MACEPA PATH
Malaria Control and Elimination Partnership in Africa

Migrant Labor Report

Ethiopia 2016

Assessing movement patterns and malaria-associated factors among agricultural migrant workers and the feasibility of implementing new targeted anti-malaria interventions in Amhara Region, Ethiopia

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Acronyms and terms

AL	Artemether-lumefantrine
ANRS	Amhara National Regional State
ARHB	Amhara National Regional State Health Bureau
Bega	Winter
CDR	Cell detail records
FGD	Focus group discussions
FTAT	Focal test and treat
FMoH	Federal Ministry of Health
Gaul	The negotiation process between a migrant and farm owner/manager regarding payment and plot of land to be worked
Gofer	Migrant worker who comes from another area but returns home after the weeding or harvest season
HDA	Health development army
HEW	Health extension workers
ICCM	Integrated community case management
IRS	Indoor residual spraying
Keremt	Summer
KII	Key-informant interviews
“Kobrare”	Farm manager
LLINs	Long-lasting insecticide-treated nets
“Meskerem”	September
MTAT	Mass test and treat
MIS	Malaria Indicator Survey
“Musiya”	Bednet
“Nehase”	August
OPD	Outpatient department
RDT	Rapid diagnostic test
SA	Surveillance assistant
“Salug”	Sudanese word for a person that comes from another area and stays permanently

SBCC	Social behavior change and communication
Seasonal migrant worker	Person who has migrated to another district within or outside the Amhara Region to work on a farm for at least one month in the last growing season
“Wesyla”	Payment/informal “check” given to the migrant laborer once the work has been completed

Acknowledgments

The *MACEPA Migrant Labor Report: Ethiopia 2016* was conducted in selected districts of Amhara Region, Ethiopia, and provides information regarding movement and malaria-associated factors among agricultural migrant workers and the feasibility of implementing new targeted malaria prevention interventions in Amhara. The result represents the efforts of the Malaria Control and Elimination Partnership in Africa (MACEPA), a program at PATH; the Amhara National Regional State Health Bureau (ANHB); and the Federal Ministry of Health (FMOH). The work was funded by MACEPA.

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Executive summary

The Malaria Control and Elimination Partnership in Africa (MACEPA), a program at PATH, in collaboration with the Federal Ministry of Health (FMOH) and the Amhara National Regional State Health Bureau (ARHB) strives to support sub-national malaria elimination through the implementation of several strategies to rapidly reduce malaria transmission in Ethiopia's Amhara Region. One such strategy involves providing evidence on the effectiveness of implementing new approaches for eliminating malaria infections from mobile populations.

Seasonal migrant workers account for the majority of the population movement in Amhara to and from the highlands (relatively low malaria endemicity) and the lowlands (higher malaria endemicity). Given that there has been an expansion of large-scale agriculture farms, particularly in the western part of Ethiopia, an estimated 400,000–500,000 people move to this area each year during planting, weeding, and harvesting seasons (June–November) and then return home. Seasonal migrant workers are susceptible to malaria infections during their travel and/or stay at farm camps and have significant barriers to the use of malaria prevention and control measures. Furthermore, they risk bringing malaria back to their home community. Thus, in order to design and implement strategies to prevent and control malaria in this high-risk group, it is necessary to first understand their movement patterns, the current malaria control interventions and behaviors associated with malaria at farms, and the feasibility and acceptability of implementing malaria prevention strategies for seasonal migrant workers during their work periods and upon their return home.

This report summarizes findings from a descriptive study using quantitative and qualitative methods. The quantitative methods included a cross-sectional farm assessment survey using a standardized questionnaire, and collection of surveillance data on travel history in malaria cases from individual patient logs from the outpatient department (OPD) register book. Qualitative methods employed were key informant interviews (KII), focus group discussions (FGD), and direct observations.

Given that there was substantial prior evidence that migrant workers were at high risk of becoming infected at farms and importing malaria back to their homes,[1] we focused on several key a priori assumptions. That is, we assumed that the options for reducing the malaria risk and the risk of importation back to their homes included:

- Reducing the risk of transmission at the farms (the source) through enhanced prevention and prompt case management; and/or
- Reducing the risk of importing malaria back to their homes (the possible spread) by:
    - Clearing infections prior to their departure for home.
    - Clearing infections immediately upon their return home.

Thus, the investigations focused on these specific issues.

