

Ethiopia Coverage Validation 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 surveys that will be conducted in Ethiopia in July 2017. Mapping was conducted in 2013 and 2015 by the Ethiopia Public Health Institute which has informed the strategy for the implementation of the preventive chemotherapy (PC) programme for schistosomiasis (SCH) and soil transmitted helminth infections (STH). The first round of PC was in April 2015. The aim of this coverage survey is to evaluate the effectiveness of the PC in reaching the target population.

Background to the Coverage Survey

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

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

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

This protocol will use the methods of Probability Sampling with Segmentation (PSS). The WHO (2016) have endorsed this methodology to reduce the potential of bias which has been approved by the Working Group M&E 2016 and The Strategic Technical Advisory Group for Neglected Tropical Diseases 2016 for evaluation of coverage of preventive chemotherapy.

Schistosomiasis and STH in Ethiopia

The WHO, ranks Ethiopia 5th among the high burden countries which require worm treatment for school-age children. The government of Ethiopia aims to reach all the global NTD targets for several diseases by 2020, and has created a number of complementary policies, documents, and programmes to reach these targets. These include the National NTD Master Plan, the National SCH/STH Action Plan & Control Strategy, the National One WASH Programme, the National School Health and Nutrition Policy, and others.

Of the 833 districts in Ethiopia, 69 are categorised as being highly endemic for SCH, 153 with moderate endemicity, and 190 as having low endemicity. A further 374 districts reported zero infection and the status for 47 districts are yet to be determined. It is estimated that a total of 14.61 million school-age children require treatment against SCH.

With regards to infection with STH, 279 districts are categorised as highly endemic, 215 as moderate endemic, and 247 as having low endemicity. Only 45 districts are known to be uninfected with STH, with a further 47 districts where the endemicity status is currently unknown. A total of 18.4 million school-aged children live in areas that qualify for mass treatment, including an estimated 10.6 million school-aged children that live in areas recommended to be treated twice a year. Therefore the total annual treatments required for STH for school-aged children is estimated to be 28.9 million.

The country first implemented large-scale deworming treatment in April 2015 with a campaign against SCH and STH targeting 99 districts, using drugs supplied through the World Health Organization donation mechanism. Following this, the FMOH launched its national SCH and STH programme in November 2015 with subsequent treatment campaigns scaling up to all districts qualifying for PC.

Ethiopian coverage surveys and results

There have been two previous coverage validation surveys, one after the April 2015 round and one after the November 2015 round. The April 2015 coverage validation survey was completed in 10 districts out of a possible 99 that were treated. The results were compared to the reported coverage showing both over and under reporting with no trend identified in either direction. Overall the WHO target of 75% treatment coverage of SAC was achieved and validated in all districts surveyed. The main findings were that (i) the denominator for reported coverage was inaccurate as three districts reported coverage of over 100%, (ii) further understanding of the coverage for non-enrolled children is required due to the validated coverage being lower in the majority of districts for that group, however the sample size is variable depending on who is randomly selected to participate in the survey, and (iii) planning, training and supervision needs to increase in quality to optimise the data validity.

Very similar findings were reported from the November 2015 round where 18 districts were surveyed out of a possible 417 districts that were treated. The main programmatic findings were that the target of over 75% coverage for both SCH and STH treatment was reached in 11/14 districts for mebendazole coverage and 6/8 districts for praziquantel coverage. Again, the non enrolled SAC population needs further investigation to gain an accurate insight into the coverage achieved, and the planning, training and

supervision need to improve to gain higher quality of results. These findings have been taken into consideration when planning the upcoming survey.

