
Evaluation of the Impact of Malaria Control Interventions on All-Cause Mortality in Children Under Five Years of Age in Liberia

Liberia Malaria Impact Evaluation Group

Annexes

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Annex 1: Methodological Considerations

A.1.1 General Survey Information and Data Availability for Liberia 2005-2013

	MIS 2005*	DHS 2007	MIS 2009	MIS 2011	DHS 2013
Sampling frame	1984 Population Census	1984 Population Census	2008 National Population and Housing Census	2008 National Population and Housing Census	2008 National Population and Housing Census
Sampling distribution	Two-Stage 1. EAs 2. HHs within EAs	Two-Stage 1. EAs 2. HHs within EAs	Two-stage 1. EAs 2. HHs within EAs	Two-stage 1. EAs 2. HHs within EAs	Two-stage 1. EAs 2. HHs within EAs
Number of cluster (census enumeration areas/sampling points)	306 clusters PPS by urban/rural and for 15 counties.	298 clusters PPS by urban/rural and for 15 counties.	150 clusters PPS by urban/rural and for 15 counties.	150 clusters PPS by urban/rural and for 15 counties.	322 clusters PPS by urban/rural and for 15 counties.
Number of household/cluster	N/A Systematic (random) sampling	184 HH/ rural cluster 114 HH/urban cluster Systematic (random) sampling	81 HH/rural cluster; 69 HH/urban cluster Systematic (random) sampling	81 HH/rural cluster; 69 HH/urban cluster Systematic (random) sampling	30 HH/cluster Systematic (random) sampling
Sample weights	Weighted to provide representative estimates for urban/rural and for 15 counties.	Weighted to provide representative estimates for five regions by urban/rural and for 15 counties.	Weighted to provide representative estimates for regions by urban/rural and for 15 counties	Weighted to provide representative estimates for regions by urban/rural and for 15 counties.	Weighted to provide representative estimates for five regions, by urban/rural and for 15 counties.
Sampling errors/Design effect		See Final Report Appendix B	Design effect of 2.0	See Final Report Appendix C	See Final Report Annex B
Representativeness (designed to provide estimates for)	<ul style="list-style-type: none"> National Urban and rural areas, separately 15 counties 	<ul style="list-style-type: none"> National Urban and rural areas, separately 6 regions (includes Monrovia) 	<ul style="list-style-type: none"> National Urban and rural areas, separately 6 regions (includes Monrovia) 	<ul style="list-style-type: none"> National Urban and rural areas, separately 6 regions (includes Monrovia) 	<ul style="list-style-type: none"> National Urban and rural areas, separately 5 regions and Monrovia 15 countries
Month(s) survey conducted	July 2005-August 2005	Dec 2006-Apr 2007	Dec 2008-Mar 2009	Sep-Dec 2011	May-Jul 2013
Biomarkers	Hemoglobin	HIV testing	Hemoglobin	Hemoglobin	HIV testing
Malaria microscopy	N/A	N/A	Thick blood smears collected	Thick blood smears collected	N/A
Rapid Malaria Diagnosis	RDT conducted, information on	N/A	Paracheck Pf™	First Response rapid diagnostic	N/A

	MIS 2005*	DHS 2007	MIS 2009	MIS 2011	DHS 2013
(brand of RDT)	brand not available			test	
Hemoglobin values (brand of Hemocue /cuvettes)	N/A	N/A	Children 6-59 months (Hemocue system)	Children 6-59 months (Hemocue system)	N/A
Under-five mortality estimate	N/A	Direct method (complete birth history)	N/A	N/A	Direct method (complete birth history)
ITN ownership	Bednet ownership available, not information on ITN ownership	Bednet ownership data available for all households, no information on ITN ownership.	A complete net roster is included. We know number of nets, treatment of each net, who used each net the previous night and duration of ownership of nets.	A complete net roster is included. We know number of nets, treatment of each net, who used each net the previous night and duration of ownership of nets.	A complete net roster is included. We know number of nets, treatment of each net, who used each net the previous night and duration of ownership of nets.
ITN use	Available for children under five	N/A	Available for children under five, pregnant women and general population.	Available for children under five, pregnant women and general population.	Available for children under five, pregnant women and general population.
IRS	N/A	N/A	N/A	Available	Available
Wealth Index	N/A	Household ownership of goods (e.g., radio, telephone, motorbike, TV, bicycle, car, fridge) and housing characteristics including, electricity, source of water supply, sanitation facilities, and type of floor of dwelling	Household ownership of goods (e.g., radio, telephone, motorbike, TV, bicycle, car, fridge) and housing characteristics including, electricity, source of water supply, sanitation facilities, and type of floor of dwelling	Household ownership of goods (e.g., radio, telephone, motorbike, TV, bicycle, car, fridge) and housing characteristics including, electricity, source of water supply, sanitation facilities, and type of floor of dwelling	Household ownership of goods (e.g., radio, telephone, motorbike, TV, bicycle, car, fridge) and housing characteristics including, electricity, source of water supply, sanitation facilities, and type of floor of dwelling
Households sampled	9,000	7471	4485	4492	9677
Households occupied	N/A	N/A	4285	4237	N/A
Households interviewed	8,226	6824	4162	4162	9333
Household response rate	91.4%	97.2%	97.1%	98.2%	99.4%
Individual interviews:					
Number of women	N/A	7448	4512	4014	9462
Number of women interviewed	9,181	7092	4397	3939	9239
Eligible woman rate	N/A	95.2	97.5	98.1	95.4

*Dataset and final report not available for review. Information was taken from a draft report and presentation of the findings.

A.1.2 Data and Indicators on ITN Coverage

Standard RBM indicators were used to estimate coverage of vector control interventions for each survey year as well as changes in coverage over the study period. These indicators are outlined below.

RBM Intervention	Indicator Description	Numerator	Denominator	Data Availability
Insecticide-treated nets (ITNs)	Proportion of households with at least one ITN	Number of households surveyed with at least one ITN	Total number of households surveyed	2005 MIS* 2007 MIS* 2009 MIS 2011 MIS 2013 DHS
	Proportion of households with at least one ITN for every two people	Number of household with at least one ITN for every two people	Total number of households surveyed	2009 MIS 2011 MIS 2013 DHS
	Proportion of population with access to an ITN within their household	Total number of individuals who could sleep under an ITN if each ITN in the household is used by two people	Total number of individuals who spent the previous night in surveyed households	2009 MIS 2011 MIS 2013 DHS
	Proportion of population who slept under an ITN the previous night.	Number of individuals who slept under an ITN the previous night	Total number of individuals who slept in surveyed households the previous night	2009 MIS 2011 MIS 2013 DHS
	Proportion of children under 5 years old who slept under an ITN the previous night.	Number of children under 5 who slept under an ITN the previous night	Total number of children under 5 who spent the previous night in surveyed households	2005 MIS 2009 MIS 2011 MIS 2013 DHS
Insecticide-treated nets and indoor residual spraying	Proportion of households with at least one ITN and/or sprayed by IRS in the last 12 months	Number of households with at least one ITN and/or sprayed by IRS in the last 12 months	Total number of households surveyed	2011 MIS 2013 DHS

* The 2007 MIS has household ownership of at least one bednet, not ownership of ITNs.

Calculating Indicators

Data used to produce estimates of ITN ownership and use come from the DHS and MIS surveys. The specific questions and methods used to calculate the indicators vary slightly across surveys, though more recently, attempts have been made to standardize questionnaires across surveys.

In the 2007 DHS, questions on household ownership of ITNs were not included, rather households were asked if and how many bednets they owned. A full bednet roster was not included, thus no specific questions were asked on the brand/type of the bednets owned or whether the bednets were treated with insecticides. Further, only bednet use among children under five was asked in the survey, thus no data are available on ITN use among children under five, pregnant women, or the general population.

In the subsequent MIS and DHS surveys, a full bednet roster was collected which allows for estimation of standard ITN indicators including the proportion of households with ITNs, the proportion of target populations (children under five years of age, pregnant women) using ITNs, as well as non-standard indicators such as proportion of the total population using ITNs, average number of ITNs per household, average duration of net ownership, etc.

The available information on bednets for the DHS and MIS are provided in the table below.

	2007 DHS	2009 MIS	2011 MIS	2013 DHS
Brand	N/A	Olyset Permanet Other ITN brand	Olyset Permanet Basf Net Other ITN brand	Olyset Permanet Basf Net Other ITN brand
Duration of ownership	N/A	Monthly 0-36 months 37+ months	Monthly 0-36 months 37+ months	Monthly 0-36 months 37+ months
Treated/dipped with insecticide since it was obtained	N/A	Yes	Yes	Yes
Timing of last treatment	N/A	Monthly 0-24 months 25+ months	Monthly 0-24 months 25+ months	Monthly 0-24 months 25+ months

Potential Biases

Some limitations may affect the validity of the indicators to correctly measure parameters of interest. Correct specification of a net as an ITN requires information on the kind of net owned or used which might not be accurately reported if interviewers were not allowed to view the net. It also requires information on treatment of nets (the timing and the substance used to treat) which is subject to recall bias. The true protection offered by ITNs requires proper use: The timing of sleep under an ITN, the condition of the net (without holes, etc.), and proper net installation, are all important factors that were not measured in these surveys. For more information on RBM indicators including calculations, strengths and limitations see the “Household Survey Indicators for Malaria Control, June 2013.”

A.1.3 Data and Indicators on Malaria in Pregnancy (IPTp and ITN Use)

Standard RBM indicators on use of interventions to prevent and control malaria in pregnant women were used in this report. These indicators are outlined below.

RBM Intervention	Indicator Description	Numerator	Denominator	Data Availability
Prevention and control of malaria in pregnant women	Proportion of pregnant women who slept under an ITN the previous night	Number of pregnant women who slept under an ITN the previous night	Total number of pregnant women within surveyed households	2009 MIS 2011 MIS 2011 DHS
	Proportion of women who received intermittent preventive treatment for malaria during ANC visits during their last pregnancy	Number of women who received 2 or more doses of SP to prevent malaria at least one during ANC visit during her last pregnancy that led to a live birth in the last 2 years	Total number of women surveyed who delivered a live baby within the last 2 years	2007 DHS* 2009 MIS 2011 MIS 2013 DHS

* The 2007 DHS only asks about the percentage of women 15-49 with a live birth in the two years preceding the survey who took any SP; it does not have information on women who received 2 or more doses during an ANC visit.

Calculating Indicators

Data used to estimate the proportion of pregnant women that used an ITN the night before the survey come from the 2009 and 2011 MIS and the 201e DHS. In these surveys, all women aged 15-49 from selected households were asked to participate in an interview. In the course of this interview each woman was asked if she was pregnant. This information along with the responses from the household questionnaire on ITN ownership and use was used to estimate the proportion of pregnant women who slept under an ITN the previous night.

Data used to estimate the proportion of pregnant women that received intermittent preventive treatment during ANC visits during their last pregnancy come from the 2009 MIS, 2011 MIS and the 2013 DHS. Interviewed women reporting a live birth in the two years prior to interview were also asked to provide information about use of antenatal care (ANC) services and other malaria prevention behaviors. This information was used to estimate the proportion of these women who received at least two doses of SP for prevention of malaria during her last pregnancy which led to a live birth, at least one of which was received during an ANC visit. The 2007 DHS only asked women 15 to 49 years with a live birth in the two years preceding the survey if they took any SP during their last pregnancy; thus, the IPTp indicator cannot be calculated for 2007.

Potential Biases

This indicator is dependent on recall by interviewed women over the two year period preceding the survey. Women were asked to remember not only whether or not they took medication for malaria prevention but also the type of medication, the number of doses and the source of these doses. Accurate information for all of these parameters is necessary for construction of the IPTp indicator. In addition, these questions were asked only of women whose most recent pregnancy ended in a

live birth in the two years preceding the survey. This excludes stillbirths and miscarriages. As birth outcomes are known to be affected by malaria and IPTp is known to reduce the risk of malaria, the results may not be representative of the general population and may bias the observed relationships. In addition, the data for this indicator come from interviews with live women: Women that died in childbirth or from malaria acquired during pregnancy are not included. Thus, the indicator may not be truly representative of the population as some selection bias may be present.

A.1.4 Data and Indicators on Case Management

The following RBM indicators measuring case management of malaria were used in this report:

RBM Intervention	Supplemental Indicator Description	Numerator	Denominator	Data Availability
Diagnostics	Proportion of children under 5 years old with fever in last 2 weeks who received a finger or heel stick.	Number of children under 5 years old with fever in last 2 weeks who received a finger or heel stick.	Total number of children under 5 who had a fever in previous 2 weeks	2009 MIS 2011 MIS 2013 DHS
Treatment	Proportion of children under 5 years old with fever in the last 2 weeks for whom advice or treatment was sought	Number of children under 5 who had a fever in previous 2 weeks who sought advice or treatment	Total number of children under 5 who had a fever in previous 2 weeks	2007 DHS 2009 MIS 2011 MIS 2013 DHS
	Proportion receiving first line treatment, among children under five years old with fever in the last two weeks who received any antimalarial drugs	Number of children under 5 who had a fever in previous 2 weeks who received first-line antimalarials	Total number of children under 5 who had a fever in previous 2 weeks who received any antimalarial.	2007 DHS 2009 MIS 2011 MIS 2013 DHS

In addition, several supplemental case management indicators were calculated. These are historical case management indicators which have been replaced by the RBM-MERG. Due to the retrospective nature of the evaluation, these historical indicators were referenced.

RBM Intervention	Indicator Description	Numerator	Denominator	Data Availability
Treatment	Proportion of children under 5 years old with fever in last 2 weeks who received any antimalarial treatment	Number of children under 5 who had a fever in previous 2 weeks who received any antimalarial treatment	Total number of children under 5 who had a fever in previous 2 weeks	2007 DHS 2009 MIS 2011 MIS 2013 DHS
	Proportion of children under 5 years old with fever in the last two weeks who received	Number of children under 5 who had a fever in previous 2	Total number of children under 5 who had a fever in	2007 DHS 2009 MIS 2011 MIS

	antimalarial treatment according to national policy (first-line treatment)	weeks who received recommended antimalarial treatment according to national policy	previous 2 weeks	2013 DHS
	Proportion of children under 5 years old with fever in last 2 weeks who received antimalarial treatment according to national policy within 24 hours from onset of fever.	Number of children under 5 who had a fever in previous 2 weeks who received recommended antimalarial treatment according to national policy <24 hours from fever onset	Total number of children under 5 who had a fever in previous 2 weeks	2009 MIS 2011 MIS 2013 DHS

Calculating Indicators

Data used to calculate these indicators came from the 2007 DHS, the 2009 MIS, the 2011 MIS survey and from the 2013 DHS. In the DHS and MIS, the denominator for these indicators is biological children of interviewed women under five years of age who had fever in the two weeks prior to interview. Mothers (or caregivers) were asked whether or not they sought treatment for their child's fever and, if so, where care was sought and what treatments were received. The timing of this treatment in relation to onset of fever was also asked in the 2009 MIS, 2011 MIS, and the 2013 DHS. Interpretation of trends in these indicators is challenging as the treatment options and the recommended treatments changed over the course of the evaluation period. The treatment options included in each survey are summarized in the table below.

Antimalarial Drugs Taken for Treatment of Fever			
2007 DHS	2009 MIS	2011 MIS	2013 DHS
<ul style="list-style-type: none"> • SP/Fansidar • Chloroquine • Amodiaquine • Quinine • ACT • Other antimalarial • ASA • Paracetamol • Other 	<ul style="list-style-type: none"> • SP/Fansidar • Chloroquine • Quinine • ACT • Other antimalarial • Aspirin • Acetaminophen • Aspirin/Panadol • Ibuprofen • Other 	<ul style="list-style-type: none"> • SP/Fansidar • Chloroquine • Quinine • ACT • Other antimalarial • Aspirin • Paracetamol • Ibuprofen • Other 	<ul style="list-style-type: none"> • SP/Fansidar • Chloroquine • Amodiaquine • Quinine • ACT • Other antimalarial • Aspirin • Paracetamol • Ibuprofen • Other

One potentially useful indicator that is less affected by changing drug recommendations is the proportion of all antimalarial treatments that are first-line. This gives an indication of whether or not the recommended antimalarials are being dispensed.

To determine whether or not the antimalarial medication given to children with fever was “prompt” mothers were asked when the child first took the medication. Responses of “Same Day” or “Next Day” following fever onset were considered “prompt” and were included in the calculation of the third treatment indicator.

In the more recent surveys, a question asking whether or not a child with fever had a finger or heel stick has been included to estimate the proportion of children with fever who were given diagnostic tests for malaria. For Liberia, the information to calculate this indicator is available in the 2009 MIS, 2011 MIS, and 2013 DHS.

Potential Biases

A potential bias is introduced by the nature of data collection for these surveys. Children whose mothers were deceased at the time of interview are not included in this estimate. This may introduce bias if the children with deceased mothers are more likely than others to have fever or if they have different treatment seeking patterns. Another potential issue is the non-specificity of the denominator. Coverage of appropriate antimalarial treatment is only relevant if a child is actually infected with *Plasmodium* spp. parasites. In this case, an assumption is made that any child with fever is likely to have malaria, without the requirement of official clinical diagnosis. However, many interviewed households do not have access to facilities that provide diagnostic testing for malaria, or do not have the resources needed to access these services, so limiting the denominator of this indicator to diagnosed cases is not currently practical. Following WHO recommendations, many national malaria control programs have changed standards to require diagnostic testing (by RDT or microscopy) before administering malaria treatment. Until widespread implementation of these standards has occurred, the current treatment indicator remains the most practical. The new indicator on diagnosis represents a proxy measure of the prevalence of diagnostic testing of children with fever. It can be used to gauge when transition to using a more specific denominator of confirmed malaria cases might be possible.

Another potential problem with this indicator is the necessity of recall of types of medications. Errors in the specification of medications taken could reduce the validity of these estimates. Additionally, proper dosage is not verified.

A.1.5 Data and Indicators on Malaria Morbidity

Morbidity indicators measured for this report include parasitemia and severe anemia prevalence in children under five years of age. The details of these indicators are outlined below.

RBM Impact Measures	Indicator Description	Numerator	Denominator	Data Availability
Morbidity Indicator	Parasitemia Prevalence: Proportion of children aged 6-59 months with malaria infection (via RDT and microscopy)	Number of children 6-59 months with malaria infection detected by an RDT (and microscopy)	Total number of children aged 6-59 months tested for malaria parasites by an RDT (and microscopy)	2005 MIS* 2009 MIS* 2011 MIS

	Severe anemia prevalence: proportion of children aged 6-59 months with a hemoglobin measurement of <8 g/dL.	Number of children 6-59 months with a hemoglobin measurement of <8g/dL	Total number of children 6-59 months who had hemoglobin measurements obtained during household survey	2009 MIS 2011 MIS
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*Only RDT results are available from the 2005 MIS. For both the 2009 MIS and 2011 MIS, microscopy (thick for parasite density) and RDT (*Pf*) test results are available.

