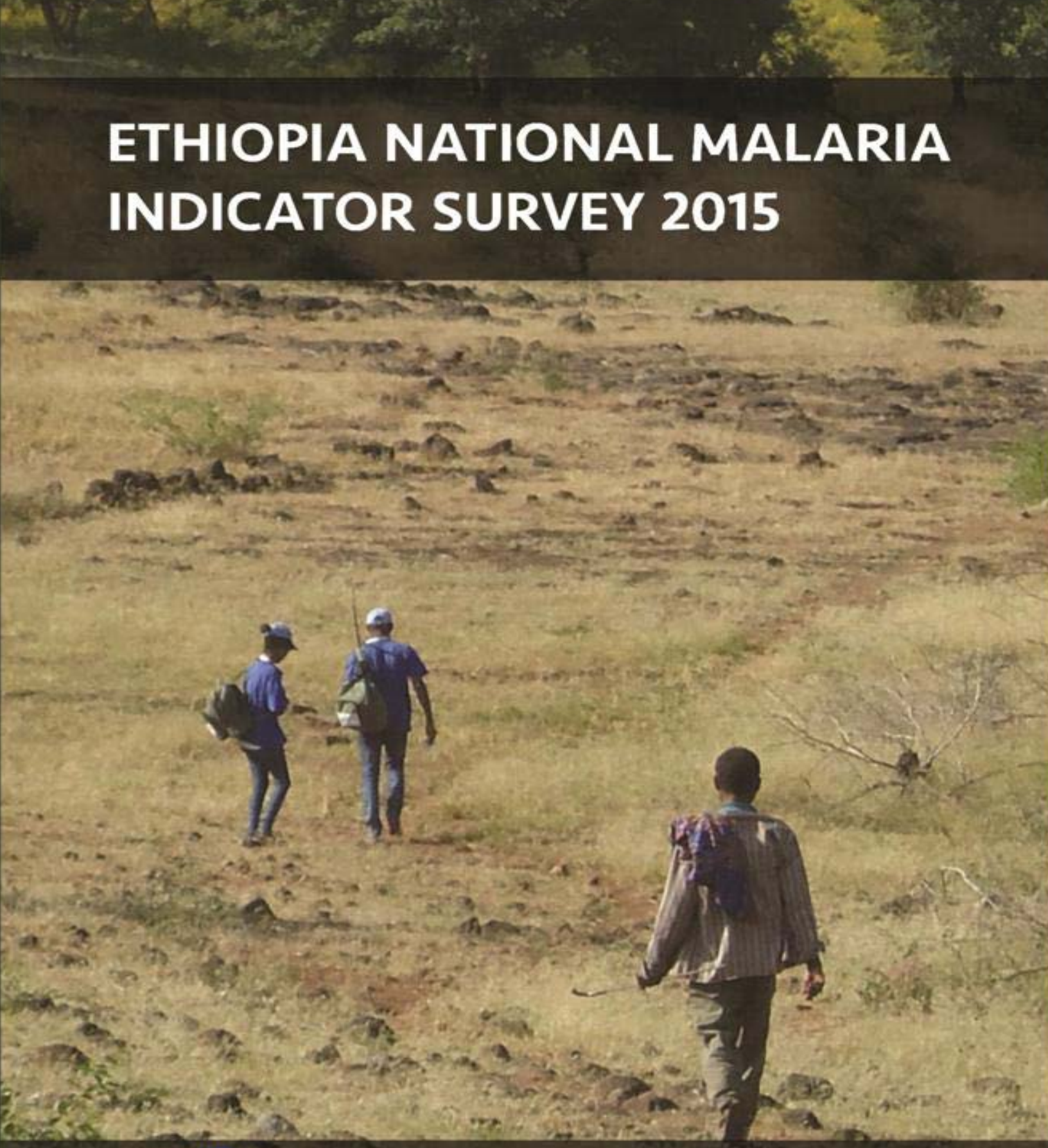
ETHIOPIA NATIONAL MALARIA INDICATOR SURVEY 2015



Federal Democratic Republic of Ethiopia
Ministry of Health

Ethiopian Public Health Institute
Addis Ababa, Ethiopia

Ethiopia National Malaria Indicator Survey 2015

Ethiopian Public Health Institute
Addis Ababa
Ethiopia

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Acronyms and terms

ACT	Artemisinin-based combination therapy
ACIPH	Addis Continental Institute of Public Health
AL	Artemether-lumefantrine
ASL	Above sea level
CDC	US Centers for Disease Control and Prevention
CSA	Central Statistical Agency
DBS	Dried blood spot
EA	Enumeration area
EMIS	Ethiopia National Malaria Indicator Survey
EPHI	Ethiopian Public Health Institute
FMOH	Federal Ministry of Health
g/dl	Grams per deciliter
GPS	Global positioning system
iCCM	Integrated community case management
IRS	Indoor residual spraying
LLIN	Long-lasting insecticide-treated net
MC	Malaria Consortium
MACEPA	Malaria Control and Elimination Partnership in Africa
NMCP	National Malaria Control Program
NSP	National Strategic Plan for Malaria Prevention, Control, and Elimination
PMI	US President's Malaria Initiative
RBM	Roll Back Malaria
RDT	Rapid diagnostic test
RHB	Regional Health Bureau
SNNPR	Southern Nations, Nationalities, and Peoples' Region
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
WHO	World Health Organization

Household	A household denotes a group of persons who often live in the same housing unit or in connected premises and have common arrangements for cooking and eating their food. A household could consist of a single person, but usually it consists of a husband, his wife, his children, relatives, etc. The members of a household could be composed of relatives and non-relatives. The non-relatives could be friends, servants, employed agricultural workers, etc.
Housing unit	A housing unit is a separate and independent part of the whole of a building or a group of buildings used or intended to be used for habitation by a household; or if not so, used or intended to be used as a school, store, a bar, barber shop, a manufacturing establishment, or for other non-residential purposes.
Enumeration area (EA)	An enumeration area is a unit of land delineated for the purpose of enumerating housing units and population without omission and duplication. An EA usually consists of 150–200 households in rural areas, and 150–200 housing units in urban centers. An EA may be equal to a kebele, if the number of households in the rural kebele, and of housing units in the urban kebele, is less than or equal to 150–200.
Stratification	Stratification consists of dividing the population into subsets (called strata) within each of which an independent sample is selected.
Cluster	A group of contiguous elements of a statistical population (e.g., a group of people living in a single house, a consecutive run of observations in an ordered series, or a set of adjacent plots in one part of a field).
Design effect	The measure of the efficiency of complex designs as compared to the design using simple random sampling of the same size.
PPS sampling	A sampling procedure whereby each unit has a probability of selection proportional to the size of some known relevant variable. In the case of household surveys, size is usually defined in terms of number of households or population.
Sampling weights	The coefficients of a linear function of the values of the sample units used to estimate population, stratum, or higher stage unit totals are called sampling weights or alternatively known as raising, multiplying, weighting, or inflation factors of the corresponding sample units.

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Foreword

Achieving Ethiopia's malaria control and elimination goals is an essential element of realizing the country's objective of growing and transforming into a healthy and productive society. The Ethiopia National Malaria Indicator Survey 2015 (EMIS 2015), the country's third malaria indicator survey, evaluates the overall progress on the coverage and use of malaria prevention and control in the country since 2011. The Ethiopian Public Health Institute (EPHI) led the survey with strong collaboration of partner organizations.

As a community-based survey, the EMIS generates reliable information that augments the routine data collected from health facilities through the health management information system (HMIS) and Public Health Emergency Management (PHEM). In the last few years, many resources have been mobilized to tackle the burden of malaria leading to encouraging results regarding the population at risk of the disease, especially children and pregnant women. The scaling up of malaria interventions (like the large-scale distribution of long-lasting insecticidal nets and indoor residual spraying), improvement of diagnostic facilities, prompt treatment, and behavioral change communication against malaria are among the government and partners' coordinated efforts to tackle the burden of the disease.

A periodic survey is an effort to measure the success and understand how much of a threat malaria poses to the well-being of our society and the developmental endeavors of the country. We sincerely hope that elimination will be possible if we continue the momentum of the scaling-up of malaria control. If we fail to properly monitor progress, the path toward elimination will be complicated by challenges such as resistance to anti-malaria drugs and insecticides. Therefore, planned and periodic evaluation of the malaria prevention and control program is the best approach to identify these multipronged challenges.

The EMIS 2015 has provided important information that allows the malaria control program and partners to be vigilant in their review and monitoring of strategic and programmatic decisions. It informs us so that we may build on existing achievements and address the weaknesses that have been observed.

The survey employed robust research tools including software-embedded smart phones that enhanced the quality of the data gathered from the field. The EMIS 2015 results focused mainly on malaria intervention areas under 2,000 meters above sea level. It assessed various malaria indicators including ownership and use of long-lasting insecticide-treated nets, indoor residual spraying coverage, prevalence of malaria, and management of malaria.

We hope that all stakeholders directly involved and working in the area of malaria prevention and control will benefit from the information gathered from this survey and that those academic institutions, researchers, and implementing partners use the information to move forward in the battle against malaria.

Finally, we are grateful to all partners and individuals who devoted their energy and time to the successful implementation of the survey. This survey would not have been impossible without strong commitment and efforts of partners and dedicated individuals.

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Executive summary

Malaria is a major public health problem in Ethiopia despite relatively low malaria prevalence compared to most other malaria-endemic countries in Africa. Unstable malaria transmission patterns make Ethiopia prone to focal and multifocal epidemics that have on occasion caused catastrophic public health emergencies. Malaria is seasonal in most parts of Ethiopia, with variable transmission and prevalence patterns affected by the large diversity in altitude, rainfall, and population movement. Generally, areas located less than 2,000 meters above sea level (<2,000m) in altitude are considered malarious areas. The massive scale-up of malaria control interventions, including case diagnosis and treatment, distribution of long-lasting insecticidal nets (LLINs), and indoor residual spraying of households with insecticides (IRS) have preferentially targeted these areas in Ethiopia.

The 2015 Ethiopia National Malaria Indicator Survey (EMIS 2015) is a large, nationally representative survey of coverage of key malaria control interventions, treatment-seeking behavior, and malaria prevalence. EMIS 2015 also assessed anemia prevalence in children under five years of age (U5), malaria knowledge among women, and indicators of socioeconomic status. The survey was conducted by the Ethiopian Public Health Institute/Ministry of Health in collaboration with the Central Statistics Agency (CSA), US President's Malaria Initiative (PMI), United Nations Children's Fund (UNICEF), Malaria Control and Elimination Partnership in Africa (MACEPA/PATH), Malaria Consortium (MC)-Ethiopia, World Health Organization (WHO), and ICAP. The survey was based on a two-stage cluster sample of 13,875 households in 555 enumeration areas (EAs), randomly selected from all regions and Dire Dawa City Administration. Of the 555 EAs, 466 EAs had altitudes of <2,000m and 89 were classified as having altitudes of 2,000–2,499 meters. EMIS 2015 is similar to the previous EMISs in that the report focuses on areas <2,000m as mapped by the global positioning system (GPS) during the survey. Differently from EMIS 2011, all regions, including Dire Dawa City Administration and Harari, have separate regional estimates. The survey was conducted from October to December 2015 by deploying 36 survey teams (each having nine data collectors) who used standard questionnaires programmed into Samsung Galaxy Neo 03 smartphones installed with EpiSample. These teams also collected blood samples from the households.

Sampled households contained 54,768 residents, including 7,897 children under five years of age (U5) and 11,463 women of child-bearing age. Blood samples were taken from all children U5 (with parents' consent) in every household and from persons of all ages in every fourth household. Malaria parasite testing was done using multi-species CareStart™ rapid diagnostic tests (RDTs) and microscopic examination of both thick and thin smeared blood slides. A hemoglobin level of children U5 was done using portable spectrophotometers (HemoCue Hb 201, Angelholm, Sweden). During the survey, 15,960 individuals had RDTs and 15,766 had blood slide examinations, and 7,897 children U5 had hemoglobin tests.

The EMIS 2015 results indicate that the majority of households own at least one LLIN (64 percent), and 32 percent own at least one LLIN for every two persons who stayed in the household the night before the survey. Sixty-four percent of households owned at least one LLIN in 2015 compared to 55 percent in 2011.

In malarious areas, 38 percent of the population slept under an LLIN the night before the survey. Among people living in households owning at least one LLIN, 61 percent slept under an LLIN the night before the survey. Forty-four percent of pregnant women and 45 percent of children U5 slept under an LLIN the previous night. However, in households owning at least one LLIN, use by children and pregnant women was 70 percent and 74 percent respectively.

IRS had been conducted in 29 percent of households in the 12 months preceding the survey. Overall, 71 percent of households are protected either by owning an LLIN/insecticide-treated net or having received IRS in the past 12 months..

It was reported that 16 percent of children U5 had fever in the two weeks preceding the survey. Of these children, 38 percent sought medical attention within 24 hours of onset of fever and 17 percent of children with fever received a heel or finger prick.

Overall, malaria prevalence in Ethiopia is very low. Malaria parasite prevalence in areas <2,000m was 0.5 percent by microscopy blood-slide examination for all ages and 0.6 percent among children U5. Similarly, RDTs indicated the prevalence of infection to be 1.2 percent among all ages and 1.4 percent among children U5.

The EMIS 2015 shows achievements and weaknesses of the malaria prevention and control strategic plan (National Strategic Plan 2011–2015) and the combined efforts of the Federal Ministry of Health and partner organizations. The results of the survey will inform the work of all concerned bodies to maximize efforts toward implementation and progress of the malaria prevention, control, and elimination strategic plan (National Strategic Plan 2014–2020).

1. Introduction

1.1 Country profile

Geography

Ethiopia, located within 3.30°–15°N, 33°–48°E in the northeastern part of Africa, has a total area of 1.1 million square kilometers. Ethiopia's topographic features range from peaks as high as Ras Dashen—4,550 meters (m) above sea level (ASL)—to 110m below sea level in the Afar Depression. The Great East African Rift Valley divides the highlands into the western, northern, and the southeastern highlands. There are three broad agro-ecological zones identified based on topography and climate in Ethiopia:

1. The "Kolla" or hot lowlands that are found below an altitude of 1,000m.
2. The "Weyna Dega" or midland between 1,000m and 1,500m.
3. The "Dega" or cool temperate highlands above 1,500m sea level.

Mean annual temperatures range from 10° to 16° C in the "Dega," 16° to 29° C in the "Weyna Dega," and 23° to 33° C in the "Kolla." In general, the highlands receive more rain than the lowlands, with annual rainfalls ranging from 500mm to over 2,000mm for the former and from 300mm to 700mm for the latter.

Demography

The total population of Ethiopia was estimated at 88,663,727 in 2015 when projected from the 2007 census. Half of the population (49.5 percent) is female. The average household size was 4.6 persons in 2011[1] and the majority (83 percent) of the population of Ethiopia lives in rural areas. Ethiopia has a very young population as is typical of many developing countries.[1] Furthermore, proportion the population consisting of children under five years of age and pregnant women was estimated to be 14.6 percent and 3.3 percent, respectively.

Economy

Ethiopia's economy is based on agriculture, which accounts for almost half of the GDP, 80 percent of exports, and 80 percent of total employment. Exports are almost all agricultural commodities with coffee as the leading commodity. Other export commodities include cut flowers, oilseeds, gold, and leather products. The main import commodities are petroleum and petroleum products, chemicals, machinery, and textiles.

Administrative structure

Ethiopia is a federal democratic republic composed of nine regional states (Tigray; Afar; Amhara; Oromia; Somali; Benishangul-Gumuz; Southern Nations, Nationalities, and Peoples' (SNNPR); Gambella; and Harari) and two city administrations (Addis Ababa and Dire Dawa).

The regional states and city administrations are further divided into zones which are further divided into 835 woredas (districts). A woreda is the basic decentralized administrative unit and has an administrative council composed of elected members. The woredas are further divided into roughly 15,000 kebeles (villages) organized under peasant associations in rural areas (10,000 kebeles) and urban dwellers' associations (5,000 kebeles) in towns.

With the devolution of power to regional governments, public service delivery is under the jurisdiction of the regional states. The regional health bureaus (RHBs) are responsible for administration of public health while the woredas are responsible for planning and implementation of services.

1.2 Malaria

In 2010, the second five-year National Strategic Plan for Malaria Prevention, Control, and Elimination (NSP 2011–2015) was developed, which itself was embedded in the health sector's overarching framework, the Government of Ethiopia Health Sector Development Plan Four (HSDP IV). Its main goals were:[2]

- By 2015, achieve malaria elimination within specific geographical areas with historically low malaria transmission.
- By 2015, achieve near zero malaria death in all malarious areas of the country.

To sustain the achievements of the previous strategic plans, further reduce the mortality and morbidity related to malaria, and initiate the elimination strategy, a new NSP was developed.[3] The goals of the NSP 2014–2020 are:

- By 2020, achieve near zero malaria deaths (no more than one confirmed malaria death per 100,000 population at risk) in Ethiopia.
- By 2020, reduce malaria cases by 75 percent from a 2013 baseline.
- By 2020, eliminate malaria in selected low transmission areas.

The main objectives of the strategy are:

- By 2020, all households living in malarious areas will have the knowledge, attitudes, and practice of malaria prevention and control.
- By 2017 and beyond, 100 percent of suspected malaria cases are diagnosed using rapid diagnostic tests (RDTs) or microscopy within 24 hours of fever onset.
- By 2015 and beyond, 100 percent of confirmed malaria cases are treated according to the national guidelines.
- By 2015 and beyond, ensure and maintain universal access of the population at risk to at least one type of globally recommended anti-vector intervention.
- By 2020, achieve and sustain zero indigenous transmission of malaria in 50 selected districts.
- By 2020, 100 percent complete data and evidence will be generated at all levels within designated time periods to facilitate appropriate decision-making.

The key interventions are:

- Community empowerment and mobilization.
- Diagnosis of all suspected cases.
- Management of confirmed malaria cases.
- Prevention/vector control.
- Surveillance and response.
- Monitoring and evaluation.

Malaria epidemiology

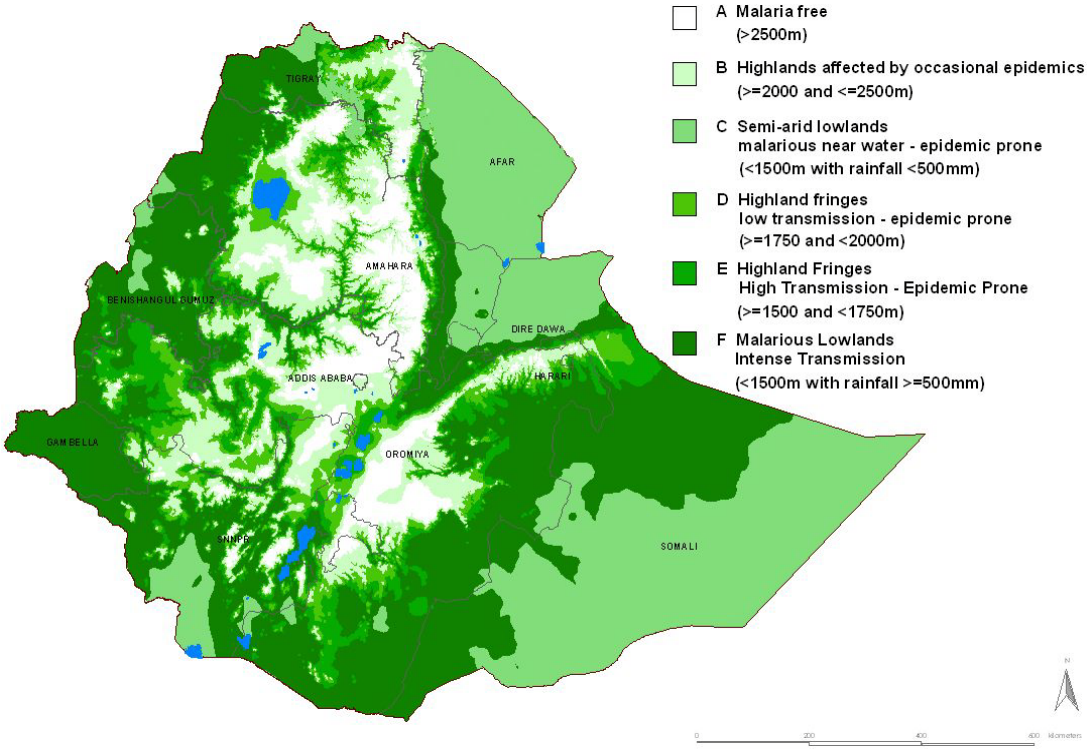
Approximately 60 percent of Ethiopia's population lives in malarious areas, and 68 percent of the country's landmass is favorable for malaria transmission, with malaria primarily associated with altitude and rainfall.[4,5] In general, the peak of malaria incidence follows the main rainfall season (July to September) each year. However, many areas in the south and west of the country have a rainfall season beginning earlier in April and May or have no clearly defined rainfall season.[4] Consequently, malaria transmission tends to be highly heterogeneous geo-spatially within each year as well as between years. Additionally, malaria in Ethiopia is characterized by widespread epidemics occurring every five to eight years, with the most recent epidemic occurring in 2003/2004.

In 2014/2015, the total number of laboratory-confirmed plus clinical malaria cases were 2,174,707. Of those cases, 1,867,059 (85.9 percent) were confirmed by either microscopy or rapid diagnostic tests (RDTs) out of which 1,188,627 (63.7 percent) were *Plasmodium falciparum* and 678,432 (36.3 percent) were *P. vivax*.[6]

Malaria stratification

Overall, the malaria transmission pattern in the country is seasonal and unstable,[7] often characterized by focal and large-scale cyclic epidemics. A relatively long transmission season exists in the western lowland areas, river basins, valleys, and irrigations schemes. Due to the unstable and seasonal transmission of malaria, protective immunity is generally low and all age groups of the population are at risk of the disease. The central highlands, which are >2,500m ASL, are generally free of malaria. The rest of the country, however, has a varied pattern of malaria transmission (**Figure 1**), with the transmission season ranging from less than three months to greater than six months.[8]

Figure 1. Malaria risk stratification, Ethiopia (adopted from the Malaria NSP 2014–2020)



Malaria risk stratification was revised in 2014 using annual parasite incidence per 1,000 population (per the World Health Organization [WHO] recommendation) plus altitude and expert opinions from different malaria stakeholders.[5]

According to the new stratification, malaria risk in Ethiopia by annual parasite incidence is classified into high, medium, low and malaria-free as shown in Figure 2 and Table 1.

Figure 2. Risk map of districts by annual parasite incidence, Ethiopia
Note: Malaria-free stratum further refined based on elevation/altitude information
Source: FMOH NSP, v. June 14, 2014

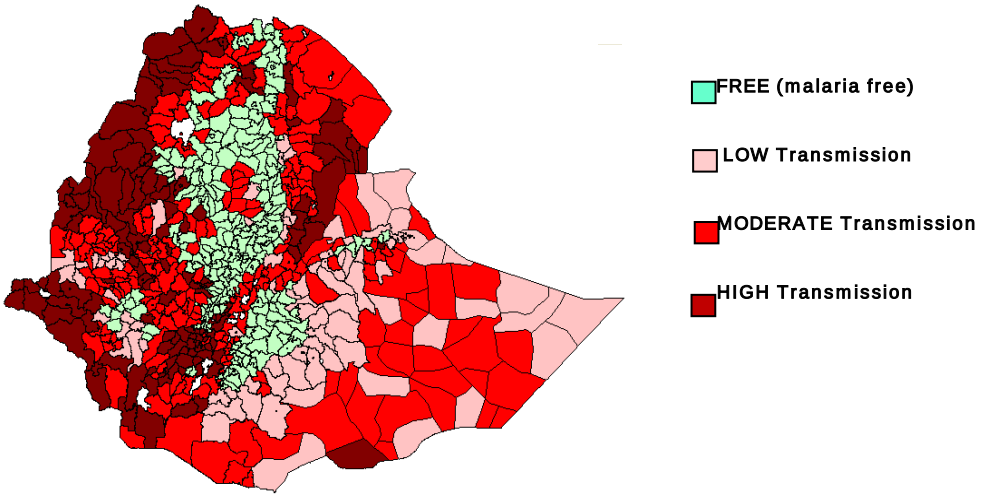


Table 1. Malaria stratification and proposed intervention per stratum

Malaria strata	API*	Elevation (m)	Population (2013)	Percent population	No. of woredas	Percentage of woredas	Interventions					
							LLIN	IRS	Larval Control	Case Mx	Surveillance	IEC/ BCC*
FREE	0	>= 2,000 ASL	33,639,639	40 percent	290	35 percent	-	-	-	X	X	X
LOW	>0 &<5	< 2,000 ASL*	11,153,499	13 percent	101	12 percent	X	X*	WA*	X	X	X
MODERATE	>=5 &<100		28,410,564	34 percent	287	34 percent	X	-	WA	X	X	X
HIGH	>=100		11,023,284	13 percent	157	19 percent	X	X	WA	X	X	X
Total			**84,226,986**	**100 percent**	**835**	**100 percent**						

*Only 32 percent of at risk population in highland fringe/epidemic-prone areas will be covered by IRS
API: Annual parasite index; ASL: above sea level; IEC/BCC: information, education, and communication/behavior change communication; WA: where applicable

For the purposes of the Ethiopia National Malaria Indicator Survey (MIS), areas below 2,000m ASL were considered as a target for malaria interventions, while those between 2,000m and 2,500m ASL were included to assess potential intervention and transmission, as these areas are historically prone to malaria transmission.

1.3 Survey organization and methodology

The 2015 Ethiopia National Malaria Indicator Survey marked Ethiopia's third such survey. As with the previous surveys in 2007 and 2011, the 2015 EMIS was designed to follow the RBM Monitoring and Evaluation Reference Group guidelines.

The 2015 EMIS field work was conducted from September 30, to December 10, 2015, covering a sample of 13,875 households in malarious areas between 2,000m and 2,500m ASL. All women 15–49 years of age in the selected households were eligible for individual interviews. They were asked questions about prevention of malaria, treatment of childhood fever, and their knowledge of malaria prevention. In addition, the survey included testing for anemia and malaria among children age 6–59 months in all selected households and malaria among all age groups using a finger-prick or heel-prick blood sample in every fourth household.

Objectives of the survey

The main goal of the EMIS 2015 was to measure the progress toward achieving the goals and objectives of the NSP 2011–2015. The specific objectives of EMIS 2015 were:

- To measure the access to, coverage, and use of the core malaria control interventions, including long-lasting insecticide-treated nets (LLINs), indoor residual spraying (IRS), diagnostic services, and anti-malarial medicines.
- To measure the prevalence of malaria-related fever, malaria parasitemia and anemia among children under five, and malaria parasitemia among populations over five years of age.
- To assess the knowledge, attitude, and practices of women of reproductive age (15–49 years) vis-à-vis malaria and methods for prevention and control.

Survey organization

Similar to the surveys in 2007 and 2011, a number of in-country malaria stakeholders technically, operationally, and financially contributed to the planning and implementation of the EMIS 2015. The planning and implementation of the 2015 survey was led by the Ethiopian Public Health Institute (EPHI). The EMIS 2015 steering committee, with representation from various partners, supported the planning and implementation of the survey. The list of individuals and organizations involved is annexed in Appendix C.

Sample design

The EMIS 2015 was conducted in malarious areas below 2,000m ASL where the malaria prevention and control interventions are being implemented and areas between 2,000m and 2,500m ASL. Areas that are known to be free of malaria (>2,500m ASL) were excluded from the sampling frame.

The sample for EMIS 2015 was designed to provide estimates for the malarious areas of the country as a whole and areas between 2,000m and 2,500m ASL, separate estimates for urban and rural areas, and regional estimates for nine regions and one city administration in the malarious areas. Accordingly, 85 percent of the households were allocated to malarious areas and 15 percent to areas between 2,000m and 2,500m ASL.

The following domains were specified for EMIS 2015:

- National (country): rural for enumeration area (EA) mean altitude of ≤2,000m ASL.
- National (country): urban for EA mean altitude of ≤2,000m ASL.
- National (country): for EA mean altitude of >2,000 and ≤2,500m ASL.
- Sub-national for EA mean altitude of ≤2,000m ASL: Tigray, Afar, Amhara, Oromia, Somali, Benishangul-Gumuz, SNNPR, Gambella, Harari, and Dire Dawa.

The sampling frame was the most recently available list of EAs and digitized EA maps from the Central Statistics Agency (CSA). All EAs were stratified into three strata. Stratum I contained EAs with mean altitude of ≤2,000m ASL, Stratum II with mean altitude of >2,000 and ≤2,500m ASL, and Stratum III with mean altitude of >2,500m ASL. EAs falling in Stratum III were excluded from the sampling frame. The list of eligible EAs was thoroughly evaluated and approved by CSA and the EMIS Technical Working Group. In each domain, a sample of EAs was selected independently with probability proportional to size (PPS) (refer Appendix A).

The EMIS 2015 followed the standard two-stage cluster sampling methodology. In the first stage, 555 EAs were selected with probability proportional to EA size. Then a complete mapping and listing of all households in the selected EAs was conducted and 25 households were randomly selected for a total of 13,875 households, of which 13,789 households were occupied at the time of the survey. Among these households, 13,354 completed the household questionnaire, yielding a response rate of 96.8 percent (Table 2).

In the 13,354 households surveyed, 12,691 women age 15-49 years women were eligible for individual interview, of whom 11,492 completed the interview, yielding a response rate of 90.6 percent.

Table 2. Results of the household and individual interviews

Number of households, interviews, and response rates, according to residence (unweighted) for areas ≤2,000m ASL and areas >2,000m and ≤2,500m ASL, Ethiopia 2015

	Residence in malarious areas ≤2,000m ASL			Residence in areas >2,000m and ≤2,500m ASL
Result	Urban	Rural	Total	
Household interviews				
Households selected	3,076	8,494	11,570	2,219
Households occupied	3,076	8,494	11,570	2,219
Households interviewed	2,939	8,236	11,175	2,179
Household response rate[1]	95.5	97	96.6	98.2
Interviews with women age 15-49				
Number of eligible women	2,878	7,790	10,668	2,023
Number of eligible women interviewed	2,625	7,019	9,644	1,848
Eligible women response rate[2]	91.2	90.1	90.4	91.3

[1] Households interviewed/households occupied
[2] Respondents interviewed/eligible respondents

Questionnaires

Two questionnaires were used for the EMIS 2015: a household questionnaire (Annex 2) and a women's questionnaire that were originally developed by the Macro MEASURE Demographic and Health Survey Roll Back Malaria (RBM)/Monitoring and Evaluation Reference Group. They were adapted and used in the EMISs in 2007 and 2011.

The household questionnaire was used to list all usual members and visitors of the selected households, including their age, sex, and relationship to the head of the household. It was also used to collect data on household socioeconomic status, household status of IRS, household LLIN ownership, and prevalence of anemia and malaria in children under five years of age and malaria prevalence for all ages in every fourth household. Furthermore, the household questionnaire enabled identification of all women ages 15 to 49 years who were eligible for the women's questionnaire.

The women's questionnaire was used to collect data from women ages 15–49 years that included: background characteristics of the respondent, reproduction history, general malaria knowledge, sources of relevant malaria messaging, fever prevalence, and fever treatment with anti-malarial medicines among children under five years of age.

Both questionnaires were programmed into Samsung I9300 S3 Neo smartphones with global positioning system (GPS) capability. English was the default data collection language. However, the questionnaires were translated in to Amharic and Oromiffa languages to enhance data collectors' and respondents' understanding of the questionnaires.

Anemia and malaria testing

All specimens for anemia testing, malaria rapid diagnostic tests (RDTs), blood smears, and dried blood spot (DBS) testing were performed using blood drawn from a single finger/heel prick of a survey participant after obtaining verbal consent.

Anemia testing: Anemia testing followed the RBM/Monitoring and Evaluation Reference Group recommendations, with hemoglobin concentrations measured using a portable spectrophotometer (HemoCue®, Anglom, Sweden). Blood samples were collected from all children under five years of age in all 25 households selected for interview per EA. For children diagnosed with anemia (hemoglobin 5–8 grams per deciliter [g/dl]), results were shared with the parent/guardian, and the children were given artemether-lumefantrine if older than four months of age as per the national protocol, albendazole if under 24 months of age per integrated management of childhood illness national protocol, and a two-week supply of supplemental iron.[9] All infants under four months of age and children with hemoglobin <5g/dl were referred to the nearest health facility for further evaluation and treatment. The treatment algorithm is presented in Appendix E.

Malaria rapid diagnostic testing: Blood samples were collected from children under five years of age in all the 25 households selected per EA for interview and for all age groups in 6 out of 25 households in each cluster. The Carestart® (*pf*/PAN) multispecies RDT used was capable of detecting both *P. falciparum* and other *Plasmodium* species.

Subjects with a positive RDT for *P. falciparum* or *P. falciparum* / mixed infection who were not pregnant, received immediate treatment for malaria using artemether-lumefantrine as per the national protocol and RDT-positive pregnant women were treated with quinine tablets. Those individuals who were positive for *P. vivax* or PAN were only treated using chloroquine (as per national protocol). Subjects who were found to be seriously ill, as determined by the survey interviewers, were advised to immediately visit the nearest possible health facility.

Malaria microscopy: Blood samples were collected from children under five in all 25 households selected per EA for interview and from all age groups in 6 out of 25 households. Thick and thin blood smears were made on a single slide; the slide was labeled, air-dried, and placed in a slide box. The slides were then stained with Giemsa at the nearest health facility the same or next day. The stained slides were transferred to EPHI where they were read by eight microscopists after the field work was completed. As part of quality assurance, all positive slides and 5 percent of negative slides from each region were selected and reread at Adama Malaria Control Center by an experienced microscopist. Furthermore, 48 slides with discordant results were reread by a third reader (a senior microscopist) whose findings were considered final.

