Health's Directorate of Preventative Services and Health Education. It operates with 28 staff members from various cadres. The program has been running in various forms since the mid-1980s and has distributed over 30 rounds of treatment. During the last implementation year, the Schistosomiasis Consortium for Operational Research and Evaluation (SCORE) program, finished its 5-year Zanzibar Elimination of Schistosomiasis Transmission (ZEST) project on the islands. A coverage survey was supported in 2015 by SCI and demonstrated an overall coverage of:

	Coverage (%) with no population adjustment			
Pemba	**Any drugs**	**PZQ**	**ALB**	**IVM***
Adult	70.8(66.7,74.5)	69.4(65.5,73)	70.6(66.5,74.3)	60.5(55.3,65.5)
Children	90.2(85.8,93.3)	85.3(80.9,88.8)	89.4(84.3,93)	67.8(60.4,74.4)
Unguja				
Adult	73.2(68.8,77.1)	67.4(62.8,71.7)	72.8(68.4,76.8)	63.7(58.5,68.5)
Children	84.5(80.5,87.9)	75.4(71.5,79.0)	83.8(79.8,87)	70.1(65,74.8)
	Coverage (%) with population adjustment			
Pemba	**Any drugs**	**PZQ**	**ALB**	**IVM***
Adult	73.7(69.4,77.5)	72.3(68,76.3)	73.3(69,77.2)	61.7(55.5,67.5)
Children	90.8(85.3,94.4)	86(81.5,89.5)	89.9(83.5,94)	67(61.8,71.9)
Unguja				
Adult	72.3(64.9,78.6)	67.2(59.4,74.1)	71.7(64.1,78.2)	57.1(50.4,63.5)
Children	80.4(77.3,83.3)	72.9(69.6,76)	80.0(76.8,82.8)	63.1(57.5,68.3)

*Ivermectin(IVM) was included for the integrated treatment of lymphatic filariasis on the islands.

See **Annex 1** '*Associated documentation*' for details on where to find related historical information, country workplans and reported treatment documents.

Details of the MDA in March 2018

The Zanzibar Ministry of Health (MoH) in conjunction with the Schistosomiasis Control Initiative (SCI), Natural History Museum (NHM), Swiss Tropical Institute for Public Health and SCORE have been working towards the elimination of SCH on Unguja and Pemba through twice yearly integrated treatment programs targeting the entire population from 5 years old and up with PZQ, for schistosomiasis, IVM, for lymphatic filariasis and ALB, for soil-transmitted helminthiasis for 5 years. Last year the Zanzibar Elimination of Schistosomiasis Transmission (ZEST) research program carried out various interventions to determine the best method for reaching elimination of SCH on the islands. Activities are now finished, and the results are being fed back to the programme. SCORE have been working very closely with 45 shehias on both islands and have good understanding of the coverage in their shehias through smaller coverage surveys.

To validate the reported coverage from the past year, SCI are supporting a national scale coverage evaluation survey. Treatments that that took place in March 2018 were delivered to the entire communities (excluding pregnant women, severely ill, children <3yrs, elderly) and school aged children across the two islands with a target population of 1.3million people. The South of Unguja and Urban A received only ALB however, as these areas are not endemic for SCH. Both Unguja and Pemba islands are on track for elimination of schistosomiasis as a public health problem and are expected to reach 80% coverage during MDA.

Prior to MDA, training is essential and happens in a cascade format. This entails training of the national supervisors at the central level, who then go on to train district and shehia supervisors who in turn train teachers and CDD's. Furthermore advocacy/sensitisation meetings are held among district, shehia and villages leaders to discuss the best approach to sensitise targeted populations. This is usually achieved through social gatherings and social mobilisation campaigns one week prior to MDA.

March 30th to April 6th 2018 is the time frame for both the school and community MDA across the entirety of both islands. School based MDA will take place during the week days to capture SAC population most effectively. The community MDA will be conducted on the weekend from 31st March to 1st April to help maximize the adult coverage, when people are more likely to be at home during the day.

Coverage targets for the MDA 2018

The aim of the MDA was to target schools aged children (SAC) and adults as follows:

Praziquantel (PZQ):

- At least 80% therapeutic coverage in SAC attending school as the country is targeting elimination.
- At least 80% therapeutic coverage in SAC not attending school as the country is targeting elimination.
- At least 80% therapeutic coverage in all adults as the country is targeting elimination.