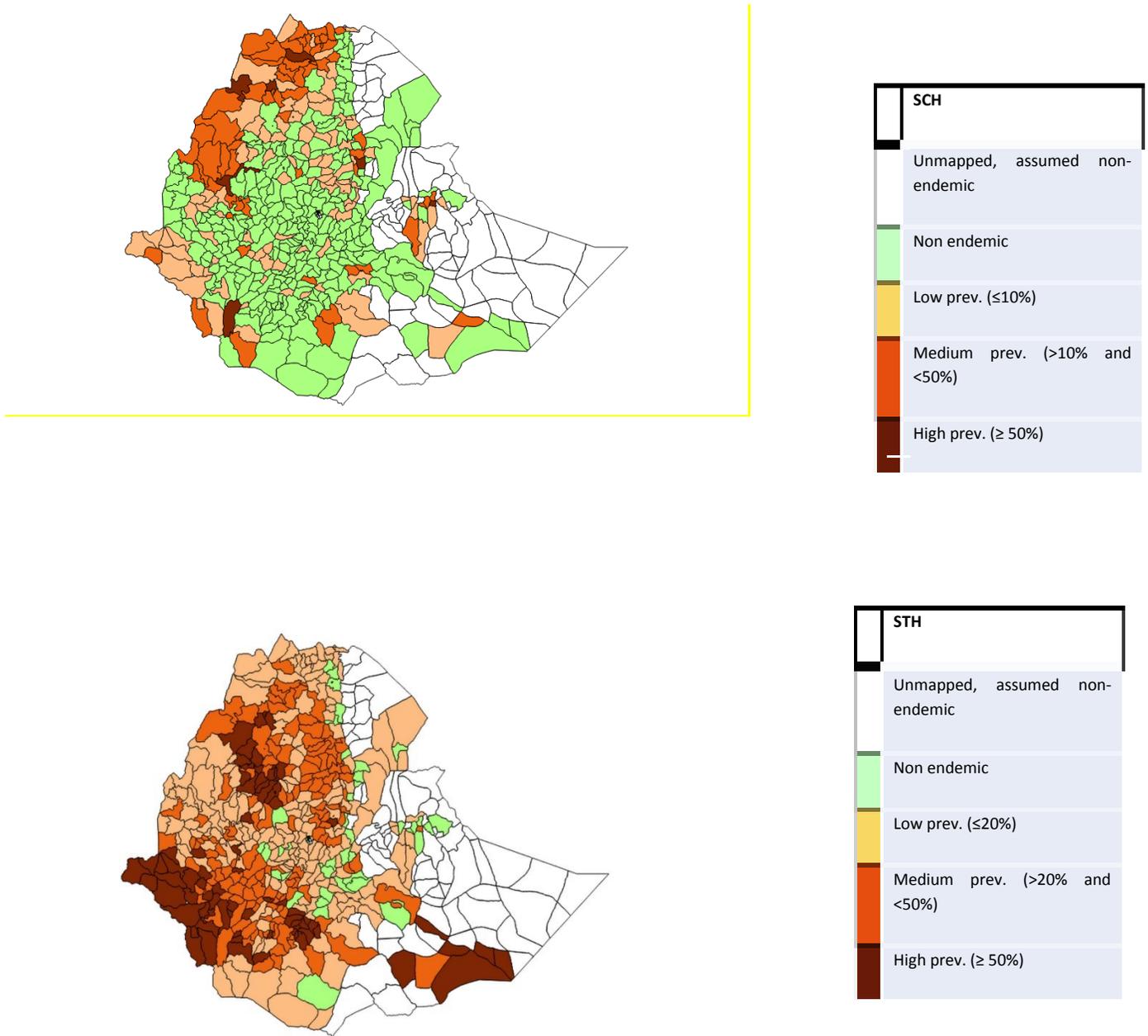


Figure 1. Distribution of a) SCH infection and b) STH infection categorised according to WHO guidelines.

Details of the MDA in Ethiopia December 2016 – May 2017

- The most recent MDA occurred between December 2016 and May 2017. The regions each treated at a different time for a variety of reasons including; conflicting priorities of work, funding distribution and ability to mobilise the resources needed.
- During these months the MDA took place in all 9 regions of Ethiopia which covers 483 districts for STH treatment and 173 districts for SCH treatment.

Regions	Reported Coverage for STH treatment in SAC	Reported Coverage for SCH treatment in SAC
Afar	89%	78%
Somale	77%	77%
Benishangul	87%	88%
Oromia	83%	84%
Tigray	91%	87%
Gambella	108%	N/A
Amhara	88%	86%
Harari	64%	61%
SNNPR	92%	73%

Obtaining reported coverage for all the regions takes a significant amount of time and this has previously delayed the data collection. As the data collection needs to take place within 3 months of the MDA to minimise recall bias, the reported coverage will not be used to determine the districts to be surveyed. The selection of districts will be done through a purposive sample, using historical data.

Coverage targets for MDA in 2016

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

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

With the following definitions:

- Pre-SAC: 1 to 4 years
- SAC: 5 to 14 years

- Child attending primary school: which is defined as ‘*attendance at some point during the school year*’. This based on the parents’ or guardians’ report as to whether the child is currently at school or, if not, whether the child attended school at some time during the school year. If the answer to either question is “yes”, the child is considered to have attended in the reference school year, even if currently absent or out of school.¹
- At-risk adults: Above 15 yrs of age. Not routinely targeted in all regions, therefore excluded from the survey

Study Aim

This survey protocol is designed to monitor the treatment coverage of PC with PZQ and ALB/MBD for the MDA campaign in November – April 2016-17. The districts selected for this survey based were treated in April 2017 to fit the inclusion criteria of being treated within three months of the survey taking place.

Ethical approval

Coverage surveys have been granted ethical approval by Imperial College Research Ethics Committee (ref: ICREC_8_2_2). Ethical approval have been granted by the Ethiopia Public Health Institute for this survey to take place.

https://share.imperial.ac.uk/fom/IDE/SCI/The%20Hub/ETH_Ethics%20Approval%20Signature%20Page.pdf

Study Objectives

The objectives of the coverage survey are:

- SO 1. To measure validated treatment coverage of PZQ and ALB/MBD in SAC, relative to coverage targets
- SO 2. To compare reported and validated coverage of PZQ and ALB/MBD for SAC
- 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:

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

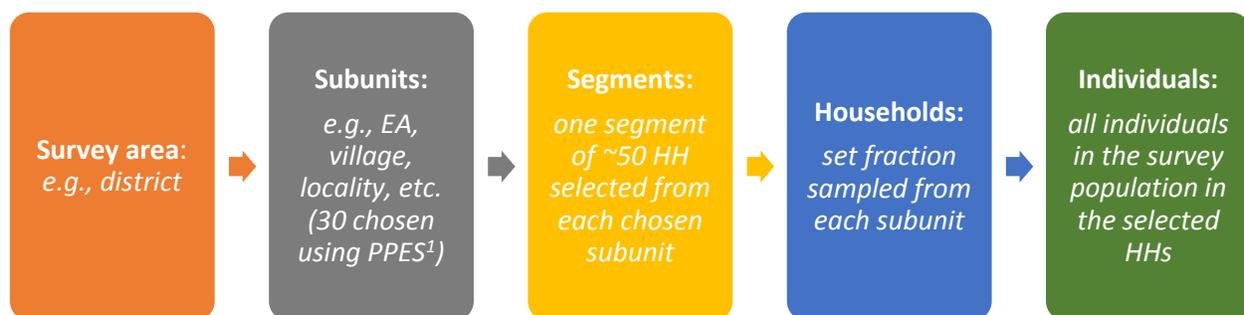
¹ UNESCO definition Children Out Of School: Measuring Exclusion From Primary Education
<http://www.uis.unesco.org/Library/Documents/oosc05-en.pdf>

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

This coverage evaluation survey design produces an equal probability sample of the survey population (see Appendix E for a description of the calculation of selection probabilities using the coverage evaluation survey design) and is derived from the “modified segment design” (1). In the first step, the sampling team gathers a list of the estimated number of households in each survey subunit (e.g., enumeration areas, villages). The number of households in each subunit is divided by 50 to determine, roughly, the number of 50-household-segments (‘segments’) to assign to each subunit. Next, 30 subunits are selected randomly with probability proportional to the number of segments in the subunit. When the interview team arrives at a selected subunit, it is mapped and geographically divided into the predetermined number of segments, such that the segments are of approximately the same size in households. Finally, one segment is selected at random and a fixed proportion of its households are selected for the survey interview.



¹Probability proportionate to estimated size sampling

The sampling methodology described in this protocol uses that outlined in the [WHO Coverage Evaluation Guidelines for Preventive Chemotherapy](#). See Appendix E for the Coverage Survey Builder for each district with sample size calculations included.

Survey team

Each survey team will consist of 4 members and a driver. The data collectors are nurses from the district who have not had any role in the MDA and are requested and selected by EPHI. One of the four data collectors will be assigned as the team leader and who this is will be determined at the training, through an evaluation of performance, understanding and leadership abilities.