Training

Training was conducted at the Ethiopian Management Training Institute in Debrezeit/Bisheftu and facilitated by EPHI, CSA, and various EMIS 2015 Steering Committee members. Overall, 326 data collectors (all from RHBs; 142 interviewers and 148 laboratory technicians), 36 field team leaders (all from RHBs) and 37 supervisors (both from RHBs and FMOH/EPHI) and partners (Addis Continental Institute of Public Health [ACIPH]/President's Malaria Initiative [PMI], ICAP, UNICEF, WHO, Malaria Consortium [MC] and MACEPA/PATH) participated in the training. Training included an introduction to smartphones and the questionnaire as well as a number of theoretical and practical sessions on questionnaire administration (e.g., role playing in different local languages), GPS data collection and geo-referencing of households, laboratory procedures (e.g., blood sampling, preparing microscopic slides, processing samples for RDTs, and hemoglobin testing), hazardous waste disposal, and mock interviews. Prior to fieldwork, the questionnaires were pre-tested and adjusted in 37 urban EAs close to the training center.

Field work

Prior to commencing field work, community sensitization activities were implemented by FMOH/EPHI and UNICEF-Ethiopia and included formal letters, radio spots, posters, and leaflets. These approaches included information regarding the purpose of the EMIS, the procedures, and expectations from local authorities and communities, as well as the importance of household participation. Furthermore, a series of television and radio spots was aired in the national language and in the two other major languages. The spots were aired three times a week, starting one week before the survey for a total period of five weeks. The field work began on September 30, 2015, and ended on December 10, 2015. Surveyors were organized in 36 teams (124 functional sub-teams). A total of 35 supervisors, 36 team leaders, 326 surveyors, and 40 drivers were deployed to their respective survey areas. A typical survey team consisted of ten people (four sub-teams of two people each, a team leader, and a driver).

Teams were visited by supervisors in the field at least twice during the survey period in order to ensure data quality. These supervisory visits covered all aspects of the survey including smartphone records and questionnaires, random inspection of some surveyed households, completion of a supervisory checklist, replenishment of supplies, transport logistics, and feedback. Institutions and individuals involved in the supervision are listed in Appendix C.

Data management and processing

The data were electronically submitted from the field to a central server at EPHI and then downloaded from the server. The data were processed to check for data quality and reporting completeness by the data manager. Processing the data concurrently with data collection allowed for regular monitoring of team performance and data quality. The data were checked for consistency and completeness and feedback was given on a regular basis, encouraging teams to continue their work and to correct areas in need of improvement. Data cleaning and analysis of the EMIS 2015 data began as soon as smartphones were received from the field. Data collected were retrieved from the smartphones and merged and converted to CSV files. A data analysis working group was formed to do the data cleaning and analysis. Analysis was done using STATA software version 13. Descriptive statistics were used to describe the characteristics of the sample and calculate coverage, use, and access estimates. Point estimates were derived using SURVEY (SVY) commands, which adjust for clustering in the sample design. Sampling weights adjusted for household and individual non-response rate were employed. Principal component analysis was used to construct a wealth index. Indicators were calculated for each of the four domains separately.

Ethical considerations

The protocol for the 2015 EMIS was approved by the EPHI Scientific and Ethical Review Committee (SERC) and the ethical review committees of MACEPA/PATH and the US Centers for Disease Control and Prevention (CDC) Atlanta. All data and other information were maintained confidentially to the greatest extent possible. The list of the identification numbers and respondents' names were stored separately during fieldwork and were removed from the electronic database during analysis. The blood samples were stored only with barcode identifiers to protect the identity of the respondent.

Verbal informed consent was sought, during which the risks and benefits of participation in the survey were explained to potential respondents. The risk of participation was minimal and was limited to temporary discomfort associated with either discussion of potentially sensitive information or with the finger- or heel-prick blood collection. The benefits of participation in the survey included anemia and malaria testing for children, malaria testing for all, and treatment or referral as appropriate. Also, the results will enable the National Malaria Control Programme (NMCP) to monitor key health indicators and provide evidence for decision-making and policy development. There was no compensation for participating respondents.

Challenges and limitations

As stated in RBM Household Survey Indicators for Malaria Control guidelines, reliable program data obtained during routine spraying activities is crucial for evaluating the performance of IRS programs. The NMCP operates in targeted to high transmission areas and a few highland fringe epidemic prone areas; however, this EMIS measures IRS coverage from all malarious areas in the country, including those areas not covered by the IRS program. Thus IRS coverage results should be interpreted cautiously.

The other limitation of this survey was a mistake in the skipping patterns. In the women's questionnaire, if the woman respondent didn't attend school, she was not asked about her literacy. This underestimates the percentage of literate women in malarious areas and areas between 2,000m and 2,500m ASL. Additionally, interviewers did not assist the respondents in remembering what drug they or their child received by showing the photo of drugs. Because of this, there were many missing values on names of the drugs and this underestimates the percentage of children who took an artemisisnin-based combination therapy (ACT). The data is therefore omitted from the current report.

Lastly, the proportion of *P. falciparum* and *P. vivax* is critical to understand the epidemiological transition of malaria as these are dominant species in Ethiopia. However, since the EMIS 2015 was conducted during the major transmission season and few malaria cases were reported during the survey (149) and close to 70 percent of the cases were from Gambella and Benshangul Gumuz (where *P. falciparum* dominates), these highly overestimate the proportion due to *P.falciparum*. Hence precaution should be taken when interpreting this result of the survey.

2. Characteristics of households and women respondents

Key findings

- About three fourths of households in malarious areas (73 percent) have access to an improved source of drinking water.
- Twelve percent of households have an improved toilet facility, not shared with other households.
- Twenty-nine percent of households have electricity.
- More than half of the households own agricultural land, and 59 percent possess one or more farm animals.
- Forty three percent of the population is under age 15.

This chapter summarizes basic demographic and socioeconomic characteristics of the population in the households sampled in the 2015 EMIS. For the purpose of this survey, a household was defined as a person or group of persons, related or not, living together in the same dwelling unit, under one household head, sharing a common cooking space. The Household Questionnaire (see Appendix E) included basic demographic and socioeconomic information (e.g., age, sex, educational attainment, and current school attendance) for all usual residents and for visitors who spent the night preceding the interview in the household. The Household Questionnaire also obtained information on housing characteristics (e.g., sources of water supply and sanitation facilities) and household possessions. This chapter also profiles the women who live in the household and their basic characteristics, including age at the time of the survey, religion, residence, education, and literacy.

The information presented in this chapter is intended to facilitate interpretation of the key demographic, socioeconomic, and health indices presented later in the report. It is also intended to assist in the assessment of the representativeness of the survey sample.

2.1 Population by age and sex

Age and sex are important variables that are the primary basis for demographic classification in vital statistics, censuses, and surveys. They are also important variables for the study of mortality, fertility, and marriage.

Table 3. Household population by age, sex, and residence

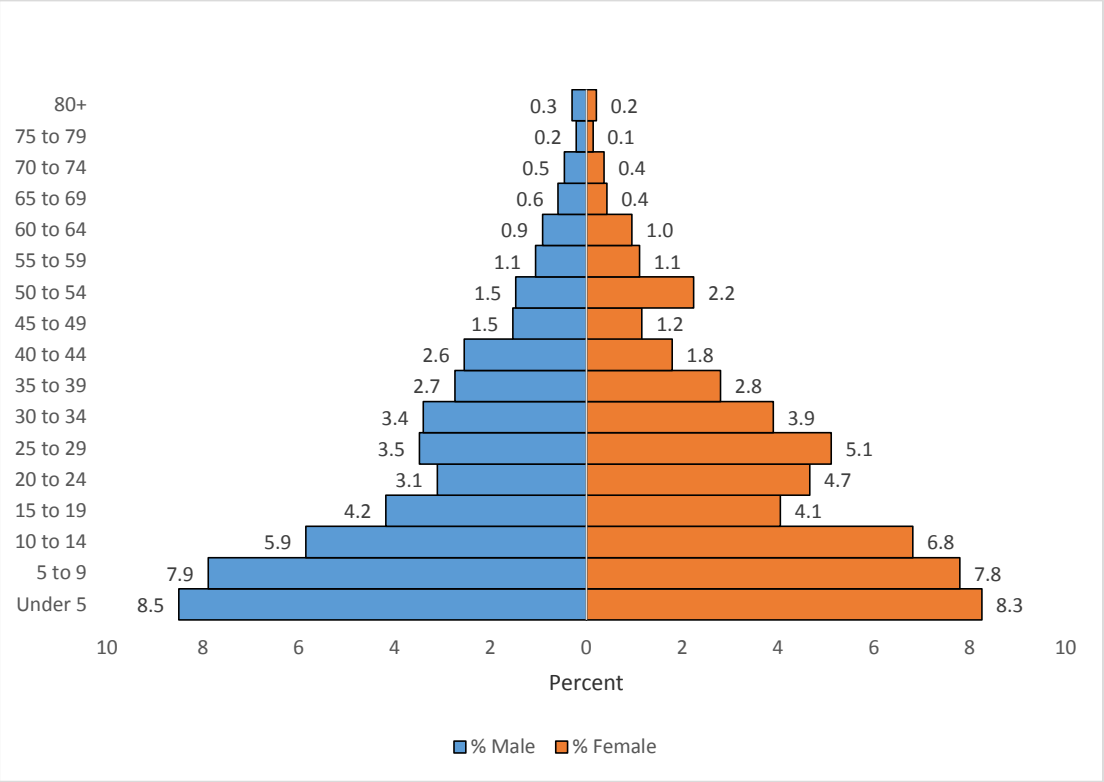
Percent distribution of the de facto household population by five-year age groups, according to sex and residence, Ethiopia 2015

	Malarious areas ≤2,000m ASL									Areas >2,000m and ≤2,500m ASL		
	Urban			Rural			Total					
Age	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
<5	15.2	11.4	13.1	18.2	17.2	17.7	17.6	15.9	16.7	13.9	12.5	13.2
5-9	11.8	9.5	10.6	17.5	16.6	17.1	16.4	15.1	15.7	17.3	16.2	16.7
10-14	10.2	11	10.6	12.6	13.7	13.2	12.1	13.1	12.7	15	15.1	15
15-19	9.6	9.9	9.8	8.4	7.2	7.8	8.7	7.8	8.2	9.8	8	8.9
20-24	8.2	11.8	10.1	6	8.2	7.1	6.4	9	7.8	6.7	8.3	7.5
25-29	10.6	12.8	11.8	6.4	9	7.7	7.2	9.9	8.6	6.2	8.5	7.4
30-34	8.8	8.7	8.8	6.6	7.2	6.9	7	7.5	7.3	5.7	6.9	6.3
35-39	6.7	5.7	6.1	5.4	5.3	5.4	5.7	5.4	5.5	5.4	6.1	5.8
40-44	5.6	3.7	4.6	5.2	3.4	4.3	5.3	3.5	4.3	5.3	3.7	4.5
45-49	3.2	2.9	3	3.2	2.1	2.6	3.2	2.2	2.7	3.4	1.9	2.6
50-54	2.8	4.7	3.8	3.1	4.2	3.7	3.1	4.3	3.7	2.7	5.2	4
55-59	2	2.4	2.2	2.2	2.1	2.2	2.2	2.1	2.2	2.2	2.4	2.3
60-64	1.8	2.3	2.1	1.9	1.7	1.8	1.9	1.8	1.9	2.7	2.1	2.4
65-69	1.4	1	1.2	1.2	0.8	1	1.2	0.8	1	1.5	1.2	1.4
70-74	1	1	1	1	0.6	0.8	1	0.7	0.8	1	0.7	0.8
75-79	0.5	0.3	0.4	0.4	0.3	0.3	0.4	0.3	0.4	0.6	0.6	0.6
80 +	0.6	0.8	0.7	0.6	0.3	0.5	0.6	0.4	0.5	0.6	0.4	0.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number	4,321	5,071	9,392	17,086	17,919	35,005	21,407	22,990	44,397	4,419	4,521	8,940

Table 3 shows the distribution of the de facto household population (i.e., those who slept in the household the night before the survey) in the 2015 EMIS by five-year age groups, according to sex and residence in malarious and epidemic-prone areas. A total of 53,335 people were enumerated in the survey, and there were fewer males than females; the overall sex ratio was 939 males per 1,000 females.

The population age pyramid shows a substantially larger proportion of persons in younger age groups than in older age groups for each sex (Figure 3). The age pyramid is wide at the base, narrowing gradually as it reaches the upper age limits, indicating that Ethiopia has a relatively young population.

Figure 3. Population pyramid



2.2 Household composition

Table 4 presents information on household composition, including the gender of the head of the household and the household size by residence in malarious and epidemic-prone areas. These characteristics are important because they are associated with the welfare of the household and their access to food, health care, and services such as mosquito nets. Table 4 shows that households in malarious areas of Ethiopia are predominantly headed by men (70 percent). The proportion of households headed by women is higher in urban areas than in rural areas (47 percent and 25 percent, respectively). Overall, the mean size of a household is four persons (3.2 persons in urban and 4.3 persons in rural areas).

Table 4. Household composition

Percent distribution of households by sex of the head of household and by household size and mean size of household, according to residence, Ethiopia 2015

Characteristics	Malarious areas ≤2,000m ASL			Areas >2,000m and ≤2,500m ASL:
	Urban	Rural	Total	
Household headship				
Male	53.5	75.4	69.6	74.0
Female	46.5	24.6	30.4	26.0
Total	100.0	100.0	100.0	100.0
Number of usual members				
1	17.9	8.4	10.9	8.9
2	22.6	14.8	16.8	16.3
3	22.9	18.5	19.6	17.9
4	16.4	17.5	17.2	16.5
5	9.5	14.2	12.9	16.1
6	5.2	10.8	9.3	11.5
7	3.1	7.5	6.4	7.2
8	1.5	4.5	3.7	3
9+	1.1	3.9	3.2	2.6
Total	100.0	100.0	100.0	100.0
Mean size of households	3.2	4.3	4.0	4.1
Number of households	2,939	8,236	11,175	2,179

Note: Table is based on de jure household members (i.e., usual residents)

2.3 Household characteristics

Physical characteristics of a household's environment are important determinants of the health status of household members, especially children. They can also serve as indicators of the socioeconomic status of households. The 2015 EMIS asked respondents about their household environment, including access to electricity, source of drinking water, type of sanitation facility, type of flooring material, and number of rooms in the dwelling. The results are presented in terms of households and of the de jure population.

Drinking water

Increasing the percentage of the population with sustainable access to an improved water source in both urban and rural areas was among the Millennium Development Goals (MDGs) that Ethiopia and other countries adopted.[10] Improved water sources include piped water; water from a public standpipe, tube well, or borehole; and water from a protected well or spring. Water that must be fetched from an improved source may be contaminated during transport or storage. Thus, a long distance to an improved source of water may limit the quantity and quality of drinking water available to a household.

Table 5. Source of drinking water

Percent distribution of households and de jure population by source of drinking water and time to obtain drinking water, according to residence for areas ≤2,000m ASL and areas >2,000m and ≤2,500m ASL, Ethiopia 2015

	Malarious areas ≤2,000m ASL						Areas >2,000m and ≤2,500m ASL	
	Households			Population				
Characteristics	Urban	Rural	Total	Urban	Rural	Total	Households	Population
Source of drinking water								
Improved source	96.2	64.4	72.7	95.7	64.2	71.0	71.1	68.6
Piped water into dwelling/yard/plot	61.3	5.9	20.4	60.3	5.5	17.2	17.7	15.3
Public tap/standpipe	27.7	37	34.5	28.2	37.1	35.2	33.5	33.1
Tube well/borehole	1.0	2.8	2.3	1.1	2.8	2.5	3.4	3.5
Protected dug well	3.8	5.5	5.1	3.6	5.6	5.2	8.0	7.8
Protected spring	2.0	8.9	7.1	2	9.3	7.7	8.4	8.8
Rainwater	0.3	4.1	3.1	0.4	3.8	3.1	0.1	0.1
Bottled water	0.1	0.2	0.2	0.1	0.1	0.1	0.0	0.0
Non-improved source	3.8	35.6	27.4	4.1	35.6	20	28.9	31.2
Unprotected dug well	0.9	6.4	4.9	1	6.1	5	5.9	6.1
Unprotected spring	0.2	14.8	11	0.4	15.1	12	16.4	18.5
Tanker truck/cart with drum	1.7	0.8	1.1	1.8	0.6	0.9	0.2	0.1
Surface water	0.4	13.6	10.2	0.4	13.8	11.0	6.4	6.5
Other source	0.6	0.0	0.2	0.5	0	0.1	0.0	0.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Time to obtain drinking water (round trip)								
Water on premises	61.2	5.9	20.4	60.3	5.5	17.1	17.7	15.3
Less than 30 minutes	31.4	57.6	50.7	32.1	57.6	52.2	58.1	59.6
30 minutes or longer	7.4	36.5	28.8	7.6	36.8	30.7	24.2	25.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number	2,939	8,236	11,175	9,650	35,904	45,554	2,179	9,214

Table 5 shows the percent distribution of households and the de jure population by source of drinking water and time to obtain drinking water stratified by malarious (areas ≤2,000m ASL) and areas >2,000m and ≤2,500m ASL, according to residence. The results show that 73 percent of the households and 71 percent of the population have access to improved sources of water in malarious areas. In urban areas, 96 percent of the households have access to improved sources of water compared with 64 percent of households in rural areas. Piped water to the dwelling or to a public tap is the main source of drinking water for households in urban areas (61 percent), whereas in rural areas the main source of drinking water is a public tap or protected spring (46 percent).

In areas >2,000m and ≤2,500m ASL, 71 percent of the households and 69 percent of the population have access to improved sources of water. The most commonly used unimproved source of water is an unprotected spring.

Twenty and 18 percent of households have a source of drinking water on the premises in malarious and epidemic-prone areas, respectively. In malarious areas, availability of water on the premises is substantially higher in urban households (61 percent) than in rural households (6 percent). Twenty-nine percent of the households take 30 minutes or longer to travel round trip to obtain water; that includes 37 percent of the rural households and 7 percent of the urban households. In areas >2,000m and ≤2,500m ASL, 24 percent of the households take 30 minutes or longer to travel round trip to obtain water.

Household sanitation facilities

Ensuring adequate sanitation facilities is another Millennium Development Goal that Ethiopia shares with other countries. At the household level, adequate sanitation facilities include an improved toilet and disposal that separates waste from human contact. A household is classified as having an improved toilet if it is used only by members of one household (that is, it is not shared) and if the facility used by the household separates the waste from human contact.[11]

Table 6. Household sanitation facilities

Percent distribution of households and de jure population by type of toilet/latrine facilities, according to residence for malarious and epidemic-prone areas, Ethiopia 2015

	Malarious areas ≤2,000m ASL						Areas >2,000m and ≤2,500m ASL	
	Households			Population			Households	Population
Type of toilet/latrine facility	Urban	Rural	Total	Urban	Rural	Total		
Improved, not shared facility	**29.8**	**4.7**	**11.5**	**26.7**	**4.1**	**9.0**	**11.7**	**8.6**
Flush/pour flush to piped sewer system	1.5	0.0	0.4	1.3	0.0	0.3	0.1	0.0
Flush/pour flush to septic tank	1.4	0.0	0.4	1.3	0.0	0.3	0.6	0.5
Flush/pour flush to a pit latrine	8.3	0.3	2.4	7.5	0.3	1.9	2.6	1.8
Ventilated improved pit (VIP) latrine	6.0	0.7	2.1	5.2	0.6	1.6	0.8	0.6
Pit latrine with a slab	12.4	3.6	6	11.2	3.1	4.8	7.6	5.7
Composting toilet	0.2	0.1	0.2	0.2	0.1	0.1	0.0	0.0
Shared facility[1]	**42.8**	**28**	**31.8**	**45.4**	**30.2**	**33.3**	**40.3**	**44.9**
Flush/pour flush to piped sewer system	2.5	0.2	0.8	2.4	0.2	0.6	0.3	0.2
Flush/pour flush to septic tank	2.6	0.4	0.9	2.2	0.4	0.8	0.8	0.8
Flush/pour flush to a pit latrine	7.8	1.8	3.4	7.8	1.6	2.9	3.8	3.9
Ventilated improved pit (VIP) latrine	8.9	1.8	3.7	8.8	2.0	3.4	5.1	5.8
Pit latrine with a slab	20.5	23.6	22.7	23.8	25.8	25.4	30.2	34.1
Composting toilet	0.5	0.2	0.3	0.4	0.2	0.2	0.1	0.1
Non-improved facility	**27.5**	**67.3**	**56.7**	**28**	**65.7**	**57.7**	**48.0**	**46.4**
Flush/pour flush not to sewer/ septic tank/pit latrine	1.6	0.7	0.9	1.6	0.7	0.9	0.3	0.2
Pit latrine without slab/open pit	12.3	14.4	13.8	12.8	14.8	14.4	18.8	19.7
Bucket	0.2	0.4	0.3	0.2	0.4	0.4	1.0	1.0
Hanging toilet/hanging latrine	2.1	0.4	0.8	1.4	0.4	0.6	0.6	0.6
No facility/bush/field	11.2	51.3	40.8	11.9	49.3	41.3	27.2	24.8
Other	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number	2,939	8,236	11,175	9,650	35,904	45,554	2,179	9,214

[1] Facilities that would be considered improved if they were not shared by two or more households

Table 6 shows that 12 percent of households in malarious areas use improved toilet facilities that are not shared with other households, comprising 30 percent in urban areas and 5 percent in rural areas. Forty-three percent of households in urban areas and 28 percent in rural areas use shared toilet facilities. Fifty-seven percent use non-improved toilet facilities (67 percent in rural areas and 28 percent in urban areas). Overall, 41 percent of households in the malarious areas have no toilet facility—11 percent in urban areas and 51 percent in rural areas.

In areas >2,000m and ≤2,500m ASL, 12 percent of the households use improved toilet facilities that are not shared with other households, 40 percent of the households use shared toilet facilities, and the remaining 48 percent have a non-improved facility, mostly the bush (27 percent).

Household characteristics

Table 7 presents housing characteristics of households in Ethiopia. Housing characteristics reflect the household's socioeconomic situation. They also may influence environmental conditions that have a direct bearing on the health and welfare of household members.

Twenty-nine percent of the households in malarious areas have electricity, with a very large disparity between urban and rural households (85 percent versus 9 percent, respectively) and 28 percent of households have electricity in areas >2,000m and ≤2,500m ASL.

More than two-thirds of households (70 percent) have earth or sand floors, with rural houses are more likely than urban houses to have earth, sand, or dung floors, while urban houses are more likely to have floors made with cement and ceramic tiles.

The number of rooms used for sleeping in relation to the number of household members is an indicator of the extent of crowding, which in turn increases the risk of contracting communicable diseases. In malaria-endemic areas, 73 percent of households use one room for sleeping, 23 percent use two rooms, and 4 percent use three or more rooms for sleeping.

Table 7. Household characteristics

Percent distribution of households by housing characteristics and percentage using solid fuel for cooking, according to residence for malarious and epidemic-prone areas, Ethiopia 2015

Household characteristics	Malarious areas ≤2,000m ASL			Areas >2,000m and ≤2,500m ASL
	Urban	Rural	Total	
Electricity				
Yes	84.8	9.3	29.2	27.7
No	15.2	90.7	70.8	72.3
Total	100.0	100.0	100.0	100.0
Flooring material				
Earth/sand	42.4	79.2	69.5	64.0
Dung	2.9	12.1	9.6	21.8
Wood planks	2.3	3.3	3.1	1.6
Palm/bamboo	0.6	1.5	1.2	0.9
Parquet or polished wood	1.2	0.5	0.7	0.1
Ceramic tiles	3.4	0.1	0.9	0.4
Cement	45.6	2.6	13.9	10.8
Carpet	1.4	0.7	0.9	0.5
Other	0.2	0.1	0.1	0.0
Total	100.0	100.0	100.0	100.0
Rooms used for sleeping				
One	71.1	74.1	73.3	68.1
Two	24.9	22.6	23.2	28.2
Three or more	4.0	3.3	3.5	3.7
Total	100.0	100.0	100.0	100.0
Cooking fuel				
Electricity	14.4	0.2	4.0	3.0
LPG/natural gas/biogas	0.7	0.0	0.2	0.0
Kerosene	3.8	0.1	1.1	0.6
Charcoal	39.5	2.2	12.0	6.5
Wood/straw/shrubs/grass	41.0	96.4	81.8	86.3
Animal dung	0.2	1.0	0.8	3.4
Other fuel	0.4	0.0	0.1	0.1
Total	100.0	100.0	100.0	100.0
Percentage using solid fuel for cooking[1]	80.7	99.6	94.6	96.1
Number	2,939	8,236	11,175	2,179

LPG = Liquefied petroleum gas

[1] Includes coal/lignite, charcoal, wood, straw/shrubs/grass, agricultural crops, and animal dung [list categories included in the country questionnaire]

Table 7 shows that the great majority (95 percent) of households primarily use solid fuel for cooking. The practice is nearly universal in rural households, at more than 99 percent, and is very common in urban households (81 percent) as well. Wood is the main type of cooking fuel, used by 82 percent of households (41 percent of urban households and 96 percent of rural households). In addition to wood, charcoal and kerosene are important types of cooking fuel in urban areas; 40 percent of urban households use charcoal and 4 percent use kerosene.

2.4 Household possessions

The availability of durable consumer goods is another indicator of a household's socioeconomic status. Moreover, particular goods have specific benefits. For instance, a radio or a television can bring household members information and new ideas, a refrigerator preserves food, and means of transport can increase access to many services that are beyond walking distance.

Table 8 shows the extent of possession of selected consumer goods by urban or rural households residing in malaria-endemic and epidemic-prone areas. In malarious areas, 29 percent of households have radios, 44 percent have mobile telephones, 19 percent have televisions, and 4 percent have refrigerators.

Table 8 also shows that in both urban and rural areas only a small percentage of households possess a means of transport. Urban households are slightly more likely than rural households to own bicycles (6 percent versus 1 percent) or a car (5 percent versus less than 2 percent). In malarious areas, 54 percent of

all households own agricultural land and 59 percent own farm animals. There is noticeable urban-rural variation in the proportion of households owning specific goods. Most of the electronic goods are considerably more prevalent in urban areas, while farm-oriented possessions are more common in rural areas. For example, 63 percent of urban households own televisions, compared with only 4 percent of rural households. Similarly, 81 percent of urban households own mobile telephones, compared with 31 percent of rural households. In the same line, ownership of agricultural land is much more widespread among rural than urban households (68 percent versus 12 percent), as is ownership of farm animals (75 percent versus 16 percent).

Table 8. Household possessions

Percentage of households possessing various household effects, means of transportation, agricultural land, and livestock/farm animals by residence for malarious and epidemic-prone areas, Ethiopia 2015

Possession	Malarious areas ≤2,000m ASL			Areas >2,000m and ≤2,500m ASL
	Urban	Rural	Total	
Household effects				
Radio	54.9	19.7	28.9	34.4
Television	62.7	3.6	19.2	14.6
Mobile telephone	81.4	31.2	44.4	45.1
Refrigerator	30.6	1.5	9.2	4.4
Means of transport				
Bicycle	6.3	1.4	2.7	2.3
Animal drawn cart	2.8	2.1	2.3	2.4
Motorcycle/scooter	5.1	1.6	2.5	1.0
Car/truck	4.0	0.8	1.6	1.4
Ownership of agricultural land	12.4	68.3	53.6	73.2
Ownership of farm animals*	16.0	74.5	59.1	68.5
Number	2,939	8,236	11,175	2,179

*Cattle, cows, bulls, horses, donkeys, goats, sheep, or chickens

2.5 Wealth index

The wealth index used in this survey is a measure that has been used in many demographic and health surveys and other country-level surveys to indicate inequalities in household characteristics, in the use of health and other services, and in health outcomes.[12] It serves as an indicator of level of wealth that is consistent with expenditure and income measures.[13] The index was constructed using household asset data via principal components analysis. In its current form, which takes better account of urban-rural differences in scores and indicators of wealth, the wealth index is created in three steps. In the first step, a subset of indicators common to urban and rural areas is used to create wealth scores for households in both areas.

Categorical variables to be used are transformed into separate dichotomous (0-1) indicators. These indicators and those that are continuous are then examined using a principal components analysis to produce a common factor score for each household. In the second step, separate factor scores are produced for households in urban and rural areas using area-specific indicators. The third step combines the separate area-specific factor scores to produce a nationally applicable combined wealth index by adjusting area-specific scores through a regression on the common factor scores.[14] This three-step procedure permits greater adaptability of the wealth index in both urban and rural areas. The resulting combined wealth index has a mean of zero and a standard deviation of one. Once the index is computed, national-level wealth quintiles (from lowest to highest) are obtained by assigning the household score to each de jure household member, ranking each person in the population by his or her score, and then dividing the ranking into five equal categories, each comprising 20 percent of the population.

Table 9 presents the wealth quintiles by residence and administrative regions of the country for malarious and areas between 2,000m and 2,500m ASL separately. These distributions indicate the degree to which wealth is evenly or unevenly distributed by residence and region in malarious areas and areas between 2,000m and 2,500m ASL. In urban areas, 79 percent of the population is in the highest wealth quintile, in sharp contrast to the rural areas, where only 5 percent of the population is in the highest wealth quintile. Among regions, the wealth quintile distribution varies greatly. A relatively high percentage of the

population in the most urbanized regions is in the highest wealth quintile—Harari (60 percent) and Dire Dawa (68 percent). In contrast, a significant proportion of the population in the more rural regions is in the lowest wealth quintile, as in Afar (63 percent) and Somali (31 percent).

Table 9. Wealth quintiles

Percent distribution of the de jure population by wealth quintiles, according to residence and region, Ethiopia 2015

	Malarious areas ≤2,000m ASL						
	Wealth Quintile						
Residence/region	Lowest	Second	Middle	Fourth	Highest	Total	Number of persons
Residence							
Urban	1.9	1.7	5.0	12.2	79.2	100.0	9,650
Rural	27.8	25.1	22.3	20.3	4.6	100.0	35,904
Region							
Tigray	19.7	24.7	22.8	14.4	18.4	100.0	4,956
Afar	63.3	12.2	5.9	5.7	13.0	100.0	4,112
Amhara	23.0	21.3	24.8	19.8	11.1	100.0	6,129
Oromia	20.9	16.3	20.1	27.2	15.6	100.0	8,504
Somali	32.8	25.0	15.0	6.1	21.1	100.0	3,325
Benshangul Gumuz	22.8	36.1	13.6	16.1	11.3	100.0	3,870
SNNPR	11.9	21.9	20.7	30.3	15.1	100.0	6,971
Gambella	12.8	17.3	26.6	23.2	20.1	100.0	2,865
Harari	1.0	10.7	17.0	11.1	60.3	100.0	2,495
Dire Dawa	8.4	9.8	9.6	4.2	68.0	100.0	2,327
Total	22.3	20.1	18.6	18.5	20.4	100.0	45,554
	Areas >2,000m and ≤2,500m ASL						
Wealth Quintile	8.3	20	27	27.3	17.5	100	9,214

2.6 Characteristics of female respondents

General characteristics

Table 10 presents the distribution of women age 15-49 by selected background characteristics. The proportion of women by age group declines gradually as age increases; from 18 percent for the youngest age group (15-19), to 20 percent for age 20-24, to only 7 percent for age 40-44, and to 4 percent for age 45-49. This reflects the comparatively young age structure of the population. The proportion of women age 15-49 living in rural areas is much higher (81 percent) than for women living in urban areas (19 percent). Three-fourths of women living in malarious areas of Ethiopia belong to various denominations of Christianity (75 percent), whereas 24 percent are Muslim, and less than 1 percent have no religion. Oromo (43 percent) and Amhara (20 percent) were the most common ethnic groups.

More than half of women age 15-49 have never been to school. Thirty percent have primary education, and 14 percent have secondary education. Only 4 percent of women have an education higher than secondary school.

Table 10. Background characteristics of respondents

Percent distribution of women age 15-49 by selected background characteristics, Ethiopia 2015

Background Characteristics	Malarious areas ≤2,000m ASL		
	Weighted percent	Number of Women	
		Weighted	Unweighted
Age			
15-19	18.0	1,739	1,597
20-24	19.8	1,910	1,907
25-29	21.1	2,039	2,149
30-34	17.5	1,686	1,632
35-39	12.3	1,185	1,190
40-44	7.0	671	749
45-49	4.3	414	420
Religion			
Orthodox	37.1	3,572	3,665
Catholic	0.5	51	61
Protestant	24.1	2,326	1,769
Muslim	37.5	3,618	4,103
Other	0.7	70	41
Ethnicity			
Afar	1.1	108	762
Amhara	20.4	1,970	2,231
Gurage	2.6	248	197
Oromo	43.3	4,173	2,464
Sidamo	4.1	399	252
Somali	2.0	193	734
Tigre	6.6	638	1,134
Wolayita	3.3	315	220
Other	6.1	585	515
Anywak	0.2	16	148
Berta	0.3	32	158
Gadeo	0.8	74	37
Gamo	2.0	188	108
Gumuz	0.5	45	130
Hadiya	1.4	136	83
Kefa	2.7	256	137
Nuwer	0.3	27	244
Siltie	2.4	232	85
Residence			
Urban	18.7	1,801	2,625
Rural	81.3	7,843	7,019
Region			
Tigray	6.2	595	1,058
Afar	1.6	156	958
Amhara	15.3	1,474	1,302
Oromia	46.8	4,516	1,735
Somali	1.5	143	693
Benishangul Gumuz	2.0	190	761
SNNPR	24.7	2,379	1,278
Gambela	0.7	66	672
Harari	0.5	44	616
Dire Dawa	0.8	81	571
Education			
No education	52.7	5,083	5,459
Primary	30.2	2,912	2,558
Secondary	13.6	1,310	1,181
More than secondary	3.5	333	443
Wealth quintile			
Lowest	16.1	1,557	2,013
Second	17.5	1,688	1,742
Middle	19.9	1,916	1,678
Fourth	23.8	2,292	1,668
Highest	22.7	2,191	2,543
Total 15-49	100.0	9,644	9,644

Note: Education categories refer to the highest level of education attended, whether or not that level was completed.

Education attainment of women

Education is a key determinant of a woman's socioeconomic status. Studies have consistently shown that educational attainment has a strong correlation with healthy behavior and attitudes. Generally, the higher the level of education a woman has attained, the more knowledgeable she is about the use of health facilities, family planning methods, and the management of health care for her children.