Benzimidazoles (ALB/MBD):

- At least 85% therapeutic coverage in pre-SAC children as the country is targeting elimination.
- At least 85% therapeutic coverage in SAC attending school as the country is targeting elimination.
- At least 85% therapeutic coverage in SAC not attending school as the country is targeting elimination.
- At least 85% therapeutic coverage in all adults as the country is targeting elimination.

With the following definitions:

- Pre-SAC: All children aged between 1 and 4 years old.
- SAC: All children between 5 and 14 years old.
- Child attending primary school: which is defined as '*attendance at some point during the school year*'. This is 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: all adults ≥ 15 years old.

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

Reported coverage from the MDA

The MDA took place in Zanzibar in March 2018, across both islands. A total of 1,036,868 individuals were treated (Table 2) and reported coverage of 92% (Table 3). Although this reported coverage is above the recommended coverage, there were challenges reported. The population and number households has vastly increased in Zanzibar, but the number of community drug distributors has remained the same. It was reported that the increased workload, due to this meant that some households were not visited for distribution of medication.

	School age children			Community			Combined total
	M	F	Total	M	F	Total	
Unguja	75,315	77,366	152,681	253,617	294,123	547,740	700,421
Pemba	36,083	39,710	75,793	120,927	139,727	260,654	336,447
Total	111,398	117,076	228,474	374,544	433,850	808,394	1,036,868

Table 2. Total number of individuals treated on both Unguja and Pemba islands

	% coverage SAC			% Coverage Community			Total % coverage		
	M	F	Total	M	F	Total	M	F	Total
Unguja	100%	100%	100%	95%	94%	95%	96%	96%	96%
Pemba	87%	91%	89%	84%	85%	84%	85%	86%	85%
Total	95%	97%	96%	91%	91%	91%	92%	92%	92%

Total 3. Reported coverage on both Unguja and Pemba islands

Survey Aim

This survey protocol is designed to monitor the treatment coverage of PC with PZQ and ALB for only the second MDA campaign, held in March of 2018, the first MDA campaign of FY2017/18 was held in September 2017 but coverage will not be assed at this time.

Survey Objectives

The specific objectives of this coverage survey are to:

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

SO 2. **To compare reported and validated coverage of PZQ and ALB 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

SO 6. Collect information on why targeted eligible individuals did not receive or accept treatment

Where validated coverage rate is defined as:

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

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

Ethical considerations

The program has applied for and received all ethical approvals including certification for all PC that are used in-country for the treatment pf SCH and STH. All adverse events following drug administration are reported and presented through the relevant Ministry of Health channels.

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

Consent: The village leader 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 shehia leader where the survey is explained and verbal permission to perform the survey in the village 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 2** '*Household Consent Form'*.

Survey 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 villages. See **Annex 3** for a detailed explanation of the statistical approach to the coverage survey.

Survey team

Each team will consist of 3 enumerators, a driver and 1 supervisor. The interviewers will be students who have been selected from the College of Health Sciences on Unguja island. No connection with the MDA activities will be a requirement for enumerator selection. During training three team members who excel at the training and interviewing will be chosen as supervisors. The MoH will attend training to build their own capacity and supply drivers but will have no involvement in the interviewing process to maintain an unbiased report on the MDA activity.

All teams will begin on Unguja island under supervision by one of the SCI London team. Once proficient with the protocol and questionnaires they will move on to Pemba island to complete the remainder of the survey.

It will be ensured that all interviewers have not been involved in any previous activities related to the NTD programme, specifically the MDA, to ensure that they remain unbiased

See Appendix A 'field team planning manual' for more details of the survey teams and logistics.

Timing of the survey

Coverage surveys should ideally take place as soon as possible following treatment (especially in areas with frequent MDAs) to minimise recall bias[2].

The survey should also take place during the day, and preferably not during school holidays[3].

In Zanzibar the coverage survey will take place in June 2018, which is 2 months following the MDA. The survey will take place during the day.

[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.

Implementation unit selection

Due to the relatively small size of Zanzibar, each island will represent one IU. Stratification was used to ensure the selection of at least 1 shehia from hotspot areas per island, and 1 shehia from Unguja that is only treated for STH.