Calculating Indicators

The data used to calculate these indicators come from the 2009 MIS and the 2011 DHS. These biomarkers were measured for all children older than 6 months and less than 60 months of age, for whom permission was granted, in selected households. Parasitemia was measured using both microscopy and rapid diagnostic tests (RDT).

Parasitemia

Infection with *Plasmodium falciparum* parasites was measured in all children aged 6-59 months who slept in a selected household the night before the survey, for whom parental permission was granted. Blood was taken from a finger or heel stick using a cuvette. Thick and thin blood smears were prepared for microscopy. A rapid diagnostic blood test for *Plasmodium falciparum* antigens was then performed (Paracheck Pf® for the 2009 survey and a SD Bioline Malaria Ag P.f. ® for the 2011 survey). Parasitemia is defined as a positive result via microscopy for the purposes of these analyses.

Severe Anemia

Severe anemia, defined as less than 8 grams of hemoglobin per deciliter of blood, in children aged 6-59 months who slept in a selected household the night before the survey is another outcome of interest. Hemoglobin levels were measured using the HemoCue® system (a light photometer) and samples of capillary blood from finger or heel sticks.

Potential Biases

Measuring parasitemia for use in comparative studies can be challenging as parasite prevalence in the population is influenced by a multitude of factors including temperature and rainfall. Thus the timing of data collection plays an important role in ensuring comparability of data, especially in areas with seasonal patterns of malaria transmission. The analyses presented in this report include parasitemia data from the different transmission seasons in 2009 and 2011. The survey in 2009 spanned the dry season, while the 2011 survey overlapped during the peak transmission season. Another measurement issue arises due to the different methods available for diagnosing *Plasmodium* spp. infection. The current RBM recommendation is to report microscopy results; however, obtaining good quality microscopy data is often challenging due to logistic constraints. In this case, diagnosis was determined via microscopy and rapid diagnostic tests. Comparing RDT results with those obtained via microscopy may not produce valid results as RDTs measure parasite antigens whereas microscopy measures actual parasites. RDTs have been shown to have lower sensitivity than high quality microscopy in areas of low parasitemia. False positive RDT results can also occur when parasites have recently been cleared from the body via effective treatment. For Liberia, the quality of the microscopy results was deemed questionable in the 2011 survey; with

22% of the slides found to be unreadable. For this reason, both RDT and microscopy results are presented in the report.

Severe anemia is not a very specific proxy for malaria as there are many other potential etiologies. Anemia data are dependent on valid hemoglobin readings from the HemoCue® machine which can be affected by the skill of the technician drawing blood and on the number of blood tests being conducted with the same sample. Severe anemia prevalence is also subject to seasonal variation to the extent that it is a result of malaria infection or other time-varying factors.

A.1.6 Data and Indicators on Under-five Mortality

All-cause mortality in children under five years of age is the outcome variable of greatest interest in this report.

RBM Impact Measures	Indicator Description	Data Availability
Mortality Indicator	All-cause under 5 mortality rate (5q0)	2007 DHS 2013 DHS

Calculating Indicators

Estimates of mortality require significant amounts of data, as death is a fairly rare event; thus, mortality rates for Liberia were estimated using data from the birth histories from the 2007 and 2013 DHS interviews. The surveys calculate these estimates using information collected from birth histories of each interviewed woman. Women are asked the dates of each live birth, regardless of the current survival status of the child. For any death, child age at death is recorded. There is no time limit on this birth history, so every live birth a woman ever had during her lifetime should be recorded. With this information, 5-year mortality rates, approximating a point estimate of mortality rates approximately 2.5 years before the survey, are calculated using a synthetic cohort life table approach similar to that described in detail in the “DHS Guide to Statistics” (<http://www.measuredhs.com/help/Datasets/index.htm>). Mortality rates are calculated for ages 0 months, 1-2, 3-5, 6-11, 12-23, 24-35, 36-47, and 48-60 months using a Stata program. Each rate is calculated with a generalized linear model with binomial error, log link, and an appropriate offset for risk. Adjustments are made for the survey design using svyset. Stata produces robust standard errors and 95% confidence intervals for the log of each rate. These confidence intervals are mapped onto confidence intervals for the standard set of under-five mortality rates. The rates agree exactly with the CSPro program used by DHS and the confidence intervals differ only slightly from the results of the jackknife procedure used by DHS.

Potential Biases

As birth history information was collected from interviewed women in the DHS, the mortality of children whose mothers have died is missing from the estimate. Children whose mothers have died are known to have worse survival, which may lead to mortality being underestimated. Other potential biases include under-reporting of deaths and misreported age at death. These issues and

the measures taken to avoid erroneous data are discussed in depth in the Guide to DHS Statistics (<http://www.measuredhs.com/help/Datasets/index.htm>).

Annex 2: LiST Model Details

A.2.1 Methods - Lives Saved Tool (LiST Model)

LiST Model

The Lives Saved Tool (LiST model) is a computer-projection model that runs through the Spectrum demographic program developed by the Futures Institute [1]. The Spectrum program links together the LiST module containing maternal and child health interventions, the family planning module that accounts for changes in fertility and the AIDS Impact Module (AIM) that provides information on HIV/AIDS prevalence and interventions [1]. The LiST model projections and information are available from www.jhsph.edu/dept/ih/IIP/list/. The analysis was performed with Spectrum version 5.441. Unless otherwise indicated, the values in the standard projection for Liberia were used.

Demographic Data

The default demographic data (from the United Nations Population Division) in the Spectrum projection for Liberia was used.

Family Planning Module

The values in the standard Liberia projection were used without change.

AIDS Impact Module (AIM)

The AIDS Impact Module (AIM) was used without change from the standard Liberia projection.

Mortality & Cause-Specific Mortality Profile

The baseline mortality values for 2007 were obtained from the 2007 DHS estimates. The values (deaths per 1000 live births) are neonatal (31.9) infant (71.2) and under five (109.5).

The cause-specific breakdown of child mortality used in the model are the World Health Organization – Maternal Child Epidemiology Estimation (WHO-MCEE) estimates [3]. For neonatal mortality, the cause-specific mortality profile for Liberia is as follows: diarrhea (0.8%), sepsis (18.1%), pneumonia (6.8%), asphyxia (30.5%), prematurity (31.1%), tetanus (1.9%), congenital anomalies (5.3%) and other (5.6%). The cause-specific mortality profile for children 1-59 months old was also used without change from the model inputs; diarrhea (14.9%), pneumonia (19.9%), meningitis (6.0%), measles (0.1%), malaria (32.5%), pertussis (1.4%), HIV/AIDS (3.6%), injury (4.7%) and other (17.0%).

Intervention Coverage

Table A.2.3.1 lists the values, definitions and data sources for the prevention and treatment interventions used in this LiST analysis. The intervention coverage levels for indicators were obtained from the 2005 MIS, 2007 DHS, 2009 MIS, 2011 MIS, and 2013 DHS with a few exceptions noted below. For the years between surveys, the values were linearly interpolated. “Data not available” refers to these interventions as well as those in which data is not currently being collected/reported in the surveys.

Malaria Control Intervention Coverage

The percentage of households owning at least one ITN or sprayed by IRS within the last 12 months was only available from the 2011 MIS and the 2013 DHS. Therefore, we used data on the percentage of household that own at least one bednet or ITN (depending on availability) from the 2005 MIS, 2007 DHS, and the 2009 MIS.

Since the proportion of pregnant women receiving 2 doses SP/Fansidar at an ANC visit was available for all survey years and increased progressively over the evaluation period, we used this in the LiST Model, instead of substituting it for the coverage of ITN use in pregnant women. Data on ITN use in pregnant women was only available in the 2009 MIS, 2011 MIS, and 2013 DHS and use was overall lower than coverage of IPTp.

Additional Health Status Data

Other health status data for the baseline year 2005 came from the standard projection that was last last updated in April 2016.

Malaria Intervention Protective Efficacy

The protective effect of vector control methods (household ownership of ITNs or IRS) for preventing deaths in children 1–59 months due to malaria is estimated to be 55% (ranging from 49–60%) based on a review of trials and studies [4]. The protective effect of malaria control measures (ITN use by pregnant women or use of IPTp) during pregnancy is estimated to be 35% (95% confidence interval (CI) 23–45%) during the first two pregnancies based on a review of related trials [4]. The effect of preventing malaria in pregnancy is thought to be through decreasing low birth weight by preventing IUGR and therefore can affect deaths of children 0–59 months of age [4].

Uncertainty Limits

The uncertainty bounds around the number of malaria deaths prevented are based on the uncertainty surrounding the two primary model parameters: the estimated protective effect of the malaria control interventions [4] and the malaria intervention coverage estimates from the MIS and DHS data sets.

A.2.2 LiST Model References

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[2] Oestergaard MZ, Inoue M, Yoshida S, Mahanani WR, Gore FM, Cousens S, Lawn JE, Mathers CD; United Nations Inter-Agency Group for Child Mortality Estimation and the Child Health Epidemiology Reference Group. Neonatal mortality levels for 193 countries in 2009 with trends since 1990: a systematic analysis of progress, projections, and priorities. *PLoS Med.* 2011 Aug;8(8):e1001080. doi: 10.1371/journal.pmed.1001080.

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A.2.3 Intervention Coverage Indicators and Values Used in LiST Analysis for Liberia

Intervention	2005	2007	2009	2011	2013	Data Source(s)/ Indicator Information
Periconceptual						
Contraceptive use	n/a	n/a	n/a	n/a	n/a	Used defaults in FamPlan model
Folic acid supplementation/fortification	n/a	n/a	n/a	n/a	n/a	Data not available
Safe abortion services	n/a	n/a	n/a	n/a	n/a	Data not available
Post abortion case management	n/a	n/a	n/a	n/a	n/a	Data not available
Ectopic pregnancy case management	n/a	n/a	n/a	n/a	n/a	Data not available
Pregnancy						
Antenatal care	n/a	66.7	n/a	n/a	77.6	2007 DHS, 2013 DHS
Tetanus toxoid	n/a	75.9	n/a	n/a	83.8	2007 DHS, 2013 DHS
Pregnant women protected via IPT	4.0	n/a	45.1	49.6	47.6	2005 MIS, 2009 MIS, 2011 MIS, 2013 DHS
Syphilis detection and treatment	33.4	33.4	35.2	37.0	62.1	Used defaults in LiST model
Calcium supplementation	n/a	n/a	n/a	n/a	n/a	Data not available
Iron folate supplementation	87.4	n/a	n/a	n/a	96.4	2003 DHS, 2011 DHS
Multiple micronutrient supplementation	n/a	n/a	n/a	n/a	n/a	Data not available
Balanced energy supplementation	n/a	n/a	n/a	n/a	n/a	Data not available
Hypertensive disorder case management	3.3	3.3	3.5	3.7	3.9	Used defaults in LiST Model
Diabetes case management	3.3	3.3	3.5	3.7	3.9	Used defaults in LiST Model
Malaria case management	3.3	3.3	3.5	3.7	3.9	Used defaults in LiST Model
Fetal growth restriction detection and management	n/a	n/a	n/a	n/a	n/a	Data not available
PMTCT	n/a	n/a	n/a	n/a	n/a	Used defaults in the LiST Model
Childbirth						
Skilled birth attendance	n/a	46.3	n/a	n/a	60.6	2007 DHS, 2013 DHS
Health facility delivery	n/a	36.9	n/a	n/a	55.8	2007 DHS, 2013 DHS
Place and level of delivery	n/a	n/a	n/a	n/a	n/a	Used defaults in LiST Model
Interventions for all deliveries (clean birth practices, immediate assessment and stimulation,	n/a	n/a	n/a	n/a	n/a	Used defaults in LiST Model

Intervention	2005	2007	2009	2011	2013	Data Source(s)/ Indicator Information
labor and delivery management, neonatal resuscitation, antenatal corticosteroids for preterm labor, antibiotics for pRPoM, MsSO4 management of eclampsia, AMSTL, and induction of labor for pregnancies 41+ weeks)						
Breastfeeding						
<1 month						
Exclusive	39.1	39.1	55.1	71.2	87.2	Used defaults in LiST Model
Predominant	42.6	42.6	31.5	20.3	9.2	Used defaults in LiST Model
Partial	14.5	14.5	9.9	5.4	0.9	Used defaults in LiST Model
Not	3.8	3.8	3.4	3.1	2.8	Used defaults in LiST Model
1-5 months						
Exclusive	27.7	27.7	36.0	44.4	52.7	Used defaults in LiST Model
Predominant	41.3	41.3	38.3	35.3	32.3	Used defaults in LiST Model
Partial	29.1	29.1	23.9	18.7	13.4	Used defaults in LiST Model
Not	1.9	1.9	1.8	1.7	1.5	Used defaults in LiST Model
6-11 months						
Any breastfeeding	96.4	96.4	96.5	96.6	96.7	Used defaults in LiST Model
Not breastfeeding	3.6	3.6	3.5	3.4	3.3	Used defaults in LiST Model
12-23 months						
Any breastfeeding	67.4	67.4	68.1	68.8	69.5	Used defaults in LiST Model
Not breastfeeding	32.6	32.6	31.9	31.2	30.5	Used defaults in LiST Model
Preventive						
Postnatal care (clean postnatal practices and chlorhexidine)	11.5	11.5	16.1	25.3	34.5	Used defaults in LiST
Complementary feeding – education only	24.5	24.5	24.5	24.5	24.5	Used defaults in LiST
Complementary feeding – supplementation and education	24.5	24.5	24.5	24.5	24.5	Used defaults in LiST
Vitamin A supplementation	n/a	61.5	n/a	n/a	62.3	2007 DHS, 2013 DHS
Zinc supplementation	n/a	n/a	n/a	n/a	n/a	Used defaults in LiST (0% coverage)
Improved water source	n/a	65.2	74.5	72.1	72.6	2007 DHS, 2009 MIS, 2011 MIS, 2013 DHS
Water connection in home	3.0	2.9	2.8	2.7	2.5	Used defaults in LiST
Improved sanitation – Utilization of latrines or toilets	n/a	10.0	n/a	7.3	14.2	2007 DHS, 2011 MIS, 2013 DHS
Handwashing with soap	17.0	17.0	17.0	17.0	17.0	Used defaults in LiST Model
Hygienic disposal of children’s stools	n/a	31.5	n/a	n/a	28.2	2007 DHS, 2013 DHS
ITN/IRS	18.0	30.4	47.2	54.2	58.8	Used household ownership of bednet or ITN from 2005 MIS, 2007 DHS, and 2009 MIS, and then ITN/IRS

Intervention	2005	2007	2009	2011	2013	Data Source(s)/ Indicator Information
						coverage for 2011 MIS and 2013 DHS
Vaccines						
BCG	n/a	77.1	n/a	n/a	93.9	2007 DHS, 2013 DHS
Polio	n/a	49.4	n/a	n/a	69.9	2007 DHS, 2013 DHS
Pentavent	n/a	50.3	n/a	n/a	71.4	2007 DHS, 2013 DHS
Pneumococcal	n/a	n/a	n/a	n/a	n/a	Used defaults in LiST (0% coverage)
Rotavirus	n/a	n/a	n/a	n/a	n/a	Used defaults in LiST (0% coverage)
Measles	76.7	n/a	73.7	n/a	81.5	2003 DHS, 2008 MICS, 2011 DHS
Curative Interventions						
Maternal sepsis case management	n/a	n/a	n/a	n/a	n/a	Data not available (0% coverage)
Case management of premature babies (Kangaroo mother case and full supportive care for prematurity)	n/a	n/a	n/a	n/a	n/a	Data not available (0% coverage)
Case management of neonatal sepsis/pneumonia (oral antibiotics for neonatal sepsis/pneumonia, injectable antibiotics for neonatal sepsis/pneumonia, and full supportive care for neonatal sepsis/pneumonia)	n/a	n/a	n/a	n/a	n/a	Used defaults in LiST Model
Oral rehydration solution for treatment of diarrhea	n/a	53.1	n/a	n/a	60.4	2007 DHS, 2013 DHS
Antibiotics for treatment of dysentery	13.5	13.5	13.4	13.2	13.1	Used defaults in LiST Model
Zinc for treatment of diarrhea	3.1	3.1	3.1	3.1	3.1	Used defaults in LiST Model
Oral antibiotics for pneumonia	62.2	62.2	58.4	54.5	50.7	Used defaults in LiST Model
Vitamin A treatment of measles	61.5	61.5	61.8	62.0	62.3	Used defaults in LiST Model
ACTs within 24 hours of onset of fever	n/a	n/a	16.8	24.5	16.7	2007 DHS, 2009 MIS, 2011 MIS, 2013 DHS
Treatment for severe acute malnutrition	n/a	n/a	n/a	n/a	n/a	Data not available (0% coverage)
Treatment for moderate acute malnutrition	n/a	n/a	n/a	n/a	n/a	Data not available (0% coverage)
HIV - Cotrimoxazole	n/a	n/a	n/a	n/a	n/a	Used defaults in AIM
HIV - ART	n/a	n/a	n/a	n/a	n/a	Used defaults in AIM
Fertility						
Age and birth order	n/a	n/a	n/a	n/a	n/a	Used defaults in LiST
Birth intervals	n/a	n/a	n/a	n/a	n/a	Used defaults in LiST

A.2.4 LiST Model Outputs

Table A.2.4.1 Annual deaths prevented by ITN expansion, children 1-59 months, 2005-2013

	Malaria deaths 2005	Estimated deaths prevented (1-59 months)								
		2006	2007	2008	2009	2010	2011	2012	2013	Total
Lower	3,095	84	173	320	473	543	613	671	730	3,607
Middle		120	248	428	615	700	786	846	909	4,652
Upper		164	338	568	808	885	962	1,022	1,102	5,849

*Deaths prevented are relative to 2005 coverage levels.

Table A.2.4.2 Annual deaths prevented by IPTp among pregnant women, children 0-59 months, 2005-2013

	Malaria deaths 2005	Estimated deaths prevented (0-59 months)								
		2006	2007	2008	2009	2010	2011	2012	2013	Total
Lower	3,095	12	24	37	51	54	56	58	60	352
Middle		13	27	42	58	62	67	66	65	400
Upper		15	31	47	65	69	73	72	70	442

*Deaths prevented are relative to 2005 coverage levels.