Movement patterns derived from OPD register books

Between October 2014 and October 2016, a total of 9,150 outpatient records of rapid diagnostic test (RDT)-positive cases with or without travel history 30 days prior to consultation and RDT-negatives

[1] Schicker RS, Hiruy N, Melak B, Gelaye W, Bezabih B, Stephenson R, Patterson AE, Tadesse Z, Emerson PM, Richards FO Jr, Noland GS. A Venue-Based Survey of Malaria, Anemia and Mobility Patterns among Migrant Farm Workers in Amhara Region, Ethiopia. PLoS One. 2015 10(11):e0143829. doi: 10.1371

with travel history were transcribed from 133 health posts within six project districts excluding the two districts in the source. A total of 15 data elements were transcribed from outpatient department (OPD) register books and integrated community case management (ICCM) register books, excluding patient records of RDT-negatives with no travel history. Of the total transcribed records, 95 (1%) were excluded from the analysis due to missing information. A total of 2,371 (26%) had a history of travel out of their permanent residence and 75% were males. Of those who had traveled, 40% were aged 20–44 years and 62.4% were RDT-positive for malaria.

We observed that the majority of travelers from Mecha and Bahir Dar Zuria districts traveled to the western agricultural region of Humera, Metema, Jawi, Pawi, Assosa, and their neighboring areas; almost all travelers from Tehuledire and Kalu traveled to the Afar region such as Chifra, Dubti, and neighboring areas. Finally, the majority of travelers (65–70%) from Aneded and Awabel districts traveled to local, agriculturally rich farms within the districts near Malgash and Dima villages, respectively.

Farm assessment survey

Almost all agricultural farms in Metema District were visited and farm managers provided basic information. Data from 285 agricultural farms were collected including geo-reference coordinates (longitude and latitude) and information on the number of employees hired at the peak season. Among these farms, 73.3% were less than 100 hectares; 95.1% grew sesame, 58.8% cotton, 59.8% sorghum, 2% cowpea and 1% grew Teff. On average, 35 (range 1–450) employees were hired per farm for planting, 146 (range 2–2,000) employees for weeding, and 135 (range 4–1,500) employees for harvesting.

A subset of 102 farms were included in the farm assessment cross-sectional survey to gather additional information on farm operations, assessment of malaria risk-related behaviors, and current malaria control strategies on the farms. Among these farms, 24.5% conducted malaria control practices, 19.6% provided bednets, 2% provided spray sleeping quarters, 1% offered traditional repellents, and 8.8% offered other malaria prevention interventions. Among these same farms, 30.4% offered formal healthcare. Of the total 31 farms with formal healthcare, 55% were offsite permanent, 32% offsite temporary, and 13% onsite temporary.

Qualitative evaluation at the farms to assess feasibility and acceptability of implementing malaria control interventions

Information gathered from five FGDs conducted with migrant laborers at the farms suggested that some migrant workers returned home for the Ethiopian New Year or in between planting/weeding and harvesting seasons; student migrant workers usually returned in time for the start of the school year (September). While migrant workers were aware of malaria, its symptoms, and how to prevent it, none had any knowledge about repellents and only a few used bednets. Nonetheless, the majority of migrants indicated that they would be willing to use other malaria control tools like bednets and repellents if they were distributed for free; many migrants indicated a willingness to participate in an intervention testing and treating for malaria at the farms or upon their arrival at their home kebeles.

Information on possible farm-specific interventions gathered from 14 KIIs conducted with farm owner/managers and other key stakeholders identified two main themes: most stakeholders

recommended that farm owners or government officials need to provide bednets and repellents to migrant workers to prevent malaria and there is a crucial need to provide healthcare at the farms (either through mobile or stationary clinics) that includes malaria testing and treatment. Farm owners/managers also expressed interest in employing strategies such as mass test and treat at the farms for all migrant workers.

Qualitative evaluation in the home kebeles to assess feasibility and acceptability of implementing a strategy to screen migrant workers upon return

To help inform the design of a proposed intervention to identify, test, and treat the returning migrant workers, 4 FGDs (1 in each home kebele) were conducted with community leaders, health development army members (HDAs), health extension workers (HEWs), surveillance assistants (SAs), school teachers, and students. All participants agreed that such an intervention was necessary. Additionally, almost everyone believed HDA members would be best at identifying returning seasonal migrant workers, and HEWs or SAs were best qualified for testing and treating malaria. To alleviate concerns about malaria testing and treatment, there was a consensus that campaigns should be targeted to family members to raise community awareness about the value of having all migrant workers tested even in the absence of symptoms.