Timing of survey

The coverage survey will take place within 3 months of the MDA happening in the selected districts.

Regional and District Selection

As per the WHO (2016) guidelines, the sampling framework will be purposive selection at regional level to better understand the estimated coverage. The total number of districts (woredas) that can be surveyed will be deduced from the available budget, resources and time. Districts for each regional will then be purposively selected using inclusion criteria and the demographic data will be taken and entered into Coverage Survey Builder.

Criteria for purposive selection of the Districts include:

- Treatment was given for both SCH and STH
- Safety of data collectors while in the district
- Districts that have been treated within the last 3 months
- Too high or low reported coverage (either from the current round or historical).

Implementation unit (district/woreda) selection

For this protocol, 30 subunits should be randomly selected from among all within the survey area (a district (woreda)). Subunits should be administrative areas for which population figures are available, which in Ethiopia is kebele level.

In order to improve the efficiency of household sampling, within each selected subunit a segment of households will be randomly selected. Sampling of households will take place *only* within that segment. The probability that any one subunit is selected is proportionate to the estimated number of segments it contains. The default segment size is 50 households; however, in some cases larger segments may be necessary if the expected number of households required to meet the sample size is >50. See Appendix B for a detailed explanation of the statistical approach to the coverage survey.

Number of subunits (kebeles) to survey within each IU

A segment is the area to be surveyed within each selected subunit (kebele). Segments refer to groups of households and are used to reduce the time and work required for sampling in the field. Only households within the selected segment need to be enumerated. On average, the number of households in each segment is expected to be roughly the target segment size. For most surveys the target segment size will be 50 households. A total of 30 segments will be chosen from the subunits selected (at least one segment in each selected subunit).

Selection of households (HH) to survey within each segment

Once segments have been chosen among the sampled subunits, households will be selected within each sampled segment for inclusion in the coverage survey. A previously established sampling interval, automatically applied by the Coverage Survey Builder (CSB), is used to determine which households in the segment are to be sampled to reach the expected sample size. The CSB will generate two lists (Lists A & B) to identify which households within the segment will be targeted, according to the sampling interval. It is recommended that the Survey Coordinator generate these lists in advance using the CSB and give each survey team a laminated copy of Lists A & B to carry with them in the field.

Determining the expected survey population per household

To determine the survey population per household the WHO recommends the calculation

Expected # of people in coverage pop. per HH =

(% pop. in age group) x (fraction age group in coverage pop.) x (average HH size)

For Ethiopia, this is calculated to be 1.3 SAC per household. This estimation will be used in the CSB to determine the number and location of cluster required per district.

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 (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, using the 'Household Consent Form'.

Data collection, supervision and analysis

Data will be collected by mobile devices by survey teams in the field. 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. All analyses will be fully shared with collaborating partners in country.

APPENDIX A: Field team planning manual

Survey team composition

- The survey team will be made up of district level public health professionals. Nurses are selected for training
- At least 1 team of 4 individuals will be requested from each district. 2 teams of 4 will be requested for larger districts.
- Each district will complete the survey within 15 working days. If 2 teams are working in the district it is expected that the survey will be completed in half the time.
- Supervision will be undertaken centrally through daily checks for Survey CTO for the completeness of data entry.
- Supervision of the training will be undertaken by SCI Ethiopia team
- Supervision of overall data collection will be undertaken by EPHI by random visits and spot checks.

Survey team training

Training will be held by the study coordinator with assistance for 2 other members of the EPHI team. It will be held centrally in Addis Ababa. The training will be supervised by a member of the SCI team. The training will be 3 days with the first day being presentations and introduction to the protocol. The second day will be a classroom based session using the mobile phones and the practicing the village mapping using role play. The third day will be a practical in the local village where the techniques will be tested using a realistic setting. The training will take place on the 10th – 13th July. All participants will be given the training manual that is translated to Amharic, the survey CTO guide and the coverage survey builder lists of villages to be surveyed and the list A&B for each district.

The training will cover the following aspects:

- Rationale and background for conducting the survey
- Essential aspects to maintain unbiased data collection
- The segmentation approach, selection of households and practice with the questionnaire on phones 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, a few dummy tablets and examples of the posters and leaflets used during social mobilization. These will act as visual cues to the individuals in each HH.
- Recording the answers in the mobile phones
- Mock interviews through practicing in the field (NB This should NOT be in any of the study areas)
- Discussion of experience from mock interviews, review of the survey methods, and planning the field work

Timetable of activities

Timeline	Responsibility	Description of activity	Who is involved
April	Protocol revision	Protocol will be adapted to accommodate the new WHO guidelines.	EPHI is accountable, SCI to provide Technical Assistance
April	Equipment and Tools prepared	Survey CTO to be loaded onto Mobile phone Questionnaire to be uploaded to Survey CTO server for ETH	EPHI Accountable, SCI for TA
April	Purposive Selection of study areas	2 Regions to be selected. Information obtained of the districts in that area so that the Coverage Survey Builder can be used.	FMoH accountable, SCI to provide TA support on new Coverage Survey Builder
April	Letter written to selected regions	Informing the Regions that they have been selected for coverage validation	FMoH
W/C July 10 th	Training	All Regions	EPHI
July 15 th	Data Collection started	Use of Survey CTO for data collection	EHPI
July 10 th – 31 st July	Supervision	Daily supervision on Survey CTO server to check protocol is being followed	EPHI accountable, TA given by SCI for survey CTO.
1 st August	Data cleaning and analysis	Data cleaning and analysis	EPHI with TA from SCI London
1 st September	Raw data and initial findings discussed.		EPHI SCI provides TA
15 th September	Final report	Full report with dashboards circulated.	EPHI

Roles and responsibilities

The survey team will include the following main members:

Survey Coordinator - NTD Coordinator, EPHI

The primary duties of the survey coordinator are:

- Adapt and finalise the survey protocol, including the questionnaire. Obtain TA from SCI as required.
- Obtain Ethics approval
- Attend a Technical Working Group Meeting to enable district selection.
- Provide a plan and budget to the FMOH to release the budget in a timely manner
- If necessary, arrange translation and back translation of questionnaire in local languages
- Identify the survey team
- Organise the survey logistics
- Organise the training of the survey team
- Either before or during training the Coverage Survey Builder is to be used to create the segments to be sampled and the lists for household selection.
- Oversee the data entry (mobile-based), TA given by SCI.