Table A.2.4.3. Annual deaths prevented in children by age and malaria intervention, 2006-2013

Intervention	2006	2007	2008	2009	2010	2011	2012	2013
Children under one month of age								
IPTp	12	24	37	51	54	58	57	57
ACTs	na							
Children 1-59 months of age								
IPTp	1	3	5	7	8	9	9	9
ACTs	0	0	0	0	128	252	123	-5

Annex 3: Data Tables with Values, 95% Confidence Limits and Sample Sizes

A.3.1 Population-Based Survey Data Tables (Table A.3.1.1-Table A.3.1.20)

Table A.3.1.1: Household possession of insecticide-treated nets

Percentage of households with at least one insecticide-treated net (ITN)* by background characteristics and survey year, Liberia

Background characteristic	DHS 2007*					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2007-2013 (95% CI)	
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n		
Total (National)	30.4	27.8	33.3	1.4	6,824	47.2	43.5	51.0	1.9	4,162	49.7	46.1	53.3	1.8	4,162	54.6	51.4	57.8	1.6	9,333	24.2	
Residence																						
<i>Urban</i>	31.3	27.6	35.2	1.9	2,486	42.0	37.1	47.1	2.6	1,940	52.2	47.2	57.1	2.5	2,058	49.7	45	54.4	2.4	5,289	18.4	
<i>Rural</i>	29.9	26.3	33.9	1.9	4,338	51.8	45.8	57.7	3.0	2,222	47.2	42.0	52.5	2.7	2,104	61.1	57.7	64.4	1.7	4,044	31.2	
Region																						
<i>Monrovia</i>	31.5	27.0	36.3	2.4	1,889	33.8	28	40.2	3.1	1,078	52.8	45.9	59.5	3.5	1,285	39.5	34.5	44.7	2.6	3,060	8.0	
<i>North Western</i>	9.4	7.0	12.5	1.4	694	62.9	50.2	74.1	6.1	382	43.8	36.9	51	3.6	377	69.3	63.9	74.3	2.6	909	59.9	
<i>South Central</i>	26.5	22.0	31.5	2.4	1,024	31.6	26	37.8	3	810	36.1	30.7	42	2.9	760	47.5	42.9	52.1	2.3	4,645	21.0	
<i>South Eastern A</i>	28.1	22.0	35.0	3.3	466	60.6	52.3	68.3	4.1	305	61.2	51.9	69.9	4.6	307	45.2	40.4	50.1	2.5	573	17.1	
<i>South Eastern B</i>	38.8	30.5	47.8	4.4	424	66	58	73.2	3.9	231	64.2	57.6	70.3	3.2	246	45.6	40.3	51	2.7	571	6.8	
<i>North Central</i>	36.6	30.9	42.7	3.0	2,326	56.6	46.7	66	4.9	1,355	50.9	42.5	59.2	4.3	1,188	66.1	60.8	71	2.6	2,634	29.5	
Wealth quintiles																						
<i>Lowest</i>	21.8	17.6	26.5	2.3	1,466	48.0	38.9	57.2	4.7	903	40.6	35.1	46.4	2.9	886	53.1	49.3	56.9	1.9	2,008	31.3	
<i>Second</i>	27.4	22.6	32.7	2.6	1,412	54.5	47.0	61.8	3.8	860	53.4	46.2	60.4	3.6	851	64.2	60.4	67.8	1.9	1,785	36.8	
<i>Middle</i>	32.4	28.3	36.8	2.2	1,331	52.6	46.0	59.1	3.3	785	49.2	42.7	55.7	3.3	784	61.2	56.5	65.7	2.3	1,738	28.8	
<i>Fourth</i>	30.1	25.7	34.8	2.3	1,357	42.9	36.7	49.4	3.2	811	52.3	46.5	58.0	2.9	867	51.8	46.1	57.6	2.9	2,024	21.7	
<i>Highest</i>	42.4	37.5	47.4	2.5	1,258	37.7	31.3	44.7	3.4	803	53.5	46.8	60.1	3.4	774	43.4	37.7	49.3	3	1,777	1.0	
Household with child under five																						
<i>Yes</i>	34.9	31.7	38.3	1.7	4,145	50.3	46.1	54.5	2.1	2,893	53.3	49.5	57.1	1.9	1,764	58.6	55.2	61.9	1.7	5,356	23.7	
<i>No</i>	23.5	20.5	26.7	1.6	2,679	40.3	36.2	44.6	2.1	1,269	44.7	40.4	49.2	2.2	2,398	49.3	45.4	53.2	2	3,977	25.8	

Note: * DHS 2007 measured household ownership of any net, no information is available on household ownership of an ITN; n=Weighted number of households (denominator); An insecticide-treated net (ITN) is (1) a factory-treated net that does not require any further treatment (LLIN) or (2) a pretreated net obtained within the past 12 months or (3) a net that has been soaked with insecticide within the past 12 months.

Table A.3.1.2: Use of insecticide-treated nets by children under five years of age

Percentage of children under five years of age who slept under an insecticide-treated net* (ITN) the previous night by background characteristics and survey year, Liberia

Background characteristic	DHS 2007					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2009-2013 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total (National)	n/a					26.4	22.9	30.3	1.9	4,725	37.1	33.9	40.3	1.6	3,352	38.1	35.2	41.1	1.5	7,261	11.7
Age (in years)																					
<1	n/a					33.2	28.2	38.6	2.6	915	45.3	40.3	50.4	2.6	622	48.4	44.1	52.7	2.2	1,448	15.2
1	n/a					28.1	23.3	33.5	2.6	980	38.1	33.7	42.7	2.3	713	37.6	33.5	41.9	2.1	1,445	9.5
2	n/a					27.6	23.2	32.6	2.4	935	37.2	32.2	42.6	2.6	631	36.6	32.3	41.1	2.2	1,296	9.0
3	n/a					20.3	17.0	23.9	1.7	915	35.6	30.9	40.6	2.5	698	33.6	29.9	37.5	1.9	1,531	13.3
4	n/a					23.0	18.5	28.2	2.5	981	29.8	25.4	34.7	2.4	687	34.5	31.1	38.1	1.8	1,541	11.5
Sex																					
Male	n/a					25.8	22.2	29.8	1.9	2,413	36.7	33.3	40.1	1.7	1,719	38.7	35.5	42.1	1.7	3,767	12.9
Female	n/a					27.1	23.1	31.4	2.1	2,312	37.5	33.5	41.6	2.0	1,633	37.4	34.1	40.7	1.7	3,494	10.3
Mothers Education																					
None	n/a					31.5	27.1	36.1	2.3	1,801	34.1	29.6	38.8	2.3	1,096	40.4	35.5	45.5	2.6	1,333	8.9
Primary	n/a					29	24.4	34.1	2.5	1,040	39.2	33.2	45.5	3.1	703	36.1	30.3	42.2	3.0	918	7.1
Secondary +	n/a					25.9	20.5	32.2	3	666	41.8	35.8	48.0	3.1	494	38.6	32.1	45.4	3.4	872	12.7
Missing	n/a					17.1	12.8	22.5	2.5	1,211	36.5	32.1	41.2	2.3	1,060	37.7	34.6	40.9	1.6	4,138	20.6
Residence																					
Urban	n/a					24.0	19.4	29.3	2.5	1,796	40.2	35.1	45.5	2.6	1,377	36.7	32.1	41.4	2.4	3,617	12.7
Rural	n/a					27.9	23.0	33.4	2.6	2,930	34.8	30.9	39.0	2.1	1,974	39.5	35.8	43.2	1.9	3,645	11.6
Region																					
Monrovia	n/a					19.8	15.4	25.1	2.5	823	41.5	33.9	49.5	4	748	28.3	22.3	35.2	3.3	1,769	8.5
North Western	n/a					32.2	23.9	41.7	4.5	360	35.8	28.2	44.1	4	290	51.2	46	56.4	2.6	813	19.0
South Central	n/a					17	13.7	20.9	1.8	806	26	21.7	30.8	2.3	609	33.8	29.3	38.7	2.4	2,950	16.8
South Eastern A	n/a					35.4	26.2	45.8	5	416	44.8	37	52.9	4.1	317	27.5	23.2	32.2	2.3	516	-7.9
South Eastern B	n/a					36.3	27.4	46.4	4.9	237	41.6	35.1	48.4	3.4	250	23.1	18	29.2	2.9	546	-13.2
North Central	n/a					28.8	21.5	37.3	4	2,083	37.2	30.8	44.2	3.4	1,138	44.4	39.2	49.8	2.7	2,436	15.6
Wealth quintiles																					
Lowest	n/a					25.6	18.7	34.0	3.9	1,116	31.7	26.6	37.2	2.7	863	33.8	29.9	38.1	2.1	1,752	8.2
Second	n/a					34.3	27.1	42.4	3.9	1,080	41.7	35.4	48.3	3.3	793	42.0	37.6	46.6	2.3	1,626	7.7
Middle	n/a					24.5	18.3	32.1	3.5	985	36.0	29.6	42.9	3.4	652	46.7	41.7	51.8	2.6	1,514	22.2
Fourth	n/a					22.6	16.6	30.1	3.4	900	41.8	35.1	48.8	3.5	574	37.0	31.5	42.9	2.9	1,330	14.4
Highest	n/a					22.8	17.5	29.1	2.9	645	34.8	27.4	43.0	4.0	470	27.8	21.4	35.3	3.5	1,040	5.0

Note: n=Weighted number of children (denominator); An insecticide-treated net (ITN) is (1) a factory-treated net that does not require any further treatment (LLIN) or (2) a pretreated net obtained within the past 12 months or (3) a net that has been soaked with insecticide within the past 12 months.

Source: MIS 2009, MIS 2011, DHS 2013

Table A.3.1.3: Household vector control measures

Percentage of households with indoor residual spraying† (IRS) in the last 12 months, by background characteristics and survey year, Liberia

Background characteristic	DHS 2007					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2011-2013 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total (National)	n/a					n/a					8.6	5.8	12.5	1.7	4,162	10.7	7.9	14.3	1.6	9,333	2.1
Residence																					
Urban	n/a					n/a					4.9	2.9	8.3	1.3	2,058	8.2	5.2	12.7	1.9	5,289	3.3
Rural	n/a					n/a					12.1	7	20	3.2	2,104	13.9	9.5	19.9	2.6	4,044	1.8
Region																					
Monrovia	n/a					n/a					1.4	0.7	2.8	0.5	1,285	1.8	0.9	3.3	0.6	3,060	0.4
North Western	n/a					n/a					0	0	0.4	0.1	377	0.1	0	0.5	0.1	909	0.1
South Central	n/a					n/a					32.6	19.3	49.6	7.9	760	12.8	8.7	18.5	2.5	4,645	-19.8
South Eastern A	n/a					n/a					0.5	0.2	1.7	0.3	307	0.6	0.4	1.1	0.2	573	0.1
South Eastern B	n/a					n/a					2.9	1.2	7	1.3	246	0.2	0.1	0.5	0.1	571	-2.7
North Central	n/a					n/a					6.8	2.8	15.5	2.9	1,188	15	8.9	24.2	3.8	2,634	8.2
Wealth quintiles																					
Lowest	n/a					n/a					13.8	7.2	24.7	4.3	886	16.9	11.7	23.6	3	2,008	3.1
Second	n/a					n/a					8.8	5.0	15.0	2.5	851	13.4	8.8	19.7	2.7	1,785	4.6
Middle	n/a					n/a					9.4	5.1	16.6	2.8	784	11.6	7.4	17.7	2.6	1,738	2.2
Fourth	n/a					n/a					5.6	3.1	9.9	1.6	867	6.5	4	10.6	1.6	2,024	0.9
Highest	n/a					n/a					4.8	2.9	7.9	1.2	774	4.9	3.2	7.4	1	1,777	0.1
Household with child under five																					
Yes	n/a					n/a					8.7	5.9	12.6	1.7	2398	10.8	7.9	14.5	1.7	5356	2.1
No	n/a					n/a					8.4	5.3	12.9	1.9	1764	10.6	7.7	14.3	1.7	3977	2.2

Note: n=Weighted number of households (denominator); An insecticide-treated net (ITN) is (1) a factory-treated net that does not require any further treatment (LLIN) or (2) a pretreated net obtained within the past 12 months or (3) a net that has been soaked with insecticide within the past 12 months.

Source: MIS 2011, DHS 2013

Table A.3.1.4: Household vector control measures

Percentage of households with indoor residual spraying[†] (IRS) and percentage of households with at least one insecticide-treated net** (ITN) and/or IRS in the last 12 months, by background characteristics and survey year, Liberia

Background characteristic	DHS 2007					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2011-2013 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total (National)	n/a					n/a					54.2	50.1	58.2	2.1	4,162	58.8	55.3	62.1	1.7	9,333	4.6
Residence																					
<i>Urban</i>	n/a					n/a					54.5	49.6	59.3	2.5	2,058	53	48.1	57.9	2.5	5,289	-1.5
<i>Rural</i>	n/a					n/a					53.9	47.5	60.3	3.3	2,104	66.3	62.7	69.7	1.8	4,044	12.4
Region																					
<i>Monrovia</i>	n/a					n/a					53.2	46.4	60	3.5	1,285	40.5	35.8	45.4	2.4	3,060	-12.7
<i>North Western</i>	n/a					n/a					43.8	36.9	51	3.6	377	69.3	63.9	74.3	2.6	909	25.5
<i>South Central</i>	n/a					n/a					56.5	44.7	67.6	5.9	760	52.4	47.3	57.6	2.6	4,645	-4.1
<i>South Eastern A</i>	n/a					n/a					61.5	52.5	69.8	4.4	307	45.4	40.5	50.3	2.5	573	-16.1
<i>South Eastern B</i>	n/a					n/a					64.8	58.4	70.7	3.1	246	45.6	40.3	51	2.7	571	-19.2
<i>North Central</i>	n/a					n/a					53	44.1	61.6	4.5	1,188	72.1	66.8	76.8	2.5	2,634	19.1
Wealth quintiles																					
<i>Lowest</i>	n/a					n/a					50.4	42.4	58.4	4.1	886	60.5	56.3	64.6	2.1	2,008	10.1
<i>Second</i>	n/a					n/a					57.9	50.3	65.1	3.8	851	68.6	64.8	72.2	1.9	1,785	10.7
<i>Middle</i>	n/a					n/a					52.6	45.7	59.5	3.5	784	65.5	60.7	70	2.4	1,738	12.9
<i>Fourth</i>	n/a					n/a					54.5	48.5	60.4	3.0	867	54	47.9	60	3.1	2,024	-0.5
<i>Highest</i>	n/a					n/a					55.7	49.0	62.1	3.3	774	45.8	40.2	51.5	2.9	1,777	-9.9
Household with child under five																					
<i>Yes</i>	n/a					n/a					57.6	53.3	61.7	2.1	2398.0	62.5	59	65.9	1.8	5356	4.9
<i>No</i>	n/a					n/a					49.6	44.8	54.5	2.5	1764.0	53.7	49.5	57.9	2.1	3977	4.1

Note: n=Weighted number of households (denominator); An insecticide-treated net (ITN) is (1) a factory-treated net that does not require any further treatment (LLIN) or (2) a pretreated net obtained within the past 12 months or (3) a net that has been soaked with insecticide within the past 12 months.

Source: MIS 2011, DHS 2013

Table A.3.1.5: Use of insecticide-treated nets by pregnant women

Percentage of pregnant women who slept under an insecticide-treated net** (ITN) the previous night by background characteristics, Liberia

Background characteristic	DHS 2007					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2009-2013 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total	n/a					32.9	26.9	39.5	3.2	471	39.0	33.0	45.4	3.2	363	37.1	32.0	42.5	2.7	816	4.2
Residence																					
Urban	n/a					29.3	21.3	38.8	4.5	204	39.3	29.3	50.3	5.4	160	34.0	26.5	42.4	4.1	422	4.7
Rural	n/a					35.6	26.9	45.5	4.8	268	38.8	31.6	46.6	3.8	203	40.3	34.2	46.9	3.2	394	4.7
Region																					
Monrovia	n/a					16.9	9.5	28.1	4.6	96	39.5	25.7	55.2	7.7	101	30.5	19.9	43.6	6.1	235	13.6
North Western	n/a					44.8	30.5	60.0	7.7	36	36.2	23.7	50.9	7.0	29	45.2	35.2	55.7	5.3	93	0.4
South Central	n/a					18.4	9.3	33.2	6.0	86	26.0	15.9	39.4	6.0	72	35.2	26.8	44.7	4.6	350	16.8
South Eastern A	n/a					29.7	18.6	43.9	6.5	46	54.7	43.1	65.8	5.9	25	30.6	21.0	42.3	5.5	48	0.9
South Eastern B	n/a					34.9	18.8	55.3	9.6	21	50.3	38.2	62.5	6.3	24	24.1	14.8	36.6	5.6	55	-10.8
North Central	n/a					46.1	35.1	57.6	5.8	186	41.9	31.1	53.5	5.8	112	40.5	31.5	50.2	4.8	270	-5.6
Wealth Quintile																					
Lowest	n/a					29.9	18.3	44.9	6.9	113	37.6	27.5	49.0	5.5	85	32.0	25.2	39.7	3.7	173	2.1
Second	n/a					35.5	24.1	48.7	6.3	99	47.2	37.8	56.8	4.9	87	45.9	37.7	54.4	4.3	185	10.4
Middle	n/a					46.9	34.5	59.7	6.5	98	39.3	27.3	52.7	6.6	71	38.7	29.8	48.4	4.8	184	-8.2
Fourth	n/a					27.5	18.0	39.7	5.5	101	39.5	24.8	56.5	8.3	63	52.1	36.3	67.5	8.2	128	24.6
Highest	n/a					20.5	10.6	35.9	6.4	60	27.7	17.0	41.9	6.4	58	16.5	7.3	33.3	6.5	146	-4.0
Education																					
None	n/a					38.7	29.6	48.4	4.8	219	38.8	30.5	47.9	4.5	130	38.4	30.4	47.2	4.3	304	-0.3
Primary	n/a					29.0	20.8	38.4	4.5	156	37.2	26.8	48.9	5.7	126	35.7	28.5	43.4	3.8	290	6.7
Secondary +	n/a					24.8	13.7	39.9	6.7	92	41.5	30.8	52.9	5.7	108	37.0	28.4	46.5	4.7	222	12.2
Age (In years)																					
15-19	n/a					28.6	17.4	43.2	6.6	79	30.2	19.1	44.1	6.4	80	22.2	15.5	30.8	3.9	178	-6.4
20-24	n/a					23.0	14.9	33.7	4.8	123	31.2	21.6	42.6	5.4	105	36.9	27.8	47.1	4.9	175	13.9
25-29	n/a					34.1	24.4	45.4	5.4	127	44.1	32.0	56.9	6.4	92	44.5	35.5	53.9	4.7	214	10.4
30-34	n/a					42.4	27.1	59.3	8.4	60	43.8	28.4	60.6	8.5	44	32.0	23.5	41.8	4.7	123	-10.4
35-39	n/a					44.6	31.6	58.3	6.9	62	48.6	28.1	69.6	11.2	31	47.0	34.1	60.3	6.8	91	2.4
40-44	n/a					*	*	*	*	18	*	*	*	*	12	61.1	39.9	78.8	10.4	33	n/a
45-49	n/a					*	*	*	*	3	*	*	*	*	1	*	*	*	*	3	n/a

Note: n=Weighted number of women (denominator); An insecticide-treated net (ITN) is (1) a factory-treated net that does not require any further treatment (LLIN) or (2) a pretreated net obtained within the past 12 months or (3) a net that has been soaked with insecticide within the past 12 months; * denotes less than 25 cases.

