Nigeria - Malaria Indicator Survey 2010

National Population Commission, National Malaria Control Programme

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Sampling

Sampling Procedure

The 2010 Nigeria Malaria Indicator Survey (NMIS) called for a nationally representative sample of about 6,000 households. The survey is designed to provide information on key malaria-related indicators including mosquito net ownership and use, coverage of preventive treatment for pregnant women, treatment of childhood fever, and the prevalence of anaemia and malaria among children age 6-59 months. The sample for the 2010 NMIS was designed to provide most of these indicators for the country as a whole, for urban and rural areas separately, and for each of the six zones formed by grouping the 36 states and the Federal Capital Territory (FCT). The zones are as follows:
1. North Central: Benue, FCT-Abuja, Kogi, Kwara, Nasarawa, Niger, and Plateau
2. North East: Adamawa, Bauchi, Borno, Gombe, Taraba, and Yobe
3. North West: Jigawa, Kaduna, Kano, Katsina, Kebbi, Sokoto, and Zamfara
4. South East: Abia, Anambra, Ebonyi, Enugu, and Imo
5. South South: Akwa Ibom, Bayelsa, Cross River, Delta, Edo, and Rivers
6. South West: Ekiti, Lagos, Ogun, Ondo, Osun, and Oyo

SAMPLING FRAME
The sampling frame used for the 2010 NMIS was the Population and Housing Census of the Federal Republic of Nigeria, which was conducted in 2006 by the National Population Commission (NPC). Administratively, Nigeria is divided into states. Each state is subdivided into local government areas (LGAs), and each LGA is divided into localities. In addition to these administrative units, during the 2006 Population Census, each locality was subdivided into convenient areas called census enumeration areas (EAs). The primary sampling unit (PSU), referred to as a cluster for the 2010 NMIS, is defined on the basis of EAs from the 2006 EA census frame.

Although the 2006 Population Census did not provide the number of households and population for each EA, population estimates were published for more than 800 LGA units. A combination of information from cartographic material demarcating each EA and the LGA population estimates from the census were used to identify the list of EAs, estimate the number of households, and distinguish EAs as urban or rural for the survey sample frame.

SAMPLE ALLOCATION
The 2010 NMIS sample was selected using a stratified, two-stage cluster design consisting of 240 clusters, 83 in the urban areas and 157 in the rural areas. (The final sample included 239 clusters because access to one cluster was prevented by inter-communal disturbances.) A sample of 6,240 households was selected for the survey, with a minimum target of 920 completed individual women's interviews per zone. Within each zone, the number of households was distributed proportionately among urban and rural areas. A fixed 'take' of 26 households per cluster was adopted for both urban and rural clusters.

SAMPLING PROCEDURE AND UPDATING OF THE SAMPLING FRAME
The 2010 NMIS sample is a stratified sample selected in two stages. The primary sampling units (PSUs) are the enumeration areas (EAs) from the 2006 census, and the secondary sampling units (SSUs) are the households. In the first stage of selection, the 240 EAs were selected with a probability proportional to the size of the EA, where size is the number of approximate households calculated within the sampling frame.

A complete listing of households and a mapping exercise for each cluster was carried out from August through September 2010. The lists of households resulting from this exercise served as the sampling frame for the selection of households in the second stage. In addition to listing the households, the NPC listing enumerators used global positioning system (GPS) receivers to record the coordinates of the 2010 NMIS sample clusters.

In the second stage of the selection process, 26 households were selected in each cluster by equal probability systematic sampling. All women age 15-49 who were either permanent residents of the households in the 2010 NMIS sample or visitors present in the households on the night before the survey were eligible to be interviewed. In addition, all children age 6-59 months were eligible to be tested for malaria and anaemia.

The sampling procedures are fully described in Appendix A of "Nigeria Malaria Indicator Survey 2010 - Final Report" pp.69-71.

Response Rate

A total of 6,197 households were selected, and of these 5,986 were occupied. Of the occupied households, 5,895 had

occupants who were successfully interviewed, yielding a household response rate of 99 percent. There are no significant differences in the household response rates between rural and urban areas.

In the interviewed households, a total of 6,527 women were identified as eligible for the individual interview, and 97 percent of them were successfully interviewed.

Weighting

Proper weighting of the survey data is important to guarantee the representativeness of the survey data and to adjust for differential nonresponse. The 2010 NMIS is a complex survey including multi-stage selection, clustering, stratification, and unequal probability sampling. Due to the non-proportional allocation of the samples to the different strata, conditions for a self-weighting sample were not met. Therefore, weights are required to ensure the representativeness of the sample results.