Table 11 shows the percent distribution of women age 15–49 by highest level of schooling attended or completed, and median years completed, according to background characteristics in malarious and epidemic-prone areas. The results show that 30 percent of women age 15–49 have attended and completed primary school. Younger women have higher levels of education than older women. Nineteen percent of women age 15–19 have no education compared with 77 percent of women age 45–49. Somali (84 percent) and Afar (73 percent) have the highest proportion of women with no education compared with 38 percent in Dire Dawa. Table 11 also shows the correlation between education and wealth quintiles as an indicator of the economic status of a woman. The poorer a woman is, the less likely she is to have an education; 79 percent of women in the lowest wealth quintile have no education compared with 22 percent of women in the highest wealth quintile. Overall, the median number of years of education among women age 15–49 is seven years.

Table 11. Educational attainment: women

Percent distribution of women age 15-49 by highest level of schooling attended or completed, and median years completed, according to background characteristics, Ethiopia 2015

	Malarious areas ≤2,000m ASL						
	Highest level of schooling					Median	
Background Characteristics	No education	Completed primary[1]	Completed secondary[2]	More than secondary	Total	years completed	Number of women
Age							
15-24	27.1	43.8	25.0	4.1	100.0	8	3,649
15-19	19.1	49.0	29.2	2.7	100.0	8	1,740
20-24	34.4	39.1	21.2	5.3	100.0	7	1,910
25-29	61.3	24.4	9.2	5.2	100.0	7	2,040
30-34	71.7	19.8	6.6	1.9	100.0	6	1,684
35-39	68.6	23.5	5.3	2.6	100.0	5	1,182
40-44	75.6	19.7	2.7	2.0	100.0	4	671
45-49	76.9	17.7	4.6	0.8	100.0	3	414
Residence							
Urban	24.0	28.6	35.6	11.8	100.0	10	1,801
Rural	59.3	30.6	8.5	1.5	100.0	6	7,840
Region							
Tigray	57.9	25.2	13.4	3.5	100.0	7	596
Afar	72.8	17.9	7.6	1.7	100.0	7	156
Amhara	62.8	24.4	8.8	4.0	100.0	7	1,474
Oromia	49.9	30.6	16.0	3.5	100.0	7	4,514
Somali	83.5	9.6	6.2	0.7	100.0	8	143
Benishangul Gumuz	60.6	25.0	9.4	4.9	100.0	7	190
SNNPR	47.8	36.7	12.8	2.6	100.0	6	2,377
Gambela	41.6	32.9	19.1	6.4	100.0	8	66
Harari	44.6	24.1	20.1	11.2	100.0	9	44
Dire Dawa	38.4	31.0	19.4	11.1	100.0	8	81
Wealth quintile							
Lowest	79.4	18.7	1.9	0.1	100.0	4	1,557
Second	67.9	27.6	4.2	0.3	100.0	5	1,686
Middle	62.2	29.8	6.6	1.3	100.0	5	1,916
Fourth	45.2	39.0	14.1	1.7	100.0	6	2,293
Highest	21.7	31.6	34.7	12	100.0	10	2,189
Total	52.7	30.2	13.6	3.5	100.0	7	9,641
	Areas >2,000m and ≤2,500m ASL						
Highest level of schooling	55.2	27.1	13.9	3.8	100	7	1,848

[1] Completed 8th grade at the primary level
[2] Completed 4th grade at the secondary level

Literacy of women

The level of literacy among the population is an important factor in design and delivery of health messages and interventions. Female respondents who had only primary education were shown a card with a short sentence in their local languages and asked to read the complete sentence or part of it to assess their literacy. The percentage of women considered literate included those who could read the entire sentence or part of the sentence and women who had secondary or higher education.

Table 12 shows the distribution of female respondents by level of schooling attended and literacy, and the percentage literate, according to background characteristics. The results show that, overall, 37 percent of women age 15–49 in malarious areas are literate. Younger women are more literate than older women; 67 percent of women age 15–19 and 51 percent of women age 20–24 years are literate compared with 13 percent of women age 45–49.

Table 12. Literacy: women

Percent distribution of women age 15–49 by level of schooling attended and level of literacy, and percentage literate, according to background characteristics, Ethiopia 2015

	Malarious areas ≤2,000m ASL									
	No schooling or primary school									
Background characteristic	Secon d-ary school or higher	Can read a whole sentence	Can read part of a sentence	Cannot read at all	No card with required language	Blind/ visually impaired	Didn't attend school[2]	Total	Percentage literate[1]	Number of women
Age										
15-24	29.1	16.4	13.8	13.4	0.1	0.0	27.2	100.0	59.3	3,504
15-19	31.8	21.7	13.8	13.3	0.1	0.0	19.2	100.0	67.4	1,739
20-24	26.5	11.6	13.8	13.6	0.1	0.0	34.4	100.0	51.9	1,910
25-29	14.3	6.6	7.9	9.8	0.2	0.0	61.3	100.0	28.8	2,039
30-34	8.5	5.2	7.3	7.3	0.0	0.0	71.8	100.0	20.9	1,686
35-39	7.9	4.5	8.4	10.2	0.3	0.0	68.7	100.0	20.8	1,185
40-44	4.7	2.8	10.3	6.4	0.0	0.1	75.6	100.0	17.8	671
45-49	5.4	3.6	3.6	10.4	0.0	0.0	76.9	100.0	12.6	414
Residence										
Urban	47.4	10.6	10.5	7.2	0.3	0.0	24.0	100.0	68.6	1,801
Rural	10.1	9.1	9.9	11.4	0.1	0.0	59.4	100.0	29.1	7,843
Region										
Tigray	16.9	9.0	8.1	7.9	0.0	0.2	57.9	100.0	34	595
Afar	9.3	5.7	5.8	6.4	0.0	0.0	72.8	100.0	20.8	156
Amhara	12.7	10.1	9.0	5.2	0.1	0.1	62.8	100.0	31.9	1,473
Oromia	19.5	9.5	9.3	11.7	0.2	0.0	49.9	100.0	38.2	4,516
Somali	6.8	2.3	4.1	3.3	0.0	0.0	83.5	100.0	13.2	143
Benishangul Gumuz	14.3	7.7	8.8	8.5	0.0	0.0	60.6	100.0	30.9	190
SNNPR	15.5	9.8	13.2	13.5	0.1	0.0	47.9	100.0	38.5	2,379
Gambela	25.4	7.7	17.0	8.2	0.0	0.0	41.6	100.0	50.1	66
Harari	31.3	11.7	8.0	4.3	0.0	0.0	44.6	100.0	51.1	44
Dire Dawa	30.4	7.2	12.5	10.7	0.5	0.0	38.7	100.0	50.1	81
Wealth quintile										
Lowest	1.9	3.3	6.3	9.0	0.0	0.0	79.4	100.0	11.6	1,557
Second	4.5	7.3	9.1	11	0.2	0.0	67.9	100.0	20.9	1,687
Middle	8	9.6	9.8	10.3	0	0	62.3	100.0	27.4	1,916
Fourth	15.8	13.7	11.8	13.4	0.1	0	45.2	100.0	41.3	2,292
Highest	46.7	10.8	11.8	8.8	0.2	0	21.8	100.0	69.2	2,191
Total	17	9.4	10.1	10.6	0.1	0	52.8	100.0	36.5	
	Areas >2,000m and ≤2,500m ASL									
No schooling or primary school	17.7	9.9	10.9	6.2	0.1	0.0	55.2	100	38.5	1,848

[1]Refers to women who attended secondary school or higher and women who can read a whole sentence or part of a sentence

[2]Refers to women who didn't attend school were not asked about their literacy due to an error in the skipping pattern of the questionnaire

2.7 Travel history of people in malarious and epidemic-prone areas

There is a high degree of population movement to development areas for temporary work. Such mobile people could serve as a vehicle to introduce malaria transmission to their residence upon their return. In order to estimate the percentage of people who traveled away from their home in the previous month, survey participants were asked if they had in fact travelled away from home in the month prior. Table 13 shows there was limited movement of people during the time of the survey; 3 percent of survey participants in malarious areas travelled away from home in the last one month before the survey.

Table 13. Travel history of the survey population

Percentage distribution of the survey population who had travelled away from their home, by background characteristics, Ethiopia 2015

Background characteristic	Travelled away from home in the last month	Number
Age in months		
0-4 years	1.6	7,095
5-9 years	1.3	7,358
10-14 years	1.2	6,304
15-19 years	4.2	3,870
20-24 years	3.5	3,530
25-29 years	3.9	3,743
30-34 years	2.9	3,322
35-39 years	4.4	2,533
40-44 years	5.0	1,786
45-49 years	4.1	1,231
50-54 years	3.7	1,618
55-59 years	3.3	1,038
60-64 years	2.7	835
65-69 years	1.3	496
70-74 years	1.1	390
75-79 years	3.3	169
80+	2.9	235
Residence		
Urban	4.4	6,268
Rural	2.4	39,283
Region		
Tigray	2.9	2,777
Afar	2.3	648
Amhara	1.6	6,997
Oromia	3.8	21,429
Somali	1.5	619
benishangul gumuz	1.0	887
SNNPRr	1.3	11,428
Gambela	0.6	257
Harari	0.8	184
dire dawa	2.9	324
Wealth quintile		
Lowest	2.7	8,096
Second	2.0	8,643
Middle	1.1	9,470
Fourth	2.1	11,625
Highest	6.0	7,717
Total	2.6	45,551
Areas >2,000m and ≤2,500m ASL		
Percent travelled	2.0	9,213

2.8 Sleeping space per household in malarious areas

In Ethiopia, LLINs were being distributed based on the average number of sleeping spaces per household. As per the 2015 National Malaria Guidelines, the aim of LLIN distribution was to cover all sleeping spaces in households in malaria-endemic areas so that universal coverage—one LLIN for every two persons in a household—could be ensured.

Table 14 shows the average number of sleeping spaces per household in each region stratified by urban and rural. In malarious areas, the average number of sleeping spaces per household was 1.7.

Table 14. Average number of sleeping spaces per household by region and residence

Malarious areas

Region	Urban		Rural		Total	
	Average	Number of HHs	Average	Number of HHs	Average	Number of HHs
Tigray	2.03	295	2.13	906	2.24	1,201
Afar	1.57	221	1.62	823	1.25	1,044
Amhara	1.61	237	1.60	1,249	1.61	1,486
Oromia	1.82	295	1.75	1,617	1.76	1,912
Somali	1.72	212	1.61	673	1.64	885
Benishangul Gumuz	1.74	168	1.77	768	1.76	936
SNNP	1.68	204	1.70	1,310	1.70	1,514
Gambela	1.35	263	1.45	479	1.42	742
Harari	1.80	495	1.99	219	1.86	714
Dire Dawa	1.75	549	1.50	192	1.69	741
Total	1.73	2939	1.70	8,236	1.71	11,175
Areas >2,000m and ≤2,500m ASL						
Total	1.78	364	1.78	1,815	1.78	2,179

3. Malaria prevention

Key findings

- Two-thirds (64 percent) of households in malarious areas own at least one long-lasting insecticide-treated net (LLIN), and 32 percent of households have at least one LLIN for every two people that stayed in the house the night before the survey.
- About half of the household population (49 percent) have access to an LLIN, so 49 percent of the population could sleep under a mosquito net if every net in a household were used by two people.
- Forty percent of the population slept under an LLIN the night before the survey, while 45 percent of children and 44 percent of pregnant women slept under an LLIN the previous night.

Malaria prevention and control efforts in Ethiopia have focused on the ownership and use of long-lasting insecticide-treated nets (LLINs) and indoor residual spraying (IRS). This chapter presents the indicators that relate to these primary vector control interventions and the findings on household ownership of mosquito nets, the coverage of IRS, and the use of mosquito nets among children under five years of age and pregnant women.

3.1 Prevention

The two major malaria prevention services implemented in Ethiopia are targeted IRS with insecticides and distribution of LLINs for universal coverage. Other vector control activities, mainly larval control through environmental management and chemical larviciding, are also practiced in areas where such interventions are appropriate and expected to have significant impact. The objective of the Ethiopian vector control program is to maintain universal coverage with LLINs and/or have households sprayed with IRS in targeted areas. Based on the new Malaria NSP (2014–2020), stratification and targeting of the LLIN and IRS interventions are being implemented together in high transmission strata to bring down the malaria burden.

Ownership of mosquito nets

The ownership and use of treated mosquito nets is the primary prevention strategy for reducing malaria transmission in Ethiopia, and since 2005 Ethiopia has been using LLINs. Furthermore, Ethiopia has adopted the goal of achieving universal coverage of LLINs, which involves free distribution so that there is one LLIN for every two persons in a household. To increase coverage, timely mass LLIN distribution campaigns are conducted in malarious areas (below 2,000m ASL).

This section presents findings on ownership of LLINs in malarious areas and areas >2,000m and ≤2,500m ASL. Table 15 shows that 64 percent of all households owned at least one LLIN in malarious areas (areas <2,000m ASL). On average, households in malarious areas own 1.18 LLINs per household.

Table 15 shows LLIN ownership is slightly higher in urban areas compared to rural areas (66 percent versus 63 percent) in the malarious areas. Households in Amhara and Tigray reported the highest LLIN ownership, with 73 percent of them owning at least one LLIN. However, households in Dire Dawa and Harari reported the lowest ownership, with 36 percent and 34 percent of them owning at least one LLIN, respectively. LLIN ownership differed by wealth status, with 73 percent of the households in the fourth quintile owning at least one LLIN, compared to 51 percent in the lowest quintile.

Although LLIN ownership is a key indicator for measuring the success of the NMCP, it is also important in determining if a household has a sufficient number of treated nets for those sleeping within the home. Table 15 also shows the percentage of households with at least one LLIN for every two persons who stayed in the household (universal coverage) the night before the interview. Overall, 32 percent of households in the malarious area have reached universal LLIN coverage. Universal LLIN coverage is higher among urban households compared with rural households (42 percent versus 30 percent, respectively). Fifteen percent of households in Dire Dawa have at least one LLIN for every two people, compared with 41 percent of households in Tigray. Twenty-two percent of households in the lowest wealth quintile have attained universal LLIN coverage, while in all other wealth quantiles over 30 percent of households achieved universal coverage.

In the areas >2,000m and ≤2,500m ASL which are usually not targeted by mass LLIN campaigns, 34 percent of households had at least one LLIN, and on average a household had 0.63 LLINs and 19 percent of households had attained universal coverage.

Though the household level coverage of LLINs was 64 percent, FMOH administrative reports indicated that LLINs were delivered to almost all malarious districts visited. A considerable number of our survey supervisors reported there were undistributed LLINs in several woreda offices. Similarly, a considerable number of our survey supervisors reported there were undistributed LLINs in several woreda offices during data collection.

Table 15. Household possession of mosquito nets

Percentage of households with at least one mosquito net (treated or untreated) and long-lasting insecticidal net (LLIN), average number of nets and LLINs per household, and percentage of households with at least one net and LLIN per two persons who stayed in the household last night, by background characteristics, Ethiopia MIS 2015

	Malarious areas ≤2,000m ASL							
	Percentage of households with at least one mosquito net		Average number of nets per household			Percentage of households with at least one net for every two persons who stayed in the household last night[1]		
Background characteristic	Any mosquito net	Long-lasting insecticidal net (LLIN)	Any mosquito net	Long-lasting insecticidal net (LLIN)	Number of households	Any mosquito net	Long-lasting insecticidal net (LLIN)	Number of households with a least one person who stayed in the household last night
Residence								
Urban	65.8	65.8	1.14	1.14	1,932	41.7	41.7	1,931
Rural	63.2	63.2	1.18	1.18	9,243	29.6	29.6	9,240
Region								
Tigray	72.9	72.9	1.38	1.38	727	41.4	41.4	727
Afar	60.6	60.6	0.94	0.94	179	28.4	28.4	179
Amhara	72.9	72.9	1.34	1.34	1,794	37.9	37.9	1,793
Oromia	58.5	58.5	1.12	1.12	5,225	31	31	5,224
Somali	50.6	50.6	0.98	0.98	172	30.7	30.7	171
Benishangul Gumuz	55.4	55.4	0.97	0.97	232	25	25	232
SNNPR	68.7	68.7	1.21	1.21	2,619	28.1	28.1	2,618
Gambela	59	59	0.99	0.99	70	28.9	28.9	70
Harari	35.8	35.8	0.47	0.47	54	13.8	13.8	54
Dire Dawa	33.9	33.9	0.47	0.47	104	15	15	103
Wealth quintile								
Lowest	50.8	50.8	0.81	0.81	2,021	22	22	2,021
Second	64.1	64.1	1.09	1.09	2,192	30.6	30.6	2,191
Middle	67.1	67.1	1.29	1.29	2,203	33.9	33.9	2,202
Fourth	72.5	72.5	1.51	1.51	2,590	36	36	2,589
Highest	61	61	1.1	1.1	2,169	34.4	34.4	2,168
Total	63.6	63.6	1.18	1.18	11,175	31.7	31.7	11,171
	Areas >2,000m and ≤2,500m ASL		>2,000m and ≤2,500m ASL					
LLIN ownership	33.7	33.7	0.63	0.63	2,179	19.3	19.3	2,178

[1] De facto household members

All mosquito nets in this survey were found to be LLINs

Figure 4 shows the trend in LLIN ownership from 2007 to 2015. The percentage of households in malarious areas owning at least one LLIN is higher in EMIS 2015 (64 percent) than in EMIS 2011 (55 percent), but lower than EMIS 2007 (69 percent).

Figure 4. Trends in ownership of LLINs: percentage of households with at least one LLIN

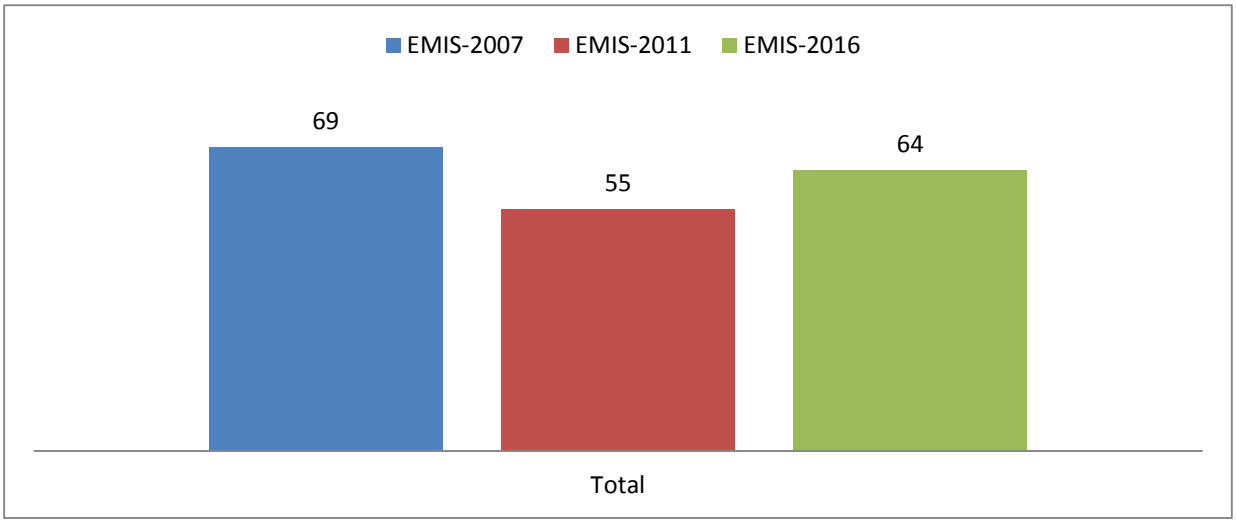
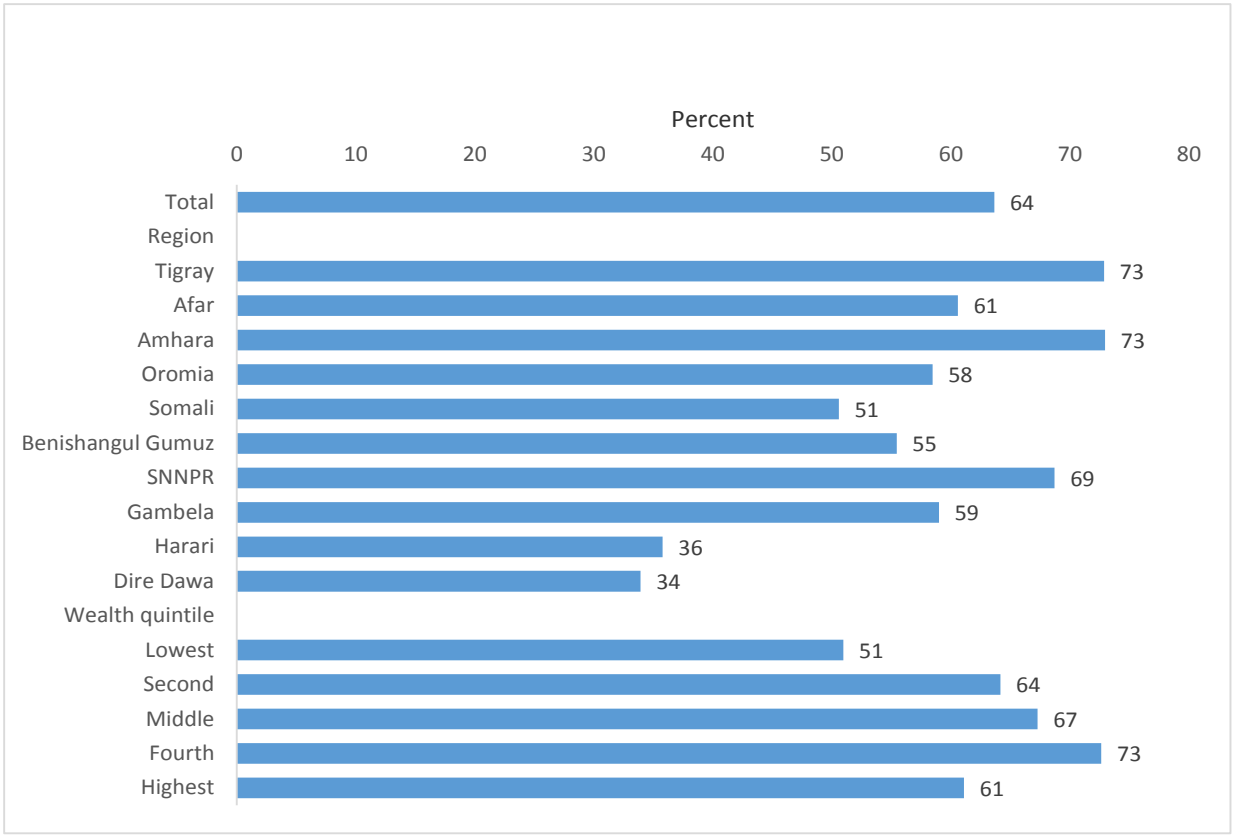


Figure 5. Percentage of households with at least one LLIN by region and wealth quintile



Indoor residual spraying

Indoor residual spraying (IRS), another vector control intervention, involves spraying the interior walls of a dwelling with long-lasting insecticide. It reduces the transmission of malaria by killing adult female mosquitoes when they rest on the walls of the structure after feeding. Based on the new stratification and targeting of interventions in 2014, high malaria transmission areas and highland fringes/epidemic-prone areas are targeted for IRS. All households interviewed for the 2015 EMIS were asked whether the interior walls of their dwelling had been sprayed to protect against mosquitoes during the 12-month period before the survey and, if IRS had indeed occurred, who had sprayed the dwelling.

The findings in Table 16 should be carefully interpreted as these are estimates not of coverage only in areas that were supposed to receive IRS, but of coverage of IRS in all the areas represented in the survey. The reason for this is that the goal was not to evaluate the performance of IRS program, but to understand the proportion of the population in malarious areas of Ethiopia being reached with IRS. While high transmission areas and highland fringes were targeted, the study was conducted in all malarious areas and areas between 2,000m and 2,500m ASL. The percentage of households with IRS in the past 12 months is presented in Table 16.

Table 16. Indoor residual spraying against mosquitoes

Percentage of households in which someone has come into the dwelling to spray the interior walls against mosquitoes (IRS) in the past 12 months, the percentage of households with at least one LLIN and/or IRS in the past 12 months, and the percentage of households with at least one LLIN for every two persons and/or IRS in the past 12 months, by background characteristics, Ethiopia 2015

Background characteristic	% of households with IRS[1] in the past 12 months	% of households with at least one LLIN and/or IRS in the past 12 months	% of households with at least one LLIN for every two persons and/or IRS in the past 12 months	Number of households
Malarious areas ≤2,000m ASL				
Residence				
Urban	11.9	67.4	46.5	1,932
Rural	32.4	71.1	49.9	9,243
Region				
Tigray	20.8	78.5	54.0	727
Afar	2.3	61.0	29.4	179
Amhara	40.1	78.9	59.6	1,794
Oromia	29.8	67.1	49.3	5,225
Somali	5.4	51.1	32.2	172
Benishangul Gumuz	43.7	71.1	54.5	232
SNNPR	24.3	73.0	44.5	2,619
Gambela	21.5	65.0	43.5	70
Harari	25.5	50.5	36.1	54
Dire Dawa	16.2	40.1	26.5	104
Wealth quintile				
Lowest	34.5	61.9	46.6	2,021
Second	34.8	73.0	52.2	2,192
Middle	36.2	74.2	54.1	2,203
Fourth	28.1	78.0	52.6	2,590
Highest	11.0	63.2	40.3	2,169
Total	28.8	70.5	49.4	11,175
Areas >2,000m and ≤2,500m ASL				
TRS status	2	33.7	20	2,179

[1]Indoor residual spraying (IRS) is limited to spraying conducted by a government, private or non-governmental organization

Table 16 shows that 29 percent of all households in malarious areas were sprayed in the previous 12 months. By residence, rural households are more likely than urban households to have had IRS (31 percent compared with 12 percent). Among the regions, a higher proportion of households in Benshangul Gumuz (44 percent) and Amhara (40 percent) have been sprayed compared with households in Afar (16 percent) and Somali (5 percent). Most IRS (98 percent) was done by government spray agents (data not shown). Table 16 also shows a combined indicator of malaria protection at the household level—that is, which households are covered by either IRS or ownership of an LLIN. Overall, 71 percent of households are protected either by owning an LLIN or having received IRS in the past 12 months. However, numbers are expected to be high if calculated from households in IRS targeted malarious areas as per the national

guidline. The IRS targeted areas represent 29% of the total at risk-population. This is documented as the majour limitation of the survey..

3.2 Access to mosquito nets

The EMIS 2015 presents data on access to an LLIN, measured by the proportion of the population that could sleep under an LLIN if each LLIN in the household were used by up to two people. Coupled with mosquito net usage, LLIN access can provide useful information on the magnitude of the behavioral gap in LLIN ownership and use, or, in other words, the proportion of the population with access to an LLIN but not using it. If the difference between these indicators is substantial, the program may need to focus on behavior change and how to identify the main drivers/barriers to LLIN use in order to design an appropriate intervention. This analysis helps the national malaria program determine whether they need to achieve higher LLIN coverage, promote LLIN use, or both.

Table 17. Access to a long-lasting insecticide-treated net (LLIN)

Percent distribution of the de facto household population by number of LLINs the household owns, according to number of persons who stayed in the household the night before the survey, Ethiopia 2015

	Malarious areas ≤2,000m ASL									
	Number of persons who stayed in the household the night before the survey									Areas >2,000m and ≤2,500m ASL
Number of LLINs	1	2	3	4	5	6	7	8+	Total	
0	48.9	44.3	34.3	36.2	32.4	33.5	35.1	28.2	36.4	
1	45.8	40.9	31.7	21.2	16	12.5	8.5	10.2	24.4	
2	5.1	13.9	30.2	34.6	39.6	32.9	29.3	25.6	27.9	
3	0.2	0.9	3.3	6.8	9.8	17.7	17.6	20.4	8.3	
4	0	0.1	0.5	1.1	2.1	3.3	8.6	13.4	2.7	
5	0	0	0.2	0	0.1	0.1	1	1.6	0.3	
6	0	0	0	0	0	0.1	0	0.5	0.1	
7	0	0	0	0	0	0	0	0.1	0	
8+	0	0	0	0	0	0	0	0	0	
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	
Number	829	1,657	2,127	2,018	1,573	1,175	828	964	11,171	
Percent with access to a LLIN[1]	51.1	55.7	55.2	53.2	50.1	47.3	43.8	42.7	49.2	26.6

[1] Percentage of the de facto household population who could sleep under a LLIN if each LLIN in the household were used by up to two people

Table 17 shows percent distribution of the de facto household population by number of LLINs the household owns, according to number of persons who stayed in the household the night before the survey. Thirty-nine percent of Ethiopians living in malarious areas slept in households with at least two LLINs the night before the survey. Twenty-four percent stayed in households that owned one LLIN. About eleven percent of Ethiopians slept in households that owned three or more LLINs.

Overall, close to half of the population (49 percent) could sleep under an LLIN if each LLIN in the household were to be used by up to two people. As expected, the proportion of persons with access to an LLIN tends to decrease as household size increases. Access to an LLIN is relatively higher for households with two, three, or four persons staying in the household the night before the survey (51–56 percent). LLIN access gradually decreases thereafter.

Figure 6. Percentage of the de facto population with access to an LLIN in the household

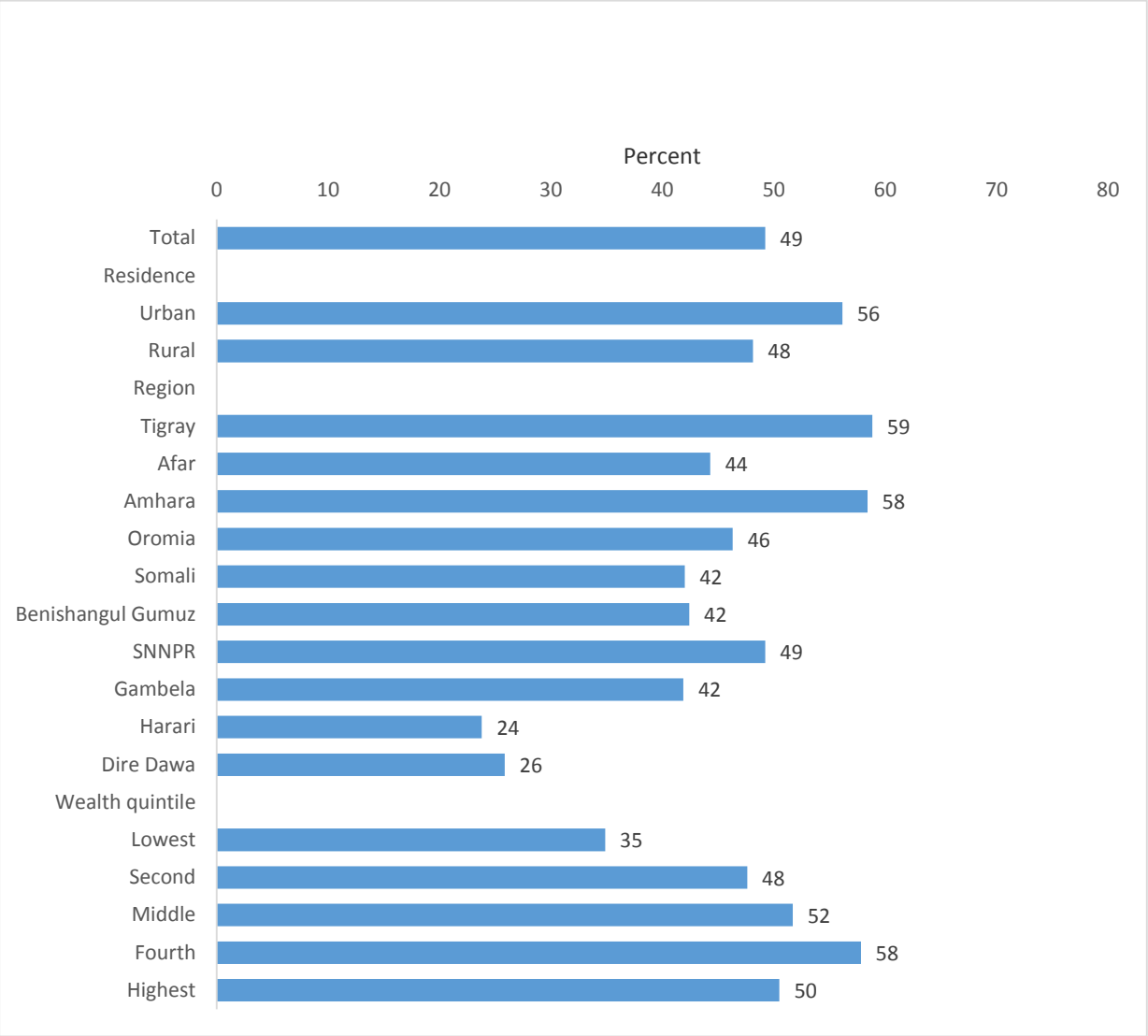


Figure 6 shows the percentage of the population with access to an LLIN in the household, by residence and wealth quintile in malarious areas. People living in urban areas are more likely to have access to an LLIN than their rural counterparts (56 percent and 48 percent, respectively). Residents of Tigray (59 percent) and Amhara (58 percent) had highest access to an LLIN compared with those in Harari (24 percent) and Diredawa (26 percent).

Use of mosquito nets by household population

Universal coverage of mosquito nets is necessary to accomplish significant reductions in malaria transmission. Moreover, the most vulnerable groups of population, such as children five years of age and pregnant women should be prioritized. The 2015 EMIS asked about the use of mosquito nets by household members during the night before the survey.

As shown in Table 18, 40 percent of the household population slept under an LLIN the night before the survey. Fifty-six percent of Ethiopians living in malarious areas were covered by a vector control intervention the night before the survey; that is, they either slept under an LLIN or slept in a dwelling sprayed with IRS in the past 12 months.

LLIN use among the general population is higher for children under age 5 years (45 percent) and adults 35-49 (43 percent) compared with other age groups. There was no significant difference in sleeping under an LLIN the previous night between females and males. Urban residents (48 percent) are more likely than rural residents (38 percent) to have slept under an LLIN. By region, LLIN use is highest in Afar (51 percent) and Amhara (43 percent), the lowest among people living in and Harari (17 percent) and Dire Dawa (16 percent). LLIN use steadily increases with wealth; 47 percent of those in the fourth wealth quintile compared with 26 percent of those in the lowest wealth quintile slept under an LLIN the previous night.