Number of Shehia and households to survey within each IU

Sample size calculations indicated that 17 shehias per island, and 15 HHs per shehia are required to obtain 9% precision on the coverage of SAC and adults within each island. As the MDA was community-wide, two adults and two children will be randomly sampled within each HH. See **Annex 3** '*Detailed survey methodology and sample size calculation*' for further details of sample size calculations.

Selection of shehias to survey within each IU

The selection of shehias will be completed by an SCI biostatistician from the shehia list provided. The shehia inventory will include a list of all shehias within each island to be visited to ensure that all shehias have the opportunity to be selected.

As population information is not available, the 17 shehias for each island will be randomly selected with no weighting.

See **Annex 3** '*Detailed survey methodology and sample size calculation*' for further details of the sampling methodology.

Due to the size of the islands and the relative accessibility of all shehias, no reserve sites have been provided in the site selection.

Selection of households to survey within each shehia

Household (HH) selection will be performed on site. Selection will be random, with the methodology dependent on whether or not 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 head of household(HH) 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 interview. See **Appendix B** 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 household is visited.

Informed consent from each selected household head or responsible adult within that household will be obtained on arrival and before the team enters the house for the interview, see **Annex 2** 'Household Consent Form'.

Data collection and analysis

Data will be collected by mobile devices, and if not possible by paper forms, by survey teams in the field (see **Annex 2**). Data will be entered on phones and will be uploaded to a remoter 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

There will be 4 teams of 3 individuals in each. All the surveyors will be independent of the MoH to ensure an unbiased approach. These enumerators will be students from the College of Health Sciences in Unguja island. The survey is estimated to take 10 days, in addition to 3 days of training. The interviewers will be students who have been selected from the College of Health Sciences.

All teams will begin on Unguja and will carry out the survey supervised by the SCI Programme Advisor before moving to Pemba to complete the survey there.

Survey team training

The interviewers will be trained for three days. The first day will be spent in Stone Town where an SCI team member will train the survey team on the coverage survey protocol. This will be comprised of presentations, discussion of roles and responsibilities, review of past surveys results, the larger NTD program in Zanzibar, an introduction to the phones and a feedback session to allow question and answering. SCI approved training material, which has been used in previous surveys across various countries, will be used. The second day will consist of continuing phone training, conducting classroom based simulated interviews. Day three will consist a mock field survey by the teams in a nearby village as well as additional training on interview methods and phone use. Translation of the questions for use in the survey will be completed by the NTD team in Zanzibar.

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 and/or paper form
- Mock interviews

Timetable of activities

Timeline	Responsibility	Description of activity	Who is involved
April 9th 2018	SCI MER Director	Sign-off protocol by SCI ME&R Director	SCI MER Team and SCI MER Director
18th December 2017	SCI PA and MoH ZNZ	Arrange for translation of the protocol	SCI PA and MoH ZNZ
April 9th 2018	MoH ZNZ	Survey team identified	MoH ZNZ
14 March 2018	MoH ZNZ	Protocol submitted for ethical approval	MoH ZNZ
1st January2018	SCI Finance Director	Funds are received in-country	SCI Finance Director, JRO, SCI PA
30-12th March 2018	MoH ZNZ	Forms are uploaded on CTO survey on phones	SCI PA, SCI Biostatistician, MoH ZNZ
6-12th April 2018	MoH ZNZ	Logistics of the survey are sorted	SCI PA and MoH ZNZ
26th-28th June 2018	SCI PA	Training – 3 days, including pilot mock survey in the field	SCI PM and National SCH Coordinator
29th June-8th July 2018	External surveyors	Undertake field survey	External surveyors in ZNZ
17th July 2018	External surveyors	Field report from survey team leaders written and shared with SCI PA	External surveyors in ZNZ
July 2018	SCI MER team	Data analysis	SCI Biostatistician
August 2018	SCI PA	Report from survey shared with in-country team	SCI PA 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 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.

Data Entry Personnel (for paper form only)

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 manager, 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: Zanzibar 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 should be entered on **arrival and departure** if the data is being collected on paper forms
    - If using phones, the GPS will be recorded as part of the village and household questionnaires

What to do if a village cannot be visited

If a selected village cannot be visited for security or other unpredictable reasons, replaced the village with the first reserve village in the same district 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 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.

