

# Sierra Leone - Multiple Indicator Cluster Survey 2017

**Statistics Sierra Leone, United Nations Children's Fund**

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# Sampling

## Sampling Procedure

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A multi-stage, stratified cluster sampling approach was used for the selection of the survey sample. The sampling frame for the Sierra Leone MICS 2017 was based on the 2015 Sierra Leone Population and Housing Census. The primary sampling units (PSUs) selected at the first stage were census enumeration areas (EAs). A new listing of households was conducted in each sample EA, and the sample households were selected at the second stage.

A unique feature of the sampling plan for the Sierra Leone MICS 2017 is that it was coordinated with the sample design for the Sierra Leone Integrated Household Survey (SLIHS) 2017. Although the sample size and allocation for the SLIHS 2017 was different from that of the MICS 2017, the sample enumeration areas (EAs) for the MICS 2017 were selected in such a way that provided a maximum overlap between the sample EAs selected for the two surveys. In the overlapping sample EAs the two surveys shared the same listing of households, and a subsample of the MICS sample households was selected for the SLIHS so that it would be possible to have an integrated database from the two surveys for the common sample households.

### SAMPLE SIZE AND SAMPLE ALLOCATION

In developing the sampling plans for the Sierra Leone MICS 2017 the sample design and results from the Sierra Leone MICS 2010, which had similar objectives, was first examined. The MICS 2010 was based on an overall sample of 480 sample clusters and 12,000 households, with 25 sample households selected per cluster. A minimum of 30 sample clusters and 750 sample households were selected for the smaller districts, and a maximum of 66 clusters and 1,650 households were selected for the Western Area Urban. In studying the sampling errors for key indicators for children under 5 at the district level it was found that the 95% confidence intervals for some of the estimates were relatively wide, so for the Sierra Leone MICS 2017 it was decided to increase the sample size to have a minimum of 936 sample households for the smaller districts. The overall sample size was increased to 15,360 households.

Based on the experience of the Sierra Leone MICS 2010, it was decided to select 26 sample households per cluster (EA) for the MICS 2017. Although this very small increase of one sample household per cluster compared to MICS 2010 would result in a very minor increase in the design effects, it would still slightly improve the level of precision. Given that a 50% subsample of the MICS sample households are selected for the men's questionnaire, it is best to select an even number of households in each sample cluster. If less households were selected per cluster for the MICS 2017 it would be necessary to select more clusters, thus increasing the survey costs for listing and transportation. Therefore, at the national level, a sample of 600 sample EAs were selected at the first stage and 15,360 households were selected at the second stage.

In allocating the sample clusters by district it was decided to have a minimum of 36 sample clusters for the smallest districts and 64 for the largest district of Western Area Urban. This resulted in a sample of 936 to 1,664 households per district. In between this range, the sample clusters were allocated to the districts approximately in proportion to the square root of the number of households in the Census frame. This approach increased the sample for smaller districts and decreased the sample for larger districts compared to a proportional allocation. Within each district the sample clusters were allocated to the rural and urban strata in proportion to the number of households in the frame.

### SELECTION OF ENUMERATION AREAS (CLUSTERS)

At the first sampling stage the EAs in each stratum (district, rural and urban) were selected from the 2015 Sierra Leone Census frame systematically with probability proportional to size (PPS), where the measure of size for each EA was based on the number of households in the Census frame.

A total of 685 EAs were selected for the Sierra Leone Integrated Household Survey (SLIHS) 2017. This sample was also stratified by district, urban and rural areas, but the allocation of the sample clusters by stratum was different from that for the Sierra Leone MICS 2017. The selection procedures were designed to provide a maximum overlap of the sample EAs between the two surveys. A total of 505 sample EAs are included in both surveys, so that the listing could be shared. In these sample EAs the SLIHS sample households were selected as a subsample of the MICS 2017 sample households.

### LISTING ACTIVITIES

Since the sampling frame (the 2015 Sierra Leone Census) was not up-to-date, a new listing of households was conducted in all the sample EAs prior to the selection of households. For this purpose, listing teams were formed who visited all of the selected enumeration areas and listed all households in each sample EA. In the case of large EAs (for example, with more than 300 households), the EA was divided into smaller segments. Following a quick count of the households in each segment, one segment was selected randomly with PPS in the EA for the listing. The mapping and household listing operations

consisted of training of mapping and listing field staff, fieldwork (mapping and listing of households), and household selection. The training of listing staff took place from 29th November - 3rd December 2016 while the fieldwork commenced on 5th December 2016 and was completed on 12th January 2017. The household listing fieldwork was carried out by 15 teams: each team consisted of a supervisor, one mapper and one lister.