Table 18. Use of mosquito nets by persons in the household

Percentage of the de facto household population who slept the night before the survey under a long-lasting insecticidal net (LLIN), and/or in a dwelling in which the interior walls have been sprayed against mosquitoes (IRS) in the past 12 months; and among the de facto household population in households with at least one LLIN, the percentage who slept under a LLIN the night before the survey, by background characteristics, Ethiopia 2015

	Malarious areas ≤2,000m ASL					
	Household population				Household population in households with at least one LLIN	
Background characteristic	Percentage who slept under any net last night	Percentage who slept under an LLIN last night	Percentage who slept under an LLIN last night or in a dwelling sprayed with IRS[1] in the past 12 months	Number	Percentage who slept under an LLIN last night	Number
Age in years						
<5	45.3	45.3	61.4	6,713	69.5	4,007
5-14	34.5	34.5	54.4	12,696	52.4	7,647
15-34	40.1	40.1	55.7	13,314	62.8	7,795
35-49	43.7	43.7	56.8	5,081	67.9	2,991
50+	40.8	40.8	55.0	4,463	63.7	2,614
Sex						
Male	38.3	38.3	55.6	20,606	59.2	12,212
Female	41.1	41.1	56.9	21,662	63.5	12,843
Residence						
Urban	48	48	52.6	5,827	70.3	3,643
Rural	38.4	38.4	56.9	36,441	59.9	21,412
Region						
Tigray	40.4	40.4	54.4	2,422	54.8	1,636
Afar	50.6	50.6	51.3	560	84.7	306
Amhara	43.4	43.4	64.3	6,580	56.8	4,604
Oromia	41	41	58.3	20,021	70	10,733
Somali	37.7	37.7	38.9	581	71.7	280
Benishangul Gumuz	40.3	40.3	65.3	842	70.4	441
SNNPR	35.5	35.5	49.5	10,576	50.6	6,795
Gambela	42.3	42.3	52.3	210	78.5	104
Harari	17.1	17.1	42.4	173	46.9	58
Dire Dawa	15.6	15.6	29.5	304	43.7	99
Wealth quintile						
Lowest	26	26	48.5	7,656	52.7	3,465
Second	36.3	36.3	56.4	8,002	56.1	4,736
Middle	42	42	61.1	8,693	62.1	5,386
Fourth	47.4	47.4	62.5	10,801	63.7	7,361
Highest	44	44	49.2	7,116	69.8	4,107
Total	39.7	39.7	56.3	42,268	61.4	25,055
	Areas >2,000m and ≤2,500m ASL					
Total	19.2	19.2	20.8	8,940	57.1	3,172

[1]Indoor residual spraying (IRS) is limited to spraying conducted by a government, private or non-governmental organization

LLIN use is higher among households that own an LLIN. In households that own at least one LLIN, 61 percent of the population slept under an LLIN the night before the survey. There is an urban-rural difference in the percentage of population who utilized an LLIN the night before the survey (70 percent and 60 percent, respectively). Among households that own an LLIN, Afar (85 percent) and Gambella (79 percent) residents are more likely than those living in other regions to sleep under an LLIN. Among households that own at least one LLIN, LLIN use increases as household wealth increases; 70 percent in the highest wealth quintile and 53 percent in lowest wealth quintile.

Figure 7. Ownership of, access to, and use of LLINs

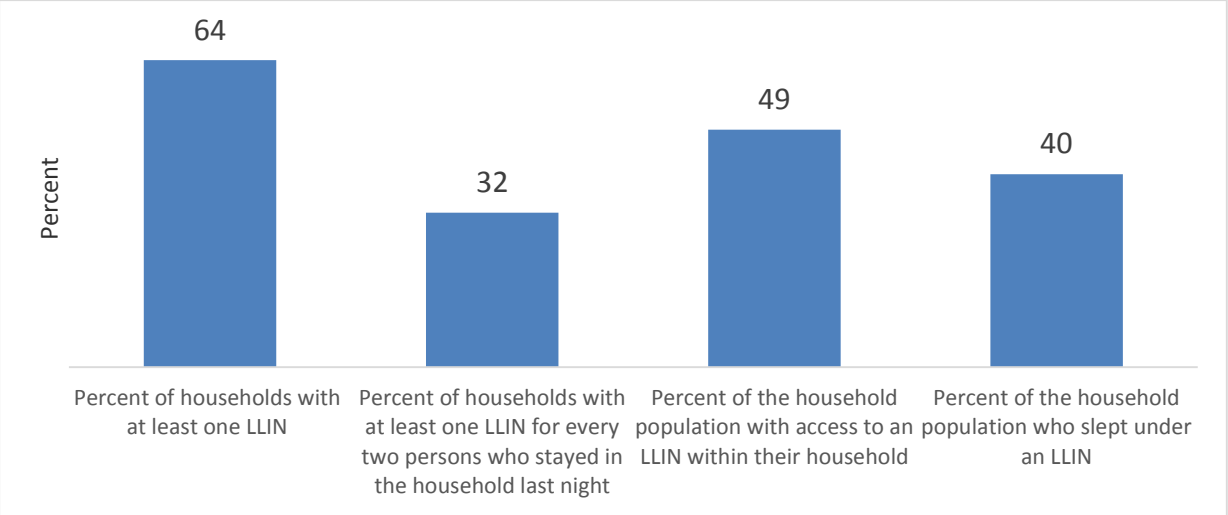


Table 19 presents the percentage of existing LLINs in households used by at least one household member the night prior to the interview. In malarious areas, 62 percent of existing LLINs in households were used the night before and the proportion of LLINs used by at least one household member was higher in urban areas than in rural areas (71 percent and 61 percent, respectively).

Table 19. Use of existing LLINs

Percentage of long-lasting insecticide-treated nets (LLINs) that were used by anyone the night before the survey, by background characteristics, Ethiopia 2015

Background characteristic	Percentage of existing LLIN used last night	Number of LLIN
	Malarious areas ≤2,000m ASL	
Residence		
Urban	71	1,911
Rural	60.6	9,489
Region		
Tigray	55.7	871
Afar	87.4	146
Amhara	55.6	2,080
Oromia	67.7	5,081
Somali	80	147
Benishangul Gumuz	74.4	196
SNNPR	56	2,756
Gambela	85.7	60
Harari	56.9	22
Dire Dawa	54.3	42
Wealth quintile		
Lowest	54.8	1,413
Second	56.4	2,063
Middle	62.4	2,471
Fourth	63.5	3,386
Highest	71.3	2,067
Total	62.3	11,400
	Areas >2,000m and ≤2,500m ASL	
Total	53	1,413

The use of existing LLINs was lowest in Amhara (56 percent), Tigray (56 percent), and Dire Dawa (54 percent) and highest in Afar (87 percent) and Gambella (86 percent). The percentage of existing LLINs in households that were used increases consistently as level of household wealth increases—from 55 percent in the lowest quintile to 71 percent in the highest wealth quintile. In areas >2,000m and ≤2,500m ASL, only 53 percent of existing LLINs in households were used the night prior to the interview.

Use of mosquito nets by children under five

Children under five years of age are considered to be the most vulnerable to severe complications of malaria infection due to their lack of acquired immunity. Those living in areas of high malaria transmission naturally acquire immunity to the disease over time.[15] Acquired immunity does not prevent *P. falciparum* infection but rather protects against severe forms of malaria and fatality. During the first six months after birth, antibodies passed from the mother protect infants born in areas of endemic malaria. Over time, this passive immunity is gradually lost and children start to develop their own immunity to malaria. Development of immunity depends on exposure to malaria infection and in high malaria-endemic areas children are likely to have attained a high level of immunity before age five. Such children may experience episodes of malaria illness but usually do not suffer from severe, life-threatening malaria.

Table 20. Use of mosquito nets by children

Percentage of children under age five who, the night before the survey, slept under a mosquito net, under a long-lasting insecticidal net (LLIN), and under LLIN or in a dwelling in which the interior walls have been sprayed against mosquitoes (IRS) in the past 12 months; and among children under five years of age in households with at least one LLIN, the percentage who slept under a LLIN the night before the survey, by background characteristics, Ethiopia 2015

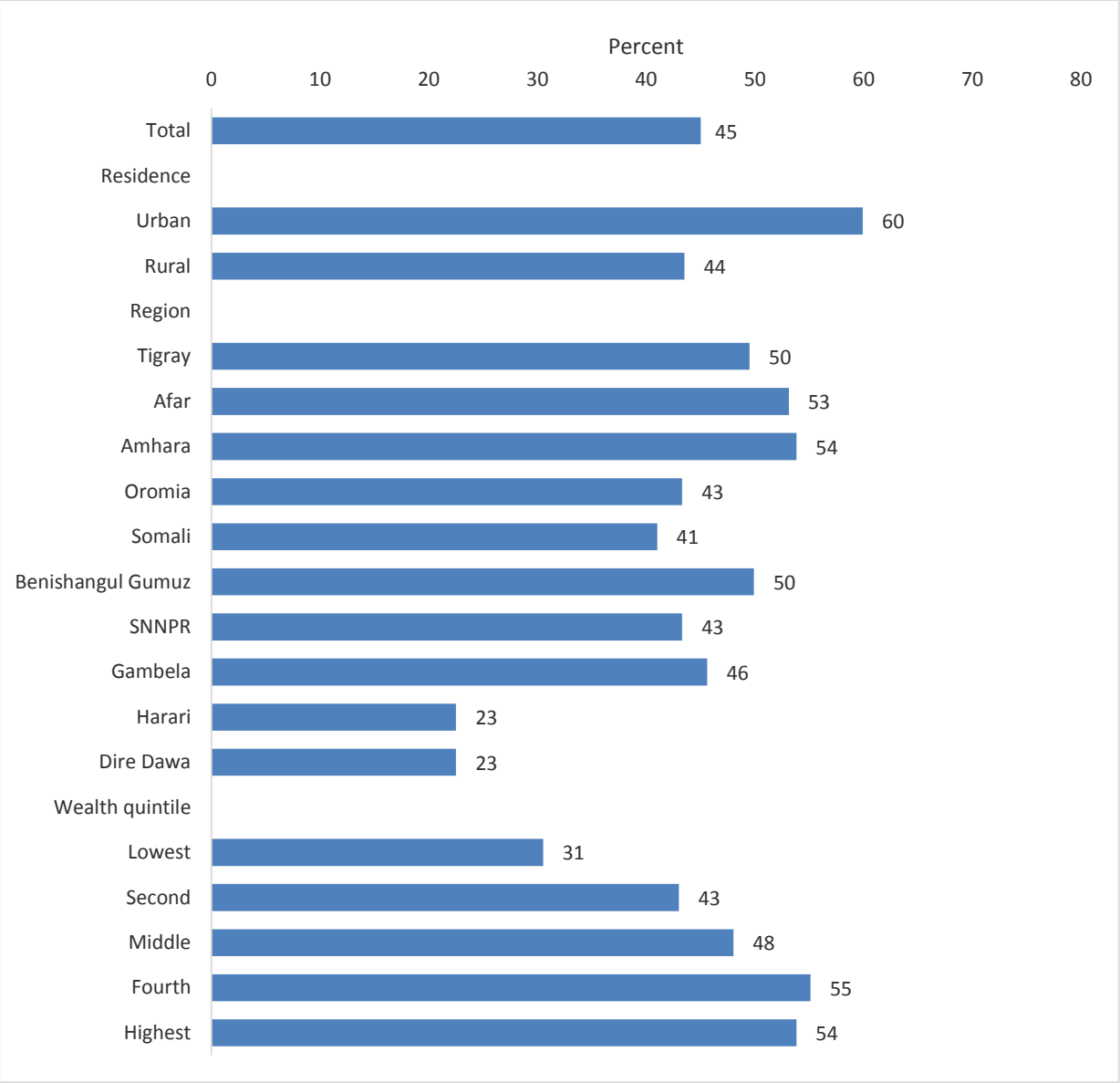
	Malarious areas ≤2,000m ASL					
	Children under age five in all households				Children under age five in households with at least one LLIN	
Background characteristic	Percentage who slept under any net last night	Percentage who slept under an LLIN last night	Percentage who slept under a LLIN last night or in a dwelling sprayed with IRS[1] in the past 12 months	Number	Percentage who slept under a LLIN last night	Number
Age (in months)						
<12	51.5	51.5	66.8	1,347	75.1	867
12-23	48.0	48.0	63.3	1,133	75.1	679
24-35	45.1	45.1	63.3	1,400	70.5	841
36-47	44.9	44.9	62.5	1,415	68.3	874
48-59	39.8	39.8	58.8	1,914	62.1	1,151
Sex						
Male	44.6	44.6	61.8	3,597	68.5	2,195
Female	46.0	46.0	63.3	3,612	70.4	2,216
Residence						
Urban	59.9	59.9	63.6	792	82.5	540
Rural	43.5	43.5	62.5	6,417	67.7	3,871
Region						
Tigray	49.5	49.5	65.4	432	66.4	303
Afar	53.1	53.1	58.4	120	90.3	66
Amhara	53.8	53.8	75.2	1,084	66.8	820
Oromia	43.3	43.3	62.1	3,487	74.5	1,901
Somali	41.0	41.0	42.7	137	76.7	69
Benishangul Gumuz	49.9	49.9	70.4	152	81.9	87
SNNPR	43.3	43.3	56.9	1,670	61.1	1,112
Gambela	45.6	45.6	57.9	47	86.0	23
Harari	22.5	22.5	53.1	30	56.6	11
Dire Dawa	22.5	22.5	42.8	48	56.3	18
Wealth quintile						
Lowest	30.5	30.5	52.5	1,675	59.7	803
Second	43.0	43.0	63.3	1,456	64.8	908
Middle	48.0	48.0	68.4	1,467	71.9	919
Fourth	55.1	55.1	69.5	1,582	71.1	1,150
Highest	53.8	53.8	58.7	1,028	82.2	632
Total	45.3	45.3	62.6	7,209	69.5	4,411
	Areas >2,000m and ≤2,500m ASL					
Total	24.1	24.1	24.1	25.1	1,174 69.1	449

[1] Indoor residual spraying (IRS) is limited to spraying conducted by a government, private or non-governmental organization

Table 20 shows the use of mosquito nets by children under five. In malarious areas, 45 percent slept under an LLIN the previous night. LLIN use among younger children is slightly higher than that of older children. For example, 67 percent of children less than a year old slept under an LLIN the night before the

survey compared with 59 percent of children between four and five years of age. LLIN use did not vary by the child's sex and residence. Those living in Amhara (54 percent) and Afar (53 percent) were more likely than others to have slept under an LLIN (Figure 8). LLIN use among children in households that have at least one LLIN is higher than among children in all households (70 percent versus 45 percent). In households with at least one LLIN, 70 percent of children slept under an LLIN the night before the survey, an improvement from 64 percent in EMIS 2011.

Figure 8. Percentage of children under age five who slept under an LLIN the night before the survey



Use of mosquito nets by pregnant women

Pregnancy suppresses immunity, and pregnant women are at increased risk of severe malaria compared with other adults. In addition, malaria in pregnant women is frequently associated with the development of anemia. To prevent complications from malaria in pregnancy such as anemia, low birth weight, and transplacental parasitemia, the NMCP has encouraged all pregnant women to sleep under an LLIN.

Table 21 shows the use of mosquito nets by pregnant women according to background characteristics. In malarious areas, 44 percent pregnant women slept under an LLIN the previous night. LLIN use among pregnant women is highest among women living in urban areas (91 percent) and in the households in highest wealth quintiles (82 percent).

Table 21. Use of mosquito nets by pregnant women

Percentage of pregnant women age 15-49 who, the night before the survey, slept under a mosquito net, under a long-lasting insecticidal net (LLIN), and under a LLIN or in a dwelling in which the interior walls had been sprayed (IRS) in the previous 12 months; and among pregnant women age 15-49 in households with at least one LLIN, the percentage who slept under a LLIN the night before the survey, by background characteristics, Ethiopia 2015

	Malarious areas ≤2,000m ASL				
	Among pregnant women age 15-49 in all households			Among pregnant women age 15-49 in households with at least one LLIN	
Background characteristic	Percentage who slept under an LLIN last night	Percentage who slept under a LLIN last night or in a dwelling sprayed with IRS[2] in the past 12 months	Number	Percentage who slept under a LLIN last night	Number
Residence					
Urban	72.2	74.2	67	90.8	49
Rural	40.5	58.1	505	70.8	265
Region					
Tigray	49.5	62	28	66.1	18
Afar	55.8	57.7	11	90.2	6
Amhara	48.1	73.6	79	66.8	53
Oromia	41.7	59.6	301	81.2	141
Somali	50.6	50.6	11	74.3	7
Benishangul Gumuz	47.7	71.7	11	83.1	6
SNNPR	46.2	53.5	121	65.2	79
Gambela	58.2	60.6	2	94.7	1
Harari	26.3	56.5	2	69.9	1
Dire Dawa	20.8	20.8	6	69.2	2
Wealth quintile					
Lowest	25.4	45.5	122	60.0	48
Second	44.4	69.0	97	73.8	54
Middle	36.5	56.5	126	68.3	58
Fourth	66.4	76.1	139	79.7	108
Highest	45.8	49.4	89	81.9	46
Total	44.3	60.0	572	73.9	314
	Areas >2,000m and ≤2,500m ASL				
Total	22.4	22.9	91	64.9	36

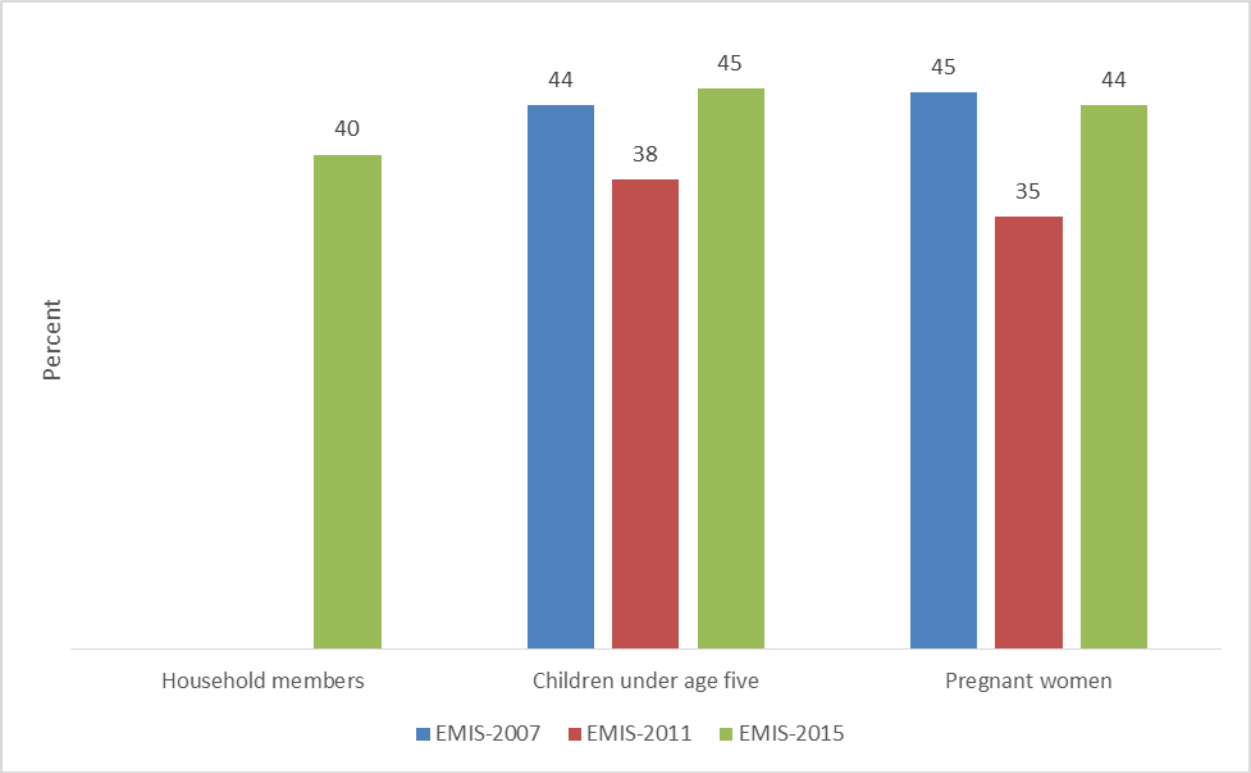
Note: Table is based on children who stayed in the household the night before the interview.

[2] Indoor residual spraying (IRS) is limited to spraying conducted by a government, private or non-governmental organization

LLIN use is considerably higher for women who live in households that own at least one LLIN than for women in all households. In malarious areas, 74 percent of pregnant women who live in households with at least one LLIN slept under an LLIN the night before the survey whereas only 44 percent of women slept under an LLIN in all households.

Figure 9 shows trends in LLIN use by all household members, children under five years old, and pregnant women living in malarious areas in 2007, 2011, and 2015. There has been a slight increase in LLIN use among children under five and pregnant women (38 percent and 35 percent measured in 2011 compared with 45 percent and 44 percent in 2015). However, the results show that LLIN use by these population groups is almost similar.

Figure 9. Trends in use of LLINs (Ethiopia 2007, 2011, and 2015)



3.3 Net shape preference and handling

Knowing the color and shape preferences of nets and LLIN washing practice of the community helps the program to revise the strategies on LLIN procurement and strengthen information, education, and communication/behavior change communication activities. During EMIS 2015, households were asked about their preference regarding shapes of LLINs. Furthermore, households that had at least one LLIN were asked if they would mend the LLINs when torn or wash the LLINs when dirty. Table 22 shows shape preference of LLINs among all the households, and Table 23 shows the mending and washing practice of the households that have at least one LLIN.

Table 22. Preference of shape of mosquito nets of households

Percent distribution of households by preference for shape of mosquito nets, by background residence and region, Ethiopia 2015

Background Characteristics	Rectangular	Conical (Circular)	Don't know	Total	Number
Malarious areas ≤2,000m ASL					
Residence					
Urban	38.3	51.0	10.8	100.0	1,919
Rural	56.1	28.2	15.6	100.0	9,168
Region					
Tigray	54.9	29.5	15.6	100.0	724
Afar	61.9	31.5	6.5	100.0	178
Amhara	62.2	25.8	12.0	100.0	1,785
Oromia	51.3	32.1	16.6	100.0	5,177
Somali	54.3	15.7	29.9	100.0	161
Benishangul Gumuz	70.1	26.2	3.7	100.0	231
SNNPR	48.0	38.8	13.2	100.0	2,608
Gambela	72.0	13.9	14.2	100.0	69
Harari	29.8	48.9	21.3	100.0	54
Dire Dawa	40.2	41.2	18.6	100.0	102
Total	53.0	32.2	14.8	100.0	11,087
Areas >2,000m and ≤2,500m ASL					
Total	50.7	25.7	23.6	100.0	2,166

Table 22 shows that more than half of households interviewed (53 percent) prefer rectangular mosquito LLINs in malarious areas. Fifty-six percent of households in rural areas prefer rectangular LLINs, 28

percent prefer conical (circular) LLINs, and 16 percent don't know their mosquito net shape preference. In urban areas, 51 percent of households prefer conical nets, 38 percent prefer rectangular, and the rest of the households don't know. By region, more than 70 percent of the households in Gambella and Benshangul Gumuz prefer rectangular shaped LLINs whereas 49 percent and 41 percent of households in Harari and Dire Dawa prefer conical LLINs, respectively.

Table 23 shows that among households in malarious areas that own at least one mosquito net, 67 percent are likely to mend a torn net while 33 percent are unlikely to mend a torn net. This varies in urban and rural areas, where 74 percent and 67 percent, respectively, were likely to mend a torn net. Mending of torn nets varies greatly across regions; 93 percent in Gambella and Somali were likely to mend a torn net.

Households were also asked how often they wash their net(s). Twelve percent of the households in malarious areas that own at least one net reported they never wash their net(s). By residence, 11 percent of households in urban areas and 13 percent of households in rural areas never wash a net. By region, 28 percent of households in Dire Dawa and 21 percent of households in Amhara never wash their nets.

Table 23. Mending and washing mosquito nets

Percentage distribution of households that own at least one net by their mending and washing practice, by residence and region, Ethiopia 2015

	Malarious areas ≤2,000m ASL												
	Mending practice					Washing practice							Number
Background Characteristics	Very likely	Some-what likely	Some-what unlikely	Very unlikely	Total	When it gets dirty	1 time a year	2–3 times a year	4–5 times a year	6 or more times a year	Not at all	Total	
Residence													
Urban	67.7	6.6	3.7	22.0	100.0	48.9	5.0	28.2	2.9	4.5	10.5	100.0	1,146
Rural	56.8	8.7	4.1	30.4	100.0	49.7	8.6	22.0	3.7	3.3	12.8	100.0	5,284
Region													
Tigray	42.8	8.1	5.2	43.9	100.0	47.4	6.5	21.4	4.1	5.7	15.0	100.0	479
Afar	46.4	17.3	3.8	32.5	100.0	69.5	4.7	14.2	0.8	3.7	7.0	100.0	98
Amhara	40.8	5.2	5.2	48.8	100.0	46.6	7.7	18.7	3.5	2.1	21.4	100.0	1,185
Oromia	66.1	8.7	3.7	21.4	10.00	47.3	8.0	28.7	3.2	1.6	11.2	100.0	2,762
Somali	79.3	13.7	4.3	2.7	100.0	65.2	11.8	4.8	0.4	0.1	17.8	100.0	78
Benishangul Gumuz	58.4	13.1	7.1	21.4	100.0	78.2	1.1	14.6	3.0	0.8	2.4	100.0	116
SNNPR	63.8	8.6	3.3	24.4	100.0	52.5	8.9	19.3	4.1	7.4	7.9	100.0	1,627
Gambela	91.2	1.4	0.2	7.3	100.0	34.4	10.9	33.0	12.9	6.0	2.9	100.0	37
Harari	47.0	11.7	5.4	36.0	100.0	72.8	2.4	9.4	1.2	2.2	11.9	100.0	18
Dire Dawa	23.1	24.6	3.8	48.5	100.0	38.7	16.7	12.2	1.3	3.0	28.2	100.0	32
Total	58.7	8.3	4.0	28.9	100.0	49.6	8.0	23.1	3.5	3.5	12.4	100.0	6,430
	Areas >2,000m and ≤2,500m ASL												
Total	48.6	10	5.2	36.2	100.0	48.3	8.5	19.3	3.3	3.2	17.3	100.0	786

4. Case management

Key findings

- Sixteen percent of children under five years of age in malarious areas had fever in the two weeks preceding the survey. Of these children, 38 percent sought advice or treatment and 17 percent had blood taken from a finger or heel for testing.
- Among those children who were reported to have taken antimalarial medicine, 89 percent took an ACT.
- Among children with fever for whom advice or treatment was sought 82 percent get their advice or treatment from public sectoe sources. r

Malaria case management, including prompt diagnosis and treatment within 24 hours of onset of symptoms with appropriate and effective medicines, is one of the main interventions indicated in the NSP 2014–2020. Access to prompt and effective treatment and improvement of the quality of care are key to reducing malaria-associated morbidity and mortality. The National Malaria Guidelines recommend that all suspected cases of malaria be confirmed using microscopy or a rapid diagnostic test (RDT) before being treated with an antimalarial drug. For uncomplicated malaria cases, artemether-lumefanthrine (AL) is the recommended first line of treatment for *P. falciparum* and chloroquine for *P. vivax*.[16]

This chapter presents results from the EMIS 2015 related to the case management of fever and malaria in children under five years of age.

4.1 Prevalence and prompt treatment of fever and malaria

Ethiopia has documented a remarkable reduction in the mortality in children under five years of age in the last decade. However, children under five are still dying every year of causes that can be prevented through known, simple, low-cost prevention and curative interventions. Contribution of malaria to under-five mortality is significant. The integrated community case management (iCCM) of childhood illnesses approach provides an opportunity to reduce overall child mortality in concordance with the aims of the malaria control program. Based on national and global experiences, and following the roll-out of the health extension program, the FMOH launched a new policy of adding community-based treatment of pneumonia to treatment of malaria and diarrhea by health extension workers in October 2009. Accordingly, iCCM implementation was rolled out in 2010 and included the treatment of pneumonia with antibiotics and diarrhea with Zinc and ORS.[9]

Malaria case management, including the identification, diagnosis, and prompt treatment of all malaria cases with appropriate and effective antimalarial drugs, is one of the key interventions for malaria control in Ethiopia. Fever is a major manifestation of malaria and other acute infections in children. Most malarial fevers occur at home, and prompt and effective treatment is critical to prevent morbidity and mortality. The EMIS 2015 asked mothers whether their children under five years of age had a fever in the two weeks preceding the survey and, if so, whether any advice/treatment was sought. Questions were also asked about blood testing, the types of drugs given to the child, and how soon and for how long the drugs were taken.

Table 24 shows the percentage of children under five years of age who had fever in the two weeks preceding the survey and, among those children under five with fever, the percentage for whom advice or treatment was sought from a health facility, provider, or pharmacy; the percentage who had blood taken from a finger- or heel-prick (presumably for a malaria test); the percentage who took ACT or other antimalarial drugs; and the percentage who took drugs on the same or next day. However, some data are removed from the table due to high missing value.

Table 24. Prevalence, diagnosis, and prompt treatment of children with fever

Percentage of children under age 5 with fever in the two weeks preceding the survey; and among children under age 5 with fever, the percentage for whom advice or treatment was sought, the percentage who had blood taken from a finger or heel, the percentage who took any artemisinin-based combination therapy, the percentage who took any ACT the same or next day following the onset of fever, the percentage who took antimalarial drugs, and the percentage who took the drugs the same or next day following the onset of fever, by background characteristics, Ethiopia 2015

	Malarious areas ≤2,000m ASL									
	Among children under age five:			Among children under age five with fever:		Among children under age five with fever that reported having a positive blood test				
Background characteristic	Percentage with fever in the two weeks preceding the survey	Number	Percentage for whom advice or treatment was sought[1]	Percentage who had blood taken from a finger or heel for testing	Number	Percentage who took any ACT	Percentage who took any ACT same or next day	Percentage who took antimalarial drugs	Percentage who took antimalarial drugs same or next day	Number
Age (in months)										
<12	15.8	1,234	51.1	16.9	189	-	-	-	-	-
12-23	16.7	959	36.6	20.1	156	-	-	-	-	-
24-35	14.8	1,174	36.7	15.6	169	-	-	-	-	-
36-47	14.9	1,160	35.4	13.0	168	-	-	-	-	-
48-59	16.2	1,570	32.4	17.8	246	-	-	-	-	-
Sex										
Male	15.2	3,040	36.1	17.0	449	-	-	-	-	-
Female	16.1	3,058	40.3	16.5	478	-	-	-	-	-
Residence										
Urban	17.0	676	50.3	31.5	111	-	-	-	-	-
Rural	15.5	5,429	36.5	14.7	818	-	-	-	-	-
Region										
Tigray	23.1	383	31.2	17.8	86	-	-	-	-	-
Afar	16.7	105	33.3	23.9	17	-	-	-	-	-
Amhara	17.6	947	34.0	17.1	162	-	-	-	-	-
Oromia	10.7	2,807	37.3	8.8	292	-	-	-	-	-
Somali	12.0	110	34.2	24.3	13	-	-	-	-	-
Benishangul gumuz	14.4	126	45.0	24.9	18	-	-	-	-	-
SNNPR	22.1	1,534	42.4	21.5	330	-	-	-	-	-
Gambela	21.0	38	46.8	36.1	8	-	-	-	-	-
Harari	4.9	23	75.5	56.2	1	-	-	-	-	-
Dire dawa	10.6	33	48.3	14.1	3	-	-	-	-	-
Mother's education										
No education	15.1	4,002	33.6	14.3	586	-	-	-	-	-
Primary	18.1	1,541	43.7	17.5	271	-	-	-	-	-
Secondary	13.8	404	50.8	33.0	54	-	-	-	-	-
More than secondary	13.5	116	57.4	32.2	15	-	-	-	-	-
Wealth quintile										
Lowest	15.1	1,418	25.6	10.2	208	-	-	-	-	-
Second	14.0	1,214	39.2	17.6	164	-	-	-	-	-
Middle	17.1	1,239	31.2	10.6	205	-	-	-	-	-
Fourth	17.4	1,368	49.4	20.8	231	-	-	-	-	-
Highest	14.3	867	48.8	29.1	120	-	-	-	-	-
Total	15.7	6,105	38.2	16.7	929	-	-	-	-	-
	Areas >2,000m and ≤2,500m ASL									
	11.4	1,028	50.4	9.8	123	-	-	-	-	-

[1] Excludes advice or treatment from a traditional practitioner

- Missing values

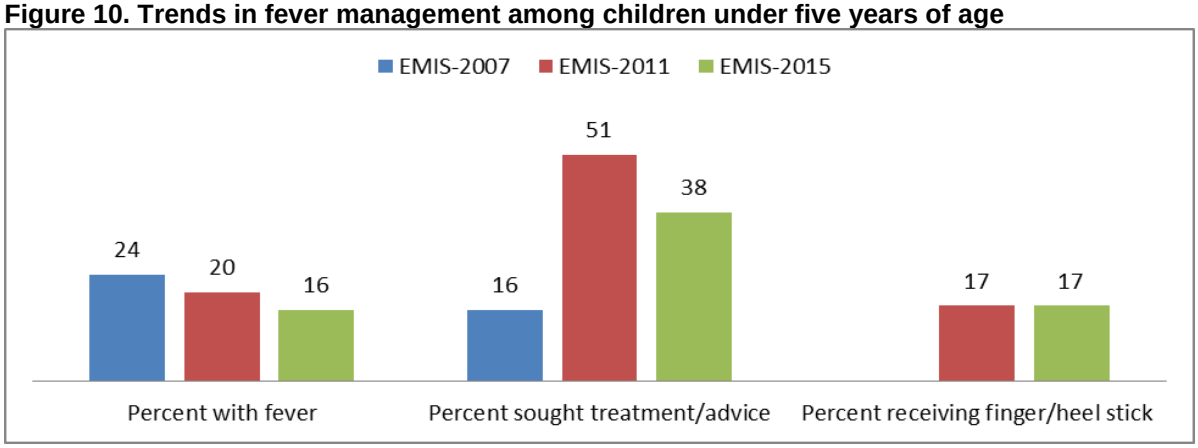
Table 24 shows that 16 percent of children under age five had fever during the two weeks preceding the survey. Children under 24 months are more likely to have had fever than older children. The prevalence of fever is not affected by the type of residence or by the sex of the child. However, fever prevalence varies by region, 23 percent and 22 percent of children under five had fever in the two weeks preceding the survey in Tigray and SNNPR, respectively, compared to only 5 percent in Harari and 11 percent in Oromia and Dire Dawa. Children under five years old whose mothers have secondary or higher educational attainment are slightly less likely than other children to have a fever two weeks prior to the survey. There is no clear association between fever prevalence and wealth quintiles.