Several sets of weights were calculated for the NMIS. First, a set of household weights was calculated for the selected households. The basic sampling weight for each household is the inverse of its selection probability. This weight was further adjusted for nonresponse at the household level. The adjustment of the weight is performed to adjust for nonresponse of households that are found. Out of scope households (i.e., households absent for extended periods and households no longer extant because the dwelling is either vacant or destroyed) are not included in the calculation.

The above adjusted weight was further normalized (called standard weight) at the national level to make the number of weighted cases equal to the number of unweighted cases for all household indicators based on the whole national sample. This treatment has no effect on the indicators themselves, but it does affect the number of weighted cases to reflect the relative scale of the base population it represents. The normalization was done by multiplying the whole set of weights by a unique constant, which was the number of unweighted total number of households interviewed over the weighted total number of households interviewed. All household indicators are tabulated applying this set of weights.

Second, a set of women individual standard weights was calculated based on the household standard weight calculated above, correcting for women's nonresponse and normalizing the resulting weights. Women should share the same weight as that of the household to which they belong, because all women age 15-49 were interviewed in every selected household. Furthermore, the household standard eight must be corrected for women's nonresponse, because there are nonresponses at the individual level – that is, not all of the eligible women in the selected household answered the questionnaire.

The reason for normalization of the individual weight is the same as for normalization of the household weight. The household and women's weights are PSU weights. All of the households in the same cluster share the same household weights; all women in the same PSU share the same weight.

Questionnaires

Overview

Two questionnaires were used in the NMIS: a Household Questionnaire and a Woman's Questionnaire, which was administered to all women age 15-49 in the selected households. Both instruments were based on the standard Malaria Indicator Survey Questionnaires developed by the Roll Back Malaria and DHS programmes. These questionnaires were adapted to reflect the population and health issues relevant to Nigeria during a series of meetings convened with various stakeholders from the NMCP and other government ministries and agencies, nongovernmental organisations, and international donors. The questionnaires were translated into three major Nigerian languages: Hausa, Igbo, and Yoruba.

The Household Questionnaire was used to list all the usual members and visitors in the selected households. Some basic information was collected on the characteristics of each person listed, including age, sex, and relationship to the head of the household. The main purpose of the Household Questionnaire was to identify women who were eligible for the individual interview and children age 6-59 months who were eligible for anaemia and malaria testing. The Household Questionnaire also collected information on characteristics of the household's dwelling unit, such as the source of water; type of toilet facilities; materials used for the floor, roof, and walls of the house; ownership of various durable goods; and ownership and use of mosquito nets. In addition, the questionnaire was used to record the results of the anaemia and malaria testing as well as the signatures of the interviewer and the respondent who gave consent. Children's temperatures were also recorded.

The Woman's Questionnaire was used to collect information from all women age 15-49. These women were asked questions on the following main topics:
- Background characteristics (such as age, residence, education, media exposure, and literacy)
- Birth history and childhood mortality
- Antenatal care and malaria prevention for most recent birth and pregnancy
- Malaria prevention and treatment
- Knowledge about malaria (symptoms, causes, prevention, and drugs used in treatment)

Data Collection

Data Collection Dates

Start	End	Cycle
2010-10	2010-12	N/A

Data Collection Mode

Face-to-face [f2f]

DATA COLLECTION NOTES

Training of Field Staff
NPC and NMCP recruited and trained 86 people for the main fieldwork. They served as supervisors/editors, interviewers, reserve interviewers, and quality control interviewers. Training of the field staff for the main survey was conducted September 16-30, 2010. The classroom training consisted of instruction regarding interviewing techniques and field procedures, a detailed review of items on the questionnaires, instruction for administering and obtaining parental/guardian consent to test children for anaemia and malaria, and mock interviews between participants in the classroom. There were also field practice interviews with real life individuals from areas outside the 2010 NMIS clusters.

Fifteen laboratory scientists underwent two weeks of training consisting of instruction and practice in collection of blood samples from children age 6-59 months. Additionally, 15 nurses were trained on taking children's temperature and offering and administering treatment to children who tested positive on the RDTs. During this period, 15 team supervisors/editors and 6 quality control interviewers were provided with additional training on field editing, data quality control procedures, and fieldwork coordination.

Fifteen supervisors/editors, 30 interviewers, 5 reserve interviewers, 15 nurses, and 15 laboratory scientists were selected for 15 data collection teams for the 2010 NMIS. Six additional laboratory scientists engaged in the logistics of transferring slides from the field to the central laboratory in Lagos.

Data Collection
Through its experience with field surveys such as NDHS and the Nigerian National Census, NPC has developed a field team structure that maximises data quality. Furthermore, the NMCP has had experience working with nurses and laboratory scientists. The existing data collection team capacity was used in the 2010 NMIS. As mentioned above, 15 data collection teams consisting of field interviewers, nurses, and laboratory scientists were formed to cover the 36 states and FCT. More specifically, each team consisted of one supervisor/editor (team leader), two female interviewers, one nurse/interviewer, one laboratory scientist, and one driver.