## SELECTION OF HOUSEHOLDS

Lists of households were prepared by the listing teams in the field for each enumeration area. The households were then sequentially numbered from 1 to Mhi (the total number of households in each enumeration area) at the Statistics Sierra Leone (SSL) central office, where the selection of 26 households in each EA was carried out using random systematic selection procedures.

The survey also included a questionnaire for individual men that was to be administered in one-half of the sample of households. A random number of 1 or 2 specified whether the sample households with odd or even serial numbers would be selected for the men's questionnaire in each sample cluster. All men between the ages of 15 and 49 years in the selected households were interviewed.

The Sierra Leone MICS 2017 also included water quality tests for a subsample of households within each sample EA. A subsample of 3 of the 26 households was selected in each cluster using random systematic sampling for conducting water quality tests, for both water in the household and at the source. The MICS household selection template includes an option to specify the number of households to be selected for the water quality tests, and the spreadsheet automatically selects the corresponding subsample of households.

## Response Rate

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Of the 15,605 households selected for the sample, 15,364 were found to be occupied. Of these, 15,309 were successfully interviewed for a household response rate of 99.6 percent.

The Water Quality Testing Questionnaire was administered to 3 randomly selected households in each cluster. Of these, 1,780 were successfully tested for household drinking water yielding a response rate of 98.8 percent. Also, 1,748 were successfully tested for source drinking water quality yielding a response rate of 97.1 percent.

In the interviewed households, 18,006 women (age 15-49 years) were identified. Of these, 17,873 were successfully interviewed, yielding a response rate of 99.3 percent within the interviewed households.

The survey also sampled men (age 15-49) but required only a subsample. All men (age 15-49) were identified as eligible for interview in every second household. 7,534 men (age 15-49 years) were listed in these households. Questionnaires were completed for 7,415 eligible men, which corresponds to a response rate of 98.4 percent within eligible interviewed households.

There were 11,774 children under age five listed in the household questionnaires. Questionnaires were completed for 11,764 of these children, which corresponds to a response rate of 99.9 percent within interviewed households.

A sub-sample of children age 5-17 years was used to administer the questionnaire for children age 5-17 years. Only one child was selected randomly in each household interviewed, and there were 25,116 children (5-17 years) listed in the household questionnaires. Of these, 11,046 children age 5-17 years were selected, and questionnaires were completed for 11,033 children, which corresponds to a response rate of 99.9 percent within interviewed households.

Overall response rates of 98.9, 98.1, 99.6, and 99.5 are calculated for the individual interviews of women, men, under-5s and children 5-17 years, respectively.

## Weighting

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The Sierra Leone MICS 2017 sample is not self-weighting. Given the oversampling of households in the smaller districts, the sampling rates and corresponding weights vary by district. For this reason, sample weights were calculated, and these were used in the subsequent analyses of the survey data.

The major component of the weight is the reciprocal of the sampling fraction employed in selecting the number of sample households in the particular sampling stratum (h) and PSU (i).

Since the number of households in each sample EA from the 2015 Sierra Leone Census frame used for the first stage selection and the updated number of households in the EA from the listing are generally different, individual overall probabilities of selection for households in each sample EA (cluster) were calculated.

A final component in the calculation of sample weights takes into account the level of non-response for the household and individual interviews.

After the completion of fieldwork, response rates were calculated for each sampling stratum. These were used to adjust the sample weights calculated for each cluster.

The non-response adjustment factors for the individual women and under-5 questionnaires were applied to the adjusted household weights. The numbers of eligible women and under-5 children were obtained from the list of household members in the Household Questionnaire for households where interviews were completed.

The weights for the questionnaire for individual men were calculated in a similar way. In this case the number of eligible men in the list of household members in all the MICS sample households in the stratum was used as the numerator of the non-response adjustment factor, while the number of completed questionnaires for men in the stratum was obtained from the 50% subsample of households. Therefore, this adjustment factor includes an implicit subsampling weighting factor of 2 in addition to the adjustment for the non-response to the individual questionnaire for men.