Among children with fever, 38 percent were taken to a health facility, provider, or pharmacy for advice or treatment. Treatment-seeking for fever is highest among children less than 12 months old, and there is a trend of decreasing treatment-seeking for fever as the child gets older. Children in urban areas are more likely than children in rural areas to have been taken to a health facility, provider, or pharmacy for advice or treatment. Among regions, the proportion of children who were taken for treatment is highest in Harari (76 percent) and lowest in Tigray (32 percent). Care seeking for children with fever generally increases with the mother's education. Treatment for fever was sought by 57 percent of children whose mothers have at least a secondary education compared with only 34 percent of children whose mothers have no education. Children living in the highest wealth quintile are most likely to be taken to a health facility, provider, or pharmacy for advice or treatment (49 percent) compared with other children, but there is no clear association between seeking advice or treatment for fever and wealth quintiles.

In the EMIS 2015, mothers were asked whether their under-five children with fever had blood taken from a finger or heel for testing, presumably for diagnostic purposes. Among children under five with fever in the two weeks preceding the survey, 17 percent of children with fever had a heel or finger prick; similar to the EMIS 2011.The percentage of children who had a finger or heel prick varies with age of the child, place of residence, region, mother's education, and household wealth, but it does not vary by gender. The percentage of children who had blood taken from a figure or heel prick or testing is highest among children ages 12 to 23 months, and higher for children in urban areas than in rural areas. The probability of a child having blood taken for testing during fever increases as the mother's education attainment increases and as the level of household wealth index increases. For example, the proportion of children who had blood taken from a finger or heel for testing increases from 14 percent for children whose mothers have no education to 18 percent for children whose mothers have a primary education, to 33 percent for children whose mothers have secondary education or higher.

Figure 10 shows the trend of the percentage of children under five with fever and, among those who had fever, the percentage who sought treatment or advice and the percentage who had blood taken from a finger or heel for testing.

Figure 10. Trends in fever management among children under five years of age



4.2 Sources of advice or treatment for children with fever

Information on the sources from which advice or treatment was sought was collected using the EMIS 2015 women's questionnaire. The questions from the questionnaire were asked for all children with fever in the two weeks before the survey for whom the mother reported advice or treatment was sought from any source. Mothers were asked to name all sources of advice or treatment.

Table 25. Source of advice or treatment for children under five

Percentage of children under age five with fever in the two weeks preceding the survey for whom advice or treatment was sought from specific sources; and among children under age five with fever in the two weeks preceding the survey, the percentage for whom advice or treatment was sought, from specific sources, by background characteristics, Ethiopia 2015

Source	Malarious areas ≤2,000m ASL		Areas > 2,000m & <= 2,500m ASL	
	Among children with fever	Among children with fever for whom advice or treatment was sought	Among children with fever	Among children with fever for whom advice or treatment was sought
Any public sector sources	**31.0**	**81.6**	**38.1**	**75.8**
Government Hospital	2.4	6.3	1.4	2.9
Government Health Center	18.8	49.5	32.5	64.6
Government Health Post or Extension worker	9.5	24.9	4.2	8.3
Mobile Clinic	0.3	0.9	0.0	0.0
Fieldworker	0.0	0.0	0.0	0.0
Private Sector	**9.2**	**24.1**	**13.1**	**26.1**
Private Hospital/Clinic	8.4	22.0	10.6	21.1
Pharmacy	0.3	0.8	1.8	3.6
Private Doctor	0.2	0.6	0.0	0.0
Mobile Clinic	0.0	0.0	0.7	1.4
Fieldworker	0.3	0.7	0.0	0.0
Other Source	**0.5**	**0.0**	0.0	0.0
Shop	0.0	0.0	0.0	0.0
Traditional Practitioner	0.5	0.0	0.0	0.0
Other	0.0	0.0	0.0	0.0
Care Sought	38.1	100.0	50.4	100.0
Total Number of children	929	367	123	56

Table 25 shows that in malarious areas, of the children with fever who sought advice/treatment, half went to government health centers, a quarter to health posts, and 22 percent to a private hospital/clinic. Conversely, in the areas >2,000m and ≤2,500m ASL, 65 percent went to government health centers and 21 percent to a private hospital/clinic.

4.3 Malaria case management among children

Table 26 shows the types and timing of antimalarial medicines given to children to treat fever. When interpreting the results, it is important to remember that the information is based on reports from the mothers of the ill children, many of whom may not have known the specific medicine given to the child.

As shown in Table 26, 89 percent of children under five years of age with fever who took an antimalarial medicine were given an ACT, while 1 percent were given quinine and 4 percent received chloroquine. However, the sample of 52 children is too small for making meaningful inferences.

Table 26. Type of antimalarial drugs used

Among children under age five with fever in the two weeks preceding the survey who took any antimalarial medication, the percentage who took specific antimalarial medicine, by background characteristics, Ethiopia 2015

Background characteristic	Percentage of children who took medicine				Number of children with fever who took any anti-malarial medicine
	Any ACT	Quinine	Chloroquine	Other anti-malarial	
Age (in months)					
<12	70.6	0.0	0.0	29.4	12
12-23	100.0	0.0	0.0	0.0	4
24-35	89.8	5.8	4.5	0.0	8
36-47	100.0	0.0	0.0	0.0	13
48-59	90.1	0.0	9.9	0.0	15
Sex					
Male	98.2	1.5	0.3	0.0	31
Female	74.9	0.0	8.2	16.9	21
Residence					
Urban	73.5	0.0	1.9	24.7	14
Rural	94.7	1.2	4.1	0.0	38
Region					
Tigray	100.0	0.0	0.0	0.0	2
Afar	100.0	0.0	0.0	0.0	1
Amhara	58.6	0.0	41.4	0.0	3
Oromia	51.2	0.0	0.0	48.8	7
Benishangul Gumuz	100.0	0.0	0.0	0.0	4
SNNPR	100.0	0.0	0.0	0.0	31
Gambela	67.7	16.4	15.9	0.0	3
Harari	-	-	-	-	0
Dire Dawa	-	-	-	-	0
Mother's education					
No education	93.3	0.0	6.7	0.0	20
Primary	96.0	2.0	1.9	0.0	23
Secondary	57.4	0.0	0.0	42.6	8
More than secondary	100.0	0.0	0.0	0.0	0
Wealth quintile					
Lowest	98.8	0.0	1.2	0.0	8
Second	99.2	0.0	0.8	0.0	11
Middle	81.0	19.0	0.0	0.0	2
Fourth	87.6	0.0	12.4	0.0	11
Highest	80.6	0.0	1.4	18.0	20
Total	88.9	0.9	3.5	6.8	52

ACT = Artemisinin-based combination therapy
N.B = The total sample of 52 children is too small for making meaningful inferences

5. Malaria and anemia prevalence

Key findings

- Malaria parasite prevalence by microscopy was 0.5 percent among all age groups residing in malarious areas.
- Among children under five years of age living in malarious areas, malaria prevalence by microscopy was 0.6 percent.
- Gambella and Benshangul Gumuz had the highest malaria prevalence compared to other regions.
- In malarious areas, 6 percent of children under five had hemoglobin levels less than 8g/dl, while 44 percent had hemoglobin less than 11g/dl.

One of the major objectives of the EMIS 2015 was to assess the prevalence of malaria among all age groups and children ages 6 months to 59 months. Because of the assumed correlation between malaria infection and anemia, the EMIS also included anemia testing for children under five years of age.

Finger- or heel-prick blood samples were collected. Test results for malaria rapid diagnostic testing (Carestart®) and for anemia testing (HemoCue®) were available immediately and were provided. Survey participants that were RDT-positive for malaria and did not show signs of complicated malaria were offered a full course of medicine according to national malaria treatment guidelines. Additionally, confirmatory testing for malaria was done using thick and thin blood smears that were prepared in the field from the finger- or heel-prick procedures and transported to the EPHI laboratory.

5.1 Malaria prevalence among all age groups and children under five years of age

Malaria testing for this survey was conducted using RDTs and microscopy. The RDT was used primarily for rapid diagnosis and treatment of malaria during the survey period and microscopy slide testing was used for determination of the prevalence of malaria. The survey deployed Carestart® malaria RDTs, which can detect *P. falciparum*, *P.falciparum* or mixed, and *P.vivax* infections. Table 27 and Table 28 present malaria prevalence among all ages and children under five by RDT and microscopy.

Overall, malaria prevalence in malarious areas is very low. Table 27 shows malaria prevalence among all age groups living in malarious and areas >2,000m and ≤2,500m ASL by RDT and microscopy. Malaria prevalence was 1.2 percent and 0.5 percent by RDT and microscopy, respectively. By region, Gambella (6 percent) and Benshangul Gumuz (3 percent) have the highest prevalence by microscopy.

Table 27. Malaria prevalence among all ages

Percentage of all age groups classified in two tests as having malaria, by background characteristics, Ethiopia 2015

	Malarious areas			
	Malaria prevalence according to RDT		Malaria prevalence according to microscopy	
Background characteristic	RDT positive	Number	Microscopy positive	Number
Age in months				
0-4 years	1.3	6,081	0.6	5,999
5-9 years	1.4	1,514	1.0	1,505
10-14 years	1.4	1,113	0.3	1,098
15-19 years	0.8	718	0.8	708
20-24 years	0.6	728	0.0	717
25-29 years	0.8	718	0.5	712
30-34 years	0.1	610	0.1	600
35-39 years	3.9	504	1.7	488
40-44 years	0.1	304	0.1	301
45-49 years	0.2	279	0.1	277
50-54 years	0.2	297	0.1	294
55-59 years	0.6	181	0.2	178
60-64 years	0.2	145	0.0	144
65-69 years	0.0	79	0.3	79
70-74 years	0.0	65	0.0	64
75-79 years	1.3	43	0.0	43
80+	0.0	58	0.0	58
Sex				
Male	1.4	6,336	0.6	6,239
Female	1.0	7,103	0.5	7,025
Residence				
Urban	0.6	1,668	0.1	1,649
Rural	1.2	11,771	0.6	11,616
Region				
Tigray	1.9	814	0.9	811
Afar	0.8	209	0.2	205
Amhara	1.1	2,154	0.8	2,141
Oromia	0.7	6,444	0.3	6,344
Somali	0.2	186	0.0	175
Benishangul Gumuz	10.4	279	2.7	278
SNNPR	0.8	3,135	0.5	3,098
Gambela	18.4	89	6.0	85
Harari	1.9	49	0.4	49
Dire Dawa	0.2	79	0.0	77
Wealth quintile				
Lowest	2.2	2,682	0.8	2,655
Second	1.1	2,517	0.6	2,491
Middle	1.4	2,826	0.7	2,780
Fourth	0.5	3,268	0.4	3,236
Highest	0.8	2,146	0.0	2,103
Total	1.2	13,439	0.5	13,264
	Areas >2,000m and ≤2,500m ASL			
Total	0.1	2,521	0.1	2,502

Figure 11 shows the trend in malaria parasite prevalence since 2007 by RDT and microscopy in malarious areas. There was a reduction in malaria prevalence by RDT in 2015 (1.2 percent) compared to the results in 2011 (4.5 percent). Similarly, when comparing the microscopy results, malaria prevalence in 2015 is lower than that of 2007 and 2011.

Figure 11. Trends in malaria prevalence by RDT and microscopy (Ethiopia 2007, 2011, and 2015)

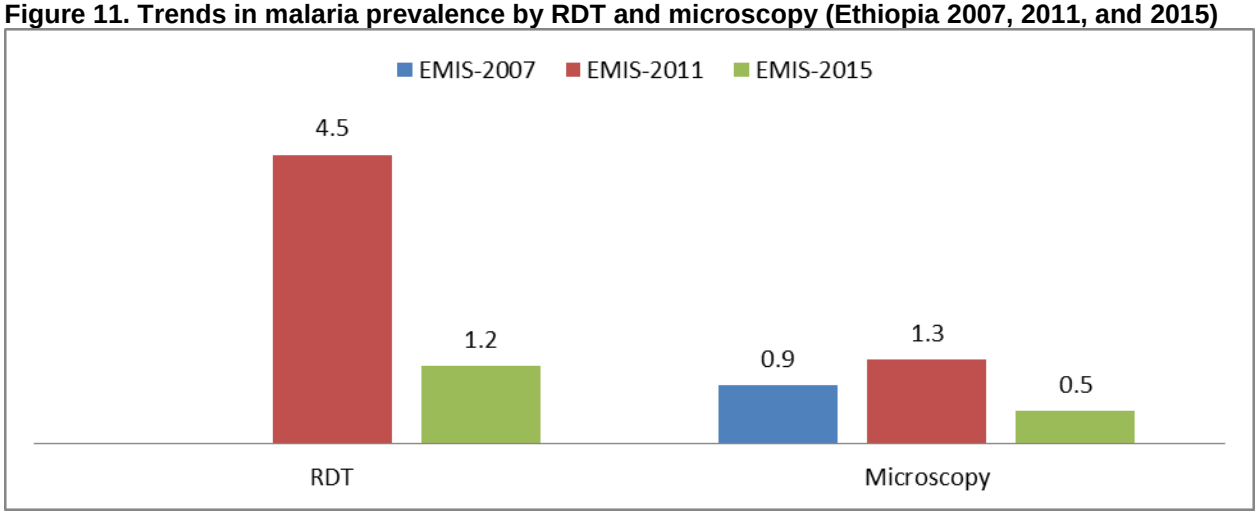


Table 28 shows that 1.4 percent of children under five had malaria parasites, according to RDTs. The prevalence was highest in Gambella (21 percent) and Benshangul Gumuz (14 percent). Table 28 also shows that less than one percent of children under five living in malarious areas had malaria during the survey (0.6 percent), according to microscopy. Malaria prevalence among children under five years of age differed by age of the child, residence, region, mother's education, and wealth quintiles, but it did not vary by gender of the child. Children ages 9–11 months old (1.5 percent) had the highest level of parasitemia compared with other age groups among children under five, as indicated in Figure 12, and children under five years of age in Gambella (7 percent) and Benshangul Gumuz (4 percent) had the highest prevalence followed by those in Amhara (1 percent), as indicated in Figure 13. Malaria prevalence among children under five living in areas >2,000m and ≤2,500m ASL was zero percent.

Table 28. Prevalence of malaria in children

Percentage of children age 6-59 months classified in two tests as having malaria, by background characteristics, Ethiopia 2015

Background characteristic	Malarious Areas			
	Malaria prevalence according to RDT		Malaria prevalence according to microscopy	
	RDT positive	Number of children	Microscopy positive	Number of children
Age in months				
6-8	0.0	342	00	329
9-11	1.6	260	1.5	259
12-17	0.9	517	0.0	509
18-23	1.1	589	0.3	582
24-35	0.9	1,383	0.2	1,363
36-47	2.1	1,390	0.7	1,375
48-59	1.5	1,918	1.1	1,896
Sex				
Male	1.5	3,183	0.4	3,131
Female	1.2	3,216	0.7	3,181
Mother's interview status				
Not interviewed[1]	1.0	482	0.6	473
Interviewed	1.4	5,917	0.6	5,840
Residence				
Urban	1.1	685	0.0	674
Rural	1.4	5,714	0.7	5,639
Region				
Tigray	1.9	387	0.5	386
Afar	1.0	111	0.2	108
Amhara	1.3	935	1.1	930
Oromia	0.8	2,993	0.2	2,941
Somali	0.1	130	0.0	123
Benishangul Gumuz	13.9	139	3.2	139
SNNPR	0.7	1,589	0.7	1,574
Gambela	20.8	52	6.6	50
Harari	1.7	22	0.5	22
Dire Dawa	0.4	40	0.0	39
Education[2]				
No education	1.5	3,961	0.7	3,912
Primary	1.1	1,476	0.4	1,451
Secondary	0.7	383	0.0	381
More than secondary	1.9	101	0.2	98
Wealth quintile				
Lowest	2.6	1,488	1.1	1,471
Second	1.4	1,298	0.7	1,289
Middle	1.2	1,320	0.5	1,293
Fourth	0.5	1,426	0.4	1,414
Highest	0.6	867	0.0	845
Total	1.4	6,399	0.6	6,313
	Areas > 2,000m & <= 2,500			
Total	0.0	1,040	0.0	1,034

[1] Includes children whose mothers are deceased
[2] Excludes children whose mothers were not interviewed

Figure 12. Malaria prevalence among children 6–59 months by age, according to microscopy

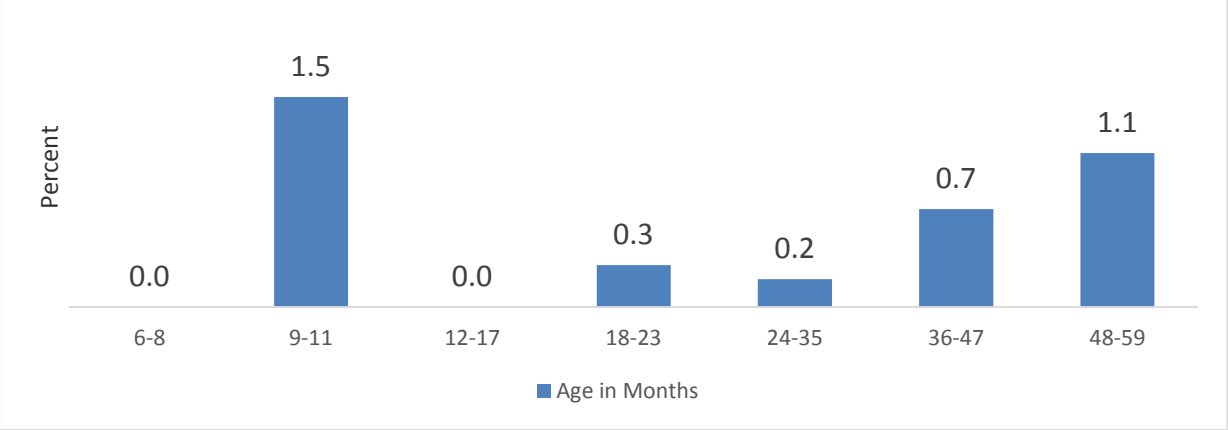


Figure 12. Malaria prevalence among children 6–59 months by residence and region, according to microscopy

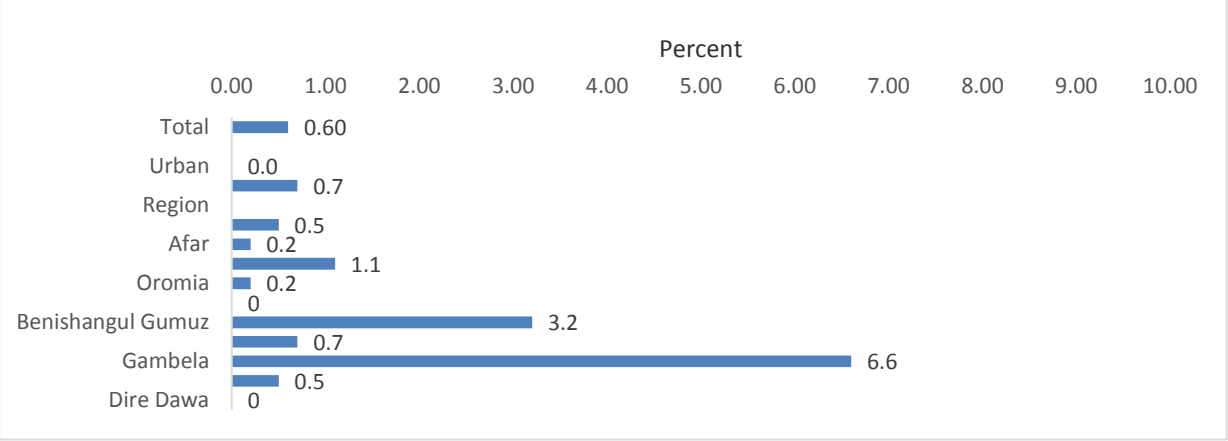
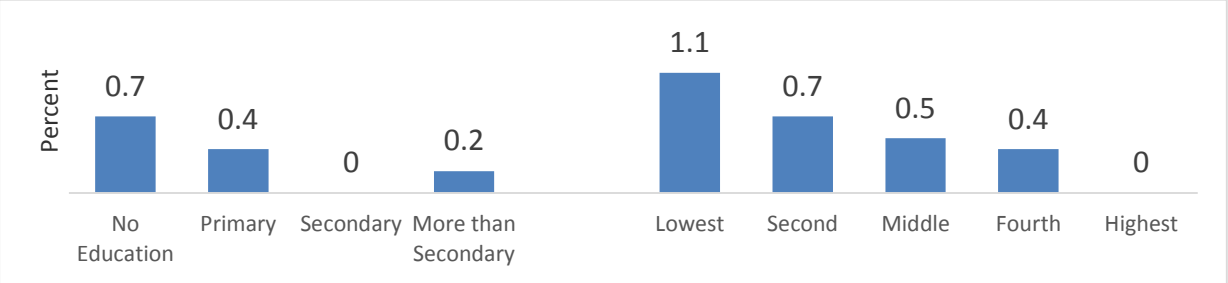


Figure 14. Malaria prevalence among children 6–59 months by mother's education and wealth quintile, according to microscopy



5.2 Proportion of *Plasmodium* species by RDT and microscopy

Table 29 shows that *P. falciparum* was the species of malaria detected in 82 percent of positive cases according to RDT and 88 percent according to microscopy, while *P. vivax* was the species in 8 percent of positive cases by RDT and 9 percent by microscopy, among all age groups. Most of the positive cases were from Benshangul Gumuz and Gambella, where the dominant species is *P. falciparum* (Table 30).

Table 29. Proportion of malaria species among all ages by RDT and microscopy

Malaria species	All ages			
	RDT		Microscopy	
	Number	Percent	Number	Percent
P. falciparum	310	81.6	131	87.9
P. vivax	31	8.0	13	8.7
P. faciparum/mixed	45	11.7	5	3.4
Total	386	100	149	100

Table 30. Number of malaria cases by species among all ages by microscopy

Region	*P. falciparum*	*P. vivax*	mixed	Total positives	Negatives	Total
Tigray	9	2	1	12	1,446	1458
Afar	4	0	0	4	1,340	1344
Amhara	11	3	0	14	1,822	1,836
Oromia	7	1	0	8	2,540	2,548
Somali	0	0	0	0	900	900
Benishangul Gumuz	43	1	0	45	1,148	1,192
SNNPR	6	2	1	9	1,857	1,866
Gambela	49	5	2	56	859	915
Harari	2	0	0	2	647	647
Dire Dawa	0	0	0	0	523	523
Total	131	13	5	149	13,080	13,229

5.3 Malaria prevalence by history of travel

Table 31 shows that malaria prevalence among all ages who traveled away from their home in the month preceding the survey was 0.4 percent, while prevalence among those who did not travel in the month prior was 0.5 percent.

Table 31. Malaria prevalence among those who traveled in the last month compared to those who did not

Traveled away from home in the last month	Malaria prevalence (RDT)		Malaria prevalence (Microscopy)	
	RDT-positive	Number	Slide Positive	Number
Yes	1.2	273	0.4	268
No	1.2	13, 166	0.5	12,996
Total	1.2	13, 439	0.5	13,264

5.4 Hemoglobin level among children under five years of age

A hemoglobin level below 8.0 g/dl is often associated with malaria infection. For nutrition programs, all children with hemoglobin below 11.0 g/dl are considered anaemic and those with a hemoglobin level below 7.0 g/dl are considered severely anaemic.

Table 32 shows that 6 percent of children under five living in malarious areas were anaemic with a hemoglobin level of less than 8g/dl. The variation is minimal by age of the child, gender, and mother's educational status. However, children under five residing in Somali Region were most likely to be anaemic (31 percent) compared to other regions. Educational attainment of the child's mother and household wealth quintile were important determinants of anemia in children.

Table 32. Hemoglobin levels in children under five years of age

Percentage of children age 6–59 months with varying hemoglobin levels, by background characteristics, Ethiopia 2015

	Malarious areas				
Background characteristic	Hemoglobin <8.0 g/dl	Hemoglobin <5.0 g/dl	Hemoglobin >=5.0 and < 8.0 g/dl	Hemoglobin >=8.0 and <11.0 g/dl	Number of children
Age (in months)					
6-8	5.9	0	5.9	63.9	336
9-11	5.8	0.1	5.7	59.2	255
12-17	8.2	0.6	7.7	61.4	506
18-23	9.1	0.7	8.3	50.5	571
24-35	7.8	0.5	7.3	45	1,366
36-47	5.8	0.3	5.5	41.5	1,358
48-59	3.4	0.3	3.1	31.4	1,886
Sex					
Male	6.5	0.2	6.3	43.4	3,120
Female	5.6	0.6	5	43.7	3,158
Mother's interview status					

Not interviewed[1]	8.6	0.5	8.1	36.7	475
Interviewed	5.8	0.4	5.4	44.1	5,803
Residence					
Urban	3	0	3	39.6	663
Rural	6.4	0.4	5.9	44	5,615
Region					
Tigray	2.8	0.2	2.6	41.5	382
Afar	9.9	0.3	9.6	51.2	104
Amhara	5.5	0.5	5	39.7	914
Oromia	5.9	0.4	5.5	45.8	2,938
Somali	31.2	4.8	26.4	49.5	130
Benishangul Gumuz	2.5	0	2.5	35.1	137
SNNPR	4.8	0	4.8	41.2	1,566
Gambela	7.9	0.4	7.6	59.3	45
Harari	7.3	0	7.3	50	22
Dire Dawa	26	4.8	21.2	42	40
Mother's education[2]					
No education	6.8	0.5	6.3	44.7	3,884
Primary	4.5	0.2	4.3	45	1,452
Secondary	2.1	0	2.1	37.7	372
More than secondary	0.3	0	0.3	33.4	99
Wealth quintile					
Lowest	9.8	1.1	8.8	47.4	1,460
Second	7.2	0.3	7	44.1	1,272
Middle	6	0.2	5.8	45.5	1,293
Fourth	3.4	0.2	3.2	38.7	1,403
Highest	2.1	0	2.1	41.2	850
Total	6.0	0.4	5.6	43.5	6,278
Areas > 2,000m & <= 2,500					
Total	3.8	0.4	3.4	40.9	1,039

Note: Table is based on children who stayed in the household the night before the interview. Hemoglobin levels are adjusted for altitude using CDC formulas (CDC, 1998). Hemoglobin is measured in grams per deciliter (g/dl).

1 Includes children whose mothers are deceased

2 Excludes children whose mothers were not interviewed

5.5 Coverage of testing for anemia and malaria in children

Table 33 shows that among eligible children under five years of age, 92 percent were tested for anemia and 94 percent were tested for malaria by both RDT and microscopy.

Table 33. Coverage of testing for anemia and malaria in children

Percentage of eligible children age 6–59 months who were tested for anemia and for malaria, by background characteristics (unweighted), Ethiopia 2015

	Malarious areas <= 2,000m ASL			
	Percentage tested for:			
Background characteristic	Anemia	Malaria with RDT	Malaria by Microscopy	Number of children
Age in months				
6-8	90	91.8	91.2	341
9-11	88.2	91.8	91.8	245
12-17	90.6	93.4	93.3	625
18-23	95.2	96.2	95.7	586
24-35	93.2	94.4	94.2	1,475
36-47	91.4	93.7	93.5	1,533
48-59	92.9	94.2	94.2	1,998
Sex				
Male	92.3	94.2	94	3,433
Female	92.3	93.9	93.7	3,370
Mother's interview status				
Interviewed	92.7	94.6	94.4	6,184
Not interviewed[1]				

	86.2	86.9	86.7	632
Residence				
Urban	89.2	90.6	90.3	1,114
Rural	92.7	94.5	94.4	5,702
Region				
Tigray	97.4	97.6	97.6	704
Afar	87.5	93.5	92.6	814
Amhara	96.3	97.1	96.9	815
Oromia	95.8	95.9	95.9	1,249
Somali	91.2	89.2	88.9	649
benishangul gumuz	95.2	95.4	95.2	588
SNNPRr	93.5	93.5	93.5	879
Gambela	78.8	93.2	93	514
Harari	86	86.3	86	336
dire dawa	86.2	86.2	86.2	268
Mother's education[2]				
No education	92.9	94.5	94.3	4,343
Primary	93	95.6	95.4	1,335
Secondary	90.8	93.8	93.8	368
More than secondary	88	90.1	90.1	142
Wealth quintile				
Lowest	92.9	94.8	94.6	1,954
Second	92.6	94.6	94.4	1,453
Middle	91.2	93.9	93.4	1,305
Fourth	93.8	95.5	95.4	1,059
Highest	89.4	89.6	89.6	1,045
Total	92.1	93.9	93.7	6,816
Areas > 2,000m and <= 2,500				
Total	96.1	96.2	96	1,081

RDT = Rapid Diagnostic Test ([Carestart, accessbio])
[1] Includes children whose mothers are deceased
[2] Excludes children whose mothers were not interviewed

6. General malaria knowledge

Key findings

- Sixty-eight percent of women in malarious areas have heard about malaria.
- Of those who had heard of malaria, 75 percent were aware that mosquito bites cause malaria and recognize that fever is a symptom of malaria.
- Of those who had heard about malaria, 77 percent knew that sleeping under mosquito nets can prevent malaria.

Community empowerment and mobilization is one of the main strategies outlined in the NSP 2014–2020. To improve the uptake of key malaria interventions, social and behavioral change communication activities are being implemented through the health extension program. One of the objectives of the 2015 EMIS was to assess general knowledge about malaria for women 15–49 years old. They were asked if they had ever heard of malaria and, if they responded yes, they were asked a series of questions about their knowledge of signs and symptoms, causes, and preventive measures.

Table 34 shows that the majority of surveyed women had heard of malaria (71 percent). Of those women who had heard of malaria, 75 percent reported fever as a symptom of malaria. In malarious areas, 75 percent of women reported mosquito bites as a cause of malaria. Knowledge of this was higher among women in the highest wealth quintile (82 percent) than among women in the lowest (66 percent). Moreover, 77 percent of all surveyed women who had heard of malaria reported mosquito nets as a prevention method against malaria.

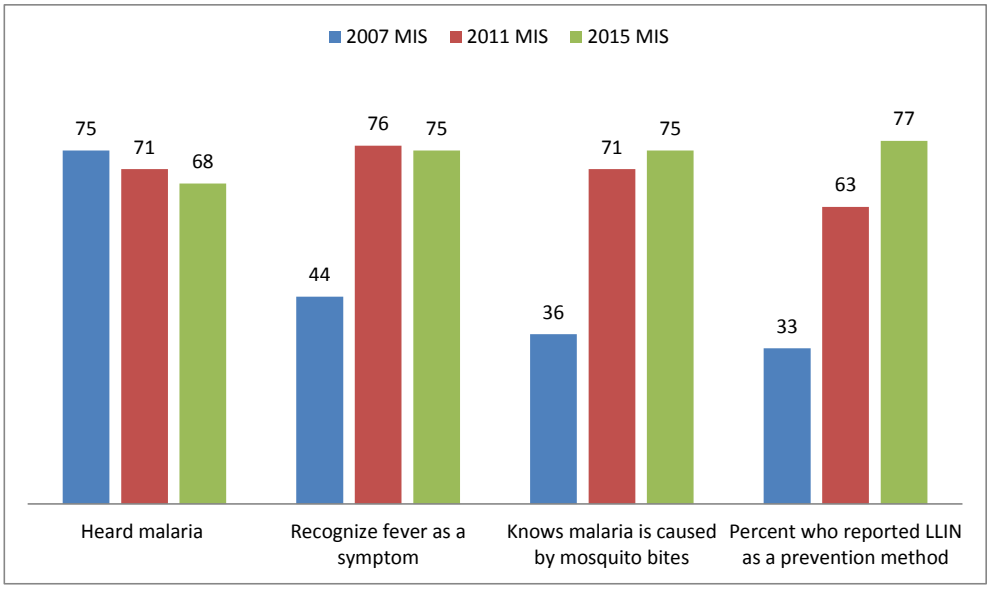
Table 34. General malaria knowledge among women ages 15 to 49 years

Percentage who reported having heard of malaria, who recognized fever as a symptom of malaria, who reported mosquito bites as a cause of malaria, and who reported mosquito nets (treated or untreated) as a prevention method by background characteristics, Ethiopia 2015

	Malarious areas					
			Among women who had heard of malaria			
Background characteristics	Percentage who had heard of malaria	Number	Percentage who recognize fever as a symptom of malaria	Percentage who report mosquito bites as a cause of malaria	Percentage who report mosquito nets (treated or untreated) as a prevention method	Number
Age						
15-19	68.3	1,736	72.9	75.1	79.3	1,113
20-24	67.8	1,909	73.4	79	80.7	1,215
25-29	67.7	2,036	77.2	75.8	79	1,294
30-34	69.5	1,682	74.3	73.1	74.2	1,097
35-39	67.6	1,177	75.9	70.6	75.5	747
40-44	72.1	669	75.9	70.8	69.1	453
45-49	66.6	411	70.7	71.1	71.6	257
Residence						
Urban	73.9	1,801	79.5	83	87	1,249
Rural	67.1	7,820	73.4	72.5	74.5	4,927
Region						
Tigray	77.5	595	67.7	74.1	80.3	433
Afar	47.8	156	88.4	86	85.4	70
Amhara	78.2	1,470	67.6	53.4	69.3	1,079
Oromia	67.4	4,502	77.9	82.8	81.2	2,850
Somali	23.5	143	88.7	93.1	90.1	31
benishangul gumuz	61	190	85.1	67.8	76.8	109
SNNPRr	66.3	2,374	72.3	72.3	71.6	1,479
Gambela	64.1	66	94.2	97.4	98.6	40
Harari	69.1	44	84.4	94.7	92.9	29
dire dawa	76.5	81	94.9	94.1	93.7	58
Education						
No education	62.1	5,073	72.8	67.1	71.2	2,958
Primary	72.6	2,904	73	77.8	79.2	1,979
Secondary	77.3	1,310	80	85.8	86.9	951
More than secondary	92.1	333	87	92.8	89.9	288
Wealth quintile						
Lowest	59.2	1,555	70.2	66.4	71	864
Second	61.9	1,676	74.3	69.9	75.1	974
Middle	68.9	1,913	72.2	72.7	73	1,238
Fourth	75.6	2,292	73.3	75.8	77.3	1,625
Highest	71.9	2,185	80.9	82.9	85	1,475
Total	68.4	9,620	74.6	74.6	77.1	6,176
			Areas			
Total	62	1,843	63.4	65.5	70.3	1,149

Figure 15 shows the trend of women's malaria knowledge and practice from 2007 to 2015. Though there was a slight reduction in the percentage of women who had heard of malaria and who recognized fever as a symptom of malaria, the percentage of women who knew malaria is caused by mosquito bites and that LLINs can prevent malaria increased each year the survey was held.