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

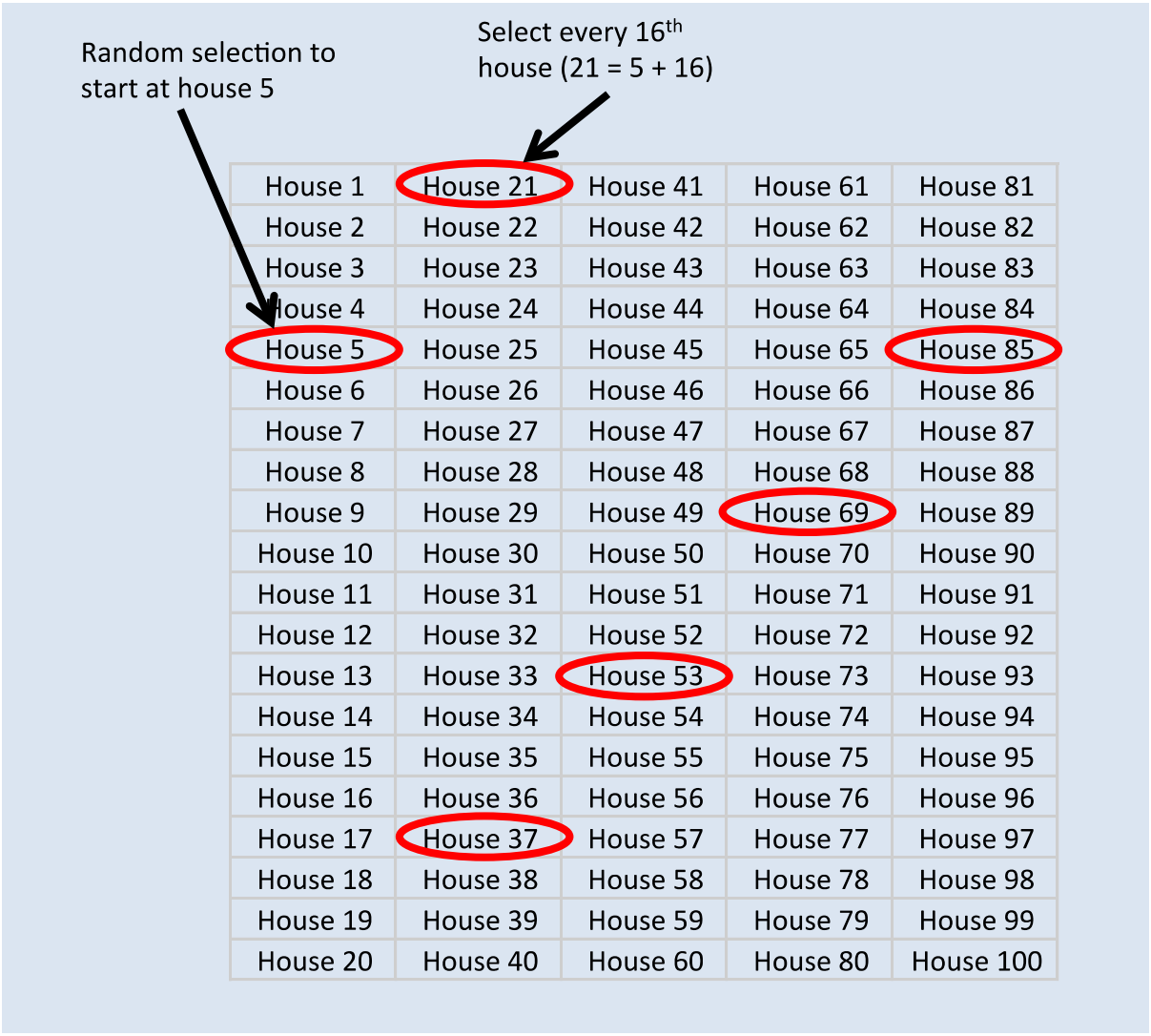
3. Select the first HH by randomly selecting a number between 1 and *h*. Random number selection can be done in the field by writing numbers on pieces of paper, folding them up,

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 5^{th} row of the village list is identified.
6. The second HH to select for interviews is 5 + 16 = 21. The HH on the 21^{st} 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.



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.