A malaria test and treat strategy was evaluated among migrant worker returnees in four home kebeles; 20% of the migrant workers who were referred for testing had a positive RDT. Shortly after implementation, 4 FGDs with HEWs, HDAs, and SAs; 4 FGDs with returning seasonal migrant workers, and 4 KIIs with community leaders were conducted to evaluate feasibility and acceptability of this intervention. Almost everyone agreed that the intervention worked, was well accepted, and should be continued in the future—yet problems were identified. During the pilot effort, challenges arose that highlighted several requirements for future efforts; these included:

- At any point in time, there may be few migrants to evaluate as they return home at different intervals, thus the intervention may need to be provided continually over some months.
- Schools could be used as a place for evaluating returnees.
- Training must not be rushed and must include continued supervision, community awareness, and an understanding of the meaning and confidence in test results and treatment needs.
- Advance supplies must be adequate for the RDTs and medicines.

Suggestions for improvement included:

- Expand and deliver comprehensive advance awareness campaigns for the entire community.
- Assess the feasibility of a test and treat intervention at the farm prior to migrant departures for their homes.
- Provide a wider spectrum of malaria and other disease treatments.
- Consider expanding malaria prevention in the farms.

Background

In Ethiopia, an estimated 61 million people (~60% of the total population) live in areas with varying malaria transmission intensity [1]. Amhara National Regional State (ARNS) is the second-most populous region in Ethiopia and accounts for 31% of the national malaria burden [2,3]. Over the past 15 years, there has been a 50–75% reduction in case incidence, admissions, and deaths [4–6], and no record of a major malaria epidemic episode since 2005, which previously had recurred every 5–8 years. Results from the Malaria Indicator Survey (MIS) surveys conducted in 2007, 2011, and 2015 indicate that the overall malaria prevalence is approximately 1–1.4% with wide regional variations [7–9]. The recent malaria reductions are largely attributable to massive national scale-up of key antimalarial interventions such as: distribution of long-lasting insecticide-treated nets (LLINs), targeted indoor residual spraying (IRS) in high risk/epidemic-prone areas, provision of prompt diagnosis with either rapid diagnostic tests (RDT) or microscopy, and provision of effective treatment with artemether-lumefantrine (AL).

As Ethiopia is striving to achieve substantial progress toward malaria elimination in low transmission areas by 2020 [1], the Malaria Control and Elimination Partnership in Africa (MACEPA), a program at PATH, in collaboration with the Federal Ministry of Health (FMOH) and the Amhara National Regional State Health Bureau (ARHB), initiated a malaria elimination demonstration project in eight districts in Amhara Region with varying transmission intensity, to support sub-national malaria elimination through the implementation of several strategies to rapidly reduce malaria transmission in Amhara Region.

Results from one of these strategies, case investigation of passively detected malaria cases with reactive focal test and treat (FTAT) conducted during the 2014 high transmission season in ten kebeles (villages), identified a total of 221 index cases. Of these, 80.0% were farmers, of which 95.4% reported having a history of travel. Specifically, in three villages (Berhan Chora, Enashenfalen, and Yeginid Lomi), most index cases had a history of travel (>62%) and there were a small number of secondary cases (less than ten), suggesting that index cases were imported and there was little local transmission. This suggests that seasonal migrant workers accounted for the majority of the imported index cases.

Majority of the population movement in Amhara occurs among seasonal migrant workers from relatively low malaria-endemic highlands to higher malaria-endemic lowlands [11], and according to recent estimates [10], around 400,000–500,000 people annually move to Metema, Quara, and Merab Armachiho districts of North Gonder Zone and Jawi of Awi Zone per year during planting, weeding, and harvesting seasons (June–November). In recent years, the western part of Ethiopia has seen a growth in large-scale agriculture farms, hence the number of seasonal migrant workers traveling to these areas has and will continue to increase in the future. Research indicates that travel history is a major risk factor of malaria infection [10, 11], and many seasonal workers have a high risk of getting infected with malaria during their travel or at farm camps and have limited access to healthcare services for treatment. As a result, a large number of workers return home during peak malaria transmission periods with untreated malaria infections with a great potential to fuel local malaria transmission.