Figure 15. Trends in women's malaria knowledge and practice (Ethiopia 2007, 2011, and 2015)



7. Lessons learned

The EMIS 2015 is Ethiopia's third malaria indicator survey following the EMISs in 2007 and 2011. The experience gained from the previous EMISs contributed to better planning and implementation of this most recent survey. This section briefly describes the major lessons learned and challenges faced during the implementation of the EMIS 2015 with the intent of further improving the planning and implementation of similar surveys in the future.

7.1 Positive outcomes

Local Android programming capacity

To improve the data collection process, smartphones were used during the 2015 survey (whereas PDAs were used in the previous two surveys). Besides ease of use, smartphones have the ability to send active data from the field to the central server. To this end, a locally developed, android-based data collection program called EpiSample was installed on the smart phones for data collection. Because the program was developed locally, it could be constructed from the ground up in the local language, Amharic, and data collectors were able to switch between English and Amharic to enhance their understanding of the questionnaires. The local programming capability made it easier to revise the questionnaires and train data collectors, and it created a platform for quick trouble-shooting, data retrieval, and management. This was a major breakthrough during EMIS 2015. The EpiSample program is growing globally and has received recognition from both PATH and the CDC.

Improvement on resolution and proportion

Malaria varies greatly in Ethiopia due to large variations in altitude and climate. Although debatable, areas below 2,000m ASL are generally considered to be suitable for malaria transmission and considered to be program implementation areas. However, as EMIS 2015 sampling used enumeration areas (EAs) from the Central Statistics Agency (CSA) and these maps did not have altitude data, sampling frame selection based on altitude was a difficult task. Previous attempts resulted in misclassification as indicated in the EMIS 2011 report. In order to address this challenge, a group of Geographic Information Systems (GIS) professionals and statisticians worked together to set criteria for altitude classification. Based on the recommendations of the group, 20x20m resolution satellite image data was used (previously 90x90m was used) and transposed on CSA digital EA maps for altitude-based selection. A mechanism was created for an EA to be considered in the sampling frame if at least 75 percent of its area should fall within the required altitude range. This improved the process of selecting the sampling frame and minimized problems with misclassification.

In terms of the proportion of the sample—<2,000m (program area), >2,000m, and 2,500m ASL—85 percent of the sample was set to represent <2,000m ASL and 15 percent of the sample was set to represent areas between >2,000m and <2,500m ASL. The disproportionate selection was performed on the assumption that most malaria interventions are implemented in the malaria transmission areas. Similar to the previous EMISs, all EAs above 2,500m ASL were excluded from the study.

In the 2011 survey, although regional estimates were made, there was a lump sum estimation for Gambela and Benishanul Gumuz as well as Afar and Somali and there were no estimates for Harari or Diredewa. Based on a request from the technical committee, the current EMIS 2015 sampling considered separate estimation for all regions except Addis Ababa during sample size calculation.

Data cleaning and analysis

EMIS 2015 benefitted from the establishment of a local data cleaning and analysis group. This, as well as the use of EpiSample, facilitated timely and efficient organization, cleaning, and analysis of data shortly after the completion of the survey. A technical group was formed with statistical expertise both from local and international stakeholders allowing the cleaning and analysis to be completed in two to three weeks.

EPHI server and feedback

Data from the survey were sent directly from the field to EPHI server using cellular mobile data capabilities of the smartphone every night. The data was converted into a readable format and was available for central coordinators to make summaries using GIS software. The information available was pivotal for immediate feedback and quality control. To improve the storage capacity, an additional server was also procured for EPHI using EMIS 2015 resources.

7.2 Challenges

Partner participation

Malaria indicator surveys are multi-partner projects requiring the collaboration of more than ten stakeholders. Their contributions were important to the success of the 2015 EMIS. However, reluctance was observed in some of them in terms of delivering their responsibilities on time and with the expected quality. There was also poor participation by a few partners during training of data collectors and the supervision of the data collection and this affected the overall progress and quality of the survey.

Logistic management

As with previous EMISs, logistic management was handled by partners to ease facilitation. Though the overall management of the survey logistics was good, there were some challenges encountered. First, the supplies were not procured in time and some of the supplies procured did not meet the project's quality standards. There was a last minute rush to procure the remaining supplies and replace some supplies, putting the success of the study at risk. Second, there were some inefficacies during per diem payment of data collectors as the payment documents were not well-organized ahead of time. Third, all 36 vehicles were not able to be supplied on the departure date for field work and thus the departure of a number of teams was delayed. There was also a mechanical breakdown of a vehicle and the replacement was a significant challenge. EPHI and ACIPH contributed vehicles to alleviate this problem. For future work, it will be important to work through these potential problems with the partners ahead of time to avoid jeopardizing the project.

Per diem dispersal

Per diem and work-related finance was transferred every 15 days to field sites. This was accomplished via a special arrangement with the Commercial Bank of Ethiopia. Using mobile technology, SMS messages were sent to each data collector's mobile phone, which he/she could bring to the local branch to receive payment. Unfortunately, an accidental miscommunication caused an interruption of this service and therefore caused some challenges with per diem dispersal. Additionally, part of the per diem was sent from EPHI and part of it was sent from Malaria Consortium. Having two sources of payment created confusion among staff. For coming similar surveys, per diems should be paid by a single institution to prevent confusion.

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9. Appendices

Appendix A. Sample design

A.1 Introduction

For the 2015 Ethiopia National Malaria Indicator Survey (EMIS 2015), the third such survey conducted in Ethiopia, a nationally representative sample of 13,875 households from 555 enumeration areas (EAs) was selected. The survey was designed to provide information on the following key malaria control indicators: (1) the proportion of households having at least one long-lasting insecticide-treated net (LLIN), (2) indoor residual spraying (IRS) status of households, (3) the proportion of study participants who slept under LLIN the night before the survey, (4) the proportion of children under five years of age who slept under an LLIN the night before the survey, and (5) the proportion of pregnant women who slept under an LLIN the night before the survey. The survey produced representative estimates for the main EMIS indictors for household populations in malarious areas of the country as a whole, for urban and rural areas separately, for each region's malarious areas, and for areas between 2,000m and 2,500m above sea level (ASL). The administrative structure of Ethiopia is regional state, zone, woreda (i.e., district), and kebele (i.e., village).

A.2 Sample frame

The sampling frame, a complete list of all eligible enumeration areas (EAs) that entirely cover a given domain, allows a probability selection of sampling units. The sampling frame used for this survey was the most recently available list of enumeration areas (the primary sampling units) and digitized EA maps from the CSA. All EAs were stratified into three strata. Stratum I contained EAs with a mean altitude of ≤2,000m ASL, Stratum II contained EAs with a mean altitude of >2,000 and ≤2,500m ASL, and Stratum III contained EAs with mean altitude of >2,500m ASL. If an EA fell within two strata, it was classified based on whichever altitude class made up 75 percent of its area. EAs falling in Stratum III were excluded from the sampling frame. The list of eligible EAs was thoroughly evaluated by CSA and the EMIS technical working group before it was used. Each EA had a size measurement (population and/or number of households) and in each domain a sample of EAs with the predetermined sample size was then selected independently with probability proportional to this measure of size. Maps of the selected EAs were used to clearly define boundaries.

The design for the survey was cross-sectional, with a representative probability sampling technique to produce national and sub-national estimates for malarious areas of the country as a whole and stratified for urban/rural development (in the lower stratum [i.e., <2,000m]). The following domains of estimation were specified for the 2015 EMIS:

- National (country): rural for enumeration area (EA) mean altitude of ≤2,000m ASL.
- National (country): urban for EA mean altitude of ≤2,000m ASL.
- National (country): for EA mean altitude of >2,000 and ≤2,500m ASL.
- Sub-national for EA mean altitude of ≤2,000m ASL: Tigray, Afar, Amhara, Oromia, Somali, Benishangul-Gumuz, SNNPR, Gambella, Harari, and Dire Dawa.

Single population proportion formula was used to determine the minimum sample size required for the survey per domain.

$$n = \frac{Z_{\frac{\alpha}{2}}^2 P(1-P)}{d^2}(DEFT)^2$$

Where:
n=the required minimum sample size

P=expected proportion

d=absolute precession=2*P*RSE

RSE=Relative Standard Error (relative precession) of the expected proportion

DEFT=Design effect for accounting for the two-stage cluster sampling method

The key indicator that was taken to calculate the samples size was proportion of children under five years of age who slept under a mosquito net the previous night from the 2011 EMIS. With the proportion of children under five who slept under a mosquito net the previous night being 38.2 percent (2011 EMIS), a relative precession of 9 percent, 95 percent CI, design effect of 2, 72 percent of households with children under five (estimated/calculated from EMIS 2011), and a 20 percent non-response rate, n=13,880 households, and EAs=555.

Based on the above formula, the sample size calculated was 799. Adjusting for the 20 percent non-response rate gives 999 (=799/0.80) under-five children per region. The number of households needed depends on the average number of children under five per household. Using the estimated 72 percent of households with under-five children, the number of households required per domain was 1,388 (=999/0.72). Since the 2015 EMIS was supposed to produce regional level estimates, the total sample size for the country was the sample size obtained above multiplied by the number of malarious regions, 13,880 (=1,388X10).

The survey was primarily designed to provide estimates for areas below 2,000m for each malarious region and national-level estimates for areas with a mean altitude of >2,000 and ≤2,500m ASL, since the upper altitude stratum of ≥2,000m to ≤2,500m is affected by infrequent epidemics and, hence, is an area of minor concentration of malaria control activities by the NMCP and FMOH. Accordingly, 85 percent of the HHs were allocated to malarious areas <2,000m ASL and 15 percent to areas ≥2,000m to ≤2,500m ASL. To have regional-level estimates of some of the indicators, the number of EAs at regional level should be adequate with acceptable relative precision and design effect. During distribution of the total country-level sample size to the regions, the size of the population living in malaria risk areas (E<2,000 m) was considered. Since precisions were considered at the regional level, a power allocation with an appropriate power value was used to guarantee sufficient sample size in small regions. A condition was imposed such that the sample size in a given region should not be smaller than a given value. For this purpose, the stratum sample (power) allocation section of the RBM guidelines for sampling was used. Power value of 0.22 was appropriate for the condition imposed that the sample size should not be smaller than 647 households in each region.

Table A1. Number of households in the sampling frame

Distribution of the households in the sampling frame by region and residence, Ethiopia 2015

	Number of households in frame			
	Malarious areas ≤2,000m ASL			Areas>2,000m and ≤2,500m ASL
Region	Urban	Rural	Total	
Tigray	100,503	336,113	436,616	241,818
Afar	44,866	180,253	225,119	0
Amhara	206,041	1,007,195	1,213,236	831,027
Oromia	470,233	2,365,189	2,835,422	1,248,367
Somali	43,904	123,878	167,782	0
Benshangul Gumuz	27,500	124,471	151,971	0
SNNPR	233,434	1,497,911	1,731,345	618,834
Gambela	18,424	37,936	56,360	0
Harari	28,552	11,637	40,189	3,217
Dire Dawa	54,505	22,113	76,618	0
Total	1,227,962	5,706,696	6,934,658	2,943,263

A.3 Sampling design and implementation

Sampling for the 2015 EMIS was a two-stage stratified cluster sampling from the sampling frame. Stratification was achieved by separating the country in to three strata by altitude as malarious areas below 2,000m ASL and areas between 2,000m and 2,500m ASL. Malarious areas below 2,000m ASL were further stratified into urban and rural and by region.

In total, 14 sampling strata were created. Samples were selected independently in each sampling stratum, by a two-stage selection process. In the first stage, 555 enumeration areas were selected with a stratified probability proportional to size selection, according to the sample allocation given in Table A2. After the first stage of selection, and before the main survey, a household listing operation was carried out in all of the selected villages.

The household listing operation consisted of visiting each of the 555 selected EAs, recording the name of each household head, and recording the GPS coordinates of each household. The resulting list of households served as the sampling frame for the selection of households in the second stage.
At the second stage, 25 households were selected from the new household listing for each selected village. Household selection was performed in the field by team leaders using EpiSample.

Table A2 shows the sample allocation of clusters and households by region and by residence. The sample allocation was population proportional to size (PPS): 555 EAs were selected; 466 EAs from malarious areas and 89 from areas >2,000m and ≤2,500m ASL.

Table A2. Sampling allocation of clusters and households

Sample allocation of clusters and households by region, according to residence, Ethiopia 2015

Region	Malarious areas ≤2,000m ASL						Areas >2,000m and ≤2,500m ASL					
	Allocation of enumeration areas			Allocation of households			Allocation of enumeration areas			Allocation of households		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Tigray	12	37	49	295	906	1,201	5	11	16	120	273	393
Afar	9	34	43	221	823	1,044	0	0	0	0	0	0
Amhara	10	51	61	237	1,249	1,486	3	19	22	73	465	538
Oromia	12	65	77	295	1,617	1,912	4	16	20	100	399	499
Somali	10	30	40	212	673	885	0	0	0	0	0	0
Benshangul Gumuz	7	32	39	168	768	936	0	0	0	0	0	0
SNNPR	9	54	63	204	1,310	1,514	2	21	23	46	511	557
Gambela	11	21	32	263	479	742	0	0	0	0	0	0
Harari	20	9	29	495	219	714	1	6	7	25	148	173
Dire Dawa	24	9	33	549	192	741	0	1	1	0	19	19
Total	124	342	466	2,939	8,236	11,175	15	74	89	364	1,815	2,179

Table A3 shows the distribution of the expected number of completed individual interviews with women ages 15–49 by urban and rural residence for each region in malarious areas and for areas >2,000m and ≤2,500m ASL.

Table A3. Sample allocation of completed interviews with women

Sample allocation of expected number of completed interviews with women and men by region, according to residence, Ethiopia 2015

Region	Malarious areas ≤2,000m ASL			Areas >2,000m and ≤2,500m ASL
	Women 15–49			
	Urban	Rural	Total	
Tigray	292	766	1,058	297
Afar	210	751	961	0
Amhara	225	1,077	1,302	500
Oromia	296	1,443	1,739	446
Somali	190	503	693	0
Benishangul Gumuz	158	605	763	0
SNNPR	160	1,122	1,282	442
Gambela	254	418	672	0
Harari	416	201	617	151
Dire Dawa	431	142	573	16
Total	2,632	7,028	9,660	1,852

A4. Sample probabilities and sample weights

Because of the non-proportional allocation of the sample to the different reporting domains, sampling weights were required for any analysis using EMIS 2015 data to ensure the sample was representative. Because the EMIS 2015 sample was a two-stage stratified cluster sample, sampling weights were calculated based on sampling probabilities that were calculated separately for each sampling stage and for each cluster.

The following notations were used:

P_{1hi}: sampling probability of the ith cluster in stratum h
P_{2hi}: sampling probability within the ith cluster for households
P_{hi}: overall sampling probability of any households of the ith cluster in stratum h

Let a_h be the number of EAs selected in stratum *h*, M_{hi} the number of households according to the sampling frame in the i^{th} EA, and $\sum M_{hi}$ the total number of households in the stratum. The probability of selecting the i^{th} EA in the EMIS 2015 sample is calculated as follows:

$$\frac{a_h \, M_{hi}}{\sum M_{hi}}$$

Let b_{hi} be the proportion of households in the selected cluster compared to the total number of households in EA *i* in stratum *h* if the EA is segmented, otherwise $b_{hi} = 1$. Then the probability of selecting cluster *i* in the sample is:

$$P_{1hi} = \frac{a_h \, M_{hi}}{\sum M_{hi}} \times b_{hi}$$

Let L_{hi} be the number of households listed in the household listing operation in cluster *i* in stratum *h*, let g_{hi} be the number of households selected in the cluster. The second stage's selection probability for each household in the cluster is calculated as follows:

$$P_{2hi} = \frac{g_{hi}}{L_{hi}}$$

The overall selection probability of each household in cluster *i* of stratum *h* is therefore the production of the two stage's selection probabilities:

$$P_{hi} = P_{1hi} \times P_{2hi}$$

The sampling weight for each household in cluster *i* of stratum *h* is the inverse of its overall selection probability:

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

The design weight is also adjusted for household non-response and individual non-response to get the sampling weights for households and for women, respectively. Nonresponse is adjusted at the sampling stratum level. For the household sampling weight, the household design weight is multiplied by the inverse of the household response rate, by stratum. For the women's individual sampling weight, the household sampling weight is multiplied by the inverse of the women's individual response rate, by

stratum. After adjusting for nonresponse, the sampling weights are normalized to get the final standard weights that appear in the data files. The normalization process is done to obtain a total number of un-weighted cases equal to the total number of weighted cases at the national level, for the total number of households and women. Normalization is done by multiplying the sampling weight by the estimated sampling fraction obtained from the survey for the household weight and the individual woman's weight. The normalized weights are relative weights, which are valid for estimating means, proportions, ratios, and rates, but not valid for estimating population totals or for pooled data.

Table A4. Sample implementation: household and women

Percent distribution of households and eligible women by results of the household and individual interviews, and overall women response rates, according to urban-rural residence and region (un-weighted), Ethiopia 2015

Region	Malarious areas ≤2,000m ASL													
	Residence			Region										
	Urban	Rural	Total	Tigray	Afar	Amhara	Oromia	Somali	Benshangul Gumuz	SNNPR	Gambella	Harari	Dire Dawa	Total
Selected households														
Completed	94.7	96	95.7	98	94.8	97.4	99.3	88.4	96	96.1	92.8	98.5	89.8	95.7
Refused	4.4	3	3.4	1.5	1.8	2.4	0.4	10.4	3.6	3.7	4.5	1.4	8.5	3.4
Unknown	0.8	0.9	0.9	0.5	3.4	0.1	0.3	1.2	0.4	0.2	2.8	0.1	1.7	0.9
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Number of sampled households	3,100	8,550	11,650	1,225	1,075	1,525	1,925	1,000	975	1,575	800	725	825	11,650
	Areas>2,000m and ≤2,500m ASL													
Selected households														
Completed	97.1	98.1	97.9	98.3	0	97.8	99.8	0	0	96.9	0	98.9	76	97.9
Refused	2.7	1.6	1.8	1	0	2.2	0.2	0	0	3	0	1.1	16	1.8
Unknown	0.3	0.3	0.3	0.8	0	0	0	0	0	0.2	0	0	8	0.3
Total	100	100	100	100	0	100	100	0	0	100	0	100	100	100
Household response rate (HRR)1	375	1,850	2,225	400	0	550	500	0	0	575	0	175	25	2,225
	Malarious areas ≤2,000m ASL													
Eligiable women														
Completed	91.2	90.1	90.4											
Refused	1.6	1.6	1.6											
Not present	5.2	5.8	5.6											
Other	1.9	2.6	2.4											
Total	100	100	100											
Number	2,823	7,588	10,411											
Eligible women response rate (EWRR)[2]														
Overall women response rate (OWRR)[3]														
	Areas>2,000m and ≤2,500m ASL													
Eligiable women														
Completed	93.1	91	91.3											
Refused	0.6	0.8	0.7											
Not present	2.9	5.3	4.9											
Other	3.5	2.9	3											
Total	100	100	100											
Number of women	335	1,627	1,962											
Eligible women response rate (EWRR)[2]														
Eligible women response rate (EWRR)[2]														

[1] Using the number of households falling into specific response categories, the household response rate (HRR) is calculated as:

$$\frac{100 * C}{C + HP + P + R + DNF}$$

[2] The eligible women response rate (EWRR) is equivalent to the percentage of interviews completed (EWC).

[3] The overall women response rate (OWRR) is calculated as:

$$OWRR = HRR * EWRR/100$$

Appendix B. Data quality tables

Table B1. Household age distribution

Single-year age distribution of the de facto household population by sex (weighted), Ethiopia 2015

Age	Malarious areas				Areas>2,000m and ≤2,500m ASL			
	Male		Female		Male		Female	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
0	642	3	675	3	101	2.3	101	2.2
1	518	2.4	569	2.5	90	2.1	65	1.4
2	695	3.2	675	3	134	3.1	96	2.1
3	642	3	736	3.2	137	3.1	114	2.5
4	991	4.6	883	3.9	155	3.5	151	3.3
5	581	2.7	537	2.4	98	2.2	106	2.3
6	854	3.9	763	3.4	172	3.9	166	3.7
7	859	4	866	3.8	170	3.9	171	3.8
8	821	3.8	819	3.6	163	3.7	179	3.9
9	568	2.6	592	2.6	138	3.1	141	3.1
10	802	3.7	888	3.9	176	4	158	3.5
11	425	2	416	1.8	94	2.1	117	2.6
12	647	3	755	3.3	161	3.7	178	3.9
13	496	2.3	576	2.5	114	2.6	106	2.3
14	477	2.2	705	3.1	125	2.8	159	3.5
15	544	2.5	410	1.8	126	2.9	72	1.6
16	361	1.7	282	1.2	89	2	72	1.6
17	339	1.6	307	1.3	64	1.4	56	1.2
18	451	2.1	527	2.3	113	2.6	111	2.4
19	210	1	304	1.3	53	1.2	67	1.5
20	490	2.3	736	3.2	90	2.1	110	2.4
21	157	0.7	236	1	37	0.8	53	1.2
22	345	1.6	387	1.7	59	1.3	75	1.7
23	240	1.1	309	1.4	46	1	52	1.1
24	218	1	297	1.3	61	1.4	75	1.7
25	554	2.6	783	3.4	78	1.8	133	2.9
26	217	1	275	1.2	28	0.6	44	1
27	287	1.3	371	1.6	41	0.9	65	1.4
28	262	1.2	392	1.7	63	1.4	84	1.9
29	238	1.1	255	1.1	39	0.9	63	1.4
30	707	3.3	865	3.8	124	2.8	140	3.1
31	149	0.7	158	0.7	38	0.9	31	0.7
32	296	1.4	313	1.4	51	1.2	63	1.4
33	163	0.8	202	0.9	27	0.6	50	1.1
34	169	0.8	172	0.8	21	0.5	34	0.8
35	514	2.4	558	2.5	75	1.7	119	2.6
36	143	0.7	120	0.5	22	0.5	19	0.4
37	246	1.1	227	1	50	1.1	69	1.5
38	210	1	158	0.7	50	1.1	46	1
39	137	0.6	133	0.6	45	1	32	0.7
40	523	2.4	427	1.9	112	2.5	100	2.2
41	104	0.5	63	0.3	19	0.4	13	0.3
42	187	0.9	74	0.3	34	0.8	24	0.5
43	77	0.4	52	0.2	30	0.7	12	0.3
44	118	0.5	62	0.3	39	0.9	14	0.3
45	270	1.2	190	0.8	60	1.4	35	0.8
46	71	0.3	73	0.3	13	0.3	7	0.2
47	137	0.6	84	0.4	29	0.7	24	0.5
48	98	0.5	64	0.3	28	0.6	13	0.3
49	102	0.5	88	0.4	20	0.4	12	0.3
50	345	1.6	485	2.1	71	1.6	127	2.8
51	72	0.3	118	0.5	7	0.1	26	0.6
52	76	0.4	136	0.6	12	0.3	38	0.8
53	59	0.3	80	0.4	13	0.3	13	0.3
54	79	0.4	112	0.5	22	0.5	17	0.4
55	177	0.8	200	0.9	41	0.9	43	0.9
56	53	0.2	55	0.2	9	0.2	3	0.1
57	106	0.5	127	0.6	28	0.6	21	0.5
58	78	0.4	50	0.2	11	0.2	15	0.3
59	85	0.4	78	0.3	11	0.3	19	0.4
60	246	1.1	265	1.2	65	1.5	63	1.4
61	24	0.1	33	0.1	7	0.2	5	0.1
62	59	0.3	52	0.2	13	0.3	15	0.3
63	39	0.2	15	0.1	13	0.3	5	0.1
64	42	0.2	37	0.2	12	0.3	5	0.1
65	102	0.5	92	0.4	31	0.7	25	0.5
66	41	0.2	23	0.1	5	0.1	1	0
67	77	0.4	34	0.1	15	0.3	11	0.2

68	26	0.1	20	0.1	7	0.2	8	0.2
69	32	0.1	33	0.1	10	0.2	11	0.2
70	477	2.2	297	1.3	91	2.1	76	1.7
Don't know/missing	0	0	0	0	0	0	0	0
Total	21,646	100	22,751	100	4,395	100	4,545	100

Table B2. Age distribution of eligible and interviewed women

De facto household population of women age 10-54 and interviewed women age 15-49; and percent distribution and percentage of eligible women who were interviewed (weighted), by five-year age groups, Ethiopia 2015

	Malarious areas				**Areas>2,000m and ≤2,500m ASL**			
Age group	Household population of women age 10–54	Interviewed women age 15-49		Percentage of eligible women interviewed	Household population of women age 10–54	Interviewed women age 15-49	Percentage of eligible women interviewed	Percentage of eligible women interviewed
		Number	Percentage			Number	Percentage	
10-14	3,391.5	NA	NA	NA	709.2	NA	NA	NA
15-19	1,860.2	1,711.6	17.9	90.7	374.3	329.5	18	86.8
20-24	1,994.9	1,889.7	19.8	93.4	355.8	334.8	18.3	92.8
25-29	2,106.5	2,018.9	21.1	94.5	381.7	364.6	20	94.2
30-34	1,740.1	1,679.2	17.6	95.1	315.8	308.1	16.9	96.2
35-39	1,213.2	1,176.6	12.3	95.6	277.0	265	14.5	94.4
40-44	685.9	662.5	6.9	95.2	163.4	150.7	8.2	91
45-49	506.1	413.6	4.3	80.5	89.4	74.3	4.1	82
50-54	943.6	NA	NA	NA	217.5	NA	NA	NA
15-49	14,442	9,552	100	93.2	2,884	1,827	100	92.1

Note: The de facto population includes all residents and nonresidents who stayed in the household the night before the interview. Weights for both household population of women and interviewed women are household weights. Age is based on the Household Questionnaire.
NA = Not applicable

Appendix C. Survey personnel

EMIS 2015 survey management

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Awal Yusuf, Laboratory Technician

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Elias Ibrahim Adem, Interviewer

Hassen Malin, Interviewer

Abdirashid Diriye, Interviewer

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Abdirashid Mohamed, Laboratory Technician

Demelash Zewede, Laboratory Technician

Heidar Osman, Laboratory Technician

Abshir Abdikarim Said , Laboratory Technician

Hoden Mohammed, Laboratory Technician

Dire Dawa City Administration HB: Team 3

Teferi Mengesha, Team Leader

Baherudin Ahomed, Interviewer

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Habtamu Tekele, Laboratory Technician

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Yohanse Besbhat, Interviewer

Aster Abayneh, Interviewer

Samson Gizaw, Interviewer

Abdo Mume, Laboratory Technician

Abedu Kassew, Laboratory Technician

Eyelachew Zenebe, Laboratory Technician

Ephrem Fikru, Laboratory Technician

Oromia RHB: Team 5

Salahadin Yusuf, Team Leader

Miliyoon Getu, Interviewer

Nuradin Ziyad, Interviewer

Getachew Guta, Interviewer

Mustefa Hajo, Interviewer

Frezer Tadese, Laboratory Technician

Ashenafi Tewold, Laboratory Technician

Robenus Tesemma, Laboratory Technician

Gizachew Tadesse, Laboratory Technician

Oromia RHB: Team 6

Abdi Gebissa, Team Leader

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Mengistu Tamiru, Interviewer

Kumera Bekele, Interviewer

Debeli Waktola, Laboratory Technician

Leta Yadessa, Laboratory Technician

Yared Nigusu, Laboratory Technician

Oromia RHB: Team 7

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Tewodres Getachow, Interviewer

Desale Hailu, Interviewer

Jibruk A/Zinab, Interviewer

Abiy Haile, Interviewer

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Abduljubar Mohammed, Laboratory Technician

Mahfuz Abdosh, Laboratory Technician

Mubarik Taju, Laboratory Technician

Oromia RHB: Team 8

Jibril Abdulkedir, Team Leader

Abinat Tamirat, Interviewer

Amanuel Berhanu, Interviewer

Tewodres Ifa, Interviewer

Geremaw Kinde, Interviewer

Nurezeman Mahemmad, Laboratory Technician

Tello Teref, Laboratory Technician

Mesfin Negawo, Laboratory Technician

Firehun Bezebih, Laboratory Technician

Oromia RHB: Team 9

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Wagene Tashome, Interviewer

Yedesa Teresa, Interviewer

Lyina Adem Ahimed, Interviewer

Sintayew Gemachu, Interviewer

Fikiru Yadeta, Laboratory Technician

Tadesse Tolosa, Laboratory Technician

Jember Fekadu, Laboratory Technician

Getu Chindi, Laboratory Technician

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Bekele Sileshi, Team Leader

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Chaltu Mohammed, Interviewer

Kitila Butta, Interviewer

Usman Birmeo, Laboratory Technician

Betiglu Alkerim, Laboratory Technician

Abate Reta, Laboratory Technician

Abdi Mohammed, Laboratory Technician

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Kedir Ahmed, Team Leader

Chala Fikadu, Interviewer

Tadelech Tola, Interviewer

Reta Ambisa, Interviewer

Tesfaye Maru, Interviewer

Tekalign Bekele, Laboratory Technician

Fufa Alemu, Laboratory Technician

Hassen Mufti, Laboratory Technician

Abate Egu, Laboratory Technician

Harari RHB: Team 12

Engida Gizaw, Team Leader

Rafika Amin, Interviewer

Yordanos Solomon, Interviewer

Afendi Yusuf, Interviewer

Shamil Abdurahman, Interviewer

Azam Jemal, Laboratory Technician

Ibsa Abdrehaman, Laboratory Technician

Mesay Assefa, Laboratory Technician

Ziad Amin, Laboratory Technician

Harari RHB: Team 13

Abdi Aliyi, Team Leader

Abdisa Mengistu, Interviewer

Rehisti G/Kidan, Interviewer

Hayat Abdo, Interviewer

Taye Mekonnen, Interviewer

Anwar Abdulkarim, Laboratory Technician

Getahun Abebe, Laboratory Technician

Sultan sani, Laboratory Technician

Teklu Degefa, Laboratory Technician

Tigray RHB: Team 14

Girmay Desta, Team Leader

Tesfay Kindeya, Interviewer

Kahsay Mulu, Interviewer

Yirgalem Alemayehu, Interviewer

Moges Tekilay, Interviewer

Mulu G/Tsadik, Laboratory Technician

Senait Haddis, Laboratory Technician

Teweldebirhan Weldegebriel, Laboratory Technician

Alem Hagos, Laboratory Technician

Tigray RHB: Team 15

Teshale Berhe, Team Leader

Fana Mulugeta, Interviewer

Kidane Zereabruk, Interviewer

Tesfay Yehdego, Interviewer

Fikadu Muruts, Interviewer

T/haymanot G/Eyesus, Laboratory Technician

Mesfin Demoz, Laboratory Technician

Alem Beyene, Laboratory Technician

Shewit Tekle, Laboratory Technician

Tigray RHB: Team 16

Kahsu Tsegay, Team Leader

Asgelet G/her, Interviewer

Tsegay Gebru, Interviewer

Mulu Girmay, Interviewer

Dawit Wedaje, Interviewer

Mulugeta Kiros, Laboratory Technician

Line Tekle, Laboratory Technician

Ataklti Hailu, Laboratory Technician

Hiwot Eubuy, Laboratory Technician

Tigray RHB: Team 17

Demawez Kifle, Team Leader

Danayt Assefa, Interviewer

Zafu Eqer, Interviewer

Dawit Welu, Interviewer

Hagos G/Tsadak, Interviewer

Markos Mulu, Laboratory Technician

H/mariam Mezgebu, Laboratory Technician

G/Giorgis Teklu, Laboratory Technician

Mulugeta Abreha, Laboratory Technician

Afar RHB: Team 18

Seada Ali, Team Leader

Ahemed Asker, Interviewer

Hussen Mohammed, Interviewer

Ahmed Mohammed, Interviewer

Mustefa Ali, Interviewer

Abdu Mohammed, Laboratory Technician

Getahun Demissie, Laboratory Technician

Mehari G/Kidan, Laboratory Technician

Seud Mohamed, Laboratory Technician

Afar RHB: Team 19

Ali Mohammed, Team Leader

Edris Adem, Interviewer

Kedija Ala, Interviewer

Abdilla Adem, Interviewer

Mohammed Adem, Interviewer

Kedir Darasa, Laboratory Technician

Ayalew Asfaw, Laboratory Technician

Nursefa Nesru, Laboratory Technician

Kassahun Shifaraw, Laboratory Technician

Afar RHB: Team 20

Ahmed Ali, Team Leader

Mohammed Abdo, Interviewer

Abdo Mohammed, Interviewer

Mohammed Ebrahim, Interviewer

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Armaye Eyasu, Laboratory Technician