Source: MIS 2009, MIS 2011, DHS 2013

Table A.3.1.6: Use of Intermittent preventive treatment during pregnancy

Percentage of women age 15-49 with a live birth in the two years preceding the survey who received IPTp during ANC visits during their last pregnancy, by background characteristics and survey year, Liberia

Background characteristic	DHS 2007					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2009-2013 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total	n/a					45.1	40.2	50.0	2.5	1,573	49.6	45.4	53.9	2.1	1,230	47.6	44.4	50.8	1.6	2,650	2.5
Residence																					
<i>Urban</i>	n/a					47.1	38.5	55.8	4.4	585	44.3	39.1	49.6	2.7	540	49.9	45.4	54.5	2.3	1351	2.8
<i>Rural</i>	n/a					43.9	38.2	49.7	2.9	988	53.8	47.3	60.3	3.3	689	45.2	40.8	49.7	2.3	1,299	1.3
Region																					
<i>Monrovia</i>	n/a					42.6	33.1	52.7	5	285	40.1	32.7	48	3.9	312	49.1	42.1	56.1	3.6	667	6.5
<i>North Western</i>	n/a					60.1	42.7	75.3	8.5	127	50.8	40.2	61.3	5.4	112	50.9	40.8	61	5.2	288	-9.2
<i>South Central</i>	n/a					45.3	38.2	52.6	3.7	313	38.8	30	48.4	4.7	207	46.9	41.8	52.1	2.6	1109	1.6
<i>South Eastern A</i>	n/a					49.5	38.7	60.3	5.5	143	55.5	47.1	63.5	4.2	120	35.9	30.7	41.5	2.7	196	-13.6
<i>South Eastern B</i>						22	14.7	31.7	4.3	85	61.8	53.1	69.8	4.3	79	41.2	33.5	49.4	4.1	197	19.2
<i>North Central</i>						45.1	35.4	55.2	5.1	619	58.3	48.5	67.4	4.9	400	51.5	45.7	57.3	3	860	6.4
Wealth Quintile																					
<i>Lowest</i>	n/a					38.6	29.5	48.5	4.9	390	54.3	44.2	64.0	5.1	304	42.1	37.8	46.5	2.2	636	3.5
<i>Second</i>	n/a					42.5	36.8	48.3	2.9	337	55.8	48.6	62.8	3.6	282	47.7	41.7	53.8	3.1	567	5.2
<i>Middle</i>	n/a					49.7	41.3	58.1	4.3	330	49.6	42.2	57.0	3.8	234	52.8	46.7	58.8	3.1	551	3.1
<i>Fourth</i>	n/a					48.2	38.1	58.5	5.2	303	40.2	32.1	48.8	4.2	227	46.5	39.6	53.6	3.6	509	-1.7
<i>Highest</i>	n/a					49.4	37.9	60.9	5.9	212	44.2	34.2	54.8	5.3	183	50.8	41.7	59.8	4.7	386	1.4
Education																					
<i>None</i>	n/a					45.7	39.1	52.3	3.4	738	45.1	38.4	51.9	3.4	498	45.6	41.1	50.2	2.3	1000	-0.1
<i>Primary</i>	n/a					42.1	37.0	47.4	2.6	513	54.4	48.9	59.8	2.8	399	49.6	45.1	54.1	2.3	858	7.5
<i>Secondary +</i>	n/a					48.3	39.0	57.8	4.8	322	50.8	44.1	57.4	3.4	333	48.0	42.9	53.2	2.6	792	-0.3
Age (In years)																					
<i>15-19</i>	n/a					39.8	30.8	49.6	4.8	218	51.5	42.7	60.2	4.5	157	41.7	34.9	48.9	3.6	422	1.9
<i>20-24</i>	n/a					49.1	40.5	57.8	4.4	464	49.1	42.1	56.1	3.6	373	46.6	41.1	52.2	2.8	725	-2.5
<i>25-29</i>	n/a					43.8	37.1	50.8	3.5	351	52.6	45.2	59.8	3.7	301	50.4	45.1	55.8	2.7	627	6.6
<i>30-34</i>	n/a					43.5	34.1	53.4	5.0	233	46.7	37.6	55.9	4.7	202	48.4	42.2	54.6	3.2	425	4.9
<i>35-39</i>	n/a					47.0	39.1	55.1	4.1	190	55.0	43.8	65.8	5.7	117	51.2	43.4	59.0	4.0	325	4.2
<i>40-44</i>	n/a					41.9	31.2	53.5	5.7	98	39.0	27.5	51.9	6.3	70	48.5	36.8	60.4	6.1	105	6.6
<i>45-49</i>	n/a					*	*	*	*	19	*	*	*	*	11	*	*	*	*	22	n/a
Parity																					
<i>1</i>	n/a					39.1	31.4	47.3	4.0	337	48.8	43.2	54.4	2.8	484	44.5	38.6	50.5	3.0	668	5.4
<i>2+</i>	n/a					46.7	41.9	51.5	2.4	1,236	50.2	45.1	55.3	2.6	746	48.7	45.3	52.0	1.7	1,982	2.0

Note: n=Weighted number of women (denominator); ¹ IPTp: Intermittent Preventive Treatment during pregnancy is preventive treatment with two or more doses of SP/Fansidar; * denotes fewer than 25 cases.

Source: MIS 2009, MIS 2011, DHS 2013

Table A.3.1.7: Use of insecticide-treated nets by general population

Percentage of individuals who slept under an insecticide-treated net** (ITN) the previous night by background characteristics, Liberia

Background characteristic	DHS 2007					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2009-2013 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total (National)	n/a					22.8	20.2	25.6	1.4	22,559	32.1	29.4	34.9	1.4	18,265	31.7	29.5	34.1	1.2	45,042	8.9
Sex																					
Male	n/a					21.4	18.9	24.1	1.3	11,090	30.9	28.2	33.7	1.4	9,037	30.7	28.4	33.1	1.2	22,317	9.3
Female	n/a					24.2	21.4	27.2	1.5	11,470	33.3	30.5	36.2	1.4	9,228	32.7	30.3	35.3	1.3	22,725	8.5
Residence																					
Urban	n/a					19.9	16.9	23.3	1.6	10,376	34.2	30.1	38.5	2.1	8,935	28.1	25	31.4	1.6	25,438	8.2
Rural	n/a					25.3	21	30	2.3	12,183	30.1	26.8	33.7	1.8	9,330	36.4	33.4	39.6	1.6	19,604	11.1
Region																					
Monrovia	n/a					14.5	11.9	17.5	1.4	5,431	34.8	29.4	40.6	2.8	5,351	21.3	17.3	25.9	2.2	13,960	6.8
North Western	n/a					34	26.9	41.9	3.8	1,586	28.7	23.8	34.3	2.6	1,451	43.1	38.8	47.6	2.2	4,388	9.1
South Central	n/a					12.9	10.4	15.8	1.4	4,221	22.3	19	26	1.8	3,554	26.2	22.8	29.8	1.8	21,487	13.3
South Eastern A	n/a					30	22.9	38.3	3.9	1,679	40.8	35.1	46.9	3	1,440	24.5	21	28.4	1.9	2,820	-5.5
South Eastern B	n/a					31	24.9	37.8	3.3	1,316	36.3	30.7	42.4	3	1,193	21.1	17.1	25.7	2.2	3,144	-9.9
North Central	n/a					28.4	22	35.8	3.5	8,326	33.6	27.5	40.3	3.2	5,276	41.1	36.9	45.5	2.2	13,203	12.7
Wealth quintiles																					
Lowest	n/a					22.4	16.8	29.4	3.2	4,488	27.3	23.6	31.4	2	3,650	31.1	28	34.3	1.6	8,909	8.7
Second	n/a					30.1	25	35.7	2.7	4,500	34.8	30	40.1	2.6	3,615	38.5	35.1	42	1.8	8,923	8.4
Middle	n/a					24.6	20	29.9	2.5	4,552	32.2	26.8	38.1	2.9	3,637	38.1	35.2	41.1	1.5	8,962	13.5
Fourth	n/a					21.2	17	26.2	2.3	4,499	35.8	30.8	41.1	2.6	3,666	29.6	25.9	33.7	2	9,115	8.4
Highest	n/a					15.7	12.7	19.2	1.6	4,521	30.4	25.6	35.6	2.5	3,697	21.7	17.8	26.1	2.1	9,133	6

Note: n=Weighted number of households (denominator); An insecticide-treated net (ITN) is (1) a factory-treated net that does not require any further treatment (LLIN) or (2) a pretreated net obtained within the past 12 months or (3) a net that has been soaked with insecticide within the past 12 months.

Source: MIS 2009, MIS 2011, DHS 2013

Table A.3.1.8: Universal Access of ITNs

Percentage of de facto household population who could sleep under an insecticide-treated net* (ITN) if each ITN in the household is used by two people, by background characteristics, Liberia

Background characteristic	DHS 2007*					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2007-2013 (95% CI)	
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n		
Total (National)	16.2	14.6	17.9	0.8	33,456	24.7	21.9	27.7	1.5	22,559	29.9	27.5	32.5	1.3	18,265	36.2	33.7	38.7	1.3	45,042	20	
Residence																						
<i>Urban</i>	16.7	14.2	19.6	1.4	12575	21.3	18.0	24.9	1.8	10,376	32.7	29.2	36.4	1.8	8,935	32.3	28.8	36	1.8	25,438	15.6	
<i>Rural</i>	15.9	13.9	18.1	1	20881	27.7	23.2	32.6	2.4	12,183	27.3	24.0	30.9	1.7	9,330	41.2	38.2	44.3	1.6	19,604	25.3	
Region																						
<i>Monrovia</i>	17.3	14.2	21.1	1.7	9438	16.2	13.4	19.3	1.5	5,431	33.5	28.5	38.8	2.6	5,351	23.8	20.5	27.5	1.8	4,453	6.5	
<i>North</i>																						
<i>Western</i>	5.9	4.1	8.3	1	2663	39.6	31.6	48.3	4.3	1,586	25.2	21.1	29.8	2.2	1,451	47.3	42.6	52	2.4	4,388	41.4	
<i>South Central</i>	13.5	11	16.5	1.4	4841	14.7	12.1	17.8	1.4	4,221	20.6	17.5	24	1.6	3,554	30.5	27.1	34.2	1.8	21,487	17	
<i>South Eastern</i>	15.3	11.4	20.1	2.2	2086	30.5	23.8	38.1	3.6	1,679	36.7	31.7	41.9	2.6	1,440	26.8	23.5	30.3	1.7	2,820	11.5	
<i>South Eastern</i>	20.7	15.8	26.6	2.7	2308	38.3	31.6	45.4	3.5	1,316	39	33.7	44.5	2.8	1,193	26.2	22.1	30.8	2.2	3,144	5.5	
<i>North Central</i>	18	15.1	21.3	1.6	12121	29.2	22.2	37.3	3.9	8,326	30.1	24.5	36.5	3	5,276	46.1	42	50.3	2.1	13,203	28.1	
Wealth quintiles																						
<i>Lowest</i>	11.1	9	13.7	1.2	6554	25.4	19.3	32.7	3.4	4,488	23.7	20.5	27.3	1.7	3,650	34.9	31.8	38.1	1.6	2,008	23.8	
<i>Second</i>	14	11.3	17.1	1.5	6686	30.9	25.6	36.6	2.8	4,500	31.4	27	36.3	2.4	3,615	42.9	39.6	46.4	1.7	1,785	28.9	
<i>Middle</i>	17.6	15.3	20.1	1.2	6713	27.2	22.6	32.4	2.5	4,552	28.9	24.4	34	2.4	3,637	40.8	37.5	44.2	1.7	1,738	23.2	
<i>Fourth</i>	15.4	13.1	18	1.2	6748	21.3	17.1	26.2	2.3	4,499	32	27.8	36.5	2.2	3,666	33.7	29.9	37.6	1.9	2,024	18.3	
<i>Highest</i>	22.8	19.1	26.9	2	6755	18.7	15.4	22.6	1.8	4,521	33.6	28.8	38.7	2.5	3,697	28.8	24.3	33.8	2.4	1,777	6	
<p>Note: *The 2007 DHS is calculated based on household ownership of bednets, and not ITNs; n=Weighted number of households (denominator); An insecticide-treated net (ITN) is (1) a factory-treated net that does not require any further treatment (LLIN) or (2) a pretreated net obtained within the past 12 months or (3) a net that has been</p> <p>Source: DHS 2007, MIS 2009, MIS 2011, DHS 2013</p>																						

Table A.3.1.9: Antimalarial treatment received by children with fever

Among children under five years of age with fever in the two weeks preceding the survey, the percentage who received any antimalarial treatment, by background characteristics, Liberia

Background characteristic	DHS 2007					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2007-2013 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total (National)	58.8	54.3	63.2	2.3	1,577	67.2	63.2	70.9	2.0	1,610	57.1	53.4	60.7	1.9	1,416	55.7	52.3	59.1	1.7	1,728	-3.1
Age (in years)																					
<1	52.4	44.7	59.9	3.9	327	63.5	55.8	70.6	3.8	316	45.8	38.5	53.2	3.8	278	42.4	36.4	48.6	3.1	391	-10.0
1	59.1	52.2	65.6	3.4	349	65.1	58.7	70.9	3.1	401	54.3	47.8	60.7	3.3	347	60.3	54.3	66.0	3.0	429	1.2
2	64.5	57.2	71.2	3.6	376	70.5	64.0	76.3	3.1	342	59.4	52.7	65.7	3.3	301	53.8	47.1	60.4	3.4	309	-10.7
3	53.6	46.0	61.1	3.8	295	70.0	63.6	75.7	3.1	287	61.5	54.1	68.4	3.6	241	61.8	54.3	68.9	3.7	327	8.2
4	64.9	56.3	72.6	4.2	230	67.3	59.6	74.2	3.7	265	66.5	59.5	72.9	3.4	249	62.4	54.4	69.7	3.9	273	-2.5
Sex																					
Male	60.6	55.4	65.6	2.6	814	69.0	63.8	73.8	2.5	834	57.5	52.5	62.4	2.5	744	56.9	52.3	61.4	2.3	938	-3.7
Female	56.9	51.5	62.2	2.7	763	65.2	60.0	70.0	2.5	777	56.6	51.8	61.2	2.4	672	54.3	49.8	58.7	2.3	790	-2.6
Residence																					
Urban	60.6	53.8	66.9	3.3	450	72.2	66.9	76.9	2.5	659	59.3	53.7	64.7	2.8	583	57.3	50.9	63.5	3.2	793	-3.3
Rural	58.1	52.3	63.7	2.9	1,127	63.7	57.8	69.2	2.9	951	55.5	50.5	60.5	2.5	833	54.4	51.0	57.7	1.7	935	-3.7
Region																					
Monrovia	63.6	54.5	71.9	4.5	282	74.4	65.6	81.6	4.1	337	62.2	52.8	70.7	4.6	280	51.7	41.1	62.1	5.4	396	-11.9
North Western	43.5	30.0	58.1	7.3	151	55.4	43.7	66.6	5.9	115	57.0	49.0	64.7	4.0	139	63.9	57.0	70.3	3.4	240	20.4
South Central	51.3	43.6	59.0	3.9	298	57.3	48.5	65.6	4.4	297	54.5	45.2	63.6	4.7	290	52.8	46.0	59.5	3.5	706	1.5
South Eastern A	35.9	28.4	44.2	4.0	100	46.5	38.7	54.5	4.0	151	47.4	37.5	57.6	5.1	133	46.8	39.7	54.1	3.7	144	10.9
South Eastern B	54.7	46.4	62.8	4.2	158	55.6	45.6	65.1	5.0	65	56.7	48.8	64.3	4.0	103	53.2	46.9	59.4	3.2	171	-1.5
North Central	69.2	60.9	76.4	4.0	589	76.0	68.0	82.5	3.7	645	58.5	51.6	65.1	3.4	471	59.5	54.9	64.0	2.3	467	-9.7
Wealth Quintile																					
Lowest	51.0	42.7	59.2	4.2	309	54.3	44.2	64.1	5.1	365	53.0	45.8	60.1	3.6	355	51.8	46.9	56.6	2.5	460	0.8
Second	54.3	45.6	62.6	4.4	393	65.5	60.0	70.6	2.7	375	53.7	47.0	60.2	3.4	366	59.1	54.1	64.0	2.5	397	4.8
Middle	64.1	55.6	71.9	4.2	336	70.0	61.6	77.3	4.0	316	60.7	52.7	68.1	3.9	281	56.0	50.0	61.7	3.0	345	-8.1
Fourth	63.6	56.5	70.2	3.5	339	76.9	69.6	82.9	3.4	314	58.7	50.2	66.7	4.2	251	55.6	45.8	65.0	4.9	306	-8.0
Highest	62.9	54.3	70.7	4.2	200	72.8	63.0	80.8	4.5	240	65.0	52.8	75.5	5.8	162	57.5	43.3	70.6	7.1	220	-5.4
Mother's Education																					
None	56.6	50.6	62.5	3.1	719	65.2	60.1	70.0	2.5	780	51.5	46.4	56.6	2.6	652	53.2	49.0	57.3	2.1	670	-3.4
Primary	59.3	53.1	65.2	3.1	574	66.0	59.2	72.2	3.3	502	58.5	52.6	64.1	2.9	446	58.2	53.2	63.0	2.5	540	-1.1
Secondary +	63.2	56.0	69.8	3.5	282	73.6	66.3	79.8	3.4	328	66.6	59.9	72.6	3.2	317	56.4	49.9	62.8	3.3	518	-6.8

Note: n=Weighted number of children (denominator)

Source: DHS 2007, MIS 2009, MIS 2011, DHS 2013

Table A.3.1.10: First-line antimalarial treatment received by children with fever

Among children under five years of age with fever in the two weeks preceding the survey, the percentage who received treatment according to national policy (first-line treatment), by background characteristics, Liberia