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

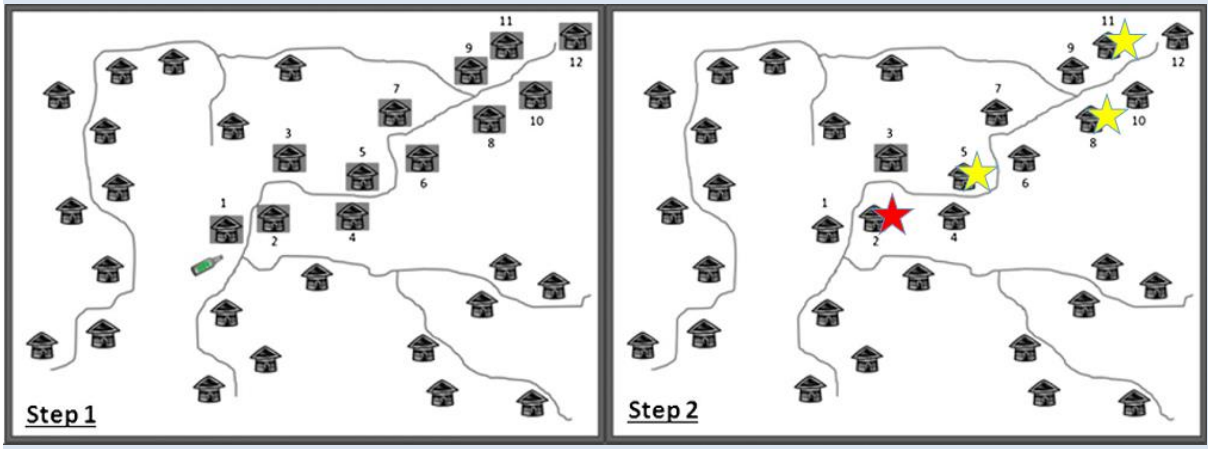
5. Find the first HH to sample by randomly selecting a number between 1 and *h*. Random number selection can be done in the field by writing numbers on pieces of paper, folding them up, placing them in a container and mixing before drawing one out at random, and then selecting the HH that is on this 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 <country>, 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 one**[4].

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 is all children aged 5 -14 years
- Adults is all people aged 15 or over

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

[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.

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.

Annex 1: Associated documentation

Historical documentation

2015 Coverage Survey Report
https://imperiallondon.sharepoint.com/:w:/r/sites/fom/schisto/mer/2_Country_M%26E/ZNZ/Coverage/FY_1415/3_Reports/Zanzibar%20Coverage%20survey%20report%202015.docx?d=w51798d779068414c94ea7e8497d45e88&csf=1&e=DjCVCZ

2015 Coverage Survey Protocol
https://imperiallondon.sharepoint.com/:w:/r/sites/fom/schisto/mer/2_Country_M%26E/ZNZ/Coverage/FY_1415/1_Protocol_%26_pre-survey/Zanzibar_Coverage_Survey_Protocol_2015_10_08_JW.docx?d=wed0ebef28b1f404fa83ec368f7ba9018&csf=1&e=zsA5Ov

Other documentation

2017/18 Annual workplan
https://imperiallondon.sharepoint.com/:w:/r/sites/fom/schisto/operations/2_Country_Administration/SCI_Operations_Documents/Annual_Planning/FY_1718/ZNZ/Workplan/ZNZ_Unguja_Workplan_FY8_24102016.doc?d=w546de0784dc94617a9cd06921c931584&csf=1&e=eDbCym

Annex 2: Data Collection Forms

Household Consent Form

Household Consent Form

For adults or for adults on behalf of children <15 years

Informed Consent per household – to be submitted to the head of the household

Coverage Survey

District: |_____| Village: |_____|

Interviewer Name: HH No: |__|__|__|

Interview date (dd/ mm/yyyy): |__|__|/|__|__|/2018

We are asking any individuals of both sexes to learn more about the Ministry of Health-led activity which took place in this village during the past months.

We have randomly selected this household to perform a interview.

If you and your family want to take part in the survey, please provide your consent to perform the interviews and we will treat your answer anonymously.

There will be no problem if you or any of the household members do not want to answer.

Have all the members of this household been residing in this household since the last MDA?

YES □ **NO** □

If yes, can we proceed with the survey and interview the eligible household members?