Defaru G/Mariam, Laboratory Technician

Worku Asnake, Laboratory Technician

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Gambella RHB: Team 21

Abdissa Tarekegn, Team Leader

Zelalem Lemma, Interviewer

Ojulu Obang, Interviewer

Okello Nyigwo, Interviewer

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Fero Ochan, Laboratory Technician

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Gambella RHB: Team 22

Wiyual Thong, Team Leader

Thiol Jiech, Interviewer

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Bothpal Kaoth, Laboratory Technician

Gatluak Deng Thot, Laboratory Technician

Benshangul Gumuz RHB: Team 23

Hundessa Olani, Team Leader

Ararsa Tura, Interviewer

Abdulkfar Mohammed, Interviewer

Fetiya Hajanur, Interviewer

Desalegn Wolde, Interviewer

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Ali Awadjed, Laboratory Technician

Amanuel Lulu, Laboratory Technician

Alfadil Mohammed, Laboratory Technician

Benshangul Gumuz RHB: Team 24

Gizachew Mekuriaw, Team Leader

Limu Polino, Interviewer

Yaikob Zekaria, Interviewer

Amentie Arega, Interviewer

Desalegn Shibabaw, Interviewer

Getachew Tsegaye, Laboratory Technician

Desalegn Alkedir, Laboratory Technician

Asmamaw Kindenew, Laboratory Technician

Yeshidinber, Laboratory Technician

Amhara RHB: Team 25

Adisu Aleme, Team Leader

Mulugeta Slenkudt, Interviewer

Abera Alemu, Interviewer

Tadese Dasalgn, Interviewer

Wosen Aragie, Interviewer

Abebaw Solomon, Laboratory Technician

Alemu Sebrala, Laboratory Technician

Abdi Diriba, Laboratory Technician

Abdu Yimam, Laboratory Technician

Amhara RHB: Team 26

Taye Wagaye, Team Leader

Meseret Ayzobelew, Interviewer

Tadesse Bithamu, Interviewer

Tayachew Nega, Interviewer

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Getachew Mengistu, Laboratory Technician

Amhara RHB: Team 27

Belay Mekonnen, Team Leader

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Yihalem Ayirab, Interviewer

Berhanu Tigabe, Interviewer

Amakelew Alemu, Interviewer

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Marye Engdayehu, Laboratory Technician

Mesafint Awoke, Laboratory Technician

Melese G/Silassie, Laboratory Technician

Amhara RHB: Team 28

Amare Lema, Team Leader

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Simachew Abie, Interviewer

Yohannes Tibebu, Interviewer

Aragaw Abera, Interviewer

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Bazezew Tessema, Laboratory Technician

Dereje Tadesse, Laboratory Technician

Amhara RHB: Team 29

Kelemu Dessie , Team Leader

Worku Nigatu, Interviewer

Desalegn Berihun, Interviewer

Sileshi Abe, Interviewer

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Tedilla Dessalew, Laboratory Technician

Habtu Debash, Laboratory Technician

Amhara RHB: Team 30

Nibret Berihun , Team Leader

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Dagnachew Asnakew, Interviewer

Belaynesh Minale, Interviewer

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Shegaw Yenealem, Laboratory Technician

Belachew Melesse, Laboratory Technician

Goshu Basha, Laboratory Technician

SNNP RHB: Team 31

Tiglu Gebre, Team Leader

Alemayehu Ayele, Interviewer

Eden Chanylew, Interviewer

Ayalew Asfaw, Interviewer

Sebre Kemal, Interviewer

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Temima Seman, Laboratory Technician

Kedir Geleto, Laboratory Technician

Nuredin Abdurhaman, Laboratory Technician

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Atakilt Muez, Interviewer

Demelash Shiferaw, Interviewer

Dawit Dangiso, Interviewer

Selamawit Bayou, Laboratory Technician

Tsegaye Abraham, Laboratory Technician

Bereket Matusala, Laboratory Technician

Mitiku Atara, Laboratory Technician

SNNP RHB: Team 33

Jeginaw Wolde, Team Leader

Moges Yigezu, Interviewer

Wondiferaw G/Meskel, Interviewer

Yimame Youte, Interviewer

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Mathewos Nana, Laboratory Technician

Tamirat Sisay, Laboratory Technician

Agere Teklu, Laboratory Technician

SNNP RHB: Team 34

Samuel Wolde, Team Leader

Birhanesh Dese, Interviewer

Moges Amana, Interviewer

Desta Dartumo, Interviewer

Tigabu Mathewos, Interviewer

Sorsa Lapiso, Laboratory Technician

Wogayehu Workneh, Laboratory Technician

Abinet Beykaso, Laboratory Technician

Awlachew Haile, Laboratory Technician

SNNP RHB: Team 35

Hizbayehu Delbo, Team Leader

Yisma Yishak , Interviewer

Getahun Getachew, Interviewer

Gudeta Guyita, Interviewer

Amanuale Woldhiwot, Interviewer

Emoshe Eraga, Laboratory Technician

Tamirat Fantaye, Laboratory Technician

Kifle Asseged, Laboratory Technician

Temesgen Mekuria, Laboratory Technician

SNNP RHB: Team 36

Meseret W/Mariam, Team Leader

Frehiwot Mesele, Interviewer

Getachew Haile, Interviewer

Kassaye Tilahun, Interviewer

Argaw Haile, Laboratory Technician

Tekalign Mersha, Laboratory Technician

Asmare Bermue, Laboratory Technician

Appendix D. Ethiopia National Malaria Indicator Survey 2015 job aid

Blood Sample ProcessJob Aid for Ethiopia National Malaria Indicator Survey 2015

1. Require Material and Participant Preparation

- Glove
- Cotton
- Alcohol (70%)
- Blood lancet
- HemoCue machine
- Slide template
- DBS paper
- DBS envelope
- QR-Code
- Log book and Pen
- Giemsa stock solution
- Distil water
- Buffer tablet
- Measuring cylinder

Participant preparation: Clearly inform blood collection process for participant

2. Capillary Blood Collection

- Select the finger to puncture (3rd or 4th) and clean with 75% alcohol swab
- Dry with cotton and puncture the side of the ball of the finger, don't make near to the nail, remove the first blood drop (to remove body fluid)
- If the blood does not well up from the puncture, gently squeeze the finger and allow free blood flow from the finger.
- For 6 to 59 months

3. Malaria RDT Test

- Label device with patient's information
- Add 5µl blood on blood sample well (use pipette to measure the blood)
- Add 60µ of assay buffer on to buffer well. (the whole drop form the plastic)
- Read result after 20 min and record result on log book and smart phone

4. Hemoglobin Determination

- Plug AC adaptor/use 4 batteries
- Pull the cuvette holder to the loading position
- Press and hold left button = turn on
- Wait for three flashing dashes (after 10sec)
- Fill the cuvette completely(wipe off excess blood and no air bubble)
- Place the filled cuvette in the holder and push to the stop point
- Result after 15–50 sec/beeping soundrecord before remove the cuvette
- Pull the cuvette holder out to the loading position to discard cuvette in sharp container
- Clean the machine with cleaning solution if necessary

5. Dried Blood Sample (DBS)

- Arrange DBS filter paper and label card with bar code sticker
- Do not touch circles with your fingers, or anything else**
- Allow large drop (6µl) to fall on a filter paper
- Fill at least 3 circles, should not have any sign of hemolysis, clotting, scratching, or contamination, do not touch or try to smear
- Allow complete spots dry (keep away direct sun light, dust and bugs)
- On the next day insert into sealable plastic bag, add 2 silica gel and press air out of bag
- Label bag with Region, zone, Team no and sub team no
- Finally keep all the collected envelop at room temperature and dark place

6. Thick and thin Blood film on single slide

- Put frosted slide on blood film slide template and label with barcode
- Put large drop (6µl) for thick and small drop (2µl) blood for thin BF on single slide. (do not touch slide surface with your hand)
- Using corner of another slide first spread thin smear then thick smear
- Allow smear horizontally for air dry and fix thin smear by absolute methanol immediately after drying
- Store in labeled slide box (prevent scratch of smear and any dirt)
- Stain blood film by preparing 10% giemsa working solution for 10 min within dayof smear collection to prevent autofixation
- Record all information on log book and store slide in slide box

Appendix E. Treatment algorithm

Positive for Pf/mixed

- AL (Coartem) except pregnant women in first trimester,
  Note: Recently treated cases may be positive for 1-2 weeks
- In pregnant for 1st trimester 1st quarter quinine tablet
  Note: Side effect of hypoglycemia

Positive for PV

- Chloroquine tab/syrup 1st

Negative

- Refer negative fever cases to the nearest health

Subjects, who were found to be seriously ill or severe malaria, as determined by the survey nurses, will be advised to immediately visit the nearest health facility/health center.

Weight (KG)	Age	Day 1		Day 2		Day 3		remark
		Morning	Evening	Morning	Evening	Morning	Evening	
5-14 kg	From 4 months to 2 years	1 tablet	1 Tablet	1 tablet	1 tablet	1 tablet	1 tablet	Dispersible
15-24 kg	From 3 years to 7 years	2 tabs	2 Tabs	2 tabs	2 tabs	2 tabs	2 tabs	Dispersible
25-34 kg	From 8 years to 10 years	3 tabs	3 Tabs	3 tabs	3 tabs	3 tabs	3 tabs	
>35	10 years & above	4 tabs	4 Tabs	4 tabs	4 tabs	4 tabs	4 tabs	

Weight (kg)	Age	Day 1	Day 2	Day 3
5 – 6	< 4 months	½ tablet OR 5 ml syrup	¼ tablet OR 5 ml syrup	¼ tablet OR 2.5 ml syrup
7 – 10	4 – 11 months	½ tablet OR 7.5 ml syrup	½ tablet OR 7.5 ml syrup	½ tablet OR 5 ml syrup
11 – 14	1 – 2 years	1 tablet OR 12.5 ml syrup	0.5 tablet OR 12.5 ml syrup	0.5 tablet OR 7.5 ml syrup
15 – 18	3 – 4 years	1 tablet OR 15 ml syrup	1 tablet OR 15 ml syrup	1 tablet OR 15 ml syrup
19 – 24	5 – 7 years	1 ½ tablets OR	1 ½ tablets OR	1 tablet OR

Weight (kg)	Age (years)	Oral (tablets) Dosage to be given 3 times daily (300 mg salt)
4 – 6	2 – 4 months	-
6 – 10	4 – 12 months	¼
10 – 12	1 – 2 years	1/3
12 – 14	2 – 3 years	1/2
14 – 19	3 – 5 years	½
20 – 24	5 – 7 years	¾
25 – 35	8 – 10 years	1
36 – 50	11 – 13 years	1 ½
50+	14+	2

Appendix F. Household and women's questionnaires

Ethiopia Malaria Indicator Survey 2015

Household Questionnaire

Federal Ministry of Health
Ethiopian Public Health Institute
Malaria Indicator Survey Working Group

September 2015

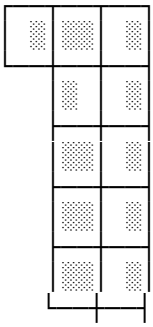
MALARIA INDICATOR SURVEY
MODEL HOUSEHOLD QUESTIONNAIRE

[Ethiopia]

[Ministry of Health]

IDENTIFICATION[1]

REGIONAL STATE:_____
ZONE:_____
DISTRICT:_____
KEBELE NAME:_____
ENUMERATION AREA NUMBER:_____



Please record the GPS Location

The GPS may take a minute please be patient

Latitude:
Longitude:
Altitude:
Accuracy:

READ INFORMED CONSENT FOR HOUSEHOLD QUESTIONNAIRE

RESPONDENT AGREES TO BE INTERVIEWED.....1 ↓

RESPONDENT DOES NOT AGREE TO BE INTERVIEWED ....2 —<END

INTERVIEWER VISITS

	1	2	FINAL VISIT
DATE	_____	_____	DAY / MONTH / YEAR 2 0 / NAME / RESULT
INTERVIEWER'S NAME	_____	_____	
RESULT*	_____	_____	
NEXT VISIT: DATE	_____		TOTAL NO. OF VISITS
TIME	_____		

*RESULT CODES:

1	COMPLETED
2	NO HOUSEHOLD MEMBER AT HOME OR NO COMPETENT RESPONDENT AT HOME AT TIME OF VISIT
3	ENTIRE HOUSEHOLD ABSENT FOR EXTENDED PERIOD OF TIME
4	POSTPONED
5	REFUSED
6	DWELLING VACANT OR ADDRESS NOT A DWELLING
7	DWELLING DESTROYED
8	DWELLING NOT FOUND
9	OTHER _____ (SPECIFY)

TOTAL PERSONS IN HOUSEHOLD

TOTAL ELIGIBLE WOMEN

LINE NUMBER OF RESPONDENT TO HOUSEHOLD QUESTIONNAIRE

HOUSEHOLD LISTING

Now we would like some information about the people who usually live in your household or who are staying with you now.

DENTS AND ORS	RELATIONSHIP TO HEAD OF HOUSEHOLD	SEX	RESIDENCE		AGE			Travel History		
the names who usually sehold and ousehold e last night, e head of the	What is the relationship of (NAME) to the head of the household?*	Is (NAME) male or female?	Does (NAME) usually live here?	Did (NAME) stay here last night?	How old is (NAME)?		The age of (name) is XX years (YY months). Is this correct? *Age calculation depends on the data and time setting of your phone. Please make sure the date and time of your phone is set correctly.*	Did (name) traveled away from home in the last month If yes, where did the (NAME) travel? If yes and guest, from where did the (NAME) come from?	Region	Zone
	(2)*	(3)	(4)	(5)	(6)		(7)	(8)	(9)	(
		M F	YES NO	YES NO	IN YEARS	IN MONTHS	YES NO	YES NO		
		1 2	1 2	1 2			1 2	1 2		
		1 2	1 2	1 2			1 2	1 2		

HEAD OF HOUSEHOLD:

D

R
AW

05 = GRANDCHILD
06 = PARENT
07 = PARENT-IN-LAW
08 = BROTHER OR SISTER
09 = OTHER RELATIVE
10 = ADOPTED/FOSTER/ STEPCHILD
11 = NOT RELATED
98 = DON'T KNOW

TICK HERE IF CONTINUATION SHEET USED ☐

Just to make sure that I have a complete listing:

12) Are there any other persons such as small children or infants that we have not listed? YES ☐ -> ENTER EACH IN TABLE NO ☐

13) In addition, are there any other people who may not be members of your family, such as domestic servants, lodgers or friends who usually live here? YES ☐ -> ENTER EACH IN TABLE NO ☐

14) Are there any guests or temporary visitors staying here, or anyone else who stayed here last night, who have not been listed? YES ☐ -> ENTER EACH IN TABLE NO ☐

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
15	What is the main source of drinking water for members of your household	PIPED INTO DWELLING ..... 11 PIPED INTO YARD/PLOT..... 12 PUBLIC TAP/STANDPIPE ..... 13 TUBE WELL OR BOREHOLE..... 21 PROTECTED WELL ..... 31 UNPROTECTED WELL ..... 32 PROTECTED SPRING ..... 41 UNPROTECTED SPRING ....42 RAINWATER ..... 51 TANKER TRUCK..... 61 CART WITH SMALL TANK..... 71 SURFACE WATER (RIVER/DAM/ LAKE/POND/STREAM/CANAL/ IRRIGATION CHANNEL ..... 81 BOTTLED WATER..... 91 OTHER _____ 96 (SPECIFY)	—<17 —<17
16	How long does it take to go there, get water, and come back?	Minutes……. ☐☐ Don't Know…….998	
17	What kind of toilet facility do your household use?[1]	FLUSH TO PIPED SEWER SYSTEM..... 11 FLUSH TO SEPTIC TANK ..... 12 FLUSH TO PIT LATRINE..... 13 FLUSH TO SOMEWHERE ELSE..... 14 FLUSH, DON'T KNOW WHERE ..... 15 VENTILATED IMPROVED PIT LATRINE (VIP) ..... 21 PIT LATRINE WITH SLAB ..... 22 PIT LATRINE WITHOUT SLAB/ OPEN PIT ..... 23 COMPOSTING TOILET..... 31 BUCKET TOILET..... 41 HANGING TOILET/HANGING LATRINE..... 51 NO FACILITY/BUSH/FIELD ..... 61 OTHER _____ 96 (SPECIFY)	—<20
18	Do you share this toilet facility with other households?	YES……1 NO……2	—<20
19	How many households use this toilet facility?	NO. OF HOUSEHOLDS IF LESS THAN 10 …… ☐☐ 10 OR MORE HOUSEHOLDS……..95 DON'T KNOW……98	
20	Does your household have:[2] Electricity? A radio? A television? A telephone/mobile? A refrigerator?	YES NO ELECTRICITY..... 1 2 RADIO ..... 1 2 TELEVISION..... 1 2 TELEPHONE ..... 1 2 REFRIGERATOR 1 2	
21	What type of fuel does your household mainly use for cooking?	ELECTRICITY..... 01 LPG/NATURAL GAS..... 02 BIOGAS..... 03 KEROSENE..... 04 CHARCOAL..... 05 FIREWOOD/STRAW ..... 06 DUNG ..... 07 OTHER _____ 96 (SPECIFY)	

[1] Coding categories to be developed locally and revised based on the pretest; however, the broad categories must be maintained.
[2] Additional indicators of socioeconomic status should be added, especially to distinguish among lower socioeconomic classes.

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
22	MAIN MATERIAL OF THE FLOOR.[1] RECORD OBSERVATION.	EARTH/SAND .....11 DUNG.....12 WOOD PLANKS.....21 PALM/BAMBOO.....22 PARQUET OR POLISHED WOOD.....31 VINYL .....32 CERAMIC TILES.....33 CEMENT .....34 CARPET.....35 OTHER _____ 96 (SPECIFY)	
23	MAIN MATERIAL OF THE WALL.[1] RECORD OBSERVATION.	No walls.....11 Cane/trucks/bamboo/reed .....12 Bamboo/wood with mud .....21 Stone with mud.....22 Uncovered adode .....23 Plywood.....24 Carton .....25 Cement.....31 Stone with lime/cement.....32 Bricks .....33 Cement blocks.....34 Covered Adobe .....35 Wood planks/shingles.....36 Corrugated iron .....37 OTHER _____ 96 (SPECIFY)	
24	MAIN MATERIAL OF THE ROOF.[1] RECORD OBSERVATION.	Thatch/Leaf .....11 Sticks and mud.....12 Rustic mat/plastic sheet.....21 Reed/bamboo.....22 Wood planks.....23 Corrugated iron .....31 Wood.....32 Calamine/cement fiber.....33 Cement/concrete .....34 Roofing shingles.....35 OTHER _____ 96 (SPECIFY)	
25	Any WINDOW RECORD OBSERVATION	YES.....1 NO.....2	→28
26	Total number of Windows	☐☐	
27	TYPE OF WINDOWS RECORD OBSERVATION.	YES NO WINDOWS WITH GLASS..... 1 2 WINDOWS WITH SCREENS...1 2 WINDOWS WITH CURTAINS OR SHUTTERS.....1 2	
28	How many separate rooms are in this household? INCLUDE ALL ROOMS, INCLUDING KITCHEN, TOILET, SLEEPING ROOMS, SALON, etc.	NUMBER OF ROOMS ☐☐	

29	How many rooms in this household are used for sleeping? INCLUDE ONLY ROOMS WHICH ARE USUALLY USED FOR SLEEPING.	NUMBER OF SLEEP ROOMS ☐☐	
30	How many separate sleeping spaces are there in your household? INCLUDE ALL SLEEPING SPACES, INCLUDING IF THERE IS MORE THAN ONE SLEEPING SPACE IN EACH ROOM USED FOR SLEEPING.	NUMBER OF SLEEP SPACES ☐☐	
31	Does this household own any livestock, herds, other farm animals, or poultry?	YES……1 NO……2	→33
32	How many of the following animals / birds does your household own? IF NONE, ENTER '0' IF MORE THAN 95, ENTER '95' IF UNKNOWN, ENTER '98' Cattle? Goats? Sheep? Donkey? Chickens? Horse/mule? Camel?	CATTLE ☐☐ GOATS ☐☐ SHEEP ☐☐ Donkey ☐☐ CHICKENS ☐☐ Horse/mule ☐☐ Camel ☐☐	
33	Does any member of your household own: A bicycle? A motorcycle or motor scooter/Bajaj? A car or truck? Animal Cart ?	YES NO BICYCLE……1 2 MOTORCYCLE/SCOOTER……1 2 CAR/TRUCK ……1 2 Animal cart ……1 2	
34	Does any member of this household own any agricultural land?	YES……1 NO……2	→36
35	How many "TIMAD" of agricultural land do members of this household own? Note: One hectare is equal to four timad If the respondent do not know, enter 98	TIMADS…… ☐☐ DON'T KNOW……98	
36	Does any member of this household have bank (Saving) account?	YES……1 NO……2	
37	At any time in the past 12 months, has anyone sprayed the interior walls of your dwelling against mosquitoes?	YES……1	→42

		NO.....2 DON'T KNOW.....8	→<42
38	How many months ago was the house sprayed against mosquitoes? IF LESS THAN ONE MONTH, RECORD '0' MONTHS AGO.	MONTHS AGO..... ☐☐	
39	Who sprayed the house against mosquitoes?	GOVERNMENT WORKER/PROGRAM ... 1 HOUSEHOLD MEMBER..... 2 OTHER _____ 6 (SPECIFY) DON'T KNOW..... 8	
40	At any time in the past 12 months, have the walls in your dwelling been plastered or painted?	YES.....1 NO.....2 DON'T KNOW.....8	→<42 <42
41	How many months ago were the walls plastered or painted? IF LESS THAN ONE MONTH, RECORD '0' MONTHS AGO.	MONTHS AGO ☐☐	
42	Does your household have any mosquito nets that can be used while sleeping?	YES ..... 1 NO 2	→ 55
43	How many mosquito nets does your household have? IF 7 OR MORE NETS, RECORD '7'.	NUMBER OF NETS..... ☐	

[1] Categories to be developed locally and revised based on the pretest; however, the broad categories must be maintained. In some countries, it may be desirable to ask an additional question on the material of walls or ceilings.

44	ASK RESPONDENT TO SHOW YOU THE NET(S) IN THE HOUSEHOLD. IF MORE THAN THREE NETS, USE ADDITIONAL QUESTIONNAIRE(S).	NET #1 OBSERVED .....1 NOT OBSERVED…….2 If 2 skip to 46	NET #2 OBSERVED .....1 NOT OBSERVED…….2 If 2 skip to 46	NET #3 OBSERVED .....1 NOT OBSERVED…….2 If 2 skip to 46
45	PLEASE RECORD OR ASK THE GENERAL CONDITION OF THE NET.	GOOD (NO HOLES)……1 FAIR (no holes that fit a torch battery)…… 2 POOR (1-4 holes that fit a torch battery)…… 3 UNSAFE (>5 holes that fit a torch battery…… 4 UNUSED (still in package… 5 UNKNOWN…… 6	GOOD (NO HOLES)……1 FAIR (no holes that fit a torch battery)……2 POOR (1-4 holes that fit a torch battery)……3 UNSAFE (>5 holes that fit a torch battery)……4 UNUSED (still in package……5 UNKNOWN……6	GOOD (NO HOLES)……1 FAIR (no holes that fit a torch battery)……2 POOR (1-4 holes that fit a torch battery)……3 UNSAFE (>5 holes that fit a torch battery)……4 UNUSED (still in package……5 UNKNOWN……6
46	How long ago did your household obtain the mosquito net?	Months AGO ☐☐ Enter "95" if the net is obtained more than 3yrs ago	Months AGO ☐☐ Enter "95" if the net is obtained more than 3yrs ago	Months AGO ☐☐ Enter "95" if the net is obtained more than 3yrs ago
47	OBSERVE OR ASK THE BRAND OF MOSQUITO NET. IF BRAND IS UNKNOWN, AND YOU CANNOT OBSERVE THE NET, SHOW PICTURES OF TYPICAL NET TYPES/BRANDS TO RESPONDENT.	LONG LASTING INSECTICIDAL TREATED NET Permanet…… 11 Olyset…… 12 MagNet…… 13 Interceptor…… 14 Yorkool……15 Dawanet……16 OTHER BRAND……31 DON'T KNOW BRAND…… 98	LONG LASTING INSECTICIDAL TREATED NET Permanet…… 11 Olyset…… 12 MagNet……13 Interceptor…… 14 Yorkool……15 Dawanet……16 () OTHER BRAND……31 DON'T KNOW BRAND ……98	LONG LASTING INSECTICIDAL TREATED NET Permanet…… 11 Olyset…… 12 MagNet……13 Interceptor…… 14 Yorkool……15 Dawanet……16 OTHER BRAND……31 DON'T KNOW BRAND……98

48	Where did you obtain the net?	GOVERNMENT CLINIC/HOSPITAL…….1 NEIGHBORHOOD HEALTH COMMITTEE……..2 HEALTH EXTENSION WORKER/HEALTH POST……..3 COMMUNITY HEALTH WORKER / AGENT…..4 RETAIL SHOP……5 PHARMACY……6 WORKPLACE……7 OTHER (SPECIFY)_____ DON'T KNOW……98	GOVERNMENT CLINIC/HOSPITAL…….1 NEIGHBORHOOD HEALTH COMMITTEE……..2 HEALTH EXTENSION WORKER/ HEALTH POST ……..3 COMMUNITY HEALTH WORKER / AGENT…..4 RETAIL SHOP……5 PHARMACY……6 WORKPLACE……7 OTHER (SPECIFY)_____ DON'T KNOW……98	GOVERNMENT CLINIC/HOSPITAL…….1 NEIGHBORHOOD HEALTH COMMITTEE……..2 HEALTH EXTENSION WORKER/ HEALTH POST ……..3 COMMUNITY HEALTH WORKER / AGENT…..4 RETAIL SHOP……5 PHARMACY……6 WORKPLACE……7 OTHER (SPECIFY)_____ DON'T KNOW……98
49	Did you purchase the net?	YES .....1 NO.(skip to 51)..... 2 NOT SURE.(skip to 51..... 8	YES.....1 NO.(skip to 51).....2 NOT SURE.(skip to 51.....8	YES.....1 NO.(skip to 51).....2 NOT SURE. .(skip to 51..... 8
50	How much did you pay for the net when it was purchased? Not sure ……..0	How much did you pay? ……. ☐	How much did you pay? ……. ☐	How much did you pay? ……. ☐

51	Did anyone sleep under this mosquito net last night? Not observed nets will not appear	YES..... 1 (SKIP TO 53) NO..... 2	YES.....1 (SKIP TO 53) NO 2	YES.....1 (SKIP TO 53) NO.....2
52	Why did no-one sleep under this mosquito net last night?	NO MALARIA..... 1 NO NUISANCE/INSECTS 2 NO SPACE FOR NET. 3 IRRITATION ..... 4 SUFFOCATION / TOO HOT 5 DIFFICULT HANGING NET SHAPE ..... 7 ABSENCE FROM HOME 8 OTHER_____ 9 DON'T KNOW..... 10	NO MALARIA..... 1 NO NUISANCE/INSECTS 2 NO SPACE FOR NET 3 IRRITATION..... 4 SUFFOCATION / TOO HOT 5 DIFFICULT HANGING NET 6 SHAPE..... 7 ABSENCE FROM HOME 8 OTHER_____ 9 DON'T KNOW 10	NO MALARIA..... 1 NO NUISANCE/INSECTS 2 NO SPACE FOR NET. 3 IRRITATION..... 4 SUFFOCATION / TOO HOT 5 DIFFICULT HANGING NET 6 SHAPE..... 7 ABSENCE FROM HOME 8 OTHER_____ 9 DON'T KNOW..... 10

		NET #1	NET #2	NET #3
53	Who slept under this mosquito net last night? RECORD THE RESPECTIVE LINE NUMBER FROM THE HOUSEHOLD SCHEDULE.	NAME _____ LINE NO ☐ NAME _____ LINE NO ☐ NAME _____ LINE NO ☐ NAME _____ LINE NO ☐ NAME _____ LINE NO ☐	NAME _____ LINE NO ☐ NAME _____ LINE NO ☐ NAME _____ LINE NO ☐ NAME _____ LINE NO ☐ NAME _____ LINE NO ☐	NAME _____ LINE NO ☐ NAME _____ LINE NO ☐ NAME _____ LINE NO ☐ NAME _____ LINE NO ☐ NAME _____ LINE NO ☐
55	What is the shape of LLIN you would prefer to have?	Rectangular……1 Conical(circular)……2 Don't Know……98		

56	When your bednet is torn or gets a hole, how likely are you to mend it or to have a tailor mend it? READ THE RESPONSE OPTIONS TO THE PARTICIPANT AND ASK HIM OR HERTO CHOOSE THE BEST RESPONSE	VERY LIKLEY, I mend all holes in my net 1 SOMEWHAT LIKELY. I sometimes mend holes in my net ..... 2 SOMEWHAT UNLIKELY, I rarely mend on holes in my net ..... 3 VERY UNLIKLEY, I never mend holes in my net 4	
57	How often do you wash your net(s)? DO NOT READ THE RESPONSE OPTIONS	When it gets dirty ..... 1 1 time a year ..... 2 2 – 3 times a year ..... 3 4 – 5 times a year ..... 4 6 or more times a year ..... 5 Not at all ……6	
58	Will insecticide treated nets still be effective against mosquitoes if you wash them	YES..... 1 NO..... 2 DON'T KNOW..... 8	
59	If there are not enough nets for everyone in a household, who should be given priority when deciding who can sleep under a net? DO NOT PROVIDE ANSEWRS MULTIPLE RESPONSES POSSIBBLE Probe once (anything else?)	Elderly people……1 Head of household ……2 Young children…… 3 Pregnant women …… 4 People who obtained/bought the net ……..…… 5 Other (Specify) …….. Don't Know …….. 98	

HAEMOGLOBIN/MALARIA PARASITE MEASUREMENT

60	Is the parent/custodian responsible for the child is listed in the household roster?	YES……..1 NO……2	
61	Who is the parent/custodian responsible for the child:		
62	Read consent statement *Granted:* *If not granted for women 15-49 women ques will appear others wise will go to the end*	YES……..1 NO……2	
63	Did you measure hemoglobin?	Measured……..1 Not present……..2 Refused……3 Other……..4	
64	Hemoglobin level (g/dl): [only for children 6 – 59 months]		→ 68 → 68
We detected a low level of hemoglobin in the blood of A. This indicates that A has developed severe anemia, which is a serious health problem. We would like to inform the doctor at _____ about the condition of A. This will assist you in obtaining appropriate treatment for the condition.			→ 68
65	Do you agree that the information about the level of hemoglobin in the blood of A may be given to the doctor?	YES……..1 NO……2	

→ 68

66	Did you give anemia treatment? *(for Hg 5-8g/dl)Look for presence of malnutrition*	YES……1 NO……2	
67	Anemia treatment *(for Hg 5-8g/dl)*	Coartem……1 Iron……2 Albendazole……3	→ 70 → 70 → 70
68	RDT result:	Pf positive ……1 Pv, Pm or Po Positive ……2 Pf or mixed infection Positive……3 Negative ……4 INVALID……5 NOT DONE……6 Refused……7	→ 70 → 70 → 70
69	Malaria treatment:	CoArtem and other brands of AL ……1 Chloroquine……2 Quinine……3 No treatment……4 Refer 5	
70	Blood slide:	DONE……1 NOT PRESENT……2 REFUSED……3 Other……4	
71	Dried Blood Spot:	DONE……1 NOT PRESENT……2 REFUSED……3 Other……4	
72	Barcode:	Get Barcode	

Ethiopia 2015 Malaria Indicator Survey

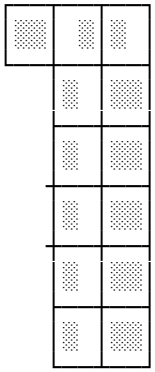
Women's Questionnaire

Federal Ministry of Health
Ethiopian Public Health Institute
Malaria Indicator Survey Working Group

Semptember 2015

MALARIA INDICATOR SURVEY
WOMEN'S QUESTIONNAIRE

[Ethiopia
[Ministry of Health]

IDENTIFICATION[1]	
KEBELE NAME _____ NAME OF HOUSEHOLD HEAD _____ EA NUMBER ..... HOUSEHOLD NUMBER..... REGION ..... ZONE ..... DISTRICT..... NAME AND LINE NUMBER OF WOMAN _____	

	1	2	FINAL VISIT
DATE	_____	_____	DAY MONTH YEAR 2 0
INTERVIEWER'S NAME	_____	_____	NAME
RESULT*	_____	_____	RESULT
NEXT VISIT: DATE	_____	_____	
TIME	_____	_____	TOTAL NO. OF VISITS

*RESULT CODES:

1	COMPLETED	4	REFUSED
2	NOT AT HOME	5	PARTLY COMPLETED
3	POSTPONED	6	INCAPACITATED

COUNTRY-SPECIFIC INFORMATION: LANGUAGE OF QUESTIONNAIRE, LANGUAGE OF INTERVIEW, NATIVE LANGUAGE OF RESPONDENT, AND WHETHER TRANSLATOR USED

SUPERVISOR	OFFICE EDITOR	KEYED BY
NAME _____ DATE _____		

[1] This section should be adapted for country-specific survey design.
[2] The following guidelines should be used to categorize urban sample points: "Large cities" are national capitals and places with over 1 million population; "small cities" are places with between 50,000 and 1 million population; and the remaining urban sample points are "towns".

SECTION 1. RESPONDENT'S BACKGROUND

INTRODUCTION AND CONSENT

73. Read the informed consent for women's questionnaire to all eligible women between 15 and 49 identified in the household listing.