In order to achieve malaria elimination, it is important to prevent the re-introduction of malaria infections in areas with already-low transmission. Thus, the goal of this study was to describe seasonal migration patterns and understand the behaviors and factors associated with malaria risk in the agricultural farms in Metema and Gende Wuha (Amhara Region, Ethiopia), and to inform the design of new targeted malaria prevention interventions at the farms and/or in the low-transmission home kebeles.

Overview

Introduction and objectives

This was a descriptive mixed methods study using quantitative and qualitative methods.

Given that there was substantial prior evidence that the migrant workers were at high risk of becoming infected at the farms and bringing their malaria back to their homes, we focused on several key a priori assumptions. That is, we assumed that the options for reducing the malaria risk and the risk of importation back to their homes included:

- Reducing the risk of transmission at the farms (the source) through enhanced prevention and prompt case management; and/or
- Reducing the risk of importing malaria back to their homes (the possible spread) by:
    - Clearing infections prior to their departure for home.
    - Clearing infections immediately upon their return home.

Thus, the investigations focused on these specific issues.

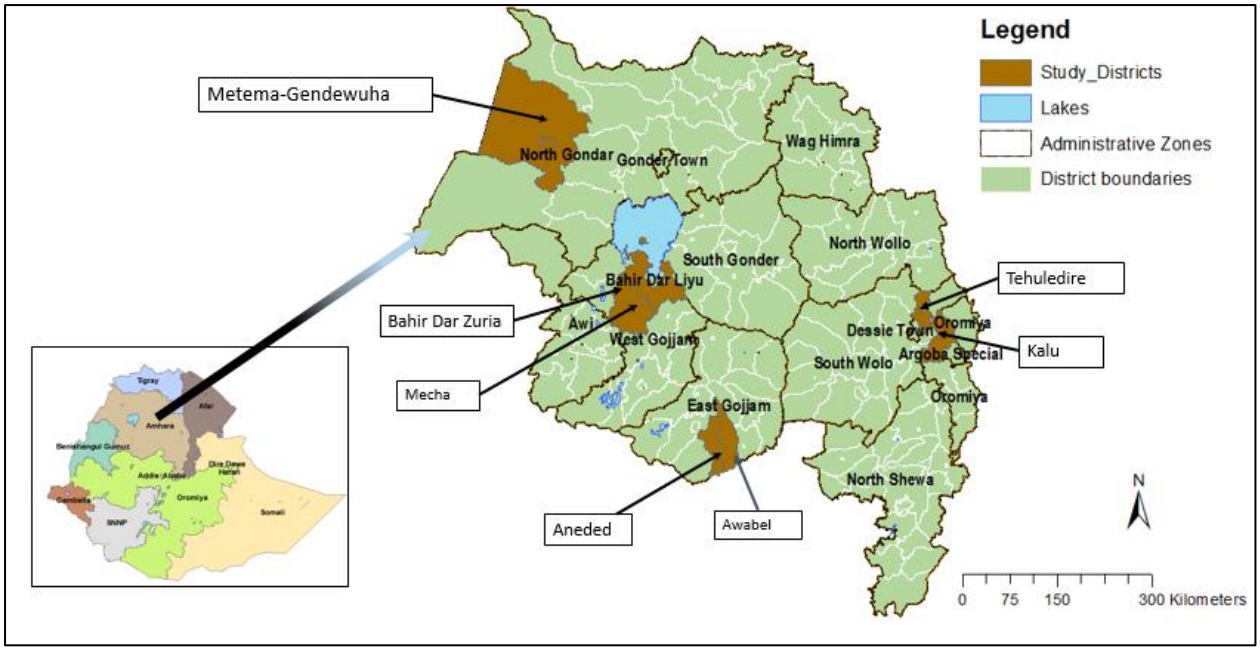
The quantitative methods included a cross-sectional farm assessment survey using a standardized questionnaire, and collection of surveillance data on travel history in malaria cases from individual patient logs from the outpatient department (OPD) register book. Qualitative methods employed were key informant interviews (KII), focus group discussions (FGD), and direct observations. Five objectives of the pilot project were defined:

1. Describe the temporal and spatial population movement within Amhara related to malaria risk.
2. Map and update information on basic characteristics of all agricultural farms in Metema and Gende Wuha (Amhara Region), Ethiopia.
3. Conduct a landscape analysis of a subset of farms to describe farm operations, malaria risk-related behaviors, and current malaria control strategies, and identify potential malaria prevention and control strategies to be implemented at the farms.
4. Assess perspectives and feasibility of potential malaria interventions to be implemented at farms.
5. Implement a strategy to clear malaria from returning seasonal migrant workers in their home kebeles and evaluate feasibility and acceptability pre- and post-implementation.