YES □ **NO** □

Continue with questionnaire

Thumb print or signature of household head

H1. Date (DD/MM/YYYY)		H4. Shehia name	
H2. Interviewer Name		H5. Village	
H3. District name		H6. Head of household name	

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

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

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

Answer codes for village questions

8. Interviewee position? 1. Shehia chief (Sheha) 2. Shehia deputy chief 3. School head teacher	**11. Source of population data** 1. Village 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 village??** 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
15. If treatment was community based, how was treatment in the village carried out? 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. District name	

H4. Shehia name	
H5. Village	
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 shehia? *(Enter one number)*	
8a	Are you able to interview this household? *(Tick one box)*	☐ No ☐ Yes on first visit ☐ Yes on second visit
8b	*If not able to interview household*: Reason why household not interviewed *(Tick one box)*	☐ Nobody home ☐ Refused to participate ☐ Household not found or destroyed ☐ Other
8c	*If not able to interview household and reason 'other'* Reason not interviewed: other *(Enter reason)*	
9a	Name of health of household or other responsible adult	
9b	*If household interviewed:* Consent form signed by Head of House or other responsible? *(Tick one box)*	☐ No: *stop interview* ☐ Yes
9c	Record the GPS co-ordinates of the household	
	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 (5-14 years old)? *(Enter one number)*	
14	How many **girls** live in this house (5-14 years old)? *(Enter one number)*	
15	Notes about household interview *Answered by interviewer*	

The equity questionnaire below is based on the supporting file TanzaniaDHS2015_public-sharing-file-2017-04-14.xlsm from http://www.equitytool.org.

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

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

Equity Questionnaire – *To be answered by the household head or other adult interviewee*	
E1. Does your household have electricity? *(Tick one box)*	☐ Yes ☐ No
E2. Does your household have a television ? *(Tick one box)*	☐ Yes ☐ No
E3. Does your household have a radio ? *(Tick one box)*	☐ Yes ☐ No
E4. Does your household have an iron? *(Tick one box)*	☐ Yes ☐ No
E5. Does any member of this household have a bank account? *(Tick one box)*	☐ Yes ☐ No
E6. What is the main material of the floor of your dwelling? *(Tick one box)*	☐ Earth/Sand/Dung ☐ Cement/Concrete ☐ Other
E7. What is the main material of the exterior walls of your dwelling? *(Tick one box)*	☐ Cement blocks ☐ Other
E8. What is the main material of the roof of your dwelling? *(Tick one box)*	☐ Iron sheet ☐ Grass/Thatch/Palm Leaf/Mud ☐ Other
E9. What type of fuel does your household mainly use for cooking? *(Tick one box)*	☐ Firewood ☐ Charcoal ☐ Other
E10. What is the main source of energy for lighting in the household? *(Tick one box)*	☐ Electricity ☐ Battery/Solar powered Flashlight or Lamp ☐ Other

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

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

Coverage Survey - Individual Form *To be answered by the interviewee*					
		Adult 1	**Adult 2**	**Child 1**	**Child 2**
16	Name of person randomly selected? *(Enter name)*				
17	Participant age? *(Enter one number)*				
18	Sex (M/F)? *(Tick one box)*	☐ Male ☐ Female	☐ Male ☐ Female	☐ Male ☐ Female	☐ Male ☐ Female
19a	Are you able to interview this person? *(Tick one box)*	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
19b	*If not able to interview this person:* Reason for no interview? *(Tick one box)*	☐ Absent during survey ☐ Refused to participate ☐ Other	☐ Absent during survey ☐ Refused to participate ☐ Other	☐ Absent during survey ☐ Refused to participate ☐ Other	☐ Absent during survey ☐ Refused to participate ☐ Other
19c	*If person not interviewed and reason no interview 'other':* Other reason no interviewed? *(Enter reason)*				
20	Is this person being interviewed confidentially? *(Tick one box)*	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
21	Consent received? *(Tick one box)*	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
22	Interview start time *(HH.MM)*				
23a	*Adults only:* What is your occupation? **(ENTER CODE)**				
23b	*Adults only, if occupation is other:* What is your occupation - other? (*write answer)*				
23c	Were you pregnant or breastfeeding during March 2018?				