In the case of the questionnaire for children age 5-17 years, in each sample household, one child was randomly selected from all the children in this age group recorded in the list of household members. The household weight for the children age 5-17 years is first adjusted based on the response rate for this questionnaire at the stratum level. Once this adjusted household weight is normalised as described below, it is multiplied by the number of children age 5-17 years recorded in the list of household members. Therefore, the weights for the individual children age 5-17 years will vary by sample household.

For the water quality tests (both for home consumption and at source) a subsample of 3 households was selected from the 26 MICS sample households in each sample cluster.

The MICS household full (raw) weights were standardized (or normalized), one purpose of which is to make the weighted sum of the interviewed sample units equal to the total sample size at the national level. Normalization is achieved by dividing the full sample weights (adjusted for nonresponse) by the average of these weights across all households at the national level. This is performed by multiplying the sample weights by a constant factor equal to the unweighted number of households at the national level divided by the weighted total number of households (using the full sample weights adjusted for nonresponse). A similar standardization procedure was followed in obtaining standardized weights for the individual women, men, under-5 modules and water quality data. Adjusted (normalized) household weights varied between 0.144223 and 5.348511 in the 600 sample enumeration areas (clusters).

Sample weights were appended to all data sets and analyses were performed by weighting sample households, women, men, under-5s and water quality tests with these sample weights.

# Questionnaires

## Overview

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Seven questionnaires were used in the survey: 1) a household questionnaire which was used to collect basic demographic information, the household, and the dwelling; 2) a water quality testing questionnaire administered in 3 households in each cluster of the sample; 3) a questionnaire for individual women; 4) a questionnaire for individual men; 5) an under-5 questionnaire; 6) a questionnaire for children age 5-17 years, administered to the mother (or caretaker) of one randomly selected child age 5-17 years living in the household; 7) and a verbal autopsy questionnaire, administered to mothers (or caretakers) of all children under 5 who had died in the five years preceding the survey.

All the questionnaires were based on the MICS6 model questionnaire except for Verbal Autopsy questionnaire is not a standard MICS questionnaire. From the MICS6 model English version, the questionnaires were customised and were pre-tested in Western Area Rural District between January and February 2017. Based on the results of the pre-test, modifications were made to the wording of the questionnaires. A copy of the Sierra Leone, 2017 MICS questionnaires is provided as Related Material.

In addition to the administration of questionnaires, fieldwork teams tested the salt used for cooking in the households for iodine content, observed the place for handwashing, and measured the weights and heights of children age under 5 years, as well as tested household and source water for E. coli levels. Details and findings of these observations and measurements are provided in the respective sections of the report (attached as Related Material).

# Data Collection

## Data Collection Dates

Start	End	Cycle
2017-05	2017-08	N/A

## Data Collection Mode

Face-to-face [f2f]

### DATA COLLECTION NOTES

Training for the fieldwork was conducted for 30 days in April and May 2017. Training included lectures on interviewing techniques and the contents of the questionnaires, and mock interviews between trainees to gain practice in asking questions. Participants first completed full training on paper questionnaires, followed by training on the CAPI application. The trainees spent 3 days in field practice and 4 days on a full pilot survey in the Western Area Urban District. The training agenda was based on the standard MICS6 training agenda.

Measurers received dedicated training on anthropometric measurements and water quality testing for a total of 6 days, including 5 days in field practice and pilot survey.

Field Supervisors attended additional training on the duties of team supervision and responsibilities.

The data were collected by 24 teams; each was comprised of one supervisor, three female interviewers, one male interviewer, one measurer and one driver. Fieldwork began in May 2017 and concluded in August 2017.

Data was collected using tablet computers running the Windows 10 operating system, utilising a Bluetooth application for field operations, enabling transfer of assignments and completed questionnaires between supervisor's and interviewer's tablets.

### SUPERVISION

Team supervisors were responsible for daily monitoring of the fieldwork. Forced re-interviewing was implemented on three randomly selected household per cluster. Daily observations of interviewer skills and performance was conducted.

During the fieldwork period, each team was visited multiple times by survey management team members and field visits were arranged for UNICEF MICS Team members.

Throughout the fieldwork, Field check tables (FCTs), were being produced weekly for analysis and action with field teams. The FCTs were customised versions of the standard tables produced by the MICS Programme.

