

# Malaria Behavior Survey

## Analysis Plan

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# Acronym List

ACT	Artemisinin-based combination therapies
ANC	Antenatal care
HMIS	Health management information system
ICT	Information and communications technology
IPTp	Intermittent preventive treatment of malaria in pregnancy
IRB	Institutional review board
IRS	Indoor residual spraying
ITN	Insecticide-treated net
MDA	Mass drug administration
MOH	Ministry of health
NGO	Non-governmental organization
NMCP	National Malaria Control Program
NSP	National Strategic Plan
PMI	U.S. President's Malaria Initiative
RDT	Rapid diagnostic test
SBC	Social and behavior change
SMC	Seasonal malaria chemoprevention
SP	Sulfadoxine pyrimethamine
USG	United States Government
USAID	United States Agency for International Development

# Introduction

To be effective, malaria social and behavior change (SBC) interventions must be theory-informed and based on empirical, formative data on behavioral determinants (1, 2). The Malaria Behavior Survey (MBS) is a population-based, theory-informed survey that aims to: (i) provide a better understanding of the socio-demographic and ideational (psychosocial) characteristics associated with malaria-related behavioral outcomes in a given country, and (ii) determine the appropriate focus of programmatic activities designed to improve malaria-related behavioral outcomes.

Typically, the study adopts a cross-sectional design and uses structured questionnaires to collect relevant information from a random sample of women and men. The survey targets men and women of reproductive age (15-49 years for women and 15-59 years for men) recruited through a multi-stage sampling process. The sampling design involves successive and random selection of clusters, households, and individuals. Included in the data collection tools are ideational questions about knowledge, perceived severity, perceived vulnerability, perceived response efficacy, attitudes, perceived self-efficacy, norms, and social interactions related to key malaria-related behavioral outcomes. Such outcomes include access to and use of insecticide-treated nets (ITNs), acceptance of indoor residual spraying (IRS), uptake of intermittent preventive treatment of malaria in pregnancy (IPTp), appropriate care-seeking behaviors for fever in children under-five years of age, and uptake of seasonal malaria chemoprophylaxis (SMC) (3-6). The data collection tools also include questions on media habits and exposure to SBC interventions with a focus on malaria prevention and treatment.

The data analysis plan for the MBS provides guidance on data management, processing, and reporting to highlight survey results in a manner that will be useful to program managers, implementers, donors, and other stakeholders. It also provides guidance concerning the indicators presented in the survey report, and the level of analysis expected. It is expected that this analysis plan will help to ensure timely synthesis and dissemination of survey results.

In line with the MBS focus on sociodemographic characteristics associated with malaria-related behavioral outcomes, it is recommended to stratify the data by age, sex, education, economic status, urban/rural residence, and region of the country, as applicable. This plan includes the descriptive analyses, construction of indices/scores for relevant variables, generation of key indicators, and recommended cross-tabulations and regression analyses using the MBS data.

## Data Processing

The basic approach of the MBS is to collect data that are comparable across countries using standard model questionnaires. Once data have been collected and entered into an electronic database, data cleaning and editing may

be required to make the data available for analysis in a coherent and consistent form. The first step towards producing the MBS Report tables is to create new variables from the original ones in the data set. New variables are created from existing ones so that the variable names and definitions are, wherever possible, consistent across all surveys without changing the original variables. Also, missing responses are recoded as applicable. In addition, the survey sampling weight and wealth index are created. At this point, a decision will need to be made about what to do with invalid responses, for example, assign them as missing or change them to the median for that variable. It is recommended that the data entry program includes appropriate checks to minimize the occurrence of invalid responses.

## Missing Values

A missing value is defined as a variable that should have a response but does not have a response. There are various ways to deal with missing data depending on the pattern and amount of missing data. Note that responses such as “missing,” “don’t know,” “not applicable” and “blank” codes should be excluded when calculating statistics such as means or medians; otherwise they are treated as real values. The decision can be made to replace these responses with the mean, the median or the mode depending on the circumstance (7). The data entry program should have included appropriate checks to minimize as much as possible the occurrence of invalid responses.

## Response Rates

In order to calculate survey response rates, the data collection procedure should have detailed information on the number of enumerated eligible households/respondents, as well as the numbers approached and enrolled into the study. The survey response rate is the total number of households/respondents enrolled divided by the numbers approached. This value should be included in the MBS report. If the survey response rate is lower than expected, there may be a non-response bias in which there are distinct differences between survey participants and those who did not participate. This information is useful in determining ideal sample size for future similar surveys in the country. More importantly, a lower than expected survey response rate implies that efforts to promote awareness and cooperation of households and respondents should be increased in future community entry process.

Response rates for individual questions can be explored from the frequency distribution of participant responses. The majority of the questions in the MBS include a “don’t know”/“don’t remember” as well as a “refused to answer” option. Thus, a frequency distribution of the response options can help the data managers and other stakeholders compare non-response rates across subgroups and identify if certain types of questions seem to be better received or more sensitive in certain areas or among certain subgroups of respondents.

## Sampling weights

Sampling weights are adjustment factors applied to the data to adjust for differences in probability of selection and interview between cases in a sample. Sampling weight can be calculated from the inverse probabilities of clusters, households and individuals being selected (8). The sampling weight is typically applied to survey data in order to estimate behavioral and ideational outcomes at a population level. The MBS sample is a multi-stage stratified clustered sample, therefore weights are calculated based on the sampling probabilities for each stage and also account for non-response. In addition, the weights should be calculated differently for men and women surveyed based on the differential sampling strategies.

### Women's Survey Weights

Sampling strategy: In the MBS, all women are sampled from all households selected within each cluster. Thus the household and women's individual weights are the same.

For the calculation, the following notations are used:

$P_{1i}$ : first stage's sampling probability of the  $i^{th}$  cluster

$P_{2hi}$ : second-stage's sampling probability of  $h^{th}$  households within the  $i^{th}$  cluster

$c_i$  is the number of clusters selected in each district/region and  $\sum C_i$ , the total number of clusters in the district/region. The probability of selecting the  $i^{th}$  cluster is calculated as follows:

$$P_{1i} = \frac{c_i}{\sum C_i}$$

$h_i$  is the number of households selected in the  $i^{th}$  cluster .

$\Sigma_{hi}$  the total number of households in the  $i^{th}$  cluster according to the sampling frame.

The second stage's selection probability for each household in the cluster is calculated as follows:

$$P_{2hi} = \frac{h_i}{\Sigma_{hi}}$$

The overall selection probability of each household in cluster  $i$  is therefore the product of the selection probabilities:

$$P_{hi} = P_{1i} \times P_{2hi} = \frac{C_i h_i}{\sum c_i \Sigma_{hi}}$$

The sampling weight for each household in cluster  $i$  is the inverse of its selection probability:

$$W_{hi} = 1/P_{hi}$$

As such, the probability of selecting any woman was the same and equal to the probability of selecting the household ( $W_{hi}$ ).

### Men's Survey Weights

Sampling strategy: Only one man was selected in every third household selected within each cluster. Therefore, an adjustment of the sampling weights for men was necessary to account for the individual probability of being selected within the household as well as the probability of the household being selected from the cluster.

For the calculation, the following notations were used:

$P_{1i}$  1<sup>st</sup> stage's sampling probability of the  $i^{th}$  cluster

$P_{2hi(m)}$  2<sup>nd</sup> stage's sampling probability of  $h^{th}$  male survey household within the  $i^{th}$  cluster

$P_{3jhi(m)}$  3<sup>rd</sup> stage's sampling probability of  $j^{th}$  man in the  $h^{th}$  male survey household within the  $i^{th}$  cluster

The total selection probability of men is the product of the selection probability for the household and the individual. Thus, the second stage's selection probability for each household where a man is surveyed in the cluster is calculated as follows:

$$P_{2hi(m)} = \frac{h_{i(m)}}{M_{hi}}$$

where  $h_{i(m)}$  is the number of the households selected for a men's survey (typically a third of all households selected for the women's survey).  $M_{hi}$  remains the total number of households within the cluster.

The third stage's selection probability for the individual man surveyed is calculated as follows:

$$P_{3jhi(m)} = P_{1i} \times P_{2hi(m)} \times \frac{j_i}{\sum j_i}$$

where  $j_i$  is the number of men surveyed in each household and  $j_i=1$  for all households selected (per MBS protocol) while  $\sum j_i$ , the total number of eligible men within the household.