Background characteristic	DHS 2007					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2007-2013 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total (National)	13.4	10.7	16.6	1.5	1,577	29.9	25.8	34.4	2.2	1,610	39.7	35.8	43.8	2.0	1,416	23.9	20.3	27.8	1.9	1,728	10.5
Age (in years)																					
<1	9.8	6.2	15.3	2.3	327	20.8	15.6	27.2	2.9	316	28.0	21.2	36.0	3.8	278	14.7	11.3	18.8	1.9	391	4.9
1	13.0	8.7	19.2	2.6	349	27.1	21.5	33.4	3.0	401	34.0	27.4	41.3	3.6	347	23.4	18.5	29.1	2.7	429	10.4
2	16.7	12.2	22.5	2.6	376	34.8	27.9	42.4	3.7	342	44.0	37.6	50.5	3.3	301	24.0	18.4	30.6	3.1	309	7.3
3	10.8	6.6	17.0	2.6	295	36.0	28.3	44.6	4.2	287	46.6	38.8	54.6	4.0	241	30.3	24.1	37.4	3.4	327	19.5
4	16.6	10.6	25.2	3.7	230	32.2	25.8	39.5	3.5	265	48.9	41.6	56.3	3.7	249	30.1	22.5	39.0	4.2	273	13.5
Sex																					
Male	11.5	8.9	14.7	1.5	814	32.3	27.1	38.0	2.7	834	40.6	35.8	45.5	2.5	744	25.9	21.5	30.8	2.4	938	14.4
Female	15.4	11.5	20.2	2.2	763	27.3	22.7	32.6	2.5	777	38.8	33.5	44.3	2.7	672	21.5	17.9	25.7	2.0	790	6.1
Residence																					
Urban	14.6	11.0	19.0	2.0	450	25.8	21.4	30.6	2.3	659	35.8	29.8	42.3	3.2	583	20.6	15.7	26.7	2.8	793	6.0
Rural	12.9	9.5	17.2	1.9	1,127	32.8	26.6	39.6	3.3	951	42.4	37.4	47.6	2.6	833	26.7	22.0	31.8	2.5	935	13.8
Region																					
Monrovia	13.1	8.4	19.9	2.9	282	16.8	11.9	23.3	2.9	337	29.6	21.1	39.8	4.8	280	15.7	9.2	25.7	4.1	396	2.6
North Western	7.9	4.0	15.3	2.7	151	38.0	26.0	51.6	6.6	115	41.5	31.4	52.5	5.4	139	41.1	30.0	53.2	6.0	240	33.2
South Central	14.1	8.8	21.9	3.3	298	33.6	24.2	44.5	5.2	297	39.9	30.1	50.6	5.2	290	16.8	12.3	22.7	2.6	706	2.7
South Eastern A	11.1	7.4	16.4	2.2	100	26.3	19.0	35.1	4.1	151	36.8	28.9	45.5	4.2	133	23.5	17.6	30.7	3.3	144	12.4
South Eastern B	4.1	2.4	6.8	1.1	158	21.1	12.6	33.1	5.2	65	38.5	27.8	50.5	5.9	103	30.1	21.0	41.0	5.1	171	26.0
North Central	17.4	12.0	24.5	3.2	589	35.4	27.5	44.1	4.2	645	46.1	39.5	52.9	3.4	471	23.6	18.7	29.3	2.7	467	6.2
Wealth Quintile																					
Lowest	11.5	7.1	18.2	2.8	309	30.1	23.2	38.2	3.8	365	41.9	35.2	48.9	3.5	355	25.7	21.2	30.8	2.4	460	14.2
Second	7.7	4.3	13.3	2.2	393	33.5	27.0	40.6	3.5	375	40.2	34.2	46.4	3.1	366	28.1	21.8	35.5	3.5	397	20.4
Middle	19.0	13.3	26.4	3.3	336	35.8	25.2	48.0	5.9	316	43.5	33.8	53.7	5.1	281	23.8	17.4	31.7	3.6	345	4.8
Fourth	19.2	14.1	25.7	2.9	339	28.6	21.2	37.3	4.1	314	35.8	28.1	44.2	4.1	251	18.3	11.7	27.3	3.9	306	-0.9
Highest	8.0	4.7	13.3	2.1	200	18.0	12.5	25.3	3.2	240	33.4	21.9	47.3	6.5	162	20.4	12.6	31.4	4.8	220	12.4
Mother's Education																					
None	13.3	9.5	18.3	2.2	719	31.5	26.5	37.1	2.7	780	39.2	33.7	44.9	2.9	652	24.0	19.5	29.2	2.5	670	10.7
Primary	15.4	11.5	20.4	2.3	574	30.5	23.3	38.8	3.9	502	40.8	35.2	46.7	2.9	446	27.4	22.0	33.5	2.9	540	12.0
Secondary +	9.3	6.1	13.9	1.9	282	25.2	19.7	31.7	3.0	328	39.3	31.7	47.5	4.0	317	20.1	15.5	25.6	2.6	518	10.8

Note: n=Weighted number of children (denominator)

Source: DHS 2007, MIS 2009, MIS 2011, DHS 2013

Table A.3.1.11: Timing of antimalarial treatment received by children with fever

Among children under five years of age with fever in the two weeks preceding the survey, the percentage who received antimalarial treatment according to national policy within 24 hours from onset of fever, by background characteristics, Liberia

Background characteristic	DHS 2007					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2009-2013 (95% CI)
	ASAQ					ASAQ					ASAQ					ASAQ					
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total (National)	n/a					16.8	13.3	21.0	1.9	1,610	24.5	20.7	28.7	2.0	1,416	16.7	14.2	19.5	1.4	1,728	-0.1
Age (in years)																					
<1	n/a					10.6	6.4	17.0	2.6	316	16.4	12.0	22.2	2.6	278	9.3	6.6	12.9	1.6	391	-1.3
1	n/a					15.1	10.8	20.7	2.5	401	21.7	15.9	28.8	3.3	347	17.2	13.3	22.0	2.2	429	2.1
2	n/a					21.8	15.4	29.9	3.6	342	26.4	20.0	34.1	3.6	301	14.4	10.5	19.4	2.3	309	-7.4
3	n/a					19.1	13.7	26.2	3.2	287	28.8	21.7	37.1	3.9	241	20.8	16.3	26.1	2.5	327	1.7
4	n/a					18.0	12.9	24.6	2.9	265	30.7	23.6	38.8	3.9	249	24.2	17.6	32.2	3.7	273	6.2
Sex																					
Male	n/a					18.2	13.6	23.9	2.6	834	25.2	20.4	30.7	2.6	744	18.2	14.8	22.2	1.9	938	0.0
Female	n/a					15.4	11.9	19.6	2.0	777	23.7	19.2	28.9	2.5	672	14.9	12.0	18.3	1.6	790	-0.5
Residence																					
Urban	n/a					15.5	11.3	21.0	2.5	659	17.9	13.0	24.2	2.8	583	14.9	11.0	20.0	2.3	793	-0.6
Rural	n/a					17.7	12.7	24.2	2.9	951	29.0	24.3	34.2	2.5	833	18.2	15.3	21.5	1.6	935	0.5
Region																					
Monrovia	n/a					8.8	5.7	13.3	1.9	337	13.5	7.6	23	3.8	280	10.7	5.7	19.3	3.3	396	1.9
North Western	n/a					29.9	19.9	42.4	5.8	115	27.2	20.6	34.9	3.7	139	23.9	16.3	33.7	4.4	240	-6.0
South Central	n/a					12.6	8.8	17.8	2.3	297	24.8	16.9	34.8	4.6	290	11.9	8.3	16.9	2.2	706	-0.7
South Eastern A	n/a					8.3	5.4	12.6	1.8	151	21.5	16.5	27.5	2.8	133	16.1	10.9	23.0	3.1	144	7.8
South Eastern B	n/a					8.8	4.9	15.3	2.6	65	27.1	18.4	37.9	5	103	22.8	15.4	32.4	4.3	171	14.0
North Central	n/a					23.5	16	33	4.3	645	30.2	22.4	39.4	4.3	471	18.2	14.2	23.0	2.2	467	-5.3
Wealth Quintile																					
Lowest	n/a					12.0	8.0	17.6	2.4	365	31.9	25.0	39.7	3.7	355	18.8	15.1	23.2	2.1	460	6.8
Second	n/a					21.3	15.5	28.6	3.3	375	27.5	22.3	33.4	2.8	366	17.8	14.0	22.4	2.1	397	-3.5
Middle	n/a					23.4	14.0	36.5	5.7	316	21.4	15.9	28.1	3.1	281	15.0	11.0	20.0	2.3	345	-8.4
Fourth	n/a					15.2	9.2	24.2	3.8	314	14.9	9.6	22.4	3.2	251	13.1	8.1	20.3	3.1	306	-2.1
Highest	n/a					10.7	6.8	16.6	2.4	240	21.5	12.6	34.1	5.4	162	18.0	10.9	28.2	4.4	220	7.3
Mother's Education																					
None	n/a					17.3	13.2	22.2	2.3	780	25.9	20.5	32.1	2.9	652	16.6	13.6	20.1	1.7	670	-0.7
Primary	n/a					17.0	10.9	25.7	3.7	502	23.5	19.0	28.7	2.5	446	18.5	14.4	23.5	2.3	540	1.5
Secondary +	n/a					15.5	11.4	20.6	2.3	328	22.8	16.2	31.1	3.8	317	14.9	11.0	19.9	2.3	518	-0.6

Note: n=Weighted number of children (denominator)

Source: DHS 2007, MIS 2009, MIS 2011, DHS 2013

Table A.3.1.12: Care-seeking in children with fever

Among children under five years of age with fever in the two weeks preceding the survey, the percentage who sought advice or treatment¹, by background characteristics, Liberia

Background characteristic	DHS 2007					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2007-2013 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total (National)	65.0	60.8	69.0	2.1	1,577	65.2	60.4	69.7	2.3	1,610	59.7	55.2	64.0	2.2	1,416	68.8	64.9	72.4	1.9	1,728	3.8
Age (in years)																					
<1	66.5	59.7	72.7	3.3	327	73.0	65.7	79.2	3.4	316	62.8	56.0	69.1	3.3	278	71.7	65.6	77.2	2.9	391	5.2
1	70.0	64.1	75.3	2.9	349	66.3	59.7	72.3	3.2	401	62.0	54.1	69.3	3.9	347	72.8	67.2	77.8	2.7	429	2.8
2	63.4	55.8	70.5	3.8	376	57.9	50.0	65.4	3.9	342	57.9	50.4	65.0	3.7	301	66.2	59.5	72.3	3.3	309	2.8
3	63.0	55.2	70.2	3.8	295	66.9	59.9	73.2	3.4	287	58.6	50.6	66.2	4.0	241	67.0	60.4	73.0	3.2	327	4.0
4	60.4	51.5	68.7	4.4	230	61.9	52.8	70.3	4.5	265	56.1	47.6	64.3	4.3	249	63.3	55.7	70.3	3.7	273	2.9
Sex																					
Male	67.1	62.2	71.6	2.4	814	66.3	60.8	71.5	2.7	834	58.2	52.2	63.9	3.0	744	69.9	65.2	74.2	2.3	938	2.8
Female	62.8	57.4	67.9	2.7	763	64.0	58.1	69.5	2.9	777	61.3	56.3	66.0	2.4	672	67.5	62.9	71.8	2.3	790	4.7
Residence																					
Urban	77.0	71.4	81.9	2.7	450	74.2	68.4	79.4	2.8	659	68.2	63.8	72.3	2.1	583	76.8	70.4	82.2	3.0	793	-0.2
Rural	60.2	54.8	65.3	2.7	1,127	59.0	51.8	65.7	3.6	951	53.7	46.7	60.5	3.5	833	62.0	57.8	66.0	2.1	935	1.8
Region																					
Monrovia	79.8	71.9	86.0	3.6	282	78.3	69.5	85.1	4.0	337	75.6	68.5	81.5	3.3	280	83.0	72.4	90.1	4.5	396	3.2
North Western	53.6	39.8	66.9	7.1	151	56.7	39.2	72.7	8.8	115	68.9	57.8	78.1	5.2	139	66.5	56.2	75.4	5.0	240	12.9
South Central	58.1	50.5	65.4	3.8	298	49.6	40.2	59.0	4.8	297	49.5	40.7	58.4	4.5	290	75.1	68.4	80.8	3.2	706	17.0
South Eastern A	47.7	37.8	57.9	5.2	100	48.5	37.8	59.4	5.6	151	50.3	39.4	61.2	5.6	133	63.3	57.0	69.1	3.1	144	15.6
South Eastern B	63.6	52.5	73.5	5.4	158	51.8	35.0	68.2	8.7	65	57.6	44.4	69.7	6.5	103	67.7	61.0	73.8	3.3	171	4.1
North Central	67.6	59.4	74.8	3.9	589	72.3	63.8	79.5	4.0	645	56.8	46.6	66.4	5.1	471	62.6	55.3	69.3	3.6	467	-5.0
Wealth Quintile																					
Lowest	46.3	37.0	55.9	4.9	309	57.0	46.8	66.8	5.1	365	47.3	38.1	56.7	4.7	355	58.0	53.1	62.8	2.5	460	11.7
Second	58.8	50.7	66.5	4.0	393	57.7	48.1	66.7	4.7	375	57.2	49.5	64.6	3.8	366	64.4	57.5	70.8	3.4	397	5.6
Middle	72.4	65.2	78.6	3.4	336	70.8	62.6	77.9	3.9	316	61.2	52.0	69.6	4.5	281	68.6	61.5	74.9	3.4	345	-3.8
Fourth	74.5	68.6	79.6	2.8	339	71.7	62.0	79.8	4.5	314	68.7	62.4	74.3	3.0	251	82.8	77.4	87.1	2.5	306	8.3
Highest	77.5	68.9	84.2	3.9	200	73.4	64.9	80.5	4.0	240	75.6	66.0	83.2	4.3	162	80.1	65.7	89.4	6.0	220	2.6
Mother's Education																					
None	57.1	51.4	62.7	2.9	719	62.1	55.5	68.2	3.2	780	53.7	47.4	59.9	3.2	652	64.2	59.0	69.2	2.6	670	7.1
Primary	68.9	62.5	74.6	3.1	574	64.0	56.6	70.8	3.6	502	57.8	52.2	63.2	2.8	446	68.4	63.4	72.9	2.4	540	-0.5
Secondary +	77.5	71.0	82.9	3.0	282	74.5	67.4	80.5	3.3	328	74.6	67.9	80.3	3.1	317	75.1	67.8	81.2	3.4	518	-2.4
Note: n=Weighted number of children (denominator); Appropriate provider includes public/private health professional or pharmacy, excludes shop and traditional healer																					
Source: DHS 2007, MIS 2009, MIS 2011, DHS 2013																					

Table A.3.1.13: Timely care-seeking in children with fever

Among children under five years of age with fever in the two weeks preceding the survey, the percentage for whom advice or treatment was sought from an appropriate health provider¹, by background characteristics, Liberia

Background characteristic	DHS 2007					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2007-2009 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total (National)	31.2	28.0	34.6	1.7	1,577	33.4	28.9	38.2	2.3	1,610	n/a					n/a					2.2
Age (in years)																					
<1	33.3	27.8	39.3	2.9	327	36.0	29.1	43.6	3.7	316	n/a					n/a					2.7
1	31.0	25.2	37.4	3.1	349	30.6	24.7	37.2	3.2	401	n/a					n/a					-0.4
2	29.7	24.3	35.8	2.9	376	33.7	27.4	40.7	3.4	342	n/a					n/a					4.0
3	29.6	23.1	37.1	3.6	295	33.8	26.8	41.6	3.8	287	n/a					n/a					4.2
4	33.0	25.9	40.9	3.8	230	33.6	25.0	43.5	4.7	265	n/a					n/a					0.6
Sex																					
Male	31.2	27.3	35.4	2.1	814	33.5	28.0	39.6	3.0	834	n/a					n/a					2.3
Female	31.2	26.4	36.4	2.6	763	33.2	28.2	38.7	2.7	777	n/a					n/a					2.0
Residence																					
Urban	41.4	34.9	48.2	3.4	450	39.0	32.7	45.8	3.3	659	n/a					n/a					-2.4
Rural	27.1	23.5	31.0	1.9	1,127	29.5	23.1	36.8	3.5	951	n/a					n/a					2.4
Region																					
Monrovia	44.9	35.3	54.9	5.0	282	40.1	31.6	49.3	4.5	337	n/a					n/a					-4.8
North Western	28.0	19.4	38.6	4.9	151	27.1	17.3	39.8	5.7	115	n/a					n/a					-0.9
South Central	25.2	19.8	31.6	3.0	298	18.1	13.3	24.0	2.7	297	n/a					n/a					-7.1
South Eastern A	22.4	16.4	29.9	3.4	100	15.8	11.3	21.8	2.6	151	n/a					n/a					-6.6
South Eastern B	32.8	24.8	42.0	4.4	158	23.0	13.2	37.1	6.1	65	n/a					n/a					-9.8
North Central	29.5	24.1	35.5	2.9	589	43.2	35.1	51.7	4.3	645	n/a					n/a					13.7
Wealth Quintile																					
Lowest	19.3	13.6	26.6	3.3	309	22.8	15.5	32.2	4.2	365	n/a					n/a					3.5
Second	21.8	16.0	29.0	3.3	393	34.1	26.2	43.1	4.3	375	n/a					n/a					12.3
Middle	36.2	30.7	42.2	2.9	336	39.8	31.9	48.2	4.2	316	n/a					n/a					3.6
Fourth	39.0	33.4	44.8	2.9	339	36.2	28.4	44.9	4.2	314	n/a					n/a					-2.8
Highest	46.3	35.6	57.3	5.6	200	36.3	26.4	47.4	5.4	240	n/a					n/a					-10.0
Mother's Education																					
None	25.2	20.8	30.1	2.4	719	31.1	25.4	37.3	3.0	780	n/a					n/a					5.9
Primary	33.4	28.7	38.6	2.5	574	32.4	25.7	39.9	3.6	502	n/a					n/a					-1.0
Secondary +	42.1	35.1	49.4	3.6	282	40.5	31.9	49.7	4.6	328	n/a					n/a					-1.6

Note: n=Weighted number of children (denominator); Appropriate provider includes public/private health professional or pharmacy, excludes shop and traditional healer

Source: DHS 2007, MIS 2009

Table A.3.1.14: Diagnostic tests in children with fever

Among children under five years of age with fever in the two weeks preceding the survey, the percentage who had a finger or heel stick, by background characteristics, Liberia