Study Sites

This study was conducted in two areas: source and spread areas. The source area is the location of the large-scale agricultural farms that migrant workers travel to for seasonal work. Spread areas are the home kebeles that migrant workers travel from (Figure 1).

Figure 1: Location of study districts in Amhara Region, Ethiopia



Metema District was selected as a source area as there are 308 agricultural farms employing migrant workers there, and the year-round malaria prevalence rate is 5–7%.

Mecha and Bahir dar Zuria districts were chosen as spread areas because they are the closest project districts to the source area.

Methods (summary)

To address the evaluation objectives we used qualitative and quantitative methods that are commonly used (see Table 1). A high level description is provided below, with further details about their implementation given in the objectives sections of this report.

Table 1: Methods used to address the five objectives

Objectives	KII	FGD	Farm Assessment survey	Evaluation of health posts registers information
Objective 1: Describe the temporal and spatial population movement within Amhara related to malaria risk				x
Objective 2: Map and update information on basic characteristics of all agricultural farms in Metema and Gende Wuha, Amhara Region, Ethiopia			x	
Objective 3: Identify potential malaria prevention and control strategies to be implemented at the farms			x	
Objective 4: Identify potential malaria interventions to be implemented at farms	x	x		

Objective 5: Evaluate feasibility and acceptability of implementing a strategy to clear malaria from returning seasonal migrant workers in their home kebeles	x	x		

For Objective 1, between October 2014 to 2016, a total of 9,150 outpatient records with 15 data elements were transcribed from OPD register books (94%) and from integrated community case management (ICCM) (6%)—excluding patient records that had no travel history and were RDT-negative—in 136 health posts within six elimination demonstration districts of Amhara National Regional State.

Information gathered from each case included 15 data elements: health post name, date of visit, residence kebele, age, sex, RDT result by species, travel history in the last month, origin/destination of travel (region and district), fever, treatment, and promptness of treatment. Surveillance assistants (SAs) conducted weekly data extractions from the OPD registers using DHIS2 patient tracker electronic forms from October 2014 to October 2016.

Descriptive analysis of all collected data elements were conducted and maps showing the temporal and spatial population movement within Amhara related to malaria risk were constructed (see Figures 6 and 7).

For Objective 2, we mapped 285[2] agricultural farms (per Metema District Health Office) located in Metema capital Gende Wuha (source areas). Using smartphone with ODK Collect, SAs went to each farm and collected geo-reference coordinates (longitude and latitude), information on the number of employees hired at the peak season, and the size of farm in hectares. Maps showing the location of all the farms, including size of farm and number of employees hired, were created (see Figure 8).

For Objective 3, we administered a farm assessment cross-sectional survey with a subset of 102 farm owners/managers to gather information on farm operations, assessment of malaria risk-related behaviors, and current malaria control strategies on the farms.

Standardized farm assessment questionnaires were completed by SAs using touch-screen phones and the ODK electronic data collection tool. Internal consistency checks were set up to minimize the chance of data entry errors. After collection, data was sent to a secure, maintained central server. Field supervisors reviewed the questionnaires before transmission and ensured that all the data were correctly transmitted. Statistical analyses were conducted using Stata software 13.1 (Statacorp, College Station, TX) to generate descriptive statistics of categorical and continuous variables (see Tables 3–8 and Figures 3–5).

To address Objective 4, we conducted focus group discussions (FGDs) and key informant interviews (KIIs) to understand the feasibility and perspectives of potential malaria interventions to be implemented at farms in source areas. Five FGDs were conducted with migrant laborers and 14 KIIs were conducted with seven farm managers/owners, two health worker/officers, one labor association representative, one administrative official, one environmental and land protection officer, and one labor and social affairs officer.

[2] 23 farms were excluded for missing GPS coordinates and/or missing information on farm size or number of employees hired.

A focus group discussion is a semi-structured conversation between a collection of individuals (ideally 8–12 participants), an experienced facilitator (who guides the discussion), and a note-taker. FGDs aim to collect participants' knowledge and perceptions about selected research topics and questions. Information collected through FGDs are not intended to be representative of the study population, but rather strive to investigate in-depth, issues that are pertinent to key stakeholders.