The sampling weight for each man in each cluster is the inverse of its selection probability:

$$W_{jhi(m)} = 1/P_{3jhi(m)}$$

A spreadsheet containing all relevant sampling parameters and selection probabilities will need to be constructed to facilitate the calculation of the sampling weights. Cluster, household and individual sampling weights are obtained from the above calculations. These weights are further normalized at the national level to produce un-weighted cases equal to weighted cases for both households and individuals at national level. The normalized weights are valid for estimation of proportions and means at any aggregation levels.

# Data Analysis

This section presents an overview of the data analysis methods for key indicators generated from the standard MBS. It includes the following sub-sections: study population description, cross-cutting determinants of behavior, ITNs, malaria in pregnancy, case management, IRS, and SMC. In certain instances, there may be country-specific modules outside the scope of the standard MBS questionnaire, which are not included in this analysis plan. In such situations, some of the procedures described below can be adapted. For these instances, in the case where Breakthrough ACTION /CCP (spell out) implemented the particular survey, that team can provide guidance on analysis of country-specific modules not included here.

When carrying out the data analysis procedures described below new variables should be created, and the original variables should remain unedited. Data disaggregation of variables is highly recommended to identify particular subgroups of interest in relation to behavioral antecedents as well as outcomes. It is recommended to stratify the data by age, sex, education, socio-economic status, urban/rural residence, and region of the country, as applicable.

## 1. Study Population Description

### Household Characteristics

Indicator/Information	Question No.	Notes on Calculation
Total number of household members	Household member listing form	This is the sum of people on the household listing form. This will involve extracting the individual household member information from the household data set and reshaping the data to make each case the household member instead of the household.
Average number of sleeping rooms	Household Questionnaire (HH): HH101	Clone the variable and recode <sup>1</sup> missing data or “don’t know” as applicable and examine distribution of non-missing data.
Number of people per sleeping room	HH101, Household member listing form	Divide the number of rooms by the total number of household members
Distance in kilometers to various health facilities	HH105A	Clone the variable and examine distribution of non-missing data. Replace missing data with an applicable value. Recode the data by grouping responses as appropriate.
Time (minutes) to walk to various health facilities	HH105B	
Time (minutes) by car/bus to nearest health facilities	HH105C	
Proportion of households that are near health facilities	HH105A-C	The best measure of access to facility (distance versus time) should be decided in collaboration with NMCP or key stakeholders and should reflect the

<sup>1</sup> In all instances where clone or recode is mentioned, please note that new variables should be created.

Indicator/Information	Question No.	Notes on Calculation
		context of the communities. Conditions for determining nearness to a facility should be discussed and agreed with NMCP or other relevant MOH agencies. For example, households near health facilities can be defined as those located less than 5 kilometers away OR , less than 30 minutes on foot, OR less than 10 minutes by car. The numerator is all households near health facilities and the denominator is all households.
Household wealth quintile	HH102- HH104, HH110-HH116	Clone and recode each question so that the distribution of responses is captured within a smaller number of response categories. Use principal component analysis to assign each household a wealth quintile Please see <a href="#">Steps to constructing the new DHS Wealth Index</a> for more information on wealth indices (9).

## Respondent Characteristics

Indicator/Information	Question No.	Notes on Calculation
Woman/man's age	Woman's Questionnaire (W) 101. Men's Questionnaire (M) 101	Clone variable and examine distribution of data. Replace missing responses with an appropriate value.
Woman/man's highest level of formal education completed	W102-W103, M102-M103	Consider combining categories, as appropriate. Calculate the frequency of each response option.
Woman/man's religion	W104, M104	Calculate the frequency of each response option.
Woman/man's current marital status	W105, M105	Consider combining categories, as appropriate. For example, divorce, separated, widowed. Calculate the frequency of each response option.
Number of live births/parity, among women	W106-W107	Clone variable and recode to 0 if 106 is 2 or if 107 is 00.
Proportion of women with live births in the last two years	W110	Clone variable and recode to 0 if response is 00 or 9. Divide the number of women with live births in the past two years by the total number of women respondents.
Proportion of currently pregnant women	W111	Clone variable and recode to 0 if 111 is 2 or 9. The numerator is currently pregnant women and the denominator is all women respondents
Proportion of respondents who listen to the radio at least once a week.	W1101, M1101	Recode 1,2, and 3 as 1 and other response options as 0. The numerator is all respondents who listen to the radio at least once a week and the denominator is all respondents.

Indicator/Information	Question No.	Notes on Calculation
Proportion of respondents who listen to the radio at various times during the day.	W1102, M1102	Calculate the frequency of each response option. The numerator is all respondents who listen to the radio at specific times (as applicable) and the denominator is all respondents.
Proportion of respondents who watch television at least once a week	W1103, M1103	Clone variable and recode 1,2, and 3 as 1 and other response options as 0. The numerator is all respondents that watch television at least once a week and the denominator is all respondents.
Proportion of respondents who watch television at various times during the day	W1104, M1104	Calculate the frequency of each response option. The numerator is all respondents who watch television at specific times and the denominator is all respondents.
Proportion of respondents with a mobile phone or tablet	W1105, M1105	Clone variable and recode 2 as 0. The numerator is all respondents with a mobile phone or tablet (as applicable) and the denominator is all respondents.
Proportion of respondents with a phone or tablet capable to receive specific media	W1107, M1107	Calculate the proportion that has a phone or tablet capable of receiving each of the stated media. The numerator is all respondents who reported that their phone/tablet is capable of receiving the medium and the denominator is all respondents.

### Individual Exposure to Malaria-related Communication

Indicator/Information	Question No.	Notes on Calculation
Proportion of respondents who recall hearing or seeing any malaria messages within the last six months	W1108, M1108	Calculate the frequency distribution of responses. The numerator is all respondents who recall malaria messages and the denominator is all respondents.
Number of sources to which an individual is exposed to any malaria message	W1109, M1109	For each respondent, create a variable that indicates how many response options were selected.
Specific sources (media channels) of malaria messages	W1109, M1109	Calculate the frequency distribution for each source of malaria messages.
Proportion of respondents who can correctly recall communication campaign messages <sup>2</sup>	W1110, M1110	For each respondent, create a variable that indicates how many response options were selected. The numerator is all respondents who recall campaign messages and the denominator is all respondents.
Proportion of respondents who can complete communication campaign slogan <sup>1</sup>	W1111, M1111	Clone variable and recode 2 and 9 as 0. The numerator is all respondents who correctly complete the slogan and the denominator is all respondents.
Number of sources to which an individual is exposed to a specific slogan <sup>1</sup>	W1112, M1112	For each respondent, create a variable that indicates the number of response options selected.
Proportion of respondents who recognize communication logos/images <sup>1</sup>	W1113, M1113	Clone variable and recode 2, 3, and 4 as 0. The numerator is all respondents who recognize

<sup>2</sup> This indicator is only applicable if there has been a recent communication campaign prior to the survey.

Indicator/Information	Question No.	Notes on Calculation
		communication logos/images and the denominator is all respondents.
Number of sources by which an individual is exposed to logos/pictures <sup>1</sup>	W1114, M1114	For each respondent, create a variable that indicates the number of correct response options selected.

## 2. General Malaria Ideation

Indicator/Information	Question No.	Notes on Calculation
Proportion of respondents who know the main symptom of malaria is fever (knowledge)	W501, M501	Create a variable and code as 1 if respondent selected “fever.” Code as 0 if they did not select this response and irrespective of whatever other symptoms they mentioned. The numerator is all respondents who cite fever as the main symptom of malaria and the denominator is all respondents.
Proportion of respondents who name mosquitoes as the cause of malaria (knowledge)	W502, M502	Create a variable and code as 1 if respondent selected “mosquito bites.” Code as 0 if respondent did not mention this response and irrespective of whatever other causes they mentioned. The numerator is all respondents who cite mosquitoes as the cause of malaria and the denominator is all respondents.
Proportion of respondents who know at least one major proven preventive measure for malaria (knowledge)	W503, M503	Create a variable and code as 1 if respondent selected any of the following: sleeping under a mosquito net, sleeping under an ITN, taking preventive medication, or having their house sprayed. Code as 0 if respondent did not indicate one of these responses. The numerator is all respondents who know at least one of the major proven prevention measures of malaria (as applicable to the context) and the denominator is all respondents.
Proportion of respondents who discussed malaria with a spouse/partner (interpersonal communication)	W505, M505	Clone variable and recode 2 as 0. The numerator is all respondents who discuss malaria with a spouse/partner and the denominator is all respondents.
Proportion of respondents who discussed malaria with a friend/relation during the last six months (interpersonal communication)	W506, M506	Clone variable and recode 2 as 0. The numerator is all respondents who discussed malaria with a friend/ relation and the denominator is all respondents.
Proportion of respondents who perceive they are at risk from malaria (perceived susceptibility)	W507- W510; M507-M510	Clone variables and recode each question so that the response that reflects susceptibility is coded 1, the response that reflects lack of susceptibility is coded -1, and “Don’t Know” is coded 0. Sum the score for the questions to obtain an index for susceptibility. Respondents with an index score greater than 0 are considered to perceive that they are susceptible to malaria. The numerator is all respondents with perceived susceptibility malaria and the denominator is all respondents.