SCI Program Manager

The primary duties of the SCI program manager are to:

- Provide Technical Assistance at each stage of: Protocol writing, planning, training, implementation and analysis.
- Support the use of the Coverage Survey Builder.
- Provide the Technical Support for mobile data collection. To include: set up, training, supervision and download for analysis.

FMOH

The SCH/STH Focal Person should support the process by:

- Providing the list of districts treated and time of treatment to enable selection.
- Chair a Technical Working Group Meeting to finalise selection of districts
- Facilitate information gathering on each district – to include the kebele names and number of households per kebele (for entering in the coverage survey builder)
- Processing the plan and releasing the budget in a timely manner
- Provide feedback on the final report which can be added as notes at the end of the 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 through mapping and segmentation process
- Ensure strict adherence to the survey protocol
- Provide the survey teams with necessary materials for daily activities
- Review completeness after each village is done.
- Ensure upload of data (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 (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 segment (i.e. creating sketch maps, 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 surveys, drivers play a vital role in the success of the survey by helping the survey team navigate between segments. Preferably, drivers should be familiar with the survey area. The number of drivers needed will vary based on the local situation.

SCI Biostatistician

The primary duties of the SCI biostatistician are to:

- Together with the survey coordinator and SCI program manager, adapt and finalise the survey protocol, including the questionnaire
- Support the determining of the sampling strategy and number of villages and HHs 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: Step by step guide to Planning Stage

Sample size calculation

All figures should be entered into the coverage survey builder as indicated at the end of this section.

(<http://www.ntdsupport.org/resources/coverage-survey-builder-coverage-evaluations>)

Step 1: Expected Coverage (p): The proportion of the population that you expect will have swallowed the drug (expected coverage). Sample size will increase as the reported coverage approaches 50%. To help ensure that the sample size is sufficient to meet study objectives, it is recommended that at least 15 percentage points be subtracted from the reported programme coverage. For example, if reported coverage is 85%, it would be more conservative and ensure a greater sample size to subtract 15 percentage points and assume that the expected coverage figure is 70%. If after subtracting 15 percentage points the reported coverage is less than 50%, then 50% should be used as the expected value. If you are conducting an integrated coverage assessment, the lowest of expected drug package coverage rates should be used. *Suggested default: 50%*

Step 2: Desired Precision (δ): The precision measure considered here is half the width of a 95 percent confidence interval around the coverage estimate. For example, a measure of precision of 5 percentage points around a coverage estimate corresponds to a confidence interval of +/-5%. *Suggested default: 5%*

Step 3: Design Effect (DEFF): The design effect is a measure that reflects the degree to which respondents in the same subunit are likely to be similar in terms of the information provided in response to an interview question. A design effect of 1.0 indicates that the use of cluster sampling (sampling people from select subunits) makes no contribution to the variability of the estimate. If possible, assumptions about the size of the DEFF should be based on the experience of previous surveys. Otherwise, values between 2 and 4 are recommended. *Suggested default: 4*

Step 4: Alpha (α): An alpha value corresponds to the significance level associated with a confidence interval. Selecting alpha=5% corresponds to a 95% confidence interval ($Z_{1-\alpha/2}=1.96$). If the coverage survey were repeated multiple times using methods free of bias and 95% confidence intervals calculated each time, then 95% of these intervals would be expected to contain the true coverage. *Suggested default: 5%*

Step 5: Non-response rate (r): The percent of members of the survey population sampled for the survey but for whom data were not obtained to absenteeism, refusal, or other reason. Values of 10%-20% are recommended. *Suggested default: 10%*

These responses can be used to generate the sample size to be targeted for your survey using the equation below (calculated automatically in the CSB):

$$n = \frac{(DEFF)(Z^2_{1-\alpha/2})(p)(1-p)}{\delta^2(1-r)}$$

Step 3: Divide large subunits: Additionally, it is recommended, although not required, that any subunit with >400 households be subdivided if possible and listed on separate lines. This is done in order to make segmentation more manageable in the field. It is not necessary to have sub-subunit level population information at this stage. Approximate populations (e.g. “Subunit C part 1 of 2” (50% of the population in Subunit C) and “Subunit C part 2 of 2” (50% of population of the population in Subunit C)) can be used and the exact boundaries of these sub-subunits can be determined upon arrival, based on well-defined neighborhoods or other existing administrative units, if they are selected in Step 6 below. It is important to keep track of the number of parts into which a large subunit was divided (e.g. “part 1 of 3”) so that the team in the field knows the number of initial groups in which to split the large subunit.

Step 4 (see picture below): Enter the names of the subunits and the estimated number of households in the CSB: To ensure maximum geographic representation of the survey area, subunits should be listed in geographical order. This list of subunits and number of households may be copied and pasted directly from the census spreadsheet(s) used in Steps 1-3 to save time and reduce the potential for errors. If information on the number of households does not exist, it can be approximated by dividing the total population for each subunit by the average household size and rounding to the nearest whole number.

Step 5: Determine the target segment size and number of segments per subunit: The CSB will automatically determine the target segment size, which is set at 50 households by default but may be larger if the sample size per segment is not expected to be met after visiting 50 households. For a more detailed explanation of how the target segment size is calculated, see Appendix 4. The number of segments per subunit is equal to the projected subunit size divided by the target segment size and rounded to the nearest whole number (e.g., 131 HH / 50 HH per segment \approx 3 segments).

Step 6: Select 30 subunits using PPES: The CSB will systematically select 30 subunits from the survey area with probability proportionate to the estimated number of segments they contain. It is possible for larger subunits to be selected more than once. In such cases, the number of segments to be selected from the subunit is equal to the number of times it was selected. For example, if the 6th and 7th selected segments fall within subunit #28, then it will be necessary to randomly select 2 segments from subunit #28.

Ethiopia 2017 Coverage Survey Interviewer Manual

This section has been translated to Amharic for the data collectors.

Before arriving at the kebele

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

Arriving at the village

- It is important to be at the kebele when people are available. This means interviewers should be in the kebele and ready to start at 8am every day.
- The first thing the team should do when arriving at the kebele is to seek out the head of the village:
 1. Introduce the team and ask for permission to survey
 2. Ask for a kebele leader and local representative that has not been involved with the MDA to assist with the sketch mapping and local guiding.
- The team leader will be responsible for completing the village questionnaire by interviewing the kebele leader:
 - The **GPS co-ordinates** of the village should be entered on **arrival and departure** if the data is being collected on paper forms

Dividing a subunit into segments

The following steps should be followed by survey teams in the field to divide a subunit into segments and randomly select one segment in which to sample.