Background characteristic	DHS 2007					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2009-2013 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total (National)	n/a					24.0	20.7	27.6	1.7	1,573	33.3	29.0	37.8	2.2	1,416	41.9	38.2	45.8	1.9	1,728	17.9
Age (in years)																					
<1	n/a					21.9	15.5	30.2	3.7	311	31.2	24.5	38.7	3.6	278	41.3	35.8	47	2.9	391	19.4
1	n/a					24.0	19.3	29.3	2.5	392	34.8	28.0	42.3	3.6	347	46.5	40.1	53	3.3	429	22.5
2	n/a					23.3	17.4	30.5	3.3	330	30.5	24.3	37.5	3.3	301	36.6	29.1	44.7	4	309	13.3
3	n/a					24.2	18.1	31.5	3.4	279	34.9	27.0	43.6	4.2	241	38.5	31.6	45.8	3.6	327	14.3
4	n/a					27.2	20.7	34.8	3.6	261	35.3	27.3	44.2	4.3	249	45.9	38.5	53.6	3.9	273	18.7
Sex																					
Male	n/a					24.1	19.9	28.8	2.2	815	31.8	26.9	37.3	2.6	744	43	38.5	47.5	2.3	938	18.9
Female	n/a					23.9	20.0	28.4	2.1	757	34.9	29.8	40.3	2.7	672	40.8	36.2	45.5	2.4	790	16.9
Residence																					
Urban	n/a					29.1	24.0	34.9	2.8	642	37.9	33.3	42.8	2.4	583	47.1	41	53.3	3.1	793	18.0
Rural	n/a					20.5	16.2	25.5	2.3	931	30.0	23.7	37.2	3.4	833	37.6	33.3	42	2.2	935	17.1
Region																					
Monrovia	n/a					35.2	28.4	42.5	3.6	324	43.8	37.5	50.2	3.2	280	46.7	37	56.7	5.1	396	11.5
North Western	n/a					21.3	14.1	30.9	4.2	115	34.1	25	44.6	5	139	32.5	22.5	44.3	5.6	240	11.2
South Central	n/a					11.7	8.5	15.8	1.8	293	25.7	19.9	32.5	3.2	290	45.6	39.2	52.1	3.3	706	33.9
South Eastern A	n/a					13.5	8.5	20.9	3.1	150	22.8	14.4	34.1	5	133	48.4	41	55.9	3.8	144	34.9
South Eastern B	n/a					13.1	5.5	28.1	5.5	64	32.3	22.8	43.6	5.3	103	46.8	40.3	53.4	3.4	171	33.7
North Central	n/a					28.1	22.0	35.2	3.4	626	34.6	24.8	46	5.4	471	37.5	31.8	43.7	3.1	467	9.4
Wealth Quintile																					
Lowest	n/a					20.7	15.1	27.8	3.2	357	29.4	21.2	39.3	4.6	355	35.2	30.6	40	2.4	460	14.5
Second	n/a					20.0	15.2	26.0	2.7	373	27.5	20.8	35.4	3.7	366	42.9	36.5	49.5	3.3	397	22.9
Middle	n/a					22.7	15.3	32.3	4.3	309	32.6	25.6	40.6	3.8	281	45.6	39.3	52	3.3	345	22.9
Fourth	n/a					27.3	19.5	36.7	4.4	304	38.7	31.8	46.0	3.6	251	47.3	38.6	56.2	4.5	306	20.0
Highest	n/a					32.8	25.4	41.3	4.1	230	47.6	40.0	55.3	3.9	162	41.3	28.6	55.2	6.9	220	8.5
Mother's Education																					
None	n/a					20.3	16.8	24.4	1.9	774	29.7	23.8	36.3	3.2	652	39	34.2	44	2.5	670	18.7
Primary	n/a					25.6	19.2	33.2	3.5	480	33.4	28.1	39.3	2.8	446	41.7	35.8	47.7	3	540	16.1
Secondary +	n/a					30.5	23.8	38.1	3.6	320	40.4	34.3	46.7	3.1	317	46.1	38.4	54	4	518	15.6

Note: n=Weighted number of children (denominator)

Source: DHS 2007, MIS 2009, MIS 2011, DHS 2013

Table A.3.1.14: Prevalence of severe anemia (Hemoglobin <8g/dL) in children

Percentage of children age 6–59 months with hemoglobin lower than 8.0 g/dL, by background characteristics, Liberia

Background characteristic	MIS 2009					MIS 2011					Percentage point change 2009-2011
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total (National)	4.7	3.8	5.9	0.5	4,260	7.7	6.4	9.1	0.7	2,942	3.0
Age (in months)											
<i>6-11 months</i>	4.8	2.9	8.0	1.3	500	9.0	5.2	15.1	2.4	265	4.2
<i>12-23 months</i>	7.6	5.5	10.5	1.3	968	10.0	7.8	12.8	1.3	706	2.4
<i>24-35 months</i>	6.1	4.2	8.6	1.1	910	10.1	7.4	13.7	1.6	616	4.0
<i>36-47 months</i>	2.8	1.4	5.4	0.9	901	6.6	4.6	9.3	1.2	683	3.8
<i>48-59 months</i>	2.4	1.4	4.2	0.7	979	3.4	2.1	5.6	0.8	672	1.0
<i>6-23 months</i>	6.7	4.8	9.1	1.1	1468	9.8	7.6	12.4	1.2	970	3.1
<i>24-59 months</i>	3.7	2.9	4.9	0.5	2,790	6.6	5.2	8.3	0.8	1,972	2.9
Sex											
<i>Male</i>	4.8	3.7	6.2	0.6	2,154	8.1	6.5	10.1	0.9	1,502	3.3
<i>Female</i>	4.6	3.6	6.0	0.6	2,104	7.1	5.6	9.1	0.9	1,440	2.5
Residence											
<i>Urban</i>	5.0	3.8	6.6	0.7	1599	7.0	5.1	9.6	1.1	1160	2.0
<i>Rural</i>	4.6	3.4	6.2	0.7	2,660	8.1	6.6	10.0	0.9	1,782	3.5
Region											
<i>Monrovia</i>	6.6	4.7	9.3	1.2	719	6.4	3.5	11.3	1.9	597	-0.2
<i>North Western</i>	4.4	2.3	8.4	1.5	326	6.3	3.0	12.6	2.3	267	1.9
<i>South Central</i>	3.0	1.6	5.6	1.0	720	8.9	6.1	12.9	1.7	546	5.9
<i>South Eastern A</i>	2.9	1.7	4.7	0.7	380	4.7	2.6	8.3	1.4	274	1.8
<i>South Eastern B</i>	5.9	3.8	8.9	1.3	203	8.2	5.1	12.9	1.9	222	2.3
<i>North Central</i>	5.0	3.4	7.2	0.9	1911	8.8	6.9	11.0	1.0	1035	3.8
Wealth Quintile											
<i>Lowest</i>	5.3	3.9	7.1	0.8	1017	7.6	5.7	10.1	1.1	775	2.3
<i>Second</i>	5.5	3.8	7.9	1.0	979	8.2	6.2	10.9	1.2	703	2.7
<i>Middle</i>	3.8	2.4	5.8	0.8	884	8.7	6.4	11.8	1.4	604	4.9
<i>Fourth</i>	4.3	2.7	6.7	1.0	806	7.0	4.3	11.2	1.7	474	2.7
<i>Highest</i>	4.6	2.9	7.2	1.0	574	5.8	3.6	9.3	1.4	386	1.2
Mother's Education											
<i>None</i>	5.2	3.8	7.0	0.8	1616	7.4	5.8	9.3	0.9	1084	2.2
<i>Primary</i>	5.7	4.0	8.2	1.0	931	10.1	7.5	13.4	1.5	680	4.4
<i>Secondary +</i>	4.8	3.0	7.6	1.1	562	7.4	4.6	11.5	1.7	481	2.6
Note: n=Weighted number of children (denominator)											
Source: MIS 2009, MIS 2011											

Table A.3.1.15: Prevalence of malaria in children (via microscopy)

Percentage of children age 6–59 months with malaria infection detected by microscopy, by background characteristics, Liberia

Background characteristic	MIS 2009					MIS 2011					Percentage point change 2009-2011 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total (National)	31.7	27.8	35.9	2.0	4,250	27.8	24.8	31.0	1.6	2,815	-3.9
Age (in months)											
<i>6-11 months</i>	11.2	7.0	17.5	2.6	501	14.5	9.9	20.7	2.7	252	3.3
<i>12-23 months</i>	23.0	18.9	27.7	2.2	966	20.1	15.8	25.2	2.4	674	-2.9
<i>24-35 months</i>	34.0	28.7	39.7	2.8	906	27.7	23.8	32.0	2.1	591	-6.3
<i>36-47 months</i>	39.6	34.6	44.9	2.6	900	33.4	28.9	38.2	2.4	658	-6.2
<i>48-59 months</i>	41.3	35.8	47.0	2.8	977	35.4	30.6	40.6	2.5	640	-5.9
<i>6-23 months</i>	19.0	15.2	23.5	2.1	1467	18.6	14.8	23.0	2.1	925	-0.4
<i>24-59 months</i>	38.4	34.1	42.8	2.2	2782	32.3	29.1	35.7	1.7	1889	-6.1
Sex											
<i>Male</i>	32.5	27.7	37.6	2.5	2,152	29.3	25.8	33.0	1.8	1,424	-3.2
<i>Female</i>	30.9	26.7	35.4	2.2	2,098	26.3	22.9	29.9	1.8	1,390	-4.6
Residence											
<i>Urban</i>	21.2	18.0	24.8	1.7	1594	16.7	12.5	21.9	2.4	1137	-4.5
<i>Rural</i>	38.0	32.4	43.9	2.9	2,656	35.3	31.3	39.5	2.1	1,677	-2.7
Region											
<i>Monrovia</i>	15.0	10.8	20.3	2.4	715	7.1	4.2	11.7	1.8	589	-7.9
<i>North Western</i>	27.8	20.4	36.7	4.2	325	29.0	23.2	35.6	3.1	263	1.2
<i>South Central</i>	24.4	17.5	32.9	3.9	719	26.2	20.9	32.4	2.9	538	1.8
<i>South Eastern A</i>	27.4	20.3	35.9	4.0	380	32.6	24.6	41.7	4.4	261	5.2
<i>South Eastern B</i>	34.8	28.8	41.2	3.2	203	49.2	43.8	54.7	2.8	212	14.4
<i>North Central</i>	41.9	34.7	49.4	3.7	1908	35.0	28.9	41.7	3.3	952	-6.9
Wealth Quintile											
<i>Lowest</i>	35.2	29.6	41.3	3.0	1017	35.8	30.5	41.4	2.8	761	0.6
<i>Second</i>	41.2	34.8	47.9	3.3	978	36.8	31.9	41.9	2.5	649	-4.4
<i>Middle</i>	37.8	31.0	45.1	3.6	881	29.5	24.1	35.5	2.9	555	-8.3
<i>Fourth</i>	21.0	15.0	28.4	3.4	801	17.7	11.4	26.5	3.8	466	-3.3
<i>Highest</i>	14.8	10.4	20.6	2.6	573	6.4	3.9	10.5	1.6	383	-8.4
Mother's Education											
<i>None</i>	33.9	29.4	38.8	2.4	1610	30.6	26.9	34.5	1.9	1030	-3.3
<i>Primary</i>	31.2	25.3	37.9	3.2	929	29.7	24.8	35.2	2.6	649	-1.5
<i>Secondary+</i>	15.8	11.5	21.3	2.5	560	16.3	11.8	22.0	2.6	469	0.5

Note: n=Weighted number of children (denominator)

Source: MIS 2009, MIS 2011

Table A.3.1.16: Prevalence of malaria in children (via RDT)

Percentage of children age 6–59 months with malaria infection detected by RDT, by background characteristics, Liberia

Background characteristic	MIS 2009					MIS 2011					Percentage point change 2009-2011 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total (National)	36.5	32.4	40.8	2.1	4,255	44.7	41.1	48.4	1.8	2,920	8.2
Age (in months)											
<i>6-11 months</i>	16.1	10.9	23.0	3.0	501	25.7	19.6	32.9	3.4	252	9.6
<i>12-23 months</i>	30.0	25.4	35.1	2.5	965	35.5	30.6	40.7	2.5	674	5.5
<i>24-35 months</i>	37.9	32.6	43.5	2.8	911	45.4	40.4	50.4	2.5	591	7.5
<i>36-47 months</i>	44.5	39.1	50.1	2.8	899	50.9	45.0	56.8	3.0	658	6.4
<i>48-59 months</i>	44.8	39.7	49.9	2.6	979	54.9	49.4	60.2	2.7	640	10.1
<i>6-23 months</i>	25.3	20.8	30.3	2.4	1466	32.8	28.6	37.3	2.2	964	7.5
<i>24-59 months</i>	42.5	38.2	46.8	2.2	2789	50.5	46.6	54.5	2.0	1955	8.0
Sex											
<i>Male</i>	37.1	32.5	41.9	2.4	2,152	46.5	42.1	50.8	2.2	1,494	9.4
<i>Female</i>	36.0	31.3	41.0	2.5	2,104	42.8	38.8	47.0	2.1	1,426	6.8
Residence											
<i>Urban</i>	26.7	22.8	31.0	2.1	1,597	29.5	23.2	36.7	3.4	1,149	2.8
<i>Rural</i>	42.4	36.4	48.7	3.1	2,659	54.5	50.1	58.9	2.2	1,770	12.1
Region											
<i>Monrovia</i>	19.4	14.3	25.6	2.8	717	15.3	10.6	21.5	2.7	595	-4.1
<i>North Western</i>	33.5	22.1	47.3	6.5	325	49.3	41.5	57.3	4.0	265	15.8
<i>South Central</i>	32.1	23.5	42.0	4.7	719	49.6	40.3	58.9	4.8	545	17.5
<i>South Eastern A</i>	29.6	21.7	38.8	4.4	379	55.3	48.0	62.3	3.7	272	25.7
<i>South Eastern B</i>	43.4	37.4	49.7	3.1	203	70.5	64.6	75.7	2.8	221	27.1
<i>North Central</i>	45.8	38.8	53.0	3.6	1911	49.5	42.4	56.7	3.7	1021	3.7
Wealth Quintile											
<i>Lowest</i>	40.2	33.8	46.9	3.3	1,016	54.0	48.3	59.6	2.9	771	13.8
<i>Second</i>	45.4	39.3	51.7	3.2	979	54.1	48.7	59.4	2.7	701	8.7
<i>Middle</i>	40.9	34.4	47.8	3.4	884	50.4	43.9	56.9	3.3	595	9.5
<i>Fourth</i>	29.9	22.8	38.1	3.9	803	33.4	24.0	44.4	5.2	470	3.5
<i>Highest</i>	17.4	12.1	24.5	3.1	574	13.6	9.9	18.4	2.1	383	-3.8
Mother's Education											
<i>None</i>	38.2	32.9	43.9	2.8	1616	50.0	45.4	54.6	2.3	1076	11.8
<i>Primary</i>	36.2	31.0	41.7	2.7	930	47.6	41.8	53.4	2.9	677	11.4
<i>Secondary+</i>	22.0	16.7	28.4	3.0	562	28.9	23.3	35.1	3.0	475	6.9
Note: n=Weighted number of children (denominator)										48	
Source: MIS 2009, MIS 2011											

Table A.3.1.17: Age-specific childhood mortality

Age-specific all-cause mortality (per 1,000 live births) for five-year periods preceding the survey, Liberia

	DHS 2007			DHS 2013		
	%	LCI	UCI	%	LCI	UCI
Age						
6-59 months	60	52	67	55	47	62
1-59 months	80	71	89	69	61	78
Neonatal (NN)	32	27	38	26	21	32
Postneonatal (PnN)	39	33	48	28	23	33
Infant (1q0)	71	62	80	54	46	61
Child (4q1)	41	35	48	42	35	49
Under 5 mortality (5q0)	109	99	120	94	84	103

Table A.3.1.18: Early childhood mortality

All-cause under five mortality (per 1,000 live births) for five-year periods preceding the survey, by background characteristics, Liberia

Background characteristic	DHS 2007			DHS 2013		
	Time Period: 2002-2006			Time Period: 2009-2013		
	5q0	LCI	UCI	5q0	LCI	UCI
Total (Under five $_{-5}q_0$)	109	99	120	94	84	103
Age						
<i>Neonatal (NN)</i>	32	27	38	26	21	32
<i>Postneonatal(PNN)</i>	39	33	48	28	23	33
<i>Infant ($_1q_0$)</i>	71	62	80	54	46	61
<i>Child ($_4q_1$)¹</i>	41	35	48	42	35	49
Sex						
<i>Male</i>	118	102	133	94	81	107
<i>Female</i>	101	87	115	93	80	107
Residence						
<i>Urban</i>	110	93	127	89	73	105
<i>Rural</i>	109	96	122	98	88	109
Region						
<i>Monrovia</i>	96	75	117	85	65	111
<i>North Western</i>	111	79	141	118	97	137
<i>South Central</i>	129	103	155	86	68	104
<i>South Eastern A</i>	116	86	144	96	78	114
<i>South Eastern B</i>	106	81	130	141	117	165
<i>North Central</i>	107	87	127	82	65	99
Wealth Quintile						
<i>Lowest</i>	113	113	113	101	85	117
<i>Second</i>	103	78	127	98	82	114
<i>Middle</i>	110	86	133	96	74	118
<i>Fourth</i>	118	93	143	94	60	126
<i>Highest</i>	103	77	129	69	36	101
Mother's Education						
<i>None</i>	105	90	120	100	86	114
<i>Primary</i>	118	98	137	94	76	111
<i>Secondary +</i>	106	74	136	82	61	103
Birth Order						
<i>1</i>	130	104	155	96	75	117
<i>2</i>	95	71	119	79	58	100
<i>3+</i>	106	93	119	98	85	111
Note: n=Weighted number of children (denominator); ¹ Child mortality ($_4q_1$) is mortality between exact age 1 and exact age 5, per 1,000 children surviving to 12 months of age.						
Source: DHS 2007, DHS 2013						

Table A.3.1.20: Contextual Factors

Background characteristic	DHS 2007					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2007-2103 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Household Characteristics																					
Improved source of drinking water*	65.2	60.3	69.9	2.4	6,824	74.5	67.5	80.5	3.3	4,162	72.1	65.8	77.7	3.0	4,162	72.6	67.6	77.2	2.4	9,333	7.4
Drinking water <15 min	77.7	74.5	80.7	1.6	6,824	n/a	n/a	n/a	n/a	n/a	63.3	58.8	67.5	2.2	4,162	54.2	51.2	57.2	1.5	9,333	-23.5
Access to improved toilet**	10.0	8.1	12.3	1.1	6,824	n/a	n/a	n/a	n/a	n/a	7.3	5.4	9.8	1.1	304	14.2	11.8	16.9	1.3	9,333	4.2
Household floor material not earth, sand or dung	44.8	40.9	48.8	2	6,824	47.4	41.8	53.1	2.9	4,162	55.5	49.8	61	2.8	4,162	53.4	48.5	58.2	2.5	9,333	8.6
Household has electricity	3.0	2.1	4.3	0.5	6,817	1.9	1.2	2.9	0.4	4,162	4.1	2.6	6.2	0.9	4,162	9.8	7.0	13.6	1.7	9,333	6.8
Household has telephone (landline or mobile)	28.7	25.7	31.9	1.6	6,817	43.2	38.8	47.7	2.2	4,162	54.1	49.8	58.4	2.2	4,162	64.6	60.9	68.3	1.9	9,333	35.9
*Improved water sources include: piped water into dwelling/yard/plot; public tap/standpipe; tubewell/borehole; protected dug well; protected spring; rainwater; bottled water; as per DHS VI Standard Tab plan.; ** Improved, Not Shared Toilet Facility includes: flush/pour flush to piped sewer system; flush/pour flush to septic tank; flush/pour flush to a pit latrine; ventilated improved pit (VIP) latrine; Pit latrine with a slab;																					
Socio-demographic factors																					
Proportion of women 15-49 with at least a primary school education	30.7	28.3	33.1	1.2	7,092	31.9	28.2	35.9	1.9	4,397	38.4	34.5	42.4	2.0	3,939	39.1	35.5	42.9	1.9	9,239	8.4
Mean years of education	3.8	3.6	4.1	0.1	7,092	4.2	3.7	4.7	0.2	4,397	4.4	4.0	4.8	0.2	3,939	4.5	4.1	4.8	0.2	9,239	0.7
Proportion of women 15-49 literate	40.8	38	43.6	1.4	7,092	39.6	36	43.4	1.9	4,397	n/a	n/a	n/a	n/a	n/a	47.9	44.1	51.7	2.0	9,239	7.1
Proportion of women 15-49 married	64	61.6	66.4	1.2	7,092	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	58.3	56.3	60.3	1.0	9,239	-5.7
Fertility related risk																					
High risk birth*	59.0	56.9	61.0	1.0	5,594	61.8	59	64.6	1.4	4,027	n/a	n/a	n/a	n/a	n/a	57.4	55.2	59.6	1.1	6,502	-1.6
Avoidable risk birth**	52.2	50.1	54.3	1.1	5,594	55	52.1	57.8	1.4	4,027	n/a	n/a	n/a	n/a	n/a	56.1	53.9	58.3	1.1	6,502	3.9
Unavoidable risk birth***	15.8	14.6	17.1	0.6	5,594	14.3	12.8	16	0.8	4,027	n/a	n/a	n/a	n/a	n/a	15.6	14.3	17	0.7	6,502	-0.2
*A high risk birth is defined as any birth to a birth interval <24 months, a multiple birth, birth order >3, or any birth to a woman younger than 18 or older than 34 years; **An avoidable high risk birth is a birth to a woman <18 or >34 years, a birth interval <24 mo, or a birth order >3; *** An unavoidable high risk birth is a first birth born to women ages 18-34																					
ANC coverage																					
Antenatal Care (≥4 visits)	66	61.7	70	2.1	3,928	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	77.8	75.5	79.9	1.1	4,769	11.8
At least 2 doses of tetanus toxoid during pregnancy	74.6	71	77.9	1.8	3,928	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	84.1	82.0	86.0	1.0	4,769	9.5
Postnatal vitamin A supplementation	61.5	56.8	66	2.3	3,928	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	62.3	59.1	65.5	1.6	4,769	0.8
Delivery in a health facility*	36.9	32.8	41.2	2.1	5,594	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	55.8	52.1	59.5	1.9	6,502	18.9
Skilled attendant at birth**	46.3	41.5	51.1	2.4	5,594	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	60.6	56.9	64.1	1.8	6,502	14.3
*Health facility includes all public and private place of delivery response options; **Skilled provider includes doctor, nurse, trained birth attendant, medical assistant, midwife.																					