Indicator/Information	Question No.	Notes on Calculation
Proportion of respondents who feel that consequences of malaria are serious (perceived severity)	W511-W514, M511-M514	Clone variables and recode each question so that the response that reflects perceived severity is coded 1, the response that reflects lack of perceived severity is coded -1, and “Don’t Know” is coded 0. Sum the score for the questions to obtain an index for perceived severity. Respondents with an index score greater than 0 are considered to perceive the consequences of malaria as severe. The numerator is all respondents who perceive the severity of malaria and the denominator is all respondents.
Proportion of respondents that have positive perceptions towards community health workers’ general treatment of their patients (perceptions of health workers)	W1001; M1001,	Recode 2 and 9 as 0. The numerator is all respondents with positive perceptions towards community health worker’s treatment of their patients and the denominator is all respondents.
Proportion of respondents that have positive perceptions towards facility-based health workers’ general treatment of their patients (perceptions of health workers)	W1002; M1002,	Recode 2 and 9 as 0. The numerator is all respondents with positive perceptions towards facility-based health worker’s treatment of their patients and the denominator is all respondents.
Proportion of respondents that have favorable gender norms regarding malaria prevention and treatment (gender norms)	W1021-1025 M1021-M1025	Clone variables and recode each question so that the response that reflects favorable gender norms is coded 1, the response that reflects unfavorable gender norms is coded -1, and “Don’t Know” is coded 0. Sum the score for the questions to obtain an index for favorable gender norms. Respondents with an index score greater than 0 are considered to have favorable gender-related attitudes regarding malaria prevention and treatment. The numerator is all respondents with favorable gender norms regarding malaria prevention and treatment and the denominator is all respondents.

### 3. Insecticide-treated nets

#### Net Ideation

Indicator/Information	Question No.	Notes on Calculation
Proportion of respondents who know ITN are a method of malaria prevention (knowledge)	W503, M503	Clone variable recode as 1 if respondent selected sleeping under an ITN. Code as 0 if respondent did not indicate sleeping under an ITN. The numerator is all respondents who know ITN are a method of preventing malaria and the denominator is all respondents.

Indicator/Information	Question No.	Notes on Calculation
Proportion of respondents with a favorable attitude towards sleeping under a bed net (attitudes)	W602-W612, M602- M612	Clone variables and recode each question so that the response that reflects positive attitude is coded 1, the response that reflects lack of positive attitude is coded -1, and “Don’t Know” is coded 0. Sum the score for the questions to obtain an index for positive attitudes. Respondents with an index score greater than 0 are considered to have a favorable attitude toward sleeping under a bed net. The numerator is all respondents with favorable attitudes towards sleeping under a bed net and the denominator is all respondents.
Proportion of respondents with a favorable attitude towards ITN care	TBD	Clone variables and recode each question so that the response that reflects positive attitude is coded 1, the response that reflects lack of positive attitude is coded -1, and “Don’t Know” is coded 0. Sum the score for the questions to obtain an index for positive attitudes. Respondents with an index score greater than 0 are considered to have a favorable attitude toward ITN care. The numerator is all respondents with favorable attitudes towards ITN care and the denominator is all respondents.
Proportion of respondents who believe that sleeping under a bed net will reduce their risk of malaria (perceived response-efficacy)	W613-W615, M613-M615	Clone variables and recode each question so that the response that reflects perceived response-efficacy is coded 1, the response that reflects lack of perceived response-efficacy is coded -1, and “Don’t Know” is coded 0. Sum the score for the questions to obtain an index for response-efficacy. Respondents with an index score greater than 0 are considered to perceive bed nets as an effective method of reducing their risk of malaria. The numerator is all respondents with perceived response-efficacy of ITN and the denominator is all respondents.
Proportion of respondents who are confident in their ability to sleep under nets (perceived self-efficacy)	W616-W619, M616-M619	Clone variables and recode each question so that the response that reflects perceived self-efficacy is coded 1, the response that reflects lack of perceived self-efficacy is coded -1, and “Don’t Know” is coded 0. Sum the score for the questions to obtain an index for self-efficacy. Respondents with a score greater than 0 are considered to be confident that they can sleep under a net. The numerator is all respondents with perceived self-efficacy of ITN and the denominator is all respondents.
Proportion of respondents who perceive that ITN use is the norm in their community (descriptive norm)	W620, M620	Clone variable and recode 1, 2, and 3 as 1 and other response options as 0. The numerator is all respondents who perceive ITN use as the norm in their community and the denominator is all respondents.

Indicator/Information	Question No.	Notes on Calculation
Proportion of respondents who perceive that community members approve the use of ITN (injunctive norm)	W621, M621	Clone variable and recode 4 as 1 and other response options as 0. The numerator is all respondents who perceive community members approve the use of ITN and the denominator is all respondents.

### Net Ownership, Sources and Characteristics

Indicator/Information	Question No.	Notes on Calculation
Proportion of nets that are insecticide treated nets (ITN)	HH126C, HH126F	Create variables and code ITN brands as listed in HH126F as 1 and others as 0. As applicable, also recode as 1, if HH126F is 1, 2 or 3 (public sector nets) depending on the distribution strategy. The numerator is all nets that are ITN and the denominator is all nets surveyed in the net roster.
Number of ITNs in the household	HH126C, HH126F	Create ITN variable based on above and collapse dataset to the household level and then merge with the household dataset. Then calculate the mean number of ITNs per household
Proportion of ITNs from various sources	HH126F, HH126G	In the net roster, clone the variable HH126F and replace with 126G, for those who answered No in 126F among ITNs only. The numerator is all ITN from the specific source (as applicable) and the denominator is all ITNs surveyed.
Proportion of ITNs of various colors	HH126Q	In the net roster, clone the variable HH126Q and The numerator is all ITN with the specific color and the denominator is all ITNs surveyed.
Proportion of ITNs that are three or more years old	HH126B, HH126C, HH126F	In the net roster, clone variables and create an ITN variable. Recode as 1 if HH126B is 95, recode 98 and nets 35 months or younger as 0. The numerator is all ITNs that are at least 3 years old and the denominator is all ITNs surveyed in the net roster.
Proportion of ITNs that were obtained free of charge	HH126C, HH126F, HH126H	In the net roster, clone variables and code as 1 if ITN and the response to HH126H is No and all other responses as zero. The numerator is all nets that were obtained for free and the denominator is all nets surveyed in the net roster.
Average cost of mosquito nets	HH126H, HH126I	In the net roster, clone variables and calculate the mean net cost across nets that were purchased.
Reasons why nets were not hung for sleeping	HH126O	For each response option, create a variable that equals one if that option is selected.
Proportion of households that have sufficient ITNs (at least 1 net for every 2 people)	HH126C, HH126F, Number of household members derived	Merge net roster with ITN variable and household dataset as above. For each household, divide the number of ITNs by the number of people in household. Create a variable and code each

Indicator/Information	Question No.	Notes on Calculation
	from HH member listing	household with at least 0.5 net per person as 1. Recode all other households as 0. The numerator is all households with at least 0.5 net per person and the denominator is all households.
Proportion of pregnant women who received a mosquito net during ANC	W309	In the net roster, clone variable and recode 2 and 9 as 0. The numerator is all pregnant women who received a mosquito net during ANC and the denominator is all women who gave birth in the last 2 years.

### Behavioral Outcomes Related to Insecticide-Treated Nets

Indicator/Information	Question No.	Notes on Calculation
Proportion of insecticide-treated nets (ITNs) that were used the previous night	Household member listing and net roster: HH126C, HH126J	First, create a variable if a net is an ITN based on the brands in HH126C. Then, create a variable if the net was used the previous night based on HH126J. The numerator is all ITNs used the previous night and the denominator is all ITNs. The ITN variable will be used in the creation of all ITN indicators.
Population ITN access	Household schedule and net roster HH126C	First, an intermediate variable of “potential ITN users” is created in the household dataset by multiplying the number of ITN in each household by a factor of 2.0. In order to adjust for households with more than one net for every two people, the potential ITN users is set equal to the de-facto population in that household if the potential users exceeded the number of people in the household. Next, this variable is then merged with the household listing dataset. Third, the population access indicator is calculated by dividing the potential ITN users by the number of de-facto members for each household and determining the overall sample mean of that fraction (10, 11).
The proportion of the population using ITNs the previous night	Household schedule and net roster HH126C, HH126J, HH126L	Create a variable from household members listing data set that lists all members who stayed in the household the previous night. From HH126C, identify which nets are ITNs and from HH126J (if equals 1) and HH126L (if household member name listed), identify which nets were used the previous night and which household member used them. Merge the net roster with the household member listing to identify nets used the previous night by a household member (10, 11). The numerator is the household members who slept under a net the previous night and the denominator is the number of household members who stayed in the household the previous night.