Six senior staff members from NPC and NMCP, designated as zonal coordinators, coordinated and supervised fieldwork activities. Roll Back Malaria (RBM) partners also monitored fieldwork. Data collection took place over a three-month period, from October through December 2010. One quality control (QC) interviewer was assigned to each zone. The QC interviewers, however, did not travel with the survey teams. Instead, they trailed the teams to revisit and re-administer the Household and Women's questionnaires during the first two weeks of data collection and for two weeks prior to the end of the field work. The re-interviews were done in approximately 10 percent of all the completed households.

Field supervisors/editors were responsible for the quality of the work carried out by their respective teams. They travelled with their teams, assigned the work to the team members, and edited all questionnaires in the field to ensure they were complete and filled out correctly. Whenever possible, field editors also observed field interviews to ensure that the proper interviewing techniques and testing protocols were followed.

Coordinators and trainers who conducted the main training also monitored the data collection operations in their assigned zones. They were responsible for providing the SIC chairman and the project director with feedback and updates on field team activities. National monitors, comprised of staff of NMCP, RBM partners, and academia also monitored the field work to ensure high standards of data collection.

After the data were entered, zonal coordinators reviewed data frequencies and tables to identify any data inconsistencies and errors. Coordinators periodically travelled to visit their respective field teams to provide feedback and re-training as needed. To ensure a high level of quality and compliance with study protocols, ICF International staff conducted field observation visits. During these visits, ICF International staff handled field operational problems and proposed solutions, providing feedback and encouragement to the interviewers.

Data Collectors

Name	Abbreviation	Affiliation
National Population Commission	NPC	
National Malaria Control Programme	NMCP	

SUPERVISION

There is one supervisor for each of the 15 data collection teams in the field.

Name	Abbreviation	Affiliation

Data Processing

Data Editing

The processing of data for the 2010 NMIS ran concurrently with data collection. Completed questionnaires were retrieved by the zonal coordinators or the trainers and delivered to NPC in standard envelopes, labelled with the sample ID, team number, and state name. The shipment also contained a written summary of any issues detected during the data collection process.

The questionnaire administrators logged the receipt of the questionnaires, acknowledged the specified issues, and acted upon them if required. The data editors performed an initial check on the questionnaires, as well as coding of open-ended questions (with assistance from the data entry operators). The questionnaires were then assigned to the data entry operators. The data entry operators entered the data into the system, with the support of the data editors who handled erroneous or unclear data.

Data entry personnel were recruited from staff experienced in data entry activities from previous studies. The data entry team consisted of a supervisor, a data entry coordinator, and the data entry operators. Supervisors monitored the entire data entry and editing process, controlled the incoming questionnaires, assigned batches of questionnaires to the data entry operators, and managed the work progress. They were available at all times to ensure that proper procedures were followed and to help editors resolve inconsistencies. Data entry coordinators assisted with coordinating and overseeing the data entry process, assigning the work, tracking progress, and ensuring the quality and timeliness of the data entry process. Approximately 15 clerks were recruited and trained as data entry operators to enter all completed questionnaires and to perform the secondary entry for data verification. Two office editors and one secondary editor worked with the data entry operators to review information flagged as 'erroneous' or 'dubious' in the data entry process and to provide follow up and resolution for those anomalies.

Data entry and editing were accomplished using CSPro software. The processing of data was initiated in October 2010 and completed in February 2011.

Data Appraisal

Estimates of Sampling Error

Sampling errors, on the other hand, can be evaluated statistically. The sample of respondents selected in the 2010 NMIS is only one of many samples that could have been selected from the same population, using the same design and expected size. Each of these samples would yield results that differ somewhat from the results of the actual sample selected. Sampling errors are a measure of the variability between all possible samples. Although the degree of variability is not known exactly, it can be estimated from the survey results.

A sampling error is usually measured in terms of the standard error for a particular statistic (mean, percentage, etc.), which is the square root of the variance. The standard error can be used to calculate confidence intervals within which the true value for the population can reasonably be assumed to fall. For example, for any given statistic calculated from a sample survey, the value of that statistic will fall within a range of plus or minus two times the standard error of that statistic in 95 percent of all possible samples of identical size and design.

If the sample of respondents had been selected as a simple random sample, it would have been possible to use straightforward formulas for calculating sampling errors. However, the 2010 NMIS sample is the result of a multi-stage stratified design, and, consequently, it was necessary to use more complex formulae. The computer software used to calculate sampling errors for the 2010 NMIS is the ISSA Sampling Error Module. This module used the Taylor linearisation method of variance estimation for survey estimates that are means or proportions. The Jackknife repeated replication method is used for variance estimation of more complex statistics such as fertility and mortality rates.