Step 1: Locate the outer boundaries of the subunit. Kebele leaders to describe where the boundaries lie.

Step 2: Divide the subunit into segments with roughly the same number of households. Survey teams should carry with them a list of the selected subunits and the number of segments required in each (available from the CSB, and print out given at the training). Survey teams should work with local leaders to help divide the subunit into the *pre-determined* number of segments such that each segment has approximately the same number of households. This means that the geographic size of the segments may vary considerably – densely populated areas will have geographically small segments and low-density segments will be large. It is recommended to use natural lines of division, such as roads, foot paths, streams or other distinguishable landmarks to form the boundaries of the segments so that it is clear into which segment each household falls. Maps and the assistance of community leaders will be essential in this process. Assign each segment a number.

Note: It is important that each subunit be divided into exactly the pre-determined number of segments, based on the estimated number of households. The number of segments should *not* be revised in the field if the original estimate is found to be incorrect.

Example:

If a selected subunit is expected to have 131 households, then according to the CSB it will require 3 segments (131 HH / 50 HH per segment \approx 3 segments). But suppose that upon reaching this subunit in the field the survey team discovers that there are only 106 households. It is very important that the survey team still divide this subunit into *exactly* 3 segments, as was originally planned, even though the correct number of households is quite different. Any deviation in the number of segments from what was planned using the CSB will result in a *non-equal probability sample*.

Step 3: Randomly select one segment. Randomly select one segment by assigning a number to each segment and then drawing one number from a hat (or flipping a coin if there are only two segments from which to choose). When the entire village is a single (1) segment there is no need for random selection.

Example:

If the subunit has been divided into four segments, assign each segment a number from 1 to 4. Write the numbers 1 through 4 on pieces of paper and put these pieces into a bowl or hat. Draw one paper. The number drawn corresponds to the number of segment that has been selected.

Large Subunits. If a selected subunit corresponds to a larger subunit that was subdivided in Section Five (e.g. "Subunit C part 1 of 2") then the subunit should *first* be subdivided into the number of parts using any existing administrative structure (e.g., neighborhoods, blocks, zones) and then one of these subdivisions selected at random. It is within this selected subdivision that the segmentation should occur. Note that larger towns are often more likely to have maps at the local level, which can help tremendously with the segmentation.

Example:

The town of Lenbe is expected to have 1,336 households and for that reason it was subdivided into four parts in Section Five, with each part listed on a separate line in the CSB tool (see example below). "Lenbe part 3 of 4" was selected as a subunit by the CSB. Upon arrival in Lenbe the team learns that it contains 5 well-defined neighborhoods ("A", "B", "C", "D", and "E"). Because Lenbe was originally subdivided into 4 parts during the coverage survey planning phase, the team considers each of these neighborhoods to be a part, pairing the two smallest neighborhoods ("D" and "E"), and then randomly selects one of these neighborhoods to serve as "Lenbe part 3 of 4" – that is, the selected subunit. The team writes the neighborhood names "A", "B", "C" and "D-E" onto slips of paper and places them into a hat. Neighborhood "A" is randomly selected, which means that the part of Lenbe that corresponds with neighborhood A will serve as the selected subunit. The team then visits neighborhood A and divides it into the predetermined number of segments (7 in this example) of approximately equal size, from which one is randomly selected.

#	Subunit Names	Estimated # Households (from census)	# Segments per Subunit	Cumulative Segments	Selected Subunits
1	Lenbe part 1 of 4	334	7	7	
2	Lenbe part 2 of 4	334	7	14	
3	Lenbe part 3 of 4	334	7	21	1
4	Lenbe part 4 of 4	334	7	28	