Indicator/Information	Question No.	Notes on Calculation
Population level ITN use to access ratio	Household member listing and net roster HH126C, HH126J, HH126L	This indicator is derived from the two indicators above: i) Population ITN access and ii) The proportion of the population using ITNs the previous night. Divide the proportion of the population using ITNs the previous night by the proportion of population with access to an ITN (10, 11).
Proportion of respondents who sleep under a mosquito net every night	W201, M201	Clone variable and recode every night as 1, and all other options as 0. The numerator is all respondents who sleep under a mosquito nets every night and the denominator is all respondents.
Reasons for which a net was not used	HH126M	For each response option, create a variable that equals one if that option is selected and 0 if not.
Proportion of respondents who slept only or partly outdoors <sup>3</sup>	W204; M204	Clone variable and recode 2 or 3 as 1. The numerator is the number of respondents who slept only on partly outdoors the previous night while the denominator is all respondents.
Mean sleep time and wake time <sup>3</sup>	W202, W203; M202, M203	Clone variables and calculate the mean sleep time and wake time.
Proportion of respondents by sleeping location and time <sup>3</sup>	W202-W206 M202-M206	Clone variables. For each hour of the day, generate a variable that equals 1 if the respondent is asleep. Also for each hour of the day, generate a variable that equals 1 if the respondent is indoors. Use these two groups of variables to create a 24-hour spectrum and calculate the proportion of respondents in the following categories: outdoors and asleep, indoors and asleep, outdoors and awake, indoors and awake. This indicator categorizes respondents based on their potential exposure and when they could potentially be protected by an ITN. (12, 13)
Proportion of respondents who repurpose nets once they are no longer useful for sleeping under	W215, M215	Create a variable that equals 1 if “reused for other purpose” is selected. The numerator is all respondents who repurposed nets once they were no longer useful for sleeping under and the denominator is all respondents who had a net that was no longer useful for sleeping under.
Proportion of respondents who repurpose nets for various uses once they are no longer useful for sleeping under	W216, M216	For each response option, create a variable that equals one if that option is selected. The numerator is all respondents who repurposed nets for specific uses and the denominator is all respondents who repurposed nets once they were no longer useful for sleeping under.

<sup>3</sup> The rationale for these indicators is to be able to categorize respondents based on their potential exposure and when they could potentially be protected by an ITN. This can subsequently be overlaid with ITN use. These questions are also designed to capture the time people went inside to sleep at night and/or came outside for the day in the morning. This allows for estimates of hours during which they may be exposed to vectors. If entomological data from the study location on mosquito biting rates and times is available, this data may be triangulated to assess risk of vector exposure.

Indicator/Information	Question No.	Notes on Calculation
Reasons for which respondents repurposed nets	W217, M217	For each response option, create a variable that equals one if that option is selected.
NET CARE		
Proportion of nets found in various locations of the household	HH126N	In the net roster, clone HH126N and tabulate. The numerator is the number of nets found in different locations and the denominator is all nets surveyed in the net roster.
Proportion of nets that have been washed in the last six months	HH126R, HH126S	For each response option, create a variable that equals one if the number of times washed is greater than zero. The numerator is the number of nets washed at least once in the last six months and the denominator is all ITNs surveyed.
Proportion of nets that have been washed with various products	HH126S, HH126T	For each response option, create a variable that equals one if that option is selected and tabulate. The numerator is the number of ITNs washed with each product and the denominator is all washed ITNs surveyed.
Proportion of washed nets dried in different locations	HH126U	Clone variable and tabulate. The numerator is the number of washed ITNs dried in different locations and the denominator is all washed ITNs surveyed.
Proportion of respondents who report having practiced other net care behavior among those with nets in household	W218, M218	For each response option, create a variable that equals one if that option is selected. The numerator is all respondents who practiced specific behavior and the denominator is all respondents.

## 4. Malaria Case Management

### Care-seeking and treatment ideation

Indicator/Information	Question No.	Notes on Calculation
Proportion of respondents who mentioned ACT as an effective treatment for malaria. (knowledge)	W504; M504	Clone variable and recode as 1 if respondent selected "ACT." Code all other responses as 0 (if they did not mention ACTs). The numerator is the number of respondents who mention ACT as an effective treatment for malaria and the denominator is all respondents.
Proportion of respondents who know that care seeking for children with fever should begin the same day or next day. (knowledge)	W801; M801	Clone variable as recode as 1 if respondent selected options 1 or 2. The numerator is the number of respondents who know that care seeking for children with fever should begin the same day or next day and the denominator is all respondents.
Proportion of respondents who mention blood test as the best way to know if someone has malaria. (knowledge)	W802; M802	Clone variable as recode as 1 if respondent selected option 1. The numerator is the number of respondents who know mention blood test as the best way to know if someone has malaria best way

Indicator/Information	Question No.	Notes on Calculation
		to know if someone has malaria and the denominator is all respondents.
Proportion of respondents who know that the best source to get treatment for malaria is a health facility- depending on country context. (knowledge)	W803; M803	Clone variable as recode as 1 if respondent selected options that correspond to health facilities and potentially community health worker per the country context and guidelines regarding malaria testing and treatment. The numerator is the number of respondents who know that the best place to get treatment for malaria is a health facility and the denominator is all respondents.
Proportion of respondents who have comprehensive knowledge of malaria care-seeking and treatment (knowledge)	W504, W801- W803; M504, M801- M803	Create a variable for each of the knowledge items by coding as 1 if all the following responses are selected: “D” response option in W504; response options “1” or “2” in 801; “1” response option in 802 and response options corresponding to health facilities in 803. The numerator is the number of respondents with comprehensive knowledge of malaria care-seeking and the denominator is all respondents.
Proportion of respondents with a favorable attitude toward care-seeking for children for fever and treatment of malaria (attitudes)	W804-W812; M804-M812	Recode each question so that the response that reflects positive attitude is coded 1, the response that reflects lack of positive attitude is coded -1, and “Don’t Know” is coded 0. Sum the score for the questions to obtain an index for positive attitudes. Respondents with an index score greater than 0 are considered to have a favorable attitude toward care-seeking and treatment of malaria. The numerator is the number of respondents with favorable attitudes towards care seeking and treatment for malaria and the denominator is all respondents.
Proportion of respondents with perceived response-efficacy of malaria testing.( perceived response-efficacy)	W813, W815-W816 M813, M815-M816	Recode each question so that the response that reflects perceived response-efficacy is coded 1, the response that reflects lack of response-efficacy is coded -1, and “Don’t Know” is coded 0. Sum the scores for the questions to obtain an index for response-efficacy. Respondents with a score greater than 0 are considered as perceiving the response-efficacy for malaria testing. The numerator is the number of respondents with perceived response-efficacy regarding malaria testing and the denominator is all respondents.
Proportion of respondents with perceived response-efficacy of malaria treatment. (perceived response-efficacy)	W814, W817- W818; M814, M817-M818	Recode each question so that the response that reflects perceived response-efficacy is coded 1, the response that reflects lack of perceived response-efficacy is coded -1, and “Don’t Know” is coded 0. Sum the scores for the questions to obtain an index for response-efficacy. Respondents with a score greater than 0 are considered as perceiving the response-efficacy for malaria treatment. The