RESPONDENT AGREES TO BE INTERVIEWED.....1 RESPONDENT DOES NOT AGREE TO BE INTERVIEWED 2
Respondent not present……3

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP
74	Have you ever attended school?	YES .....1 NO 2	<78
75	What is the highest level of school you attended: primary, secondary, or higher?[1]	PRIMARY .....1 SECONDARY .....2 HIGHER.....3	
76	What is the highest (grade/form/year) you completed at that level?[1]	Primary One …… 1 Two …… 2 Three …… 3 Four …… 4 Five…… 5 Six …… 6 Seven …… 7 Eight …… 8 Secondary Nine …… 9 Ten …… 10 Eleven …… 11 Twelve …… 12 Higher Tech/Voc. Certificate University/college Diploma University/college Degree of Higher	
77	Now I would like you to read this sentence to me. SHOW CARD TO RESPONDENT IF RESPONDENT CANNOT READ THE WHOLE SENTENCE, PROBE: can you read any part of the sentence to me?	Cannot read at all ……..1 Able to read only parts of sentence ……... 2 Able to read whole sentence ……... 3 No card with required language (Specify language) …… 4 Blind/Visually impaired …….. 5	
78	What is your religion?	ORTHODOX CATHOLIC PROTESTANT MUSLIM OTHER _____(specify)	
79	What is your ethnicity?	AFFAR AMHARA GURAGIE OROMO SIDAMA SOMALI TIGRAY WELAITA OTHER (Specify)……	

SECTION 2. REPRODUCTION

NO.	QUESTIONS AND FILTERS	CODING CATEGORIES	SKIP

80	Now I would like to ask about all the births you have had during your life. Have you ever given birth?	YES.....1 NO 2	–<101
81	How old were you at your last birth in the last five years?	AGE IN COMPLETED YEARS ▒▒	
82	Do you have any sons or daughters to whom you have given birth who are now living with you?	YES.....1 NO.....2	–<101
83	How many sons live with you? And how many daughters live with you? IF NONE, RECORD '00'.	SONS AT HOME.....▒▒ DAUGHTERS AT HOME.....▒▒	
84	Do you have any sons or daughters to whom you have given birth who are alive but do not live with you?	YES.....1 NO.....2	
85	How many sons are alive but do not live with you? And how many daughters are alive but do not live with you? IF NONE, RECORD '00'.	SONS ELSEWHERE.....▒▒ DAUGHTERS ELSEWHERE...▒▒	
86	Have you ever given birth to a boy or girl who was born alive but later died? IF NO, PROBE: Any baby who cried or showed signs of life but did not survive?	YES.....1 NO.....2	
87	How many sons have died? And how many daughters have died? IF NONE, RECORD '00'.	BOYS DEAD.....▒▒ GIRLS DEAD .....▒▒	
88	Just to make sure that I have this right: you have had in TOTAL _____ births during your life. Is that correct? YES ↓ NO → PROBE AND CORRECT 83-87 AS NECESSARY.		
89	How many of these children were born in the last five years?	▒	
90	Is the child listed in the household roster?	YES.....1 NO.....2	
91	Write (Select) the name of the child		
92	What name was given to your (most recent/previous) birth?		
93	Is (NAME) a boy or a girl?	Male Female	
94	In what day, month and year was (NAME) born?		
95	The age of (Name) is _____ . Is this Correct?	YES.....1 NO 2	
96	Is (NAME) still aive?	YES.....1 NO.....2	–<99
97	How old was (NAME) at his/her last birth? RECORD AGE IN COMPLETED YEARS	▒	
98	Is (Name) living with you?	YES.....1 NO.....2	–<100
99	How old was (Name) when he/she died?	▒	

100	Were any of these births twins	Single Multiple	
101	Are you pregnant now?	YES.....1 NO .....2 Don't Know……8	 –<103 –<103
102	How many months pregnant are you? RECORD NUMBER OF COMPLETED MONTHS.		
103	Have you ever heard of an illness called malaria?	YES.....1 NO 2	 –End
104	Can you tell me the main symptoms of malaria? MULTIPLE RESPONSES PROBE ONCE (Anything else?)	Fever Feeling cold Headache Nausea and Vomiting Diarrhea Dizziness Loss of appetite Body ache or joint pain Pale eyes EXCESSIVE SWEETING Body weakness Refusing to eat or drink Other (Specify) Don't know	
105	In your opinion, what causes malaria? MULTIPLE RESPONSES PROBE ONCE (Anything else?)	Mosquito bites Eating immature sugarcane EATING mAIZE INHALING MAIZE POLLEN HUNGER (EMPTY STOMACH) Eating other dirty food Drinking dirty water Getting soaked with rain Cold or changing weather Witchcraft Other (Specify) DON'T KNOW	
106	How can someone protect themselves against malaria? MULTIPLE RESPONSES	PROBE ONCE (Anything else?) Sleep under ITN Use mosquito repellant Avoid mosquito bites Take preventive medication Spray house with insecticide Use mosquito coils Cut the grass around the house Fill in puddles (stagnant water) Keep house surroundings clean Burn leaves Don't drink dirty water Don't eat bad food (immature sugarcane/leftover food) Put mosquito screens on the windows eat garlic drink alcohol Don't get soaked with rain Other (Specify) DON'T KNOW	
107	What are the danger signs and symptoms of malaria?	Seizure / convulsions Goes unconscious Any fever Very high fever Stiff neck Weakness Not active Chills/shivering Not able to eat/DRINK Vomiting Fainting Crying all the time Restless, won't staystill Diarrhoea Other (Specify) DON'T KNOW	
108	HAVE YOU EVER SEEN OR HEARD MESSAGES ABOUT MALARIA	YES.....1 NO.....2	 –<116
109	WHERE DID YOU SEE OR HEAR THESE MESSAGES/INFORMATION? Probe once (Anything else?)	GOVERNMENT CLININC/HOSPITAL COMMUNITY HEALTH DEVELOPMENT TEAM HEALTH EXTENSION WORKER COMMUNITY HEALTH WORKER FRIENDS/FAMILY WORKPLACE DRAMA GROUPS PEER EDUCATORS POSTERS / BILLBOARDS ON TV ON THE RADIO	

		IN THE NEWSPAPER OTHER (SPECIFY) DON'T REMEMBER DON'T KNOW	
110	HOW LONG AGO DID YOU SEE OR HEAR THESE MESSAGES? Write 1 Month if <30 days	MONTHS.....| | | DO NOT KNOW …….. 88	
111	WHAT TYPE OF MALARIA MESSAGES/INFORMATION DID YOU SEE OR HEAR? Probe, but do not provide answers. Multiple answers possible. Possible answers include	SLEEPING UNDER ITN SEEK TREATMENT FOR FEVER SEEK TREATMENT FOR FEVER WITHIN 24 HOURS IMPORTANCE OF SPRAYING NOT PLASTERING WALLS AFTER SPRAYING ENVIRONMENTAL SANITATION ACTIVITIES OTHER(SPECIFY) DON'T KNOW	
112	DID YOU RECENTLY RECEIVE EDUCATION/INFORMATION ON MALARIA AT YOUR HOME?	YES.....1 NO .....2 Don't Know……..…….8	–<116 –<116
113	FROM WHOM DID YOU RECEIVE THIS INFORMATION/EDUCATION? Probe, but do not provide answers	HEALTH CARE WORKER HEALTH EXTENSION WORKER COMMUNITY HEALTH WORKER FRIENDS/FAMILY EMPLOYER PEER EDUCATORS OTHER (SPECIFY) DON'T KNOW	
114	HOW LONG AGO DID SOMEONE VISIT YOUR HOME? Write 1 month if <30 days Do not know enter 88 months	MONTH…… | | |	
115	WHAT TYPE OF INFORMATION/EDUCATION ABOUT MALARIA DID YOU RECEIVE AT YOUR HOME? Probe, but do not provide answers. Multiple answers possible. Possible answers include:	CAUSES OF MALARIA SLEEPING UNDER ITN EVERY NIGHT GIVE PRIORITY TO CHILDREN <5 YRS OF AGE AND PREGNANT WOMEN HANG YOUR NET SO IT CAN BE TUCKED WASHING NETS MENDING / REPAIRING NETS SEEK TREATMENT FOR FEVER SEEK TREATMENT FOR FEVER WITHIN 24 HOURS FREE TREATMENT OF MALARIA IMPORTANCE OF SPRAYING NOT PLASTERING WALLS AFTER SPRAYING ENVIRONMENTAL SANITATION ACTIVITIES OTHER (SPECIFY) DON'T KNOW	
116	HOW FAR IS IT TO THE NEAREST HEALTH FACILITY? Note that on average 5 km is 1 hour walk Write '00' if less than 1 kilometer If more than 95 kilometers, write '95' Write '98' if 'Don't Know'	Kilometers |……|	
117	If you were to go to this facility, how would you most likely go there?	CAR/MOTORCYCLE ..... PUBLIC TRANSPORT (BUS / TAXI) ANIMAL / ANIMAL CART. WALKING BICYCLE BOAT OTHER DON'T KNOW	

FEVER IN CHILDREN

	ENTER IN THE TABLE THE LINE NUMBER AND NAME OF EACH LIVING CHILD BORN IN 2010[1] OR LATER. (IF THERE ARE MORE THAN 2 LIVING CHILDREN BORN IN 2010[1] OR LATER, USE ADDITIONAL QUESTIONNAIRES). Now I would like to ask you some questions about the health of all your children less than 5 years old. (We will talk about each one separately.)		
118	Has (NAME) been ill with a fever at any time in the last 2 weeks?	YES.....1 NO.....2 DON'T KNOW .....8 (IF 2 or 8 go to end)	YES.....1 NO .....2 DON'T KNOW .....8 (IF 2 or 8 go to end)
119	How many days ago did the fever start?	DAYS AGO..... | | |	DAYS AGO ..... | | |

	IF LESS THAN ONE DAY, enter 0. IF DON'T KNOW, enter 98.	DON'T KNOW……98	DON'T KNOW……98
120	Did you seek advice or treatment for the fever from any source?	YES.....1 NO.....2 (SKIP TO 123) ——┘	YES.....1 NO.....2 (SKIP TO 123) ——┘
121	Where did you seek advice or treatment?[2] Anywhere else? RECORD ALL SOURCES MENTIONED.	PUBLIC SECTOR GOVT. HOSPITAL.....A GOVT. HEALTH CENTER.....B GOVT. HEALTH POST.....C MOBILE CLINIC.....D HEALTH EXTENSION WORKER E FIELD WORKER.....F OTHER PUBLIC _____G (SPECIFY) PRIVATE MEDICAL SECTOR PVT. HOSPITAL/CLINIC.....H PHARMACY.....I PRIVATE DOCTOR.....J MOBILE CLINIC.....K FIELD WORKER.....L OTHER PVT. MEDICAL _____M (SPECIFY) OTHER SOURCE SHOP.....N TRAD. PRACTITIONER.....O OTHER _____ X (SPECIFY)	PUBLIC SECTOR GOVT. HOSPITAL.....A GOVT. HEALTH CENTER.....B GOVT. HEALTH POST.....C MOBILE CLINIC.....D HEALTH EXTENSION WORKER E FIELD WORKER.....F OTHER PUBLIC _____G (SPECIFY) PRIVATE MEDICAL SECTOR PVT. HOSPITAL/CLINIC.....H PHARMACY.....I PRIVATE DOCTOR.....J MOBILE CLINIC.....K FIELD WORKER.....L OTHER PVT. MEDICAL _____M (SPECIFY) OTHER SOURCE SHOP.....N TRAD. PRACTITIONER.....O OTHER _____ X (SPECIFY)
122	How many days after the fever began did you first seek advice or treatment for (NAME)? IF THE SAME DAY, RECORD 0.	DAYS ..... ▒▒	DAYS ..... ▒▒

[1] For fieldwork beginning in 2015, the year should be 2010, respectively.
[2] Coding categories to be developed locally and revised based on the pretest; however, the broad categories must be maintained.

		YOUNGEST CHILD NAME _____	NEXT-TO-YOUNGEST CHILD NAME _____
123	Is (NAME) still sick with a fever?	YES .....1 NO .....2 DON'T KNOW.....8	YES .....1 NO .....2 DON'T KNOW.....8
124	At any time during the illness, did (NAME) get finger or heel pricked by health provider <u>in the last two week?</u>	YES .....1 NO .....2 (SKIP end)–┤ DON'T KNOW.....8	YES.....1 NO.....2 (SKIP end) –┤ DON'T KNOW.....8
125	Was a diagnostic blood test for malaria performed	YES .....1 NO .....2 (SKIP128) —┤ DON'T KNOW.....8	YES .....1 NO .....2 (SKIP128)——┤ DON'T KNOW.....8
126	Did health provider communicate the result of the blood test?	YES .....1 NO .....2 (SKIP 128)——┤ DON'T KNOW.....8	YES .....1 NO .....2 (SKIP 128) ——┤ DON'T KNOW.....8
127	What was the result of the blood test?	Pf Positive.....1 Pv , Pm or Po Positive .....2 Pf, Pv or mixed infection positive….3 NEGATIVE.....4 DON'T KNOW.....8	Pf Positive.....1 Pv , Pm or Po Positive .....2 Pf, Pv or mixed infection positive….3 NEGATIVE .....4 DON'T KNOW.....8

128	At any time during the illness, did (NAME) take any drugs for the fever?	YES ..... 1 NO ..... 2 (SKIP End) =——| DON'T KNOW..... 8	YES..... 1 NO..... 2 (SKIP End) =——| DON'T KNOW..... 8
129	Do you know the name of the drug you took?	YES ..... 1 NO ..... 2 (SKIP end) ——| DON'T KNOW..... 8	YES..... 1 NO..... 2 (SKIP end) ——| DON'T KNOW..... 8
130	What drugs did (NAME) take?[1] Any other drugs? RECORD ALL MENTIONED. ASK TO SEE DRUG(S) IF TYPE OF DRUG IS NOT KNOWN. IF TYPE OF DRUG IS STILL NOT DETERMINED, SHOW TYPICAL ANTIMALARIAL DRUGS TO RESPONDENT.	ANTIMALARIAL COARTEM..... A CHLOROQUINE ..... B QUININE..... C OTHER ANTIMALARIAL_____ F (SPECIFY) OTHER DRUGS ASPIRIN ..... G ACETAMINOPHEN/ PARACETAMOL..... H IBUPROFEN..... I OTHER _____ X (SPECIFY) DON'T KNOW..... Z	ANTIMALARIAL COARTEM..... A CHLOROQUINE ..... B QUININE..... C OTHER ANTIMALARIAL_____ F (SPECIFY) OTHER DRUGS ASPIRIN ..... G ACETAMINOPHEN/ PARACETAMOL..... H IBUPROFEN..... I OTHER _____ X (SPECIFY) DON'T KNOW ..... Z
131	How long after the fever started did (NAME) first take COARTEM?	SAME DAY ..... 0 NEXT DAY..... 1 TWO DAYS AFTER THE FEVER ..... 2 THREE DAYS AFTER THE FEVER.. 3 FOUR OR MORE DAYS AFTER THE FEVER ..... 4 DON'T KNOW..... 8	SAME DAY ..... 0 NEXT DAY ..... 1 TWO DAYS AFTER THE FEVER ..... 2 THREE DAYS AFTER THE FEVER . 3 FOUR OR MORE DAYS AFTER THE FEVER ..... 4 DON'T KNOW 8

[1] Revise list of drugs as appropriate; however, the broad categories must be maintained. Include all drugs or drug combinations that are commonly given as separate categories.

		YOUNGEST CHILD NAME _____	NEXT-TO-YOUNGEST CHILD NAME _____
132	For how many days did (NAME) take the Artemether-Lumefanthrine (AL) (COARTEM and other brands of AL)? IF 7 OR MORE DAYS, RECORD '7'. If don't know record '8'.	DAYS..... |▒▒| DON'T KNOW 8	DAYS..... |▒▒| DON'T KNOW 8
133	Did you have Artemether-Lumefanthrine (AL) (COARTEM or other brands of AL) at home or did you get it from somewhere else? IF SOMEWHERE ELSE, PROBE FOR SOURCE. IF MORE THAN ONE SOURCE MENTIONED, ASK: Where did you get the Coartem first?	AT HOME ..... 1 HEALTH EXTENSION WORKER..... 2 GOVERNMENT HEALTH FACILITY/WORKER ..... 3 PRIVATE HEALTH FACILITY/WORKER ..... 4 Pharmacy …… ..5 SHOP..... 6 OTHER_____ 7 (SPECIFY) DON'T KNOW..... 8	AT HOME ..... 1 HEALTH EXTENSION WORKER..... 2 GOVERNMENT HEALTH FACILITY/WORKER ..... 3 PRIVATE HEALTH FACILITY/WORKER ..... 4 SHOP ..... 5 OTHER_____ 6 (SPECIFY) DON'T KNOW..... 8
134	Did you purchase the Artemether-Lumefanthrine (COARTEM and other brands of AL)?	YES ..... 1 NO ..... 2 If NO, Skip to 137	YES ..... 1 NO ..... 2 If NO, Skip to 137
135	What did the drug's packaging look like?	LARGE WHITE BLISTERS ..... 1 SMALL BOX..... 2 INDIVIDUAL, LOOSE PILLS ..... 3 NOT SURE 8	LARGE WHITE BLISTERS ..... 1 SMALL BOX ..... 2 INDIVIDUAL, LOOSE PILLS ..... 3 NOT SURE 8
136	How much did you pay for the COARTEM?	……Birr	……Birr

137	How long after the fever started did (NAME) first take chloroquine?	SAME DAY .....0 NEXT DAY.....1 TWO DAYS AFTER THE FEVER.....2 THREE DAYS AFTER THE FEVER 3 FOUR OR MORE DAYS AFTER THE FEVER.....4 DON'T KNOW.....8	SAME DAY .....0 NEXT DAY.....1 TWO DAYS AFTER THE FEVER .....2 THREE DAYS AFTER THE FEVER..3 FOUR OR MORE DAYS AFTER THE FEVER .....4 DON'T KNOW.....8
138	For how many days did (NAME) take chloroquine? IF 7 OR MORE DAYS, RECORD '7'. If Don't know, record '8'.	DAYS..... ▒▒ DON'T KNOW 8	DAYS..... ▒▒ DON'T KNOW 8
139	Did you have the chloroquine at home or did you get it from somewhere else? IF SOMEWHERE ELSE, PROBE FOR SOURCE. IF MORE THAN ONE SOURCE MENTIONED, ASK: Where did you get the chloroquine first?	AT HOME .....1 HEALTH EXTENSION WORKER.....2 GOVERNMENT HEALTH FACILITY/WORKER .....3 PRIVATE HEALTH FACILITY/WORKER .....4 SHOP.....5 OTHER_____6 (SPECIFY) DON'T KNOW.....8	AT HOME .....1 HEALTH EXTENSION WORKER.....2 GOVERNMENT HEALTH FACILITY/WORKER .....3 PRIVATE HEALTH FACILITY/WORKER .....4 SHOP .....5 OTHER_____6 (SPECIFY) DON'T KNOW.....88
140	Did you purchase the chloroquine?	YES ..... 1 NO ..... 2 If NO, Skip to 143	YES ..... 1 NO ..... 2 If NO, Skip to 143
141	What did the drug's packaging look like?	LARGE WHITE BLISTERS ..... 1 SMALL BOX..... 2 INDIVIDUAL, LOOSE PILLS ..... 3 NOT SURE 8	LARGE WHITE BLISTERS ..... 1 SMALL BOX ..... 2 INDIVIDUAL, LOOSE PILLS ..... 3 NOT SURE 8
142	How much did you pay for the CHLOROQUINE?	……Birr	……Birr
143	How long after the fever started did (NAME) first take Quinine?	SAME DAY .....0 NEXT DAY.....1 TWO DAYS AFTER THE FEVER.....2 THREE DAYS AFTER THE FEVER..3 FOUR OR MORE DAYS AFTER THE FEVER.....4 DON'T KNOW.....8	SAME DAY .....0 NEXT DAY.....1 TWO DAYS AFTER THE FEVER .....2 THREE DAYS AFTER THE FEVER..3 FOUR OR MORE DAYS AFTER THE FEVER .....4 DON'T KNOW.....8
144	For how many days did (NAME) take Quinine? IF 7 OR MORE DAYS, RECORD '7'. If don't know record '8'.	DAYS..... ▒▒ DON'T KNOW 8	DAYS..... ▒▒ DON'T KNOW 8
145	Did you have the Quinine at home or did you get it from somewhere else? IF SOMEWHERE ELSE, PROBE FOR SOURCE. IF MORE THAN ONE SOURCE MENTIONED, ASK: Where did you get the Quinine first?	AT HOME .....1 HEALTH EXTENSION WORKER.....2 GOVERNMENT HEALTH FACILITY/WORKER .....3 PRIVATE HEALTH FACILITY/WORKER .....4 SHOP.....5 OTHER_____6 (SPECIFY) DON'T KNOW.....8	AT HOME .....1 HEALTH EXTENSION WORKER.....2 GOVERNMENT HEALTH FACILITY/WORKER .....3 PRIVATE HEALTH FACILITY/WORKER .....4 SHOP .....5 OTHER_____6 (SPECIFY) DON'T KNOW.....8
146	Did you purchase the Quinine?	YES ..... 1 NO ..... 2 If NO, Skip to 149	YES ..... 1 NO ..... 2 If NO, Skip to 149
147	What did the drug's packaging look like?	LARGE WHITE BLISTERS ..... 1 SMALL BOX..... 2 INDIVIDUAL, LOOSE PILLS ..... 3 NOT SURE 8	LARGE WHITE BLISTERS ..... 1 SMALL BOX ..... 2 INDIVIDUAL, LOOSE PILLS ..... 3 NOT SURE 8

148	How much did you pay for the Quinine?	……Birr	……Birr
149	How long after the fever started did (NAME) first take (NAME OF OTHER ANTIMALARIAL)?	SAME DAY .....0 NEXT DAY.....1 TWO DAYS AFTER THE FEVER.....2 THREE DAYS AFTER THE FEVER..3 FOUR OR MORE DAYS AFTER THE FEVER.....4 DON'T KNOW.....8	SAME DAY .....0 NEXT DAY.....1 TWO DAYS AFTER THE FEVER .....2 THREE DAYS AFTER THE FEVER..3 FOUR OR MORE DAYS AFTER THE FEVER .....4 DON'T KNOW.....8
150	For how many days did (NAME) take (NAME OF OTHER ANTIMALARIAL)? IF 7 OR MORE DAYS, RECORD '7'. . If don't know record '8'.	DAYS..... ▒▒ DON'T KNOW 8	DAYS..... ▒▒ DON'T KNOW 8
151	Did you have the (NAME OF OTHER ANTIMALARIAL) at home or did you get it from somewhere else? IF SOMEWHERE ELSE, PROBE FOR SOURCE. IF MORE THAN ONE SOURCE MENTIONED, ASK: Where did you get the (NAME OF OTHER ANTIMALARIAL) first?	AT HOME .....1 HEALTH EXTENSION WORKER.....2 GOVERNMENT HEALTH FACILITY/WORKER .....3 PRIVATE HEALTH FACILITY/WORKER .....4 SHOP.....5 OTHER_____6 (SPECIFY) DON'T KNOW.....8	AT HOME .....1 HEALTH EXTENSION WORKER.....2 GOVERNMENT HEALTH FACILITY/WORKER .....3 PRIVATE HEALTH FACILITY/WORKER .....4 SHOP .....5 OTHER_____6 (SPECIFY) DON'T KNOW.....8
152	Did you purchase the (NAME OF OTHER ANTIMALARIAL)?	YES ..... 1 NO ..... 2 If NO, Skip to end	YES ..... 1 NO ..... 2 If NO, Skip to end
153	What did the drug's packaging look like?	LARGE WHITE BLISTERS ..... 1 SMALL BOX..... 2 INDIVIDUAL, LOOSE PILLS ..... 3 NOT SURE 8	LARGE WHITE BLISTERS ..... 1 SMALL BOX ..... 2 INDIVIDUAL, LOOSE PILLS ..... 3 NOT SURE 8
154	How much did you pay for the (NAME OF OTHER ANTIMALARIAL)?	In Birr ☐☐	In Birr ☐☐
	RECORD THE TIME.	HOUR..... ▒▒ MINUTES ..... ▒▒	

INTERVIEWER'S OBSERVATIONS

TO BE FILLED IN AFTER COMPLETING INTERVIEW

COMMENTS ABOUT RESPONDENT:

COMMENTS ON SPECIFIC QUESTIONS:

ANY OTHER COMMENTS:

SUPERVISOR'S OBSERVATIONS

NAME OF THE SUPERVISOR:_____ DATE: _____

Appendix G. Programmatic Implications of MIS-2015 results

Programmatic implications of Malaria Indicator Survey 2015
September 01,2016

Based on the technical advisory committee(TAC) meeting held on 18 August 2016 at the FMOH, a decision was made to conduct an experts consultative meeting to discuss the programmatic implication of the current MIS-2015 results. The consultation was implemented with the support of MACEPA/PATH. As the MIS-215 report is in press during the meeting, the following minutes of the meeting conclusion and recommendations are annexed on the MIS-2015 report.

The list of experts participated are listed in the table below

Overall facilitators Mrs Hiwot Solomon FMOH 2. Mr. Ashenafi Assefa 3. Mr. Asefaw Getachew		
Group-1: Diagnosis & Treatment Facilitators: Dr Dereje Muluneh (UNICEF) Dr. Samuel Girma (USAID/PMI)	Group-2: Malaria Vector Control Facilitators: Mr Sheleme Chibsa Dr. Matthew Murphy(PMI/CDC)	Group-3: SBCC Facilitators: Mr Guda Alemayehu (USAID) Berhane Haileselassie(PATH /MACEPA)
Dr Kebede Etana (FMOH)	Achamyelesh Sisay (FMOH)	Gashu Fente (FMOH/UNICEF)
Dr Worku Bekele (WHO)	Dereje Dilu (FMOH)	Tilahun Kebede (FMOH)
Sindew Mekasha (EPHI)	Dr Adugna Woyessa(EPHI)	Wassihun Belay (WHO)
Asnakew Kebede (PATH/MACEPA)	Asefaw Getachew (PATH/MACEPA)	Samuel Hailu (FMOH)
Gezahegn Tesfaye (FMOH/PATH)	Meseret Assefa (GF)	Estifanos Bayabil (HDAMA)
Ashenafi Assefa (EPHI)	Alemayehu Getachew (ABT)	Bayissa Urgesa (JHCCP)

3. Malaria prevention

3.1 Conclusions

Sixty-nine percent of households owned an LLIN in 2007 compared with 64 percent reported in the 2015 but 55 percent for 2011. Household ownership of LLINs has improved compared to MIS 2011 but declined in relation to MIS 2007 and did not meet universal LLIN coverage.

34% of households in non-targeted areas (> 2000 m) reported owning at least one LLIN which has impact on overall LLIN distribution. Thirty-four percent of households owned LLINs in areas >2,000m and≤2,500m above sea level where malaria prevalence in children under five is negligible.

A considerable number of survey supervisors reported that undistributed LLINs were observed in several woreda/ District health offices during data collection period for MIS 2015.

Net utilization rates among children under age 5 and pregnant women have not changed in MIS-2015 when compared with MIS 2007. However, the utilization rates are higher when compare with that of MIS-2011 results.. Forty percent of the household members slept under a net the night before the survey for this MIS-2015.

The percentage of households with IRS in the past 12 months was found to be 29 percent.

3.2 Recommendations

- MIS-2015 results indicated that though percentage of households with at least one LLIN is maintained and the program is behind its target of achieving 80% and above LLIN ownership.
- FMOH, partners and stakeholders should apply practical approaches to achieve universal net coverage in the targeted malaria risk areas.
- Needs an appropriate planning and implementing timely distribution of LLINs to household level.
- Due to altitude variability within villages and enumeration areas LLINs distribution is challenged. Therefore there is a need of additional targeting parameters.
- Access to LLINs at household level mainly determines use. In addition, community level awareness activities also determine LLIN utilization rates. Among those households in malarious areas owning at least one LLIN, the LLINs utilization rates have improved when compared with MIS-2007 and 2011 indicating improvements on community awareness.
- IRS is not a universal coverage intervention and strategy to calculate coverage should consider only IRS targeted EAs as denominators. IRS coverage has been found to be 29 % which is a positive achievement from the point of view of the total at risk population despite the denominator is not taken from the targeted population.
- IRS is limited to specific areas, the program targeted 29% of the total at risk-population.
- In addition, IRS re-plastering rate as an issues should be reflected in the report to investigate possible challenges of the intervention.
- Demand creation efforts should be considered using Social Behavioral Change for Communication to improve utilization of vector control services.
- In order to assess the LLINs that were not distributed during the time of data collection, FMOH and partners are planning to conducted rapid assessment of LLIN distribution to make sure LLINs are delivered to community in need.

4. Case Management

4.1 Conclusions

The trend in percentage of children under age 5 with fever in the two weeks preceding the survey is declining overtime. Possible reason could be the result of reducing malaria, pneumonia and other childhood illnesses.

Children with fever who sought advice or treatment declined compared to MIS 2011. In addition how long after the fever started advice or treatment was sought was not specified. Blood test for malaria was found low but with variation by urban to rural and region. Primarily health centers followed by private health facilities provide most of the treatment seeking or advice for fever.

4.2 Recommendations

Declining health seeking behavior in children should be investigated despite having HDA and HEWs at community level. Period for treatment or advice sought after the fever started should be specified.

Improve testing of febrile patients through advocacy, communication and social mobilization and supportive supervision for health extension workers and community members focusing on women in the reproductive age group .

Considering febrile cases as a data element in HMIS to monitor the situation.

Currently IMNCI algorithm does not recommend malaria testing for febrile neonates. Study malaria burden in neonates and under 2 months.

Even though health post are the primary point of care for malaria patients there is a shift to health center and needs further investigation on why the community prefers the health centers.

5. Malaria and Anemia prevalence

5.1 Conclusions

National malaria parasite prevalence for all age groups has been declined compared to MIS 2007 and 2011. Malaria prevalence is highest in the age group 35-39 years compared to other age groups. But in the Ethiopian context, MIS is not a good tool to measure malaria prevalence as the malaria burden is very low and seasonal. Malaria prevalence is higher in male and rural residents but no variation with economic status.

Malaria prevalence among children under 5 living in areas >2,000m and ≤2,500m above sea level was zero percent. This may indicate no or minimum local transmission.

Prevalence of malaria in children was found highest in Gambella and Benishangul Gumuz regions. Proportion of plasmodium species were plasmodium falciparum 87.9%, plasmodium vivax 8.7% and mixed 3.4%. Many reported cases are from Gambella and BenishangulGumuz regions.

Nationally, anaemia rate was found low and there is no significant difference among age groups. Relatively highest anaemia was reported in Somali and Dire Dawa where malaria prevalence is very low. In regions with highest malaria prevalence (Gambella and BenishangulGumuz) there is no difference in anaemia rate with remaining regions with low malaria prevalence. Therefore, anaemia rate in this study may not reflect effect of malaria.

5.2 Recommendations

MIS is not a good tool for Ethiopia to estimate malaria parasite prevalence and needs to be customized to local situation or look for better options.

MIS focuses on children under 5 years of age and women in the reproductive age group. The malaria burden in Ethiopia is relatively highest in adults and males. Therefore, consideration is required for the evidence generated. Separate study or approach is required to address special populations such as mobile population, “moferzemach” and the likes.

Malaria prevalence among children under five living in areas >2,000m and ≤2,500m above sea level is zero and needs to design intervention tailored for this stratification.

To reducing malaria parasite prevalence for Gambella and Benishangul Gumuz regions, it needs intensification of case management ICCM and IMNCI services.

Proportion of plasmodium species should also be analyzed by regions separately since the high prevalence in Gambella and Benishangul Gumuz regions are affecting the national picture. It is expected more proportion of vivax cases due to reducing malaria burden in the country.

Reconsider studying anaemia as an indicator of malaria in MIS studies.

6. General Malaria Knowledge

6.1Conclusions

In malarious areas, sixty-eight percent of women have heard about malaria and there is a minor reduction in percentage. The percentage is not satisfactory in the literate women and women living in Afar and Somali regions despite living in malarious areas. Possible reasons for declining women heard about malaria might be due to weakening in SBCC interventions mainly after the reform, declined in malaria burden and quality of questionnaire administration.

Percent who recognize fever as a symptom increased from 44 percent to 75percent in MIS 2015comparing with MIS 2007 but almost no change when compared with 2011.

Among women who had heard of malaria who recognize fever as symptom of malaria was maintained since 2011. Women who knows malaria is caused by mosquito bites and percent who reported LLINs as a preventive method was improved substantially but the denominator needs improvement.

Malaria knowledge data were not disaggregated by source of information.

6.2 Recommendations

SBCC activities and IEC/BCC should be strengthened at community level with coordinated and standardized SBCC materials. Demand creation activities to optimize utilization of available

malaria prevention services. Due attention should be given to improve quality of questionnaire administration as there were language barriers among data collectors and study participants.

Implementation of national Health Promotion and Communication strategy and advocacy communication and social mobilization manual for malaria. Choice of channels to reach the rural community should be also reconsidered and source of information for malaria knowledge should be explained.

7. Lessons learned

7.3 Crosscutting issues

Malaria risk and stratification

MIS shows Gambella and Benishangul Gumuz regions had higher rate of malaria parasite prevalence. But it doesn't capture other hot spot areas in the western lowlands of the country as MIS-2015 gives only regional estimates. The MIS result does not differentiate low and moderate malaria risk areas. MIS result does not correlate with existing stratification and it is not proper tool for the current malaria stratification in Ethiopia.

It was recommended that malaria parasite prevalence may be estimated as per the stratification in the NSP rather than classifying areas below 2000m and between 2000m and 2500m asl.

Potential publications

- Organize team of experts who will be spearheaded by EPHI to identify topics for publications, for detail analysis of the data in the three MISs and utilize the biological samples collected to generate further evidence.

Investment in malaria

Investment in malaria prevention and control should be continued. Without investment the low malaria incidence can be reverted. Therefore investment is needed but not limited to the following

- To improve utilization while ensuring supply:
- To improve diagnostics and quality assurance
- To improve surveillance
- To improve case management at universities and affiliated universities
- Mapping for source of infection

MIS in the future

The future of MIS may be governed by the development of current surveillance systems and routine data collection and program monitoring. Yet there are indicators that can only be captured by a nationwide MIS tailored to the Ethiopian context. Evaluate approaches to establish malaria prevalence on a more frequent basis without MIS.MIS is excellent to measure coverage of intervention but not impact.