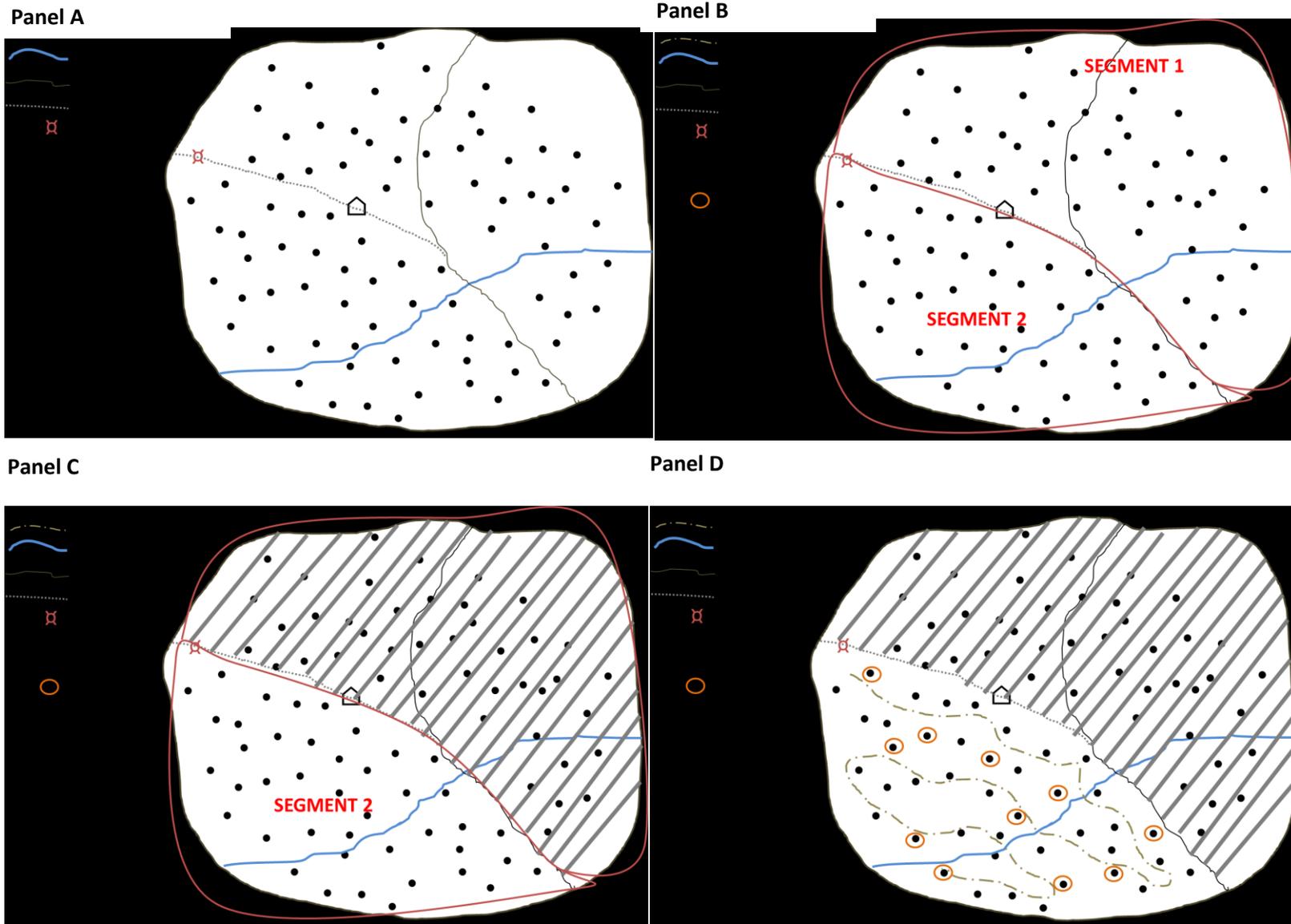
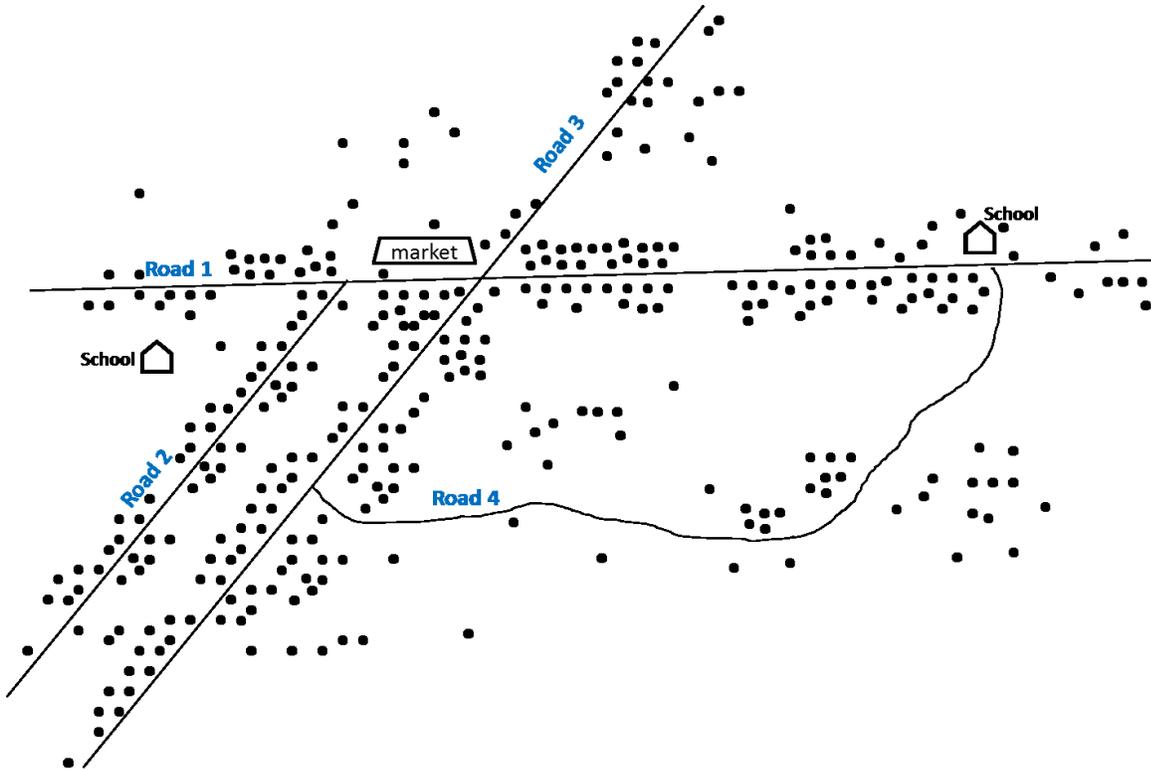
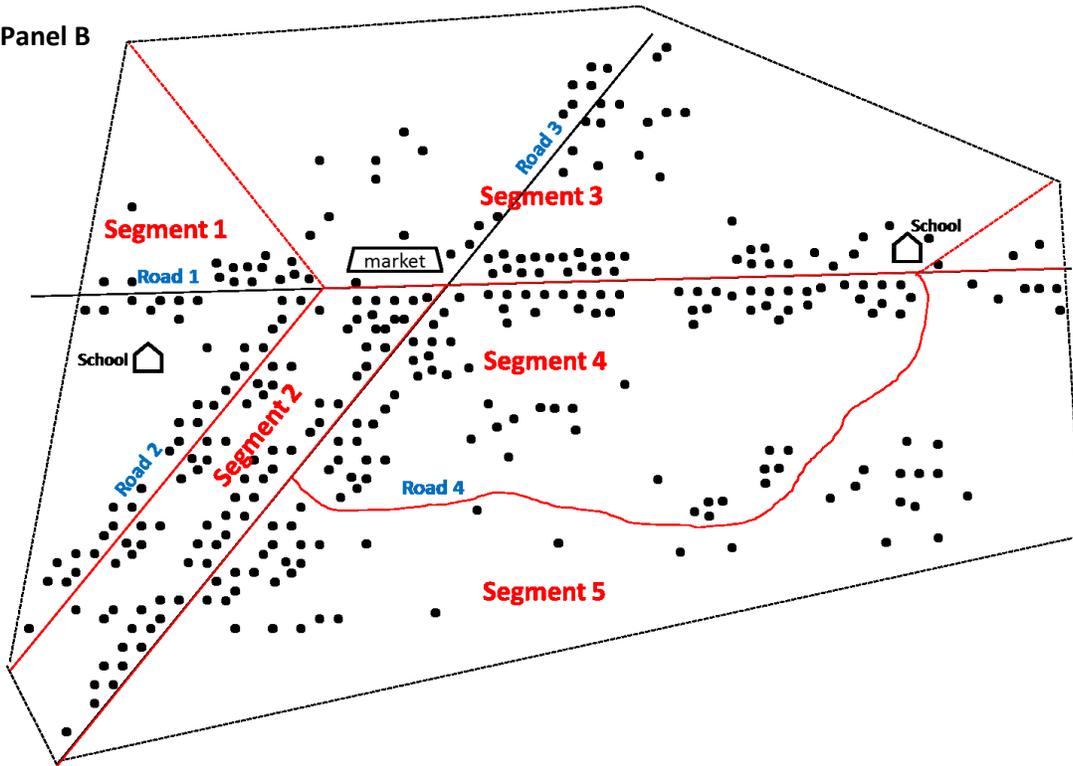