Indicator/Information	Question No.	Notes on Calculation
		numerator is the number of respondents with perceived response-efficacy regarding malaria treatment and the denominator is all respondents.
Proportion of women with perceived self-efficacy to seek care and treatment for their child with fever/malaria at a health facility. (perceived self-efficacy)	W819-W824	Recode each question so that the response that reflects perceived self-efficacy is coded 1, the response that reflects lack of self-efficacy is coded -1, and "Don't Know" is coded 0. Sum the score for the questions to obtain an index for self-efficacy. Respondents with a score greater than 0 are considered to have perceived self-efficacy regarding malaria care-seeking and treatment. The numerator is the number of women respondents with perceived self-efficacy to seek care and treatment for malaria and the denominator is all women respondents.
Proportion of respondents who believe the majority of caregivers in their community take their children to a health provider on the same day or day after they develop a fever (descriptive norm)	W825; M825	Recode 1, 2, and 3 as 1 and other response options as 0. The numerator is the number of respondents who believe at least half of all care givers in their community take their children to a health provider on the same day or the day after they develop a fever and the denominator is all respondents.
Proportion of respondents who believe the majority of children with fever in their community are taken to a health facility to get tested for malaria (descriptive norm)	W826; M826	Recode 1, 2, and 3 as 1 and other response options as 0. The numerator is the number of respondents who believe at least half of all care givers in their community take their children to get tested at a health facility after they develop a fever and the denominator is all respondents.
Proportion of respondents who perceive that community members approve of prompt care seeking for malaria in children (injunctive norm)	W827, M827	Clone variable and recode 4 as 1 and other response options as 0. The numerator is all respondents who perceive community members approve of prompt care seeking and the denominator is all respondents.
Proportion of married or cohabiting respondents who are involved in making decisions about going to the health facility when their child has a fever (decision-making)	W105, W828; M105, M828	Clone 828 and recode 1 and 3 as 1, and all other options as 0 among married and cohabiting respondents (105=1 or 2). The numerator is the number of married or cohabiting respondents involved in making decisions about going to the health facility when their child has a fever and the denominator is all married or cohabiting respondents.
Proportion of married or cohabiting respondents who are involved in making decisions about purchasing medicine when their child has a fever (decision-making)	W105, W829; M105, M829	Clone 829 and recode 1 and 3 as 1, and all other options as 0 among married and cohabiting respondents (105=1 or 2). The numerator is the number of married or cohabiting respondents involved in making decisions about purchasing medicine when their child has a fever and the denominator is all married or cohabiting respondents.

Indicator/Information	Question No.	Notes on Calculation
Proportion of married or cohabiting respondents who are involved in the decision about what to do when they themselves are sick (decision-making)	W105, W830; M105, M830	Clone 830 and recode 1 and 3 as 1, and all other options as 0 among married and cohabiting respondents (105=1 or 2). The numerator is the number of married or cohabiting respondents involved in making decisions when they are sick, and the denominator is all married or cohabiting respondents.
Proportion of respondents that have positive perceptions towards health facilities in relation to malaria case management (perceptions of health-facility workers)	W1004, W1006; M1004, M1006,	Clone variables and recode each question so that the response that reflects positive perceptions is coded 1, the response that reflects lack of positive perceptions is coded -1, and "Don't Know" is coded 0. Sum the score for the questions to obtain an index for positive perceptions. Respondents with an index score greater than 0 are considered to have positive perceptions towards health facilities. The numerator is all respondents with positive perceptions towards malaria case management services in health facilities and the denominator is all respondents.
Proportion of respondents that have positive perceptions towards community-based health workers' provision of malaria case management (perceptions of community-based health workers)	W1003, W1005, W1007, W1009, W1011; M1003, M1005, M1007, M1009, M1011	Clone variables and recode each question so that the response that reflects positive perceptions is coded 1, the response that reflects lack of positive perceptions is coded -1, and "Don't Know" is coded 0. Sum the score for the questions to obtain an index for positive perceptions. Respondents with an index score greater than 0 are considered to have positive perceptions towards community-based health workers that provide care for children with malaria. The numerator is all respondents with positive perceptions towards the malaria case management services of community-based health workers and the denominator is all respondents.
Proportion of respondents that have positive perceptions towards facility-based health workers' provision of malaria case management (perceptions of health facility workers)	W1008, W1010, W1012; M1010, M1008, M1012	Clone variables and recode each question so that the response that reflects positive perceptions is coded 1, the response that reflects lack of positive perceptions is coded -1, and "Don't Know" is coded 0. Sum the score for the questions to obtain an index for positive perceptions. Respondents with an index score greater than 0 are considered to have positive perceptions towards facility-based health workers that provide care for children with malaria. The numerator is all respondents with positive perceptions towards the malaria case management services of facility-based health workers and the denominator is all respondents.

## Behavioral Outcomes Related to Malaria Case Management

Indicator/Information	Question No.	Notes on Calculation
Number of children under five years old with fever in the past two weeks with malaria case management information	W322	Clone variable and recode as 1 if not missing. This variable is to be used as a denominator for other indicators
Proportion of children under five years old with fever in the past two weeks for whom treatment was sought the same or next day following the onset of fever	W325, W322	Clone all variables and create a new variable among children less than five with a fever in the past two weeks (W322=not missing). Recode as 1 if W325=1 or 2. Otherwise recode as 0 if W325>2 or missing. The numerator is the number of children under five years old with fever in the past two weeks for whom treatment was sought the same or next day following the onset of fever and the denominator is the number of children under five years old with fever in the past two weeks.
Proportion of children under five years old with fever in the past two weeks who were taken to a health facility or community health worker <u>first</u>	W327, W322	Clone all variables and create a new variable among children less than five with a fever in the past two weeks (W322=not missing). Recode W327 as 1 if health facility (W327=11-13, 21-23 or 31-33) or community health worker (31). otherwise recode as zero for other W327 options. The numerator is the number of children under five years old with a fever in the past two weeks who were taken to a health facility or community health worker (as applicable) and the denominator is the number of children under five years old with a fever in the past two weeks.
Proportion of children under five years old with fever in the last two weeks who had a malaria blood test	W329, W322	Clone all variables and create a new variable among children less than five with a fever in the past two weeks (W322=not missing). Recode W329 as 2 and 9 as 0. The numerator is the number of children under five years old with a fever in the past two with a malaria blood test and the denominator is the number of children under five years old with a fever in the past two weeks.
Proportion of children under five years with fever tested that have a positive malaria blood test result	W330, W322	Clone all variables and create a new variable among children less than five with a fever in the past two weeks (W322=1) and a blood test done (W329=1). Recode W330 as 2 and 9 as 0. The numerator is the number of children under five years old with a fever in the past two weeks that have a positive malaria blood test result and the denominator is the number of children under five years old with a fever in the past two weeks who had a malaria blood test.
Proportion of children under five years old with confirmed malaria receiving an ACT	W322, W330, W331, W333,	Clone all variables and create a new variable among children less than five with a fever in the past two weeks (W322=1) that have confirmed malaria (W330=1). Recode as 1 if 331 indicates that the child took any medicine and 333 indicates they took an

Indicator/Information	Question No.	Notes on Calculation
		ACT (D). The numerator is the number of children under five years old with a fever in the past two weeks who received any antimalarial drugs and the denominator for this indicator is children under five with confirmed malaria.
Proportion of children under five with fever with confirmed malaria in the last two weeks received an ACT promptly	W322, W330, W331, W333, W337	Clone all variables and create a new variable among children less than five with a fever in the past two weeks (W322=1) that have confirmed malaria (W330=1). Recode as 1 if 337=1 or 2 and 333 indicates they took an ACT (D). The numerator is the number of children under five years old with a fever in the past two weeks who received ACT promptly and the denominator is all children under five with confirmed malaria.

## 5. Malaria in Pregnancy

### Antenatal Care and Intermittent Presumptive Treatment in Pregnancy (ANC/IPTp) Ideation

Indicator/Information	Question No.	Notes on Calculation
Proportion of respondents who have comprehensive ANC/IPTp knowledge (knowledge)	W701-W703; M701-M703	Create an indicator for each of the knowledge items by coding as 1 each of the following: (1) response 3 in 701; (2) responding that the number of ANC visits is 4 or higher in 702 <sup>4</sup> ; and (3) responding three or more times in 703. Combine the three indicators to derive an index. Respondents with an index score greater than 1 are considered to have basic ANC/IPTp knowledge. The numerator is all respondents with basic ANC/IPTp knowledge, and the denominator is all respondents.
Proportion of respondents with favorable attitudes towards ANC and IPTp (attitudes)	W706-W710; M706-M710	Recode each question so that the response that reflects positive attitude is coded 1, the response that reflects lack of positive attitude is coded -1, and “Don’t Know” is coded 0. Sum the score for the questions to obtain an index for positive attitudes. Respondents with an index score greater than 0 are considered to have a favorable attitude toward ANC and IPTp. The numerator is all respondents with favorable attitudes towards ANC/IPTp and the denominator is all respondents.
Proportion of respondents that believe malaria in pregnancy has severe consequences (perceived severity)	W704-W705; M704-M705	Recode each question so that the response that reflects perceived severity is coded 1, the response that reflects lack of perceived severity is coded -1, and “Don’t Know” is coded 0. Sum the score for the