IMCI Coverage*																					
Oral rehydration therapy (ORT) for diarrhea**	58.1	53.5	62.5	2.3	1,014	n/a	61.6	57.8	65.2	1.9	1,330	3.5									
Oral rehydration salt solution (ORS) for diarrhea	53.1	48.4	57.8	2.4	1,014	n/a	60.4	56.6	64.1	1.9	1,330	7.3									
*Integrated Management of Childhood Illness (IMCI); **Child was given oral rehydration or recommended home solution.																					
Immunization coverage*																					
BCG	77.1	70.7	82.4	3	977	n/a	93.9	91.9	95.4	0.9	1,272	16.8									
DPT3	50.3	44.6	55.9	2.9	977	n/a	71.4	67.3	75.2	2.0	1,272	21.1									
polio3	49.4	44.2	54.7	2.7	977	n/a	69.9	65.8	73.7	2.0	1,272	20.5									
Measles	63.0	57.2	68.5	2.9	977	n/a	74.2	70.6	77.5	1.8	1,272	11.2									
Fully vaccinated**	39.0	34.2	44.1	2.5	977	n/a	54.8	50.8	58.8	2.0	1,272	15.8									
* Percent of children 12-23 months with the recommended immunizations; ** According to World Health Organization guidelines, children are considered fully vaccinated when they have received a vaccination against tuberculosis (BCG), three doses each of the diphtheria, pertussis, and tetanus (DPT) and polio vaccines, and a measles vaccination by the age of 12 months.																					
Acute Respiratory Infection (ARI)*																					
Children 0-4yrs had ARI symptoms in previous 2 weeks*	8.6	7.2	10.1	0.7	440	n/a	6.5	5.6	7.6	0.5	6,047	-2.1									
Children 0-4yrs with ARI sought treatment	62.2	56.0	68.0	3.0	440	n/a	64.0	57.1	70.5	3.4	396	1.8									
*Definition of ARI is based on data available in the 2000 survey: child had illness with cough in past two weeks and he/she breathed faster than usual with short, fast breaths.																					
Micronutrients																					
Vitamin A supplementation	41.9	38.2	45.6	(1.9)	4,635	n/a	60.1	56.5	63.6	1.8	5,444	18.2									
Nutritional Status																					
Stunting	39.4	37.5	41.4	(1.0)	5,166	n/a	31.6	29.3	34.0	1.2	3520	-7.8									
Underweight	19.2	17.4	21.1	0.9	5,166	n/a	15.0	13.5	16.7	0.8	3520	-4.2									
Wasting	7.5	6.4	8.6	0.6	5,166	n/a	6.0	5.0	7.3	0.6	3520	-1.5									
Low birth weight <2500g	11.6	8.7	15.4	1.1	5,594	n/a	9.7	7.9	11.9	1.0	1510	-1.9									
Breastfeeding																					
Exclusive breastfeeding <6 months	29.1	23.8	35.1	2.9	486	n/a	55.2	49.6	60.7	2.8	590	26.1									
% of 6-9 mo breastfeeding and consuming complementary foods	62.2	55.7	68.4	3.3	382	n/a	42.2	35.8	48.9	2.7	409	-20.0									
Other childhood illness																					
Diarrhea prevalence	19.8	17.8	21.8	1.0	5,132	n/a	22.0	20.4	23.7	0.9	6047	2.2									
Source: DHS 2007, MIS 2009, MIS 2011, DHS 2013																					

A.3.2 Additional Population-Based Survey Data Tables (Data not included in core report)

Table A.3.2.1: Prevalence of severe anemia and parasitemia in children

Percentage of children age 6–59 months with hemoglobin lower than 8.0 g/dL and malaria infection detected by microscopy, by background characteristics, Liberia

Background characteristic	MIS 2009					MIS 2011					Percentage point change 2009-2011 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total (National)	2.6	1.9	3.6	0.4	4,247	4.1	3.3	5.2	0.5	2,814	1.5
Age (in months)											
<i>6-23 months</i>	3.0	1.8	5.0	0.8	1,466	4.6	3.2	6.7	0.9	925	1.6
<i>24-59 months</i>	2.4	1.7	3.5	0.4	2,781	3.9	3.0	5.0	0.5	1,888	1.5
Sex											
<i>Male</i>	2.6	1.7	4.1	0.6	2,152	4.4	3.5	5.5	0.5	1,423	1.8
<i>Female</i>	2.6	1.9	3.7	0.5	2,095	3.9	2.7	5.4	0.7	1,390	1.3
Residence											
<i>Urban</i>	1.8	1.1	3.0	0.5	1,591	3.2	1.9	5.5	0.9	1,136	1.4
<i>Rural</i>	3.1	2.2	4.4	0.6	2,656	4.7	3.7	6.0	0.6	1,677	1.6
Region											
<i>Monrovia</i>	2.2	1.1	4.1	0.7	712	2.4	0.8	6.5	1.2	589	0.2
<i>North Western</i>	2.9	1.0	8.1	1.5	325	3.9	1.9	7.7	1.4	263	1.0
<i>South Central</i>	1.3	0.4	3.7	0.7	719	4.5	3.1	6.6	0.9	538	3.2
<i>South Eastern A</i>	1.5	0.8	2.7	0.5	380	3.3	1.8	6.0	1.0	261	1.8
<i>South Eastern B</i>	2.3	1.3	4.0	0.7	203	5.6	3.4	9.2	1.4	212	3.3
<i>North Central</i>	3.5	2.3	5.4	0.8	1908	4.9	3.4	7.1	0.9	951	1.4
Wealth Quintile											
<i>Lowest</i>	3.4	2.4	5.0	0.6	1,017	4.5	3.2	6.2	0.7	761	1.1
<i>Second</i>	3.1	1.9	5.1	0.8	978	4.8	3.2	7.2	1.0	649	1.7
<i>Middle</i>	3.4	2.1	5.4	0.8	881	5.7	4.0	8.0	1.0	554	2.3
<i>Fourth</i>	1.7	0.8	3.2	0.6	801	3.0	1.3	6.9	1.3	466	1.3
<i>Highest</i>	0.6	0.2	2.1	0.4	570	1.5	0.6	3.8	0.7	383	0.9
Mother's Education											
<i>None</i>	3.2	2.1	4.9	0.7	1,609	4.1	2.9	5.8	0.7	1,030	0.9
<i>Primary</i>	2.8	1.7	4.8	0.8	929	5.1	3.3	7.9	1.2	648	2.3
<i>Secondary +</i>	2.4	1.2	4.7	0.8	560	3.4	2.0	5.7	0.9	469	1.0

Note: n=Weighted number of children (denominator)

Source: MIS 2009, MIS 2011

Table A.3.2.2: Prevalence of fever in children

Percentage of children under five years of age with fever in the two weeks preceding the survey, by background characteristics, Liberia

Background characteristic	DHS 2007					MIS 2009					MIS 2011					DHS 2013					Percentage point change 2007-2013 (95% CI)	
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n		
Total (National)	30.7	28.7	32.9	1.1	5,132	43.6	40.9	46.3	1.4	3,694	49.2	46.4	52.1	1.4	2,876	28.6	26.3	30.9	1.2	5,444	-2.1	
Age (in months)																						
6-23 months	37.3	33.9	40.8	1.8	1,569	51.1	47.0	55.2	2.1	1,223	56.5	51.8	61.2	2.4	894	35.3	32.2	38.6	1.6	2,002	-2.0	
24-59 months	29.4	27.0	31.9	1.2	3,067	41.8	38.9	44.8	1.5	2,134	47.4	44.2	50.7	1.6	1,667	26.4	23.9	29	1.3	3,442	-3.0	
Sex																						
Male	30.7	28.1	33.4	1.4	2,651	44.0	41.1	47.0	1.5	1,894	49.8	46.4	53.2	1.7	1,494	30.4	27.7	33.1	1.4	3,089	-0.3	
Female	30.8	28.3	33.4	1.3	2,481	43.1	39.8	46.6	1.7	1,800	48.7	44.8	52.5	2.0	1,382	26.7	24.1	29.4	1.3	2,957	-4.1	
Residence																						
Urban	28.8	25.3	32.6	1.8	1,563	46.7	42.8	50.6	2.0	1,411	49.6	45.0	54.2	2.3	1,175	26.3	23	30	1.8	3,013	-2.5	
Rural	31.6	29.0	34.2	1.3	3,569	41.7	38.1	45.4	1.9	2,283	49.0	45.4	52.6	1.8	1,701	30.8	28	33.8	1.5	3,034	-0.8	
Region																						
Monrovia	25.7	21.8	30.2	2.1	1,094	49	43.2	54.8	2.9	689	44.8	38.8	51	3.1	624	26.4	21.2	32.4	2.8	1,503	0.7	
North Western	31.7	25.8	38.3	3.2	475	40.3	31.8	49.5	4.5	286	54.4	47.4	61.2	3.5	256	36.1	28.6	44.5	4.1	663	4.4	
South Central	36.4	30.3	42.9	3.2	819	41.9	37	47	2.5	708	54.8	48.3	61.2	3.3	528	28.4	24.7	32.4	2	2,485	-8.0	
South Eastern A	27	22.4	32.1	2.5	371	44	34.8	53.6	4.8	344	49.2	43.5	54.8	2.9	270	31.1	27.5	34.8	1.9	463	4.1	
South Eastern B	41.6	36.6	46.8	2.6	380	32.8	26.4	39.9	3.4	197	48.1	41	55.2	3.6	215	36.7	32.3	41.4	2.3	466	-4.9	
North Central	29.5	26	33.3	1.9	1,993	43.9	39.2	48.7	2.4	1,471	48	42.2	53.8	2.9	982	23.7	20.4	27.5	1.8	1,970	-5.8	
Wealth Quintile																						
Lowest	27.3	23.6	31.4	2.0	1,133	39.7	33.8	46.0	3.1	919	47.3	41.3	53.4	3.1	751	31.4	28.6	34.3	1.5	1,469	4.1	
Second	31.9	27.9	36.2	2.1	1,233	45.9	41.8	50.2	2.1	816	52.3	47.4	57.2	2.5	699	29.4	26.3	32.7	1.6	1,350	-2.5	
Middle	30.4	26.8	34.3	1.9	1,103	41.8	36.7	47.1	2.6	755	51.7	46.2	57.2	2.8	543	27.2	23	31.8	2.2	1,268	-3.2	
Fourth	32.7	28.7	36.9	2.1	1,038	44.4	39.0	49.9	2.8	707	50.4	44.5	56.3	3.0	498	27	22.1	32.6	2.7	1,132	-5.7	
Highest	32.0	27.2	37.2	2.6	625	48.5	43.0	54.0	2.8	496	42.3	34.9	50.1	3.9	384	26.6	20.9	33.2	3.1	828	-5.4	
Mother's Education																						
None	28.8	26.0	31.7	1.5	2,500	41.5	38.0	45.1	1.8	1,880	50.4	46.1	54.7	2.2	1,294	26.7	23.9	29.8	1.5	2,508	-2.1	
Primary	32.1	29.3	35.0	1.5	1,789	45.2	40.7	49.8	2.3	1,111	49.6	45.6	53.6	2.0	900	29.2	26.3	32.4	1.5	1,846	-2.9	
Secondary +	33.6	29.7	37.8	2.1	839	46.6	42.2	51.1	2.2	703	46.6	41.8	51.5	2.5	681	30.6	27.1	34.4	1.9	1,693	-3.0	

Note: n=Weighted number of cases (denominator)

Source: DHS 2007, MIS 2009, MIS 2011, DHS 2013

Table A.3.2.4: Prevalence of fever and parasitemia in children

Percentage of children age 6–59 months with fever in the two weeks preceding the survey and malaria infection detected by microscopy, by background characteristics, Liberia

Background characteristic	MIS 2009					MIS 2011					Percentage point change 2009-2011 (95% CI)
	%	LCI	UCI	SE	n	%	LCI	UCI	SE	n	
Total (National)	18.2	16.0	20.6	1.2	4,250	11.3	9.9	12.7	0.7	2,809	-6.9
Age (in months)											
<i>6-11 months</i>	6.7	4.3	10.3	1.5	501	9.8	6.4	14.9	2.1	252	3.1
<i>12-23 months</i>	16.2	13.2	19.7	1.7	966	9.6	7.2	12.6	1.3	670	-6.6
<i>24-35 months</i>	19.3	15.5	23.8	2.1	906	13.3	10.4	16.8	1.6	591	-6
<i>36-47 months</i>	23.5	19.2	28.3	2.3	900	10.1	8.1	12.5	1.1	656	-13.4
<i>48-59 months</i>	22.4	18.1	27.3	2.3	977	12.9	10.2	16.2	1.5	639	-9.5
Sex											
<i>Male</i>	18.0	15.5	20.9	1.4	2,152	11.4	9.7	13.3	0.9	1,423	-6.6
<i>Female</i>	18.3	15.6	21.3	1.4	2,098	11.1	9.2	13.4	1.1	1,390	-7.2
Residence											
<i>Urban</i>	15.4	12.5	19.0	1.7	1,594	7.0	5.4	8.9	0.9	1,136	-8.4
<i>Rural</i>	19.8	16.8	23.1	1.6	2,656	14.2	12.3	16.3	1.0	1,677	-5.6
Region											
<i>Monrovia</i>	13.1	8.4	19.9	2.9	715	2.7	1.6	4.6	0.7	589	-10.4
<i>North Western</i>	16.4	9.9	26.0	4.0	325	11.1	7.6	16.0	2.1	263	-5.3
<i>South Central</i>	18.3	13.8	23.9	2.5	719	12.7	9.3	17.0	1.9	538	-5.6
<i>South Eastern A</i>	13.3	8.6	20.0	2.9	380	13.0	9.0	18.5	2.4	261	-0.3
<i>South Eastern B</i>	15.9	10.8	22.7	3.0	203	17.8	14.1	22.1	2.0	212	1.9
<i>North Central</i>	21.9	18.4	25.9	1.9	1908	13.9	11.5	16.7	1.3	951	-8.0
Wealth Quintile											
<i>Lowest</i>	18.4	13.6	24.6	2.8	1,017	12.8	10.2	16.1	1.5	761	-5.6
<i>Second</i>	22.2	17.9	27.1	2.3	978	16.1	13.2	19.4	1.6	649	-6.1
<i>Middle</i>	21.8	18.3	25.8	1.9	881	13.9	10.8	17.6	1.7	554	-7.9
<i>Fourth</i>	16.3	11.9	22.0	2.5	801	6.3	4.1	9.4	1.3	466	-10.0
<i>Highest</i>	7.7	4.9	11.9	1.7	573	2.2	1.0	4.7	0.8	383	-5.5
Mother's Education											
<i>None</i>	19.4	16.3	23.0	1.7	1,610	15.7	13.1	18.7	1.4	1,030	-3.7
<i>Primary</i>	20.1	17.3	23.3	1.5	929	17.7	14.5	21.5	1.8	648	-2.4
<i>Secondary +</i>	11.4	7.6	16.6	2.2	560	8.5	6.1	11.8	1.4	469	-2.9

Note: n=Weighted number of children (denominator)

Source: MIS 2009, MIS 2011

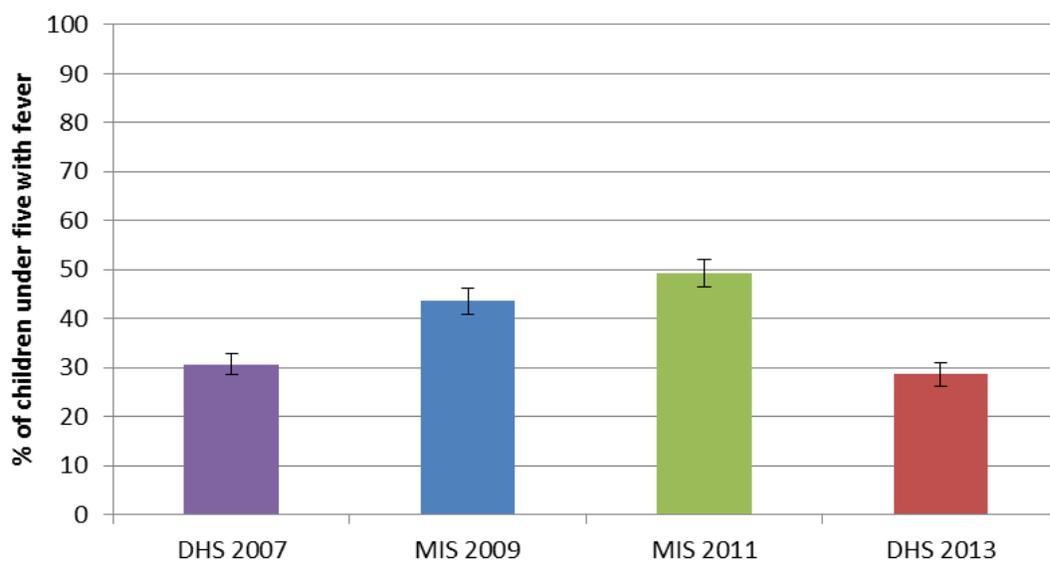
Annex 4: Additional Topics

4.1 Fever

In addition to the RBM-MERG morbidity indicators, this annex includes a description of trends in fever, defined as the proportion of children under five years of age whose mothers reported had suffered fever within a two-week period preceding the survey. The reasons for including this indicator are because an association between fever prevalence and malaria control is biologically plausible, because national trend data is available for the entire study period, and because these data can supplement analyses of facility-based measures of “presumed malaria” that are plagued with several shortcomings including incomplete reporting and lack of diagnostic confirmation.