Figure 3. Depiction of the steps required for creating segments and selecting households within each segment. Panel A) Example of a rural EA with approximately 85 households. Panel B) The EA is segmented into 2 segments of approximately equal size using natural lines of division. Panel C) One segment is randomly selected (using coin toss or drawing pieces of paper from a hat/bowl). Panel D) A walking route through the selected segment is identified that passes by all households in the segment and households are selected for the survey according to the selected sampling list (either List A or List B).

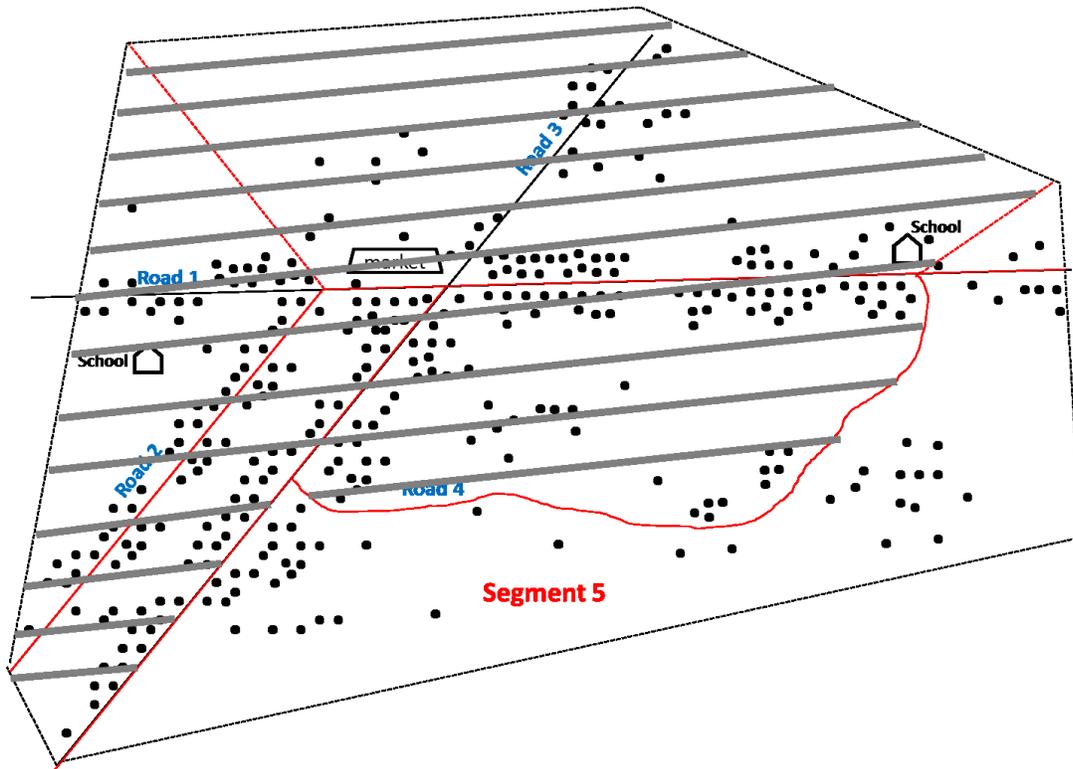
Panel A



Panel B



Panel C



Panel D

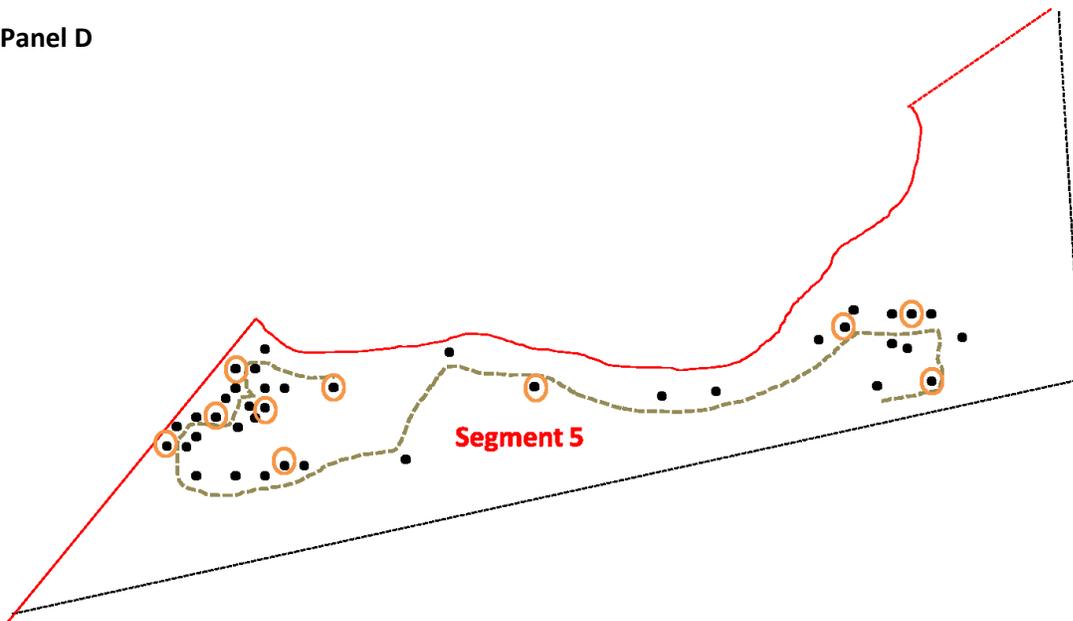


Figure 4. An example of segmentation in a larger semi-urban EA. Panel A) A sketch map of a semi-urban EA with ~270 households. Panel B) The EA is divided into 5 segments with approximately equal numbers of households using roads as the primary line of division between segments. Panel C) Segment 5 is randomly selected. Panel D) A walking route through segment 5 is identified that passes by all households in the segment and households are selected for the survey according to the selected sampling list.