<sup>4</sup> Number of ANC visits should reflect the country policy

Indicator/Information	Question No.	Notes on Calculation
		questions to obtain an index for severity. Respondents with an index score greater than 0 are considered to perceive malaria as serious condition in pregnancy. The numerator is all respondents who perceive the severity of malaria in pregnancy and the denominator is all respondents.
Proportion of respondents who believe that the medicine given to pregnant women to prevent malaria is effective (perceived response-efficacy)	W711- W713; M711-M713	Recode each question so that the response that reflects perceived response-efficacy is coded 1, the response that reflects lack of response-efficacy is coded -1, and “Don’t Know” is coded 0. Sum the score for the questions to obtain an index for response-efficacy. Respondents with an index score greater than 0 are considered to perceive IPTp as effective for reducing a pregnant woman's risk of malaria. The numerator is all respondents perceived response-efficacy regarding IPTp and the denominator is all respondents.
Proportion of women who are confident in their ability to go to ANC and take medicine to prevent malaria during pregnancy (perceived self-efficacy)	W714-719;	Recode each question so that the response that reflects perceived self-efficacy is coded 1, the response that reflects lack of perceived self-efficacy is coded -1, and “Don’t Know” is coded 0. Sum the score for the questions to obtain an index for self-efficacy. Respondents with a score greater than 0 are considered to be confident that they can go to ANC and take the medicine provided to prevent malaria. The numerator is all women with perceived self-efficacy regarding ANC/IPTp and the denominator is all women respondents.
Proportion of men who are confident in their ability to support their wife/partner to go to ANC and take medicine to prevent malaria during pregnancy (perceived self-efficacy)	M714-M719	Recode each question so that the response that reflects self-efficacy is coded 1, the response that reflects lack of self-efficacy is coded -1, and “Don’t Know” is coded 0. Sum the score for the questions to obtain an index for self-efficacy. Respondents with a score greater than 0 are considered to be confident that they can support their wife/partner to go to ANC and take the medicine provided to prevent malaria. The numerator is all men with perceived self-efficacy to support their wife/partner regarding ANC and IPTp and the denominator is all men respondents.
Proportion of respondents who believe the majority of women in their community go to ANC at least four/eight times when they are pregnant <sup>5</sup> (descriptive norm)	W720, M720	Recode 1, 2, and 3 as 1 and other response options as 0. The numerator is all respondents who believe majority of the pregnant women in their community attend ANC four/eight times (as applicable) and the denominator is all respondents.
Proportion of respondents who believe the majority of women in their	W721, M721	Recode 1, 2, and 3 as 1 and other response options as 0. The numerator is all respondents who believe

<sup>5</sup> Number of ANC visits used in this indicator should reflect the country policy

Indicator/Information	Question No.	Notes on Calculation
community take IPTp when pregnant (descriptive norm)		majority of the pregnant women in their community take IPTp and the denominator is all respondents.
<b>Proportion of respondents who perceive that community members approve of IPTp (injunctive norm)</b>	W721b, M721b	Clone variable and recode 4 as 1 and other response options as 0. The numerator is all respondents who perceive community members approve of IPTp and the denominator is all respondents.
Proportion of currently married or cohabiting respondents who are usually involved in making decisions regarding ANC attendance (decision-making)	W105, W722; M105, M722	Among all married or cohabiting respondents (Q105=1 or 2), clone 722 and recode 1 and 3 as 1, 7 as missing, and all other options as 0. The numerator is all currently married or cohabiting respondents usually involved in decision making regarding ANC and the denominator is all currently married or cohabiting respondents.
Proportion of currently married or cohabiting respondents who discussed ANC attendance with their spouse/partner in the last six months (decision-making)	W105, W723, W724; M105, M723, M724	Clone variables and among all married or cohabiting respondents (Q105=1 or 2), create a new variable as 1 if 724 is 1 but zero if 723 is 2 or 9 or 724 is >1. The numerator is all currently married or cohabiting respondents who discussed ANC attendance with their spouse/partner in the last six months and the denominator is all currently married or cohabiting respondents.
Proportion of women with a positive perception towards community-based health workers provision of care related to malaria in pregnancy (perceptions of health workers)	W1016; M1016	Clone variable and recode 2 and 9 as 0. The numerator is all respondents who positive perceptions towards community health workers that provide malaria care in pregnancy and the denominator is all women respondents.
Proportion of women with positive perceptions towards facility-based health workers provision of care related to malaria in pregnancy (perceptions of health workers)	W1015, W1017 to W1020; M1015, M1017 to M1020	Clone variables and recode each question so that the response that reflects positive perceptions is coded 1, the response that reflects lack of positive perceptions is coded -1, and "Don't Know" is coded 0. Sum the score for the questions to obtain an index for positive perceptions. Respondents with an index score greater than 0 are considered to have positive perceptions towards facility-based health workers that provide malaria care in pregnancy. The numerator is all respondents who positive perceptions towards health workers that provide malaria care in pregnancy and the denominator is all women respondents.
Proportion of women who intend to take IPTp in their next pregnancy	W317-318	Clone variables and create a variable among women who responded yes to W317, recode as 1 if W318 is yes and 0 if otherwise. The numerator is all women respondents who intend to have more children and will take IPTP and the denominator is all women respondents who intend to have more children.

## Behavioral Outcomes Related to Malaria in Pregnancy

Indicator/Information	Question No.	Notes on Calculation
Number of women with at least one child in the last two years.	W110	Create a variable that equals 1 if 110 equals 1 and 0 otherwise. This variable is used in calculating the denominator for most of the other outcomes in this section
Proportion of women with at least one child in the last 2 years who attended at least four/eight <sup>6</sup> ANC visits during last pregnancy	W110, W305	Among women with a live birth in the last two years (W110=1), clone and recode W305 as 1 if they attended four (eight) or more ANC visits during last pregnancy. Code other women with live birth but fewer than four (eight) visits as 0. The numerator is all women with at least one child in the last 2 years who attended at least four/eight ANC visits (as applicable) during their last pregnancy and the denominator is all women with at least one child in the last 2 years.
Proportion of pregnant women with at least one child in the last 2 years who obtained antenatal care from a health facility	W110, W304	Among women with at least one child in the last 2 years (W110=1), clone W304 and recode as 1 if the response to 304 is health facility (W304=11-13, 21-23 or 32-33), otherwise recode as zero. The numerator is the number of women with at least one child in the last 2 years who obtained prenatal care from a health facility during their last pregnancy and the denominator is all women with at least one child in the last 2 years
Proportion of pregnant women with at least one child in the last 2 years whose husband/partner accompanied them to an ANC visit	W302, W308	Among women with at least one child in the last 2 years (W110=1) and at least one ANC visit (302=1), clone W308 and recode 2 as 0. The numerator is the number of women with at least one child in the last 2 years who attended at least one ANC visit and had their husband/partner accompany them and the denominator is the number of women with at least one child in the last 2 years who attended at least one ANC visit
Proportion of male caregivers who accompanied wife/partner to ANC visit the last time she was pregnant	M108	Clone variable and recode 2 as 0 and 3 or 8 as missing if 3 is selected. The numerator is the number of men who accompanied their wife/partner to an ANC visit during the last pregnancy and the denominator is the number of male respondents whose wife/partner attended antenatal care.
Proportion of women with at least one child in the last 2 years who received three or more doses of IPTp during the last pregnancy	W313	Among women with at least one child in the last 2 years (W110=1), clone W313 and recode as 1 if W313 equals three or more. Recode as 0 if 2 or less. The numerator is the number of women who received at least 3 doses of IPTp, and the

<sup>6</sup> Number of ANC visits used in this indicator should reflect the country policy

Indicator/Information	Question No.	Notes on Calculation
		denominator is the number of women with at least one child in the last 2 years.
Proportion of women who do not take IPTp for various reasons	W311, W312	Among women who did not take IPTp (W311=0 or 9), clone W312 and create a variable that equals one if that option is selected. The numerator is the number of women who did not take IPTp for specific reasons (as applicable) and the denominator is the number of women with at least one child in the last 2 years who did not take IPTp in their last pregnancy.
Average cost women paid for SP at the health facility, among those who paid	W315, W316	If woman paid for SP at a health facility (W315=1), calculate the mean of all non-missing prices values of W316.
Proportion of pregnant women with at least one child in the last 2 years who obtain SP from various sources	W313, W314	Among women with at least one child in the last 2 years (W110=1) who received SP (W313=1 or more), clone W314 and create a variable that equals one if that option is selected. The numerator is the number of women who took SP from specific sources (as applicable) and the denominator is the number of women with at least one child in the last 2 years who did take SP in their last pregnancy.