Key informant interviews are qualitative, in-depth interviews with people who know what is going on in the community. The purpose of KIIs are to collect information from a wide range of people—including community leaders, professionals, or residents—who have first-hand knowledge about the community. These community experts, with their particular knowledge and understanding, can provide insight on the nature of problems and give recommendations for solutions. KIIs are one-on-one conversations between a stakeholder and an interviewer.

The MACEPA team in Ethiopia and Seattle created topic guides for each the FGDs and KIIs. Topic guides covered community perception about a range of themes regarding the migrant laborers that included:

- Migrant laborers movement practices.
- Malaria knowledge, current prevention practices, and preferred prevention practices.
- Actions taken if a migrant laborer comes down with a fever or malaria.
- Farm working and living conditions (sleeping conditions, payment, etc.).
- Views on proposed potential intervention (whether it will work, problems, acceptability, etc.).
- Suggestions for future interventions
- Suggestions to improve migrant laborers' working conditions.

To initially address Objective 5, focus group discussions were conducted to help inform the design of a suitable intervention. A test and treat strategy was then implemented in four pilot spread kebeles to screen migrant workers upon their return home. Shortly after this strategy was implemented in four home kebeles, four FGDs with health extension workers (HEWs), health development armies (HDAs), and SAs; four FGDs with returnee seasonal migrant workers; and four KIIs with community leaders were conducted to understand acceptability by the migrant workers and lessons learned during the implementation that can be used to improve the strategy. The MACEPA team created the topic guides for the FGDs with returnee migrant workers and structured them around a number of themes, which included:

- Timing and frequency of returning to their home kebele.
- Actions taken if a migrant laborer had a fever during past harvest season.
- Perceptions on being approached and referred for malaria testing and treatment.
- Concerns about getting tested.
- Acceptability, feasibility, and importance of the intervention.
- Suggestions to improve this proposed intervention.

Additionally, the MACEPA team created separate topic guides for the FGDs and KIIs with community leaders, HDAs, HEWs, SAs, school teachers, and students and structured them around a number of themes, which included:

- Acceptability, feasibility, and importance of the intervention.
- Perceptions on approaching and referring returning migrant workers for malaria testing and treatment.

- Concerns regarding how the intervention was conducted.
- Suggestions on how to improve the proposed intervention.

Qualitative data from focus group discussions and key informant interviews were cleaned and coded following transcription of the data. Seattle-based MACEPA staff conducted the qualitative analysis. This entailed using manual and computer-assisted methods (Ethnograph v6) to code and extract text corresponding to pre-structured themes and to identify emergent themes and patters in narrative data. The teams worked iteratively to refine codes and evaluate their content.

Results

Objective 1: Describe the temporal and spatial population movement within Amhara related to malaria risk

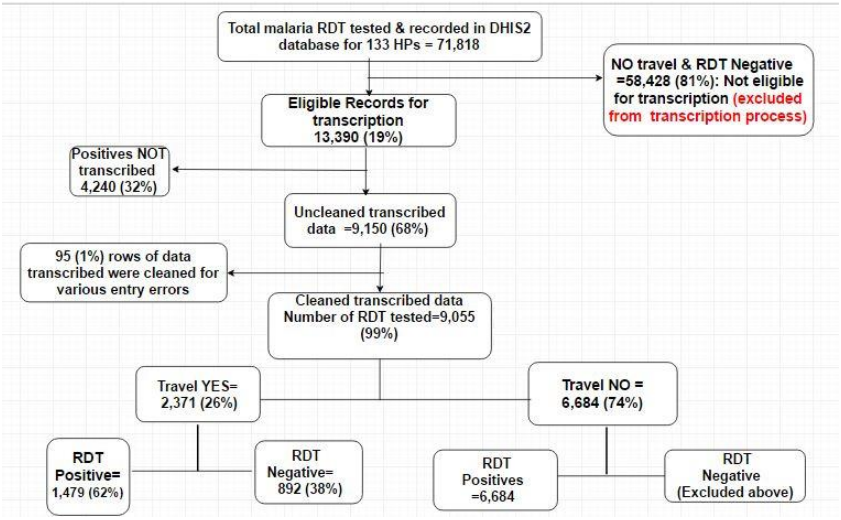
Between October 2014 and October 2016, a total of 71,818 outpatient visitors were RDT-tested and recorded in the OPD register in 133 health posts from six malaria elimination districts in Amhara Region. These districts were in low to moderate transmission areas located in the South Wollo, East Gojjam, and West Gojjam administrative zones of Amhara Region. Two districts were excluded since they were infection source areas—the destination for most migrant workers and with highest intensity of transmission in the region.