COMMON QUESTIONS:

Does each segment need to have exactly the defined number of households?

No, it is **more important** that each segment have **approximately equal numbers of households** than it is for a segment to contain exactly the target segment size. In fact, because of rounding and errors with the population estimation, it is unlikely for any one segment to have exactly the defined number of households. For example, if the target segment size is set at 50 households, in practice in some subunits the segments may end up having closer to 40 households, while in other subunits they may have 60.

What if the same subunit is selected more than once by the CSB?

If a subunit is very large it may be selected more than once (see Section 5, step 5). In this case, the number of segments selected from the subunit should correspond to the number of times it was selected. Put a piece of paper into a hat or bowl for each segment in the subunit and then draw pieces of paper from the hat corresponding to the number of times the subunit was selected. The same segment may not be selected more than once.

Example:

Suppose that *both* the 21st and 22nd selected segments come from the same subunit, which has 390 households. As with the previous example, the first step is to divide the subunit into equal subgroups. The subunit requires $390/50 = 8$ segments. Because 8 is a lot of segments, it may take some time and even require the aid of rough maps, to divide the subunit into roughly 8 equal parts. The next task is to randomly select the two segments from the eight segments which will be the 21st and 22nd selected segments. This can be done using by drawing numbers from a hat or bowl. The same segment may not be selected more than one.

How can segmentation be used in urban areas?

Segmenting urban areas can be easier than segmenting rural areas, as cities and towns are usually organized into blocks or some similar units. When using EAs, maps are usually available showing streets and blocks; if unavailable, these maps can be drawn. It is not recommended to use subunits other than EAs for urban areas, as they may vary considerably in size and be less likely to have maps to aid in segmentation.

Selecting households within each segment

Segments have been pre-selected using the Coverage Survey Builder and printed lists have been distributed at the training. Each list has the selected segments and the List A&B.

Step 1: Identify a route through the segment. The survey team should work with a local guide to identify a walking route that will pass by every house in the segment and determine which household will serve as the initial household.

Step 2: Select list A or B. Flip a coin to determine if List A or list B will be used.

Step 3: Follow the route through the segment and survey households according to the selected list. Starting with the initial household, enumerate households as you follow the predetermined route through the segment (ignoring any structures that are not households). If culturally acceptable, it is often helpful to number the door of each household with chalk. For each enumerated household that corresponds to a number on the selected list, stop and interview **all** members of the survey population who were living in the household at the time of the MDA. Continue until the next number on the selected list is greater than the total number of households in the segment.

Example: Suppose the CSB generates the following Lists A and B for this coverage survey. In addition, suppose that the survey team has already randomly selected a single segment within the subunit and identified a route through the selected segment that will pass by each house (Step 1, above). At this point a team member flips a coin and selects List A. The survey team then walks the predetermined route through the selected segment, counting each household they pass. The team does nothing except to count (or label with chalk) the 1st, 2nd, 3rd and 4th households they pass. When they arrive at the 5th household, the team stops to interview **all members** of the survey population living in the household because this is the first household number on the selected List A (the starting “0” on List A can be ignored, as there is no 0th house). Having finished all interviews in the 5th household, the team then continues counting each house along the predetermined route (e.g., 6th, 7th, 8th, ...) until they arrive at the 10th household, the next on List A. Once again the team stops and interviews all members of the survey population living in the household. This process continues until the team reaches the last household in the segment; for the sake of example, suppose this corresponds with the 47th household. **At this point the team stops because they have visited each house in the segment, even though List A has additional numbers.** The sampling is considered complete for that segment and the team may travel onto the next selected subunit.

<u>List A</u>	<u>List B</u>
0	4
5	9
10	14
15	19
20	24
25	29
30	34
35	39
40	44
45	50
50	55
56	60
61	65
66	70
71	75
76	80

Important note: Lists A & B are intentionally made to be much longer than will be necessary for most segments. Since most segments are expected to have ~50 households, most survey teams will complete sampling in a given segment before they reach the end of the list. Once a segment is complete the teams should not attempt to enrol additional households in order to reach the end of List A or List B. Lists A & B are longer than necessary to account for the rare instances where the actual

size of a selected segment is significantly greater than planned (e.g. has 80 households), which may be due to faulty census projections or a segmentation imbalance. In such instances it is important to have enough households in List A & B so that the team can still apply the set sampling interval to *all* households in the segment even if it results in an unusually large sample size from that one segment.

Household data collection

All household members living in the selected house or compound who are part of the survey population – for this survey school age children (5-14 years) should be interviewed. For young children (<10 years) data will also be collected from the child themselves where household consent (written) and child consent (verbal) is given. In cases where this preferred practice is not acceptable, data will be collected from their primary caretakers. In surveys where children were treated through schools, it will be appropriate to ask only the children directly.

What if people live in compounds instead of households?

In some settings, such as sub-Saharan Africa, households may be grouped into compounds, which are more visible and easier to enumerate than households.

Example:

Instead of sampling 1 in 4 *households* according to the List A, the survey team could use the same List A to sample 1 in 4 *compounds* throughout the segment (assuming that segment size is still based on the number of households – such as 50 households). Within each selected compound **all** members of the survey population who were living there during MDA would be surveyed.

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 or the school-age child/children (5 to 14 years) is not at home, return later in the day, or go to their school. 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 one².**

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.**

² 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.

APPENDIX D Questionnaires

The data collection is being completed using mobile phones and using Suvery CTO. The following forms have been uploaded to the phones.



ETH_2017_covera
ge_HHInd_2017-0



ETH_2017_covera
ge_village_2017-0

Appendix E: Sample size details

Sample sizes were obtained by using the WHO coverage Survey Builder. This tool was used for each of the seven districts.



NEW_Ambo_Oromi
a_Coverage Survey



NEW_Harare_Erer_C
Coverage Survey



NEW_Oromia_Kimbi
Buildbit_Coverage Survey



NEW_SNNPR_Abesh
Survey



NEW_SNNPR_Bolos
Sore_Coverage Su



NEW_Tigray_Ahfero
m_Coverage Survey



NEW_Tigray_Asged
e Tsimbla_Coverage

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