## 6. Indoor Residual Spraying (IRS)

### IRS ideation

Indicator/Information	Question No.	Notes on Calculation
Proportion of respondents who are aware of IRS (knowledge)	W1201; M1201	Clone variable and recode 2 as 0. The numerator is the number of respondents aware of IRS and the denominator is all respondents.
Proportion of respondents with favorable attitudes towards IRS (attitudes)	W1201, W1204-W1210; M1201, M1204-M1210	This indicator is only relevant for those who are aware of IRS, that is, who responded yes (1) to question 1201. Clone and recode each of questions 1204 to 1210 so that the response that reflects a positive attitude is coded 1, the response that reflects a lack of positive attitude is coded -1, and "Don't Know" is coded 0. Sum the score for the questions to obtain an index for positive attitudes. Respondents with a score greater than 0 are considered to have favorable attitudes toward IRS. The numerator is the number of respondents with favorable attitudes towards IRS and the denominator is all respondents aware of IRS.
Proportion of respondents who believe that IRS is an effective way to prevent malaria (perceived response-efficacy)	W1201, W1211-W1212; M1201, M1211-M1212	This indicator is only relevant for those who are aware of IRS, that is, who responded yes (1) to question 1201. Clone variables and recode each

Indicator/Information	Question No.	Notes on Calculation
		question so that the response that reflects response-efficacy is coded 1, the response that reflects lack of response-efficacy is coded -1, and “Don’t Know” is coded 0. Sum the scores for the questions to obtain an index for response-efficacy. Respondents with a score greater than 0 are considered to perceive IRS as effective for preventing malaria. The numerator is the number of respondents with perceived response-efficacy regarding IRS and the denominator is all respondents who are aware of IRS.
Proportion of respondents that believe they could take actions for their house to be sprayed (perceived self-efficacy)	W1201, W1213-1214; M1201, M1213-1214	This indicator is only relevant for those who are aware of IRS, that is, who responded yes (1) to question 1201. Clone variables and recode 2 and 9 as 0. The numerator is the number of respondents with perceived self-efficacy regarding IRS and the denominator is all respondents who are aware of IRS.
Proportion of respondents who are willing to accept IRS (intention)	W1202/W1203; M1202/M1203	Clone variables and recode 2 or 9 as 0 for 1202 or 1203 as applicable. The numerator is the number of respondents willing to accept IRS and the denominator is all respondents. Note that both questions are needed to calculate this indicator as Q1202 is for people who have already heard of IRS while Q1203 is prompted and for those who responded that they never heard of IRS in Q1201.

### Behavioral Outcomes Related to IRS

Indicator/Information	Question No.	Notes on Calculation
Proportion of households that have received IRS	HH119	Clone variable and recode 2 and 8 as 0. The numerator is the number of households that received IRS and the denominator is all households.
Proportion of households that were sprayed by various actors	HH119, HH120	Among households who received IRS (HH119=1) only. For each response option in HH120, create a variable that equals one if that option is selected. The numerator is the number of households that received IRS from specific actors (as applicable) and the denominator is all households that received IRS.
Proportion of households that have repainted, re-plastered or washed walls since their household was sprayed	HH119, HH121	Among households who received IRS (HH119=1) only. Clone and recode HH121 2 and 8 as 0. The numerator is the number of households that received IRS that repainted, re-plastered or washed the walls and the denominator is all households that received IRS.
Proportion of households that did not spray dwelling for various reasons	HH119, HH122	Among households who did not receive IRS (HH119=2) only. For each response option, create a variable that equals one if that option is selected.

Indicator/Information	Question No.	Notes on Calculation
		The numerator is the number of households that did not receive IRS for different reasons and the denominator is all households who did not receive IRS.
Timing of last IRS within the community	HH123	Clone the variable and analyze the frequency of the response options.

## 7. Seasonal Malaria Chemoprevention (SMC)

### SMC ideation

Indicator/Information	Question No.	Notes on Calculation
Proportion of respondents aware of SMC (knowledge)	W401	Clone variable and recode 2 as 0. The numerator is the number of respondents aware of SMC and the denominator is all women.
Proportion of respondents with knowledge of the timing of SMC administration (knowledge)	W901, W902 M901, M902	The correct response varies by country context. Create a variable if the correct number of months and days is provided for both 901 and 902 respectively depending on the country context. The numerator is the number of respondents with knowledge of the timing of SMC and the denominator is all respondents.
Proportion of respondents with comprehensive knowledge of the SMC program (knowledge)	W401, W901, W902; M901, M902	Create a variable that corresponds to correct answers for each of the knowledge questions above. The numerator is the number of respondents with comprehensive knowledge of SMC and the denominator is all respondents.
Proportion of respondents with a favorable attitude toward SMC (attitudes)	W903-W910 M903-M910	Recode each question so that the response that reflects a positive attitude is coded 1, the response that reflects a lack of positive attitude is coded -1, and "Don't Know" is coded 0. Sum the score for the questions to obtain an index for positive attitudes. Respondents with an index score greater than 0 are considered to have a favorable attitude toward SMC. The numerator is the number of respondents with favorable attitudes towards SMC and the denominator is all respondents.
Proportion of respondents with perceived response-efficacy towards SMC (response-efficacy)	W911-W913 M911-M913	Recode each question so that the response that reflects response-efficacy is coded 1, the response that reflects lack of response-efficacy is coded -1, and "Don't Know" is coded 0. Sum the scores for the questions to obtain an index for response-efficacy. Respondents with a score greater than 0 are considered as perceiving a response-efficacy for SMC. The numerator is the number of respondents

Indicator/Information	Question No.	Notes on Calculation
		perceived response-efficacy of SMC and treatment and the denominator is all respondents.
Proportion of women with perceived self-efficacy to ensure their child receives SMC (self-efficacy)	W915-W918 M915-M918	Recode each question so that the response that reflects self-efficacy is coded 1, the response that reflects lack of self-efficacy is coded -1, and "Don't Know" is coded 0. Sum the score for the questions to obtain an index for self-efficacy. Respondents with a score greater than 0 are considered to have perceived self-efficacy regarding SMC. The numerator is the number of respondents perceived self-efficacy regarding SMC and the denominator is all respondents.
Proportion of respondents who believe the majority of children in their community receive SMC (descriptive norm)	W919 M919	Recode 1, 2, and 3 as 1 and other response options as 0. The numerator is the number of respondents who believe at least half of all children in their community receive SMC and the denominator is all respondents.
Proportion of respondents who perceive that community members approve of SMC (injunctive norm)	M921, W921	Clone variable and recode 4 as 1 and other response options as 0. The numerator is all respondents who perceive community members approve of SMC and the denominator is all respondents.
Proportion of respondents who are involved in making decisions about SMC (decision-making)	W105, W923, M105, M923	Among married and cohabiting respondents (105=1 or 2), clone 923 and recode 1 and 3 as 1 and all other options as 0. The numerator is the number of respondents involved in making decisions about SMC and the denominator is all respondents currently married or living with someone.
Proportion of respondents with positive perceptions towards community-based health workers regarding seasonal malaria chemoprevention (perceptions of health workers)	W1013; M1013	Clone variable and recode 2 and 9 as 0. The numerator is all respondents with positive perceptions towards community health workers regarding seasonal malaria chemoprevention and the denominator is all respondents.
Proportion of respondents with positive perceptions towards health facilities regarding seasonal malaria chemoprevention (perceptions of health facilities)	W1014; M1014	Clone variable and recode 2 and 9 as 0. The numerator is all respondents with positive perceptions towards health facilities regarding seasonal malaria chemoprevention and the denominator is all respondents.

### Behavioral Outcomes Related to SMC

Indicator/Information	Question No.	Notes on Calculation
Proportion of women who reported SMC distribution in their community in the last rainy season	W402	Clone W402 and recode 2 and 9 as 0. The numerator is the number of respondents who report SMC distribution in their community in the last rainy season and the denominator is all women.

Indicator/Information	Question No.	Notes on Calculation
Proportion of women who reported visit from the SMC health worker to their household in the last rainy season	W40	Clone W404 and recode 2 and 9 as 0. The numerator is the number of respondents who report a visit from the SMC health worker to their household in the last rainy season and the denominator is all women.
Proportion of children under five who received of the first dose of SMC	W412-W413, W414, W416, HH member listing	Among eligible children (W412=not missing and W413 is less than 60), clone W414 and W416. The indicator is equal to 1 if 414 equals 1 or 416 equals 1. The numerator is the number of children under five in the household member listing who received the first dose of SMC and the denominator is all children under five in the household member listing.
Proportion of children under five who received of the second dose of SMC	W412-W413, W418, HH member listing	Among eligible children (W412=not missing and W413 is less than 60), clone W414 and W416. The indicator is equal to 1 if 418 equals 1. The numerator is the number of children under five in the household member listing who received the second dose of SMC and the denominator is all children under five in the household member listing.
Proportion of children under five who received of the third dose of SMC	W412-W413, W418, HH member listing	Among eligible children (W412=not missing and W413 is less than 60), clone W414 and W416. The indicator is equal to 1 if 418 equals 2. The numerator is the number of children under five in the household member listing who received the second dose of SMC and the denominator is all children under five in the household member listing.