# Data Processing

## Data Editing

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The data collection application was based on the CSPro (Census and Survey Processing System) software, Version 6.3, including a MICS dedicated data management platform. Procedures and standard programs developed under the global MICS programme and adapted to the Sierra Leone MICS 2017 questionnaire were used throughout. The CAPI application was tested in the Western Area Rural District between February and March 2017. Based on the results of the CAPI-test, modifications were made to the questionnaires and application.

Data were analysed using the Statistical Package for Social Sciences (SPSS) software, Version 23. Model syntax and tabulation plans developed by UNICEF were customized and used for this purpose.



# Data Appraisal

## Estimates of Sampling Error

The sample of respondents selected in the Sierra Leone Multiple Indicator Cluster Survey is only one of the samples that could have been selected from the same population, using the same design and size. Each of these samples would yield results that differ somewhat from the results based on the actual sample selected. Sampling errors are a measure of the variability between the estimates from all possible samples. The extent of variability is not known exactly but can be estimated statistically from the survey data.

The following sampling error measures are presented in this appendix for each of the selected indicators:

- Standard error (se): Standard error is the square root of the variance of the estimate. For survey indicators that are means, proportions or ratios, the Taylor series linearization method is used for the estimation of standard errors. For more complex statistics, such as fertility and mortality rates, the Jackknife repeated replication method is used for standard error estimation.
- Coefficient of variation (se/r) is the ratio of the standard error to the value (r) of the indicator, and is a measure of the relative sampling error.
- Design effect (deff) is the ratio of the actual variance of an indicator, under the sampling method used in the survey, to the variance calculated under the assumption of simple random sampling based on the same sample size. The square root of the design effect (deft) is used to show the efficiency of the sample design in relation to the precision. A deft value of 1.0 indicates that the sample design of the survey is as efficient as a simple random sample for a particular indicator, while a deft value above 1.0 indicates an increase in the standard error due to the use of a more complex sample design.
- Confidence limits are calculated to show the interval which contains the true value of the indicator for the population, with a specified level of confidence. For MICS results 95% confidence intervals are used, which is the standard for this type of survey. The concept of the 95% confidence interval can be understood in this way: if many repeated samples of identical size and design were taken and the confidence interval computed for each sample, then 95% of these intervals would contain the true value of the indicator.

For the calculation of sampling errors from MICS data, programs developed in CSPro Version 5.0 and SPSS Version 23 Complex Samples module have been used.

In addition to the sampling error measures described above, the tables also include weighted and unweighted counts of denominators for each indicator. Given the use of normalized weights, by comparing the weighted and unweighted counts it is possible to determine whether a particular domain has been under-sampled or over-sampled compared to the average sampling rate. If the weighted count is smaller than the unweighted count, this means that the domain had been over-sampled.



## Related Materials

### Questionnaires

#### Sierra Leone- Multiple Indicator Cluster Survey 2017: Questionnaire

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Title Sierra Leone- Multiple Indicator Cluster Survey 2017: Questionnaire  
 Country Sierra Leone  
 Language English  
 Filename Questionnaires.pdf

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### Reports

#### Sierra Leone- Multiple Indicator Cluster Survey 2017: Survey Findings Report

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Title Sierra Leone- Multiple Indicator Cluster Survey 2017: Survey Findings Report  
 Country Sierra Leone  
 Language English  
 Filename Sierra Leone 2017 MICS Survey Findings Report\_English.pdf

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#### Sierra Leone- Multiple Indicator Cluster Survey 2017: Snapshots of Key Findings

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Title Sierra Leone- Multiple Indicator Cluster Survey 2017: Snapshots of Key Findings  
 Country Sierra Leone  
 Language English  
 Filename Sierra Leone 2017 MICS Statistical Snapshots\_English.pdf

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### Technical documents

#### MICS6 Survey Planning Tools

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Title MICS6 Survey Planning Tools  
 Language English  
 Filename <http://mics.unicef.org/tools?round=mics6>

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#### MICS6 Indicator List

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Title MICS6 Indicator List  
 Filename <http://mics.unicef.org/tools?round=mics6>

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#### MICS6 Sampling Tools

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Title MICS6 Sampling Tools  
 Filename <http://mics.unicef.org/tools?round=mics6>

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