In addition to the standard error, ISSA computes the design effect (DEFT) for each estimate, which is defined as the ratio between the standard error using the given sample design and the standard error that would result if a simple random sample had been used. A DEFT value of 1.0 indicates that the sample design is as efficient as a simple random sample, while a value greater than 1.0 indicates the increase in the sampling error due to the use of a more complex and less statistically efficient design. ISSA also computes the relative error and confidence limits for the estimates.

Sampling errors for the 2010 NMIS are calculated for selected variables considered to be of primary interest for the woman's survey. The results are presented in this appendix for the country as a whole, for urban and rural areas, and for each of the 6 zones. For each variable, the type of statistic (mean, proportion, or rate) and the base population are given in Table B.1. Tables B.2 to B.10 present the value of the statistic (R), its standard error (SE), the number of unweighted (N-UNWE) and weighted (NWEIG) cases, the design effect (DEFT), the relative standard error (SE/R), and the 95 percent confidence limits (R2SE), for each variable. The DEFT is considered undefined when the standard error considering simple random sample is zero (when the estimate is close to 0 or 1).

The confidence interval (e.g., as calculated for the proportion of all women 15-49 with secondary education or higher) can be interpreted as follows: the overall proportion from the national sample is 0.405 and its standard error is 0.019. Therefore, to obtain the 95 percent confidence limits, one adds and subtracts twice the standard error to the sample estimate, i.e., 0.405 2 0.019. There is a high probability (95 percent) that the true proportion of women with secondary education or higher for all women aged 15 to 49 is between 0.366 and 0.443

Sampling errors are analysed for the national woman sample and a group of estimated proportions. The relative standard errors (SE/R) for the selected proportions range between almost 2 percent and 10 percent. But in general, the relative standard error for most estimates for the country as a whole is small.

There are differentials in the relative standard error for the estimates of sub-populations. For example, for the variable secondary education or higher for women aged 40-49, the relative standard errors, as a percent of the estimated mean for the whole country, for the urban areas, and for the rural areas are 4.8 percent, 4.6 percent, and 7.0 percent, respectively. For the total sample, the value of the design effect (DEFT), averaged over all selected variables, is 2.9326, which means that due to multi-stage clustering of the sample, the average standard error is increased by a factor of 2.9326 over that in an equivalent simple random sample.

The sampling errors are fully described in Appendix B of " Nigeria Malaria Indicator Survey 2010 - Final Report" pp.73-78.

Other forms of Data Appraisal

A series of data quality tables are available to review the quality of the data and include the following:

- Household age distribution
- Age distribution of eligible and interviewed women

The results of each of these data quality tables are shown in Appendix C of "Nigeria Malaria Indicator Survey 2010 - Final Report" pp.79-80.

Related Materials

Questionnaires

Nigeria 2010 MIS Questionnaire

Title	Nigeria 2010 MIS Questionnaire
Country	Nigeria
Language	English
Filename	NGA_2010_MIS_Questionnaire_EN.pdf

Reports

Nigeria 2010 MIS Final Report

Title	Nigeria 2010 MIS Final Report
Author(s)	National Population Commission, National Malaria Control Programme, Federal Republic of Nigeria, Abuja, Nigeria and MEASURE DHS, ICF International, Calverton, Maryland, USA
Date	2012-01-01
Country	Nigeria
Language	English
Filename	https://www.dhsprogram.com/pubs/pdf/MIS8/MIS8.pdf

Nigeria 2010 MIS Survey Presentations

Title	Nigeria 2010 MIS Survey Presentations
Author(s)	MEASURE DHS
Date	2012-01-01
Country	Nigeria
Language	English
Filename	https://www.dhsprogram.com/pubs/pdf/PPT18/PPT18.zip

Nigeria 2010 MIS Malaria Fact Sheets

Title	Nigeria 2010 MIS Malaria Fact Sheets
Author(s)	MEASURE DHS
Date	2012-01-01
Country	Nigeria
Language	English
Filename	https://www.dhsprogram.com/pubs/pdf/MF6/MF6.pdf

Technical documents

DHS-V Recode Manual

Title	DHS-V Recode Manual
Author(s)	MEASURE DHS

Language	English
Description	The Recode Manual provides the information necessary to understand these datasets. It describes each data file and contains its associated dictionary and documentation. Each data file and its associated dictionary and documentation are distributed in archived ZIP files, for all available formats (hierarchical and flat). ASCII data and System data files are available for CSPro, SAS, SPSS, and STATA. Users are strongly encouraged to download the DHS recode manual for use with all recode files.
Filename	Recode5DHS.pdf

Nigeria 2010 MIS (DHS V) Individual Recode Documentation

Title	Nigeria 2010 MIS (DHS V) Individual Recode Documentation
Country	Nigeria
Language	English
Filename	NGIR61FL.pdf