## Tabulation Templates

The tables and charts for the MBS report are produced according to a set of standard tables and charts that can be found in the **accompanying table templates in Excel**. The purpose of the accompanying excel sheet is to provide model tables and charts which display the major findings of the survey in a manner that will be useful to program managers. In most instances, the indicators are stratified by region (or applicable geographic administrative unit), as well as by other sociodemographic factors such as sex, residence, age, education, and wealth quintile. The templates also provide guidance on the most important indicators to present in the survey report, the recommended level of stratification, and suggested data visualization. The analysis plan above provides the guidance to calculate the values needed to populate the table templates in Excel. The corresponding values for each cell should be entered by the data analyst into the templates. Once the tables are populated, and charts are generated, these can be incorporated into the MBS report. Please note that the Tables are suggestions as the data generated from the analysis plan can also be included in the report as charts, figures or as text.

# Advanced Analysis

The design and scope of the MBS provides opportunities for more rigorous exploration of meaningful patterns in the MBS data that are critical for ensuring the results of the MBS are relevant and informative for programming. One of such rigorous analytical methods is regression analysis which is explained below. Where Breakthrough ACTION /CCP implemented the particular survey, the team can provide guidance on advanced analysis.

## Overview of Regression Analysis

Regression is a statistical method that attempts to discern relationships, if any exist, among sets of data. It determines the strength of the relationship between one dependent variable (usually an outcome) and another changing variable or a set of other changing variables (independent variables). In circumstances where the independent variables clearly precede the dependent variable in time, regression analysis can be used to infer causal relationships between the independent and dependent variables. Linear regression analysis is used to assess the relationships between a continuous dependent variable and a number of independent variables. If the dependent variable is dichotomous, then a regression approach suited for binary dependent variables, such as logistic or probit regression, is used. Regression models include a standard error (often a 95% confidence interval) that indicates statistical significance, or the probability that the association is not due to chance. A multivariable regression model allows for determining the variables associated with the outcome of interest, while controlling for the other variables also included in the model.

Applying this type of analysis to the MBS data is valuable to SBC programs; it indicates which socio-demographic, household and psycho-social (ideational) variables are important predictors of the malaria prevention and control behaviors we wish to influence.

## Considerations for Regression Analysis using MBS Data

### Variable selection

It can be challenging to know in advance which variables would be most interesting or informative for a regression analysis. Typically, variables of potential interest for regression can be selected based on *a priori* knowledge, from other research or available literature, or based on initial descriptive analyses of the MBS data.

### Dependent (outcome) variables

Key outcome variables include malaria-related behaviors such as use of insecticide treated nets, prompt care seeking for fever, testing for malaria, going for ANC visits, taking IPTp, and receipt of IRS or SMC.

## Independent variables

Independent variables include sociodemographic variables such as age, sex, region, residence, and wealth quintile. In addition, the MBS enables the exploration of the influence of psychosocial (ideational) variables on the outcome variables. Exposure to relevant SBC interventions are important independent variables that can influence key outcomes. Of note, variables considered as independent variables, such as psychosocial variables or exposure malaria messages, can be used as dependent variables depending on the inquiry of interest.

## Building the regression model

Detailed steps to build a regression analysis model is beyond the scope of this document, however the analysis plan above describes how to prepare many, if not all, of the outcome and independent variables that will be of interest to explore in regression analyses. As such, the guidance above considerably prepares the database for regression analysis. The research team will select and explore various regressions of interest and decide on further analyses based on the results and what will be useful to inform SBC programs. Below is an example of regression analysis results that are useful in identifying variables that SBC programs may wish to promote due to a significant association with consistent net use.

## Annotated Example of Logistic Regression Analysis

The table below shows the results of a multivariable regression analysis that explored the factors associated with the use of ITNs every night (dependent or outcome variable) among respondents surveyed in the Côte d'Ivoire MBS (14). The model included several independent variables that might influence ITN use, including sociodemographic variables (such as, age, sex, education, zone, wealth quintile), psychosocial (ideation) variables (such as, attitudes, perceptions, interpersonal communication, knowledge) and a variable on exposure to malaria messages on the media. In addition, the model includes household size and supply of ITNs, based on literature that shows that access to ITNs is an important predictor of use.

The multivariable regression results are presented in a table like the one below. For each independent variable included in the model, the association with the behavioral outcome, use of ITNs every night, is shown. The associations are shown as odds ratios because the variable for ITN use is dichotomous (yes/no). The odds ratio represents the odds that an outcome will occur given the presence of a particular variable, compared to the odds of the outcome occurring in the absence of that variable while the adjusted odds ratio represents these odds while controlling for other variables included in the model. In addition, the standard error (in this case, 95% confidence interval) provides a measure of precision for the effect size shown.

The results show that the variables significantly associated with the use of ITNs include a number of sociodemographic and ideational variables. For example, the likelihood of using an ITN every night increases with age and exposure to malaria messages on the media (depicted with the \* sign denoting the level of statistical significance).

**Results of the logistic regression exploring factors associated with use of LLIN every night – residents of households with at least one LLIN. Côte d’Ivoire, 2018**

Characteristics	% using LLIN every night	Odds ratio (standard error)
Sex		
Male (reference)	65.3	1.000 (n/a)
Female	65.6	1.163 (0.103)
Age in years	n/a	1.010** (0.004)
Level of education		
None (reference)	73.1***	1.000 (n/a)
Primary	64.9	0.764*** (0.064)
Secondary or higher	59.4	0.730*** (0.061)
Household wealth quintile		
Lowest (reference)	80.5***	1.000 (n/a)
Second	73.6	0.789*(0.083)
Middle	68.3	0.736**(0.080)
Fourth	58.1	0.671*** (0.077)
Highest	48.0	0.668** (0.086)
Zone		
North (reference)	72.7***	1.000 (n/a)
Center	72.9	1.213* (0.114)
South	71.2	0.998 (0.093)
Abidjan	38.8	0.355*** (0.043)
Attitudes favorable to the use of mosquito nets		
No (reference)	34.9***	1.000 (n/a)
Yes	68.3	2.772*** (0.335)
Perceived severity		
No (reference)	66.2	1.000 (n/a)
Yes	64.8	0.930 (0.061)
Perceived vulnerability		
No (reference)	67.1	1.000 (n/a)
Yes	65.1	0.758*** (0.061)
Talked about malaria with spouse		
No (reference)	63.7**	1.000 (n/a)
Yes	69.7	1.287** (0.115)
Talked about malaria with friends/family members		
No (reference)	64.5	1.000 (n/a)
Yes	68.2	1.262** (0.114)
Perceived mosquito net effectiveness		
No (reference)	59.7***	1.000 (n/a)
Yes	69.4	1.114 (0.074)

Characteristics	% using LLIN every night	Odds ratio (standard error)
Perceived self-efficacy for mosquito net use		
No (reference)	17.7***	1.000 (n/a)
Yes	74.2	6.581*** (0.480)
Use of mosquito nets perceived as the norm in the community		
No (reference)	56.2***	1.000 (n/a)
Yes	69.3	1.166* (0.084)
Mentioned at least one incorrect method of transmitting malaria		
No (reference)	65.7	1.000 (n/a)
Yes	65.4	0.861* (0.059)
Heard a message about malaria on the media		
No (reference)	64.6	1.000 (n/a)
Yes	67.0	1.285** (0.093)
Household size	n/a	0.948*** (0.013)
Number of LLIN	n/a	1.307*** (0.043)
Pseudo-R <sub>2</sub>	21.4%	
Number of observations	6,060	
Notes: ‡ p<0.1 * p<0.05; ** p<0.01; *** p<0.001. n/a: not applicable		

## Reporting

The MBS report template (an accompanying word document) provides guidance on how to structure the results of the MBS. This includes a detailed methodology section highlighting the study objectives, design, data collection process and ethical considerations. The results of the MBS data analysis are presented under the following headings: Description of the study sample, media consumption and message exposure, cross-cutting ideational factors, ITNs, malaria case management, malaria in pregnancy, IRS and SMC. The study tools are also included as an appendix to the report template.

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