The DHS and MIS questionnaires requested mothers to report any incidence of fever among children under five years of age, during a two-week period preceding the survey. However, it should be noted that fever is an imperfect proxy of the burden of malaria disease because malaria is not the sole cause of fever. A systematic review¹ of 39 studies across 16 countries in sub-Saharan Africa between 2001 and 2009 found that just 22% of children (of various age groups) presenting with fever tested positive for malaria. In addition, no clinical diagnosis or testing was conducted, making the validity reliant on the accuracy of self-reported fever information. In addition, information on fever was only asked of interviewed mothers, a methodological strategy which may introduce selection bias. For analyses of correlation between the morbidity indicators, this outcome variable is limited to children aged 6–59 months.

Figure 4.1: Fever during the two weeks prior to survey, children under five years of age, 2007-2013

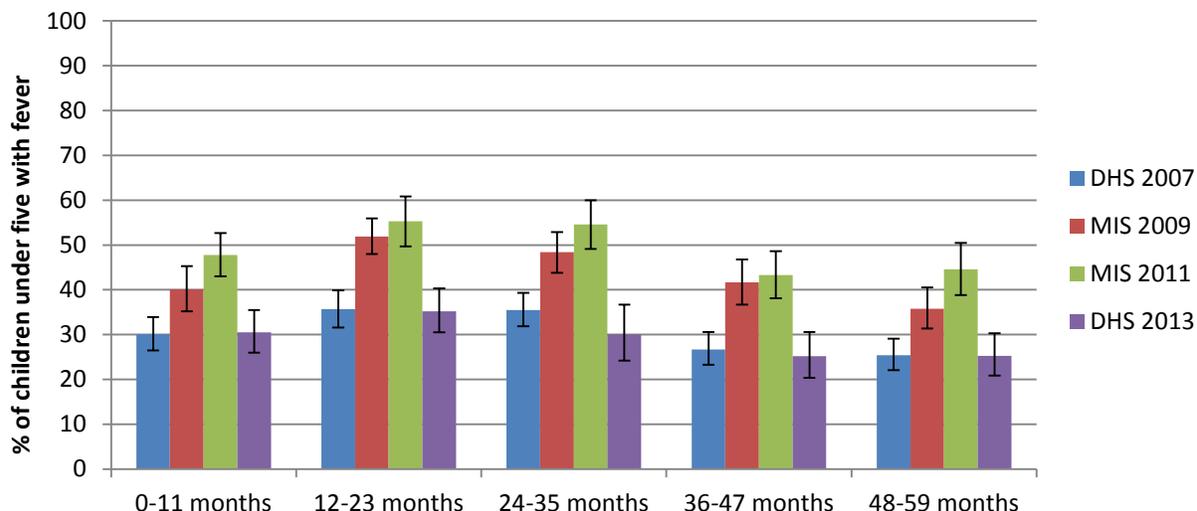


The prevalence of fever in children under five years of age increased significantly from 31% (95% CI: 29-33%) in 2007 to 49% (95% CI: 46-52%) in 2011, and then declined to 29% (95% CI: 26-31%) (Figure 4.1). As fever has many etiologies not limited to malaria and the surveys were

¹ D’Acremont, V., Lengeler, Christian, & Genton, B. (2010). Reduction in the proportion of fevers associated with *Plasmodium falciparum* parasitaemia in Africa: a systematic review. *Malaria journal*, 9, 240. doi: 10.1186/1475-2875-9-240

undertaken during different survey years, this observed trend is challenging to interpret. The trend suggests a decline at the end of the evaluation period.

Figure 4.2: Fever during the two weeks preceding the survey, by age group, 2007–2013



In examining the trends in fever by age group, a similar trend is observed across all age groups, with a steady and significant increase in the prevalence of fever between 2007 and 2011, and then a significant decline in 2013 (Figure 4.2). Overall, the prevalence of fever was more common across all survey years in younger children (0-11 months, 12-23 months, and 24-36 months), compared to older children (36-47 months and 48-59 months). These results are consistent with the declines observed at the end of the evaluation period in the number of confirmed cases of malaria among children under five.

Figure 4.3: Proportion of children 6–59 months of age with fever in the two weeks prior to the survey who tested positive via microscopy on the day of survey, by age group, 2009 MIS and 2011 MIS

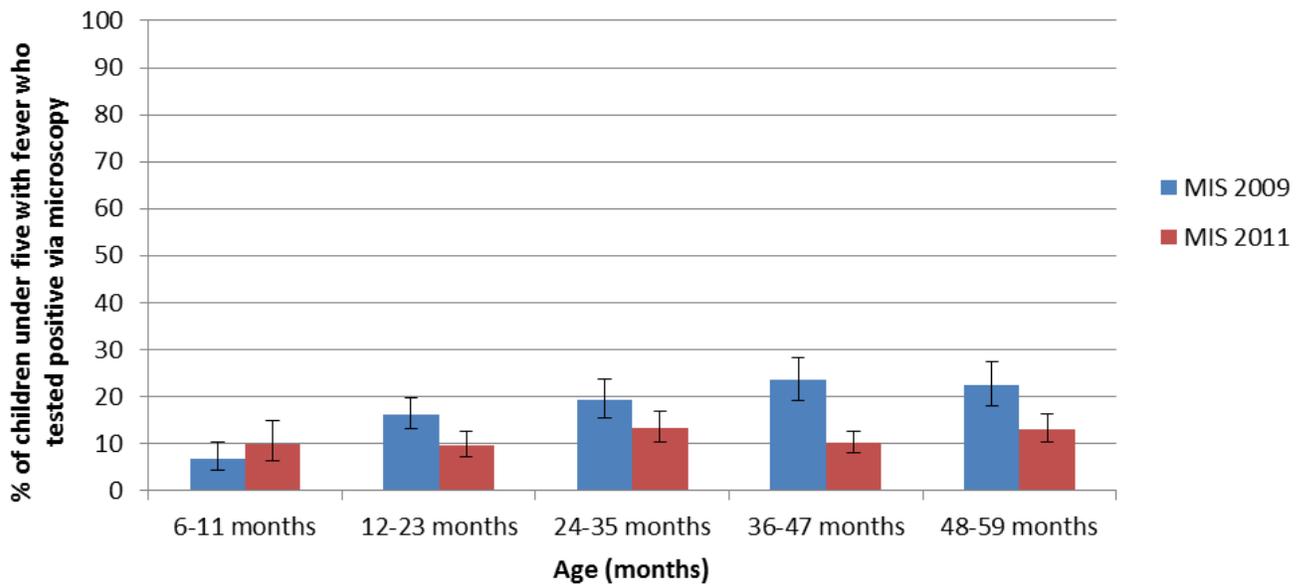


Figure 4.3 shows that the prevalence of children (6-59 months) who had experienced fever in the two weeks prior to the survey and also tested positive for malaria (microscopy) on the day of the survey declined between 2009 and 2011 for all age groups, but those 6 -11 months of age. In children 12-23 months, 36-47 months and 48-59 months, the decline between 2009 and 2011 was statistically significant. For children 6-11 months, prevalence of fever and parasitemia increased from 7% to 10% between 2009 and 2011, though the increase was no statistically significant.

Figure 4.4: Fever during the two weeks prior to survey, children under five years of age, by place of residence, 2007-2013

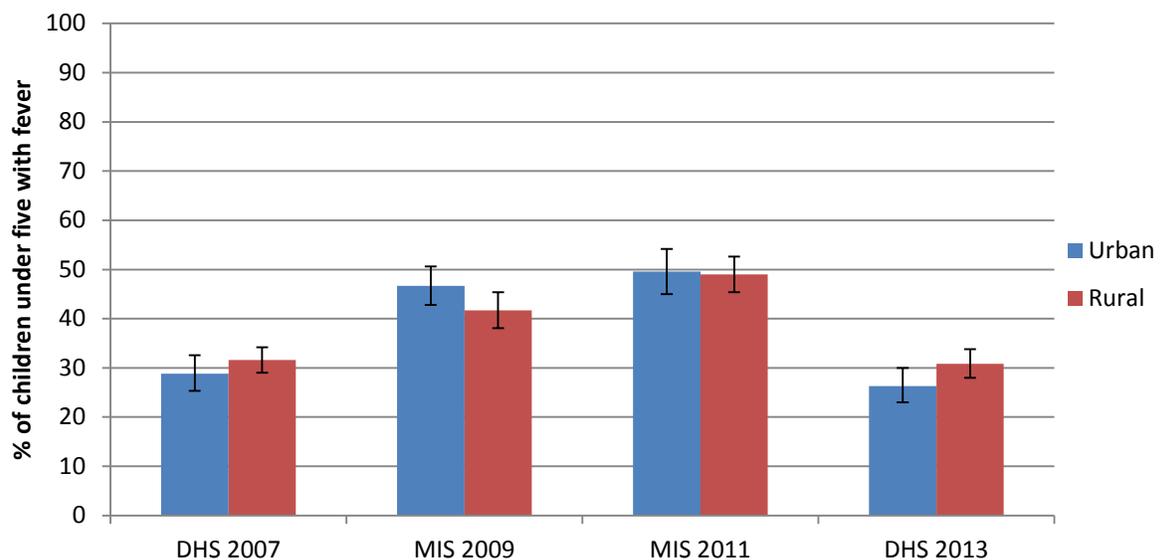


Figure 4.4 shows the percentage of children under five years of age that had a fever in the two weeks preceding the survey by place of residence. Fever prevalence in both urban and rural areas increased from 2007 to 2011, and then declined significantly in 2013. In urban areas, prevalence of fever increased from 29% (95% CI: 25-33%) in 2007 to 50% (95% CI: 45-54%), and then declined to 26% (95% CI: 23-30%) in 2013. In rural areas, the increase from 2007 to 2011 was similar, rising from 32% (95% CI: 29-34%) in 2007 to 49% (95% CI: 45-53%) in 2011, then declining to 31% (95% CI: 28-34%).

Annex 5: Multiple Regression Model Results

Model 1. Multiple logistic regression model: The effect of ITN ownership on malaria parasitemia (via RDT) in children under five years of age

Characteristic	N	Parasitemia prevalence (%)	Adjusted OR (95% CI)	P-value
Total	1,752	44.9		
Household ITN Ownership				
No ITN	810	47.8	1.00 (reference)	
Owns at least one ITN	942	42.4	0.84 (0.69, 1.04)	0.103
Sex of Child				
Male	901	46	1.00 (reference)	
Female	851	43.7	0.96 (0.78, 1.17)	0.659
Age of Child				
6-23 months	543	29.8	1.00 (reference)	
24-59 months*	1,210	51.6	2.87 (2.29, 3.60)	0.000
Mother's Education in Years				
No formal education	830	51.7	1.00 (reference)	
Primary education	517	46.7	0.87 (0.69, 1.09)	0.230
Secondary or higher*	406	28.7	0.74 (0.55, 0.99)	0.042
Region				
Monrovia	375	15.7	1.00 (reference)	
North Western	157	48.8	1.06 (0.56, 2.01)	0.860
South Central*	348	50.9	1.78 (1.03, 3.07)	0.040
South Eastern A	152	57.1	1.33 (.067, 2.64)	0.423
South Eastern B*	125	71	2.27 (1.14, 4.51)	0.020
North Central	595	50.1	1.15 (0.61, 2.18)	0.667
Had household IRS in last 12 months				
No	1,609	44.2	1.00 (reference)	
Yes	143	52.7	1.22 (0.80, 1.87)	0.354
Place of Residence				
Urban	717	29.5	1.00 (reference)	
Rural*	1,035	55.6	2.62 (1.66, 4.15)	0.000
Malaria Risk Zone				
<40%	964	34.8	1.00 (reference)	
≥40%*	788	57.2	3.99 (2.32, 6.86)	0.000
Effect of place of residence for high malaria risk zone				
<40%	-	-	1.00 (reference)	
≥40%*	-	-	0.32 (0.20, 0.53)	0.000
Wealth				
Highest	229	11.9	1.00 (reference)	
Fourth*	316	33.4	2.10 (1.24, 3.55)	0.006
Middle*	345	50.5	3.26 (1.92, 5.51)	0.000
Second*	413	55.7	2.99 (1.74, 5.11)	0.000
Lowest*	449	55.6	2.81 (1.61, 4.89)	0.000
Number of Household Members				
1-3	235	38.1	1.00 (reference)	
4-6	856	44.9	0.92 (0.67, 1.26)	0.585
7+	662	47.3	0.97 (0.70, 1.34)	0.837

Notes: The model was restricted to one child under-five years per household to avoid cluster effects; *p < 0.05; 95% CI = 95% Confidence Interval.

Model 2. Multiple logistic regression model: The effect of ITN ownership by age of net on malaria parasitemia (via RDT) in children under five years of age

Characteristic	N	Parasitemia prevalence (%)	Adjusted OR (95% CI)	P-value
Total	1,752	44.9		
ITN Net Ownership by Age of Net[^]				
No ITN	810	47.8	1.00 (reference)	
ITN owned 0-6 months*	173	35.4	0.69 (0.48, 0.98)	0.040
ITN owned 7-12 months	221	39.8	0.88 (0.64, 1.22)	0.449
ITN owned >12 months	247	53.7	1.19 (0.87, 1.63)	0.285
Sex of Child				
Male	901	46.0	1.0 (reference)	
Female	851	43.7	0.98 (0.78, 1.23)	0.864
Age of Child				
6-23 months	543	29.8	1.00 (reference)	
24-59 months*	1,210	51.6	2.79 (2.17, 3.57)	0.000
Mother's Education in Years				
No formal education	830	51.7	1.00 (reference)	
Primary education	517	46.7	0.85 (0.66, 1.11)	0.233
Secondary or higher*	406	28.7	0.70 (0.51, 0.97)	0.030
Region				
Monrovia	375	15.7	1.00 (reference)	
North Western	157	48.8	0.93 (0.46, 1.87)	0.842
South Central	348	50.9	1.69 (0.93, 3.07)	0.084
South Eastern A	152	57.1	1.27 (0.60, 2.72)	0.533
South Eastern B	125	71	2.11 (0.99, 4.50)	0.054
North Central	595	50.1	1.14 (0.57, 2.30)	0.707
Had household IRS in last 12 months				
No	1,609	44.2	1.00 (reference)	
Yes	143	52.7	1.36 (0.83, 2.21)	0.219
Place of Residence				
Urban	717	29.5	1.00 (reference)	
Rural*	1,035	55.6	2.86 (1.73, 4.74)	0.000
Malaria risk zone				
<40%	964	34.8	1.00 (reference)	
≥40%*	788	57.2	3.90 (2.14, 7.11)	0.000
Effect of place of residence for high malaria risk zone				
<40%	-	-	1.00 (reference)	
≥40%*	-	-	0.38 (0.22, 0.66)	0.001
Wealth				
Highest	229	11.9	1.00 (reference)	
Fourth*	316	33.4	2.99 (1.61, 5.55)	0.001
Middle*	345	50.5	3.63 (1.94, 6.78)	0.000
Second*	413	55.7	3.07 (1.62, 5.83)	0.001
Lowest*	449	55.6	2.84 (1.47, 5.48)	0.002
Number of Household Members				
1-3	227	38.1	1.00 (reference)	

4-6	751	44.9	0.89 (0.64, 1.25)	0.514
7+	563	47.3	1.02 (0.71, 1.45)	0.918

Notes: The model was restricted to one child under-five years per household to avoid cluster effects; ^ Due to insufficient cases (n=9) for age of net between 0-1 months, we lumped 0-6 months together. *p < 0.05; 95% CI =

Annex 6: List of Key In-Country Stakeholders Involved in Impact Evaluation Meetings

Table 5.1.1. List of Stakeholders that participated in the Liberia Impact Evaluation Introduction Meeting, November 17, 2015

	NAME	ORGANIZATION/DEPARTMENT
1.	Edward G. Wingbah	Environmental Protection Agency (EPA)
2.	Christie Hershey	USAID/PMI
3.	Richard Scott	Mentor Initiative
4.	Daniel F. Kingsley	LISGIS
5.	Cameron Taylor	DHS Program/ICF International
6.	R. Oliver Hoggard	Liberia Broadcasting System (LBS)
7.	Jasper I. Mason	Mother Pattern College of Health Sciences
8.	Samantha Herrera	MEASURE Evaluation/ICF
9.	Victor S. Koko	NMCP
10.	McAllen S. Quiah	NMCP
11.	Agnes S. Janafo	NMCP/MOH
12.	Joseph O. Alade	NMCP
13.	D. Levi Hinneh	NMCP
14.	Daniel V. Somah	NMCP
15.	Alfred C. Pah	NMCP
16.	Blamo Sieh	NMCP
17.	Richard Benson	NMCP
18.	George N. Dehnue	NMCP
19.	Fedesco W. Freeman	NMCP
20.	Stephen S. Seah, Jr.	NMCP
21.	Jamesetta T. Smith	NMCP
22.	William Belleh	Subah-Belleh Associates
23.	Forkpa D. Karmon	Subah-Belleh Associates
24.	James A. Thompson	Subah-Belleh Associates
25.	Sumo Zeze	Subah-Belleh Associates

Table 5.1.2. List of Stakeholders that participated in the Liberia Impact Evaluation Preliminary Dissemination Results Meeting, July 5th, 2016

	NAME	ORGANIZATION/DEPARTMENT
1.	Victor S. Koko	NMCP
2.	Oliver Pratt	NMCP
3.	William Belleh	SBA
4.	Sumo Zeze	SBA
5.	Luke L. Bawo	MOH
6.	Stephen M. Gbanyan, Jr.	MOH
7.	Samantha Herrera	ICF International
8.	D. Levi Hinneh	NMCP
9.	Stephen S. Seih, Jr.	NMCP-MOH
10.	Sylvester Wesseh	Plan-Liberia
11.	Desmond Williams	CDC
12.	Kwabena Larbi	NMCP/MSH
13.	Sophie Parwon	PCU/MOH
14.	Paye K. Nyansaiye	NMCP/MOH
15.	Momolu Massaquoi	MOH/PW
16.	Christie Reed	PMI/CDC
17.	Momo Horace	AM Dogliotti Medical College
18.	Moses K. Jeuronlon	WHO
19.	Raymond Oliver Hugger	E-Liberia Broadcasting Corporation
20.	Forkpa D. Karmon	SBA
21.	Anthony Yeakpalah	UNICEF
22.	Edwin Sherman	SBA
23.	Kaa Williams	USAID/PMI
24.	Chea Sanford Wesseh	MOH