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

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

24a	*Children only:* Have you attended school in the last school year: January 2017 to December 2017? *(Tick one box)*			☐ Yes ☐ No	☐ Yes ☐ No
24b	*If attended school in last school year:* What type of school do you attend? **(ENTER CODE)**				
25a	How did you hear about the mass treatment? **(ENTER CODE)**				
25b	*If heard about mass treatment is other:* How did you hear about the mass treatment - other? *(write answer)*				
26	Individual knowledge of the schistosomiasis mass treatment *show particpants props and (tick all objects recognised, or 'none' if don't recognise any)*	☐ Schisto ☐ PZQ ☐ ALB ☐ Dose pole ☐ None of above	☐ Schisto ☐ PZQ ☐ ALB ☐ Dose pole ☐ None of above	☐ Schisto ☐ PZQ ☐ ALB ☐ Dose pole ☐ None of above	☐ Schisto ☐ PZQ ☐ ALB ☐ Dose pole ☐ None of above
27a	Did you swallow PZQ at the mass treatment? (show dose pole/tablets) *(Tick one box)*	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
27b	*If did not swallow PZQ:* Reasons for not swallowing PZQ **(ENTER CODE)**				
27c	*If did not swallow PZQ, and other reason for not swallowing PZQ:* Other reasons for not swallowing PZQ *(write answer)*				
27d	*If swallowed PZQ:* Where did you take the PZQ? **(ENTER CODE)**				

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

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

28a	Did you swallow ALB at the mass treatment (show tablet)? *(Tick one box)*	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
28b	*If did not swallow ALB:* Reasons for not swallowing *ALB* **(ENTER CODE)**				
28c	*If did not swallow ALB, and other reason for not swallowing ALB:* Other reasons for not swallowing *ALB* *(write answer)*				
28d	*If swallowed ALB:* Where did you take the *ALB*? **(ENTER CODE)**				
29	*If swallowed PZQ or ALB:* How did you take the PZQ and *ALB* tablets? **(ENTER CODE)**				
30	*If swallowed PZQ or ALB:* Was the distributor present when you swallowed the tablets? *(Tick one box)*	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
31	*If swallowed PZQ or ALB/MEB:* Had you eaten in the two hours before you took the tablets? *(Tick one box)*	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No	☐ Yes ☐ No
32a	Who decided whether you took the treatment or not? **(ENTER CODE)**				
32b	*If who decided is other:* Who decided whether you took the treatment or not - other? *(write answer)*				
33	Did you know beforehand when and where the MDA would take place? **(ENTER CODE)**				

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

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

34	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. Shehia name	
H5. Village	
H6. Head of household name	

Answer codes for Household and Individual questions

Ex.	**Ex.**
1.	1.

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

25a. 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

28b: Reasons for not swallowing ALB/MEB

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

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

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

	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)
27d: Where did you take PZQ?	**29: How did you swallow PZQ and/or ALB?**
1. School	1. All at the same time
2. Home (door-to-door)	2. I took them all throughout the day but not all at the same time
3. House of the village head	3. I took them all but not on the same day
4. Central point in the village	4. One tablet a day until they were all finished
5. Local Health Centre	5. I took some but not all of them
6. District Clinic	6. I was given the tablets but did not swallow them
7. Other	7. Do not remember
8. Does not know	
32: Who decided whether you took the treatment or not?	**33: Did you know beforehand when and where the MDA would take place?**
1. Me	1. Did not know when or where
2. Father	2. Knew when only
3. Mother	3. Knew where only
4. Other family member	4. Knew when and where
5. School teacher	
6. Village Head	

H1. Date (DD/MM/YYYY)		H4. Shehia name	
H2. Interviewer Name		H5. Village	
H3. District name		H6. Head of household name	

7. Traditional Healer	
8. Health worker or drug distributor	
9. Other (please specify)	
10. Did not know about the distribution	
34: 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	

Annex 3: Detailed survey methodology and sample size calculation

Deviations from general statistical approach in this protocol

SCI principles require coverage surveys to be powered to provide implementation unit level estimates of treatment coverage. Due to the relatively small size of the treatment area it was determined that coverage surveys for Zanzibar would provide island level estimates with adequate precision and power.

Sample size details

Values imputed to the sample size calculation were:

- # children in each implementation unit = 1,000,000
- Number of children interviewed in each household on average = 2
- Number of individuals targeted in each village = 24 SAC and 24 Adults = 48 total
- 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

Principles of 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 ±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 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 ±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 that 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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Worrell C, Mathieu E (2012) Drug coverage surveys for neglected tropical diseases: 10 years of field experience. *Am J Trop Med Hyg* **87**: 216–222. Annex 1: Associated documentation