Table 2: List of zones and woredas included and excluded from OPD data transcription

Zone	Included woredas	Excluded woredas
East Gojjam	Aneded	
	Awabel	
South Wollo	Kalu	
	Tehuled	
West Gojjam	Bahir Dar	
	Mecha	
North Gondar		Metema
		Gende Wuha

Of these records, 9,150 (13%) were transcribed into the DHIS2 Event Capture app based on the inclusion and exclusion criteria. Outpatients with no travel history and who were RDT-negative (81%) were excluded from transcription. Ninety-five transcribed records (1%) were further excluded from the analysis due to missing information, thus a total of 9,055 visits were included in the analysis. Figure 2 shows a flow chart of the OPD data transcription process for the period October 2014–October 2016.

Figure 2: Flow Chart showing the OPD Data transcription process in 133 health posts from six malaria elimination districts in Amhara Region, October 2014–October 2016



The following tables show descriptive analysis of all outpatient visits included in the analysis (RDT-positive or negative individuals with travel history and RDT-positive individuals without travel history).

Table 3 shows the age and sex distribution of all outpatients. Among 9,044 recorded patients, 75% were male and over 42% of them were between the ages of 20 and 40.

Table 3: Sex and age distribution of patients recorded on the OPD register for individuals with travel history or without travel history but with a positive RDT in 133 health posts of six malaria elimination districts, Amhara Region, October 2014–October 2016

	All patients*				Patients with travel history			
Age Group (Years)	Females	Males	Total	Overall % of age group	Females	Males	Total	Overall % of patients with travel history
< 5	387 (47%)	430 (53%)	817	9%	22 (44%)	28 (56%)	50	2%
5-9	238 (36%)	422 (64%)	660	7%	21 (48%)	23 (52%)	44	2%
10-14	295 (23%)	984 (77%)	1279	14%	27 (20%)	111 (80%)	138	6%
15-19	288 (17%)	1405 (83%)	1693	19%	58 (13%)	385 (87%)	443	19%
20-44	844 (22%)	2945 (78%)	3789	42%	214 (15%)	1239 (85%)	1453	61%
45 and above	205 (25%)	601 (75%)	806	9%	31 (13%)	209 (87%)	240	10%
	2257 (25%)	6787 (75%)	9044	100%	373 (16%)	1995 (84%)	2368	100%

**Note: There were 11 cases with missing values.*

Among the RDT-positive malaria patients, 75% were male, 26% had travel history and 41% of infections were due to *P. vivax*, 36% were due to *P. falciparum*, and 23% due to mixed infections

(Table 4). *P. falciparum* (including *P. falciparum* or mixed) infections were more frequent among travelers than non-travelers.

Table 4: RDT-positive malaria cases by sex and travel history in 133 health posts of six malaria elimination demo districts in Amhara Region, October 2014–October 2016

	With travel history				With no travel history			
Sex	Pf	Pv	mixed	Total	Pf	Pv	mixed	Total
Males	455 (36%)	415 (32%)	408 (32%)	1278 (86%)	1756 (37%)	1924 (40%)	1113 (23%)	4793 (72%)
Females	61 (31%)	81 (41%)	58 (29%)	200 (14%)	625 (33%)	963 (51%)	297 (16%)	1885 (28%)
Total	516 (35%)	496 (34%)	466 (32%)	1478	2381 (36%)	2887 (43%)	1410 (21%)	6678

Note: Eight records with missing data on sex.

The majority of malaria cases with travel history were males 20–44 years old (Table 5). The percentage of cases due to *P. vivax*-only decreased with age both in travelers and non-travelers, whereas *P. falciparum* (*P. falciparum* or mixed) increased with age.

Table 5: Distribution of RDT-positive malaria cases by species and age group among patients with and without travel history in 133 health posts of six malaria elimination districts, Amhara Region, October 2014–October 2016

	With no travel history					With travel history				
Age Group	Pf	Pv	mixed	Total	Overall % of positive RDT patient with no travel history	Pf	Pv	mixed	Total	Overall % of positive RDT patient with travel history
< 5	206 (27%)	463 (60%)	98 (13%)	767	11%	3 (21%)	8 (57%)	3 (21%)	14	1%
5-9	174 (28%)	309 (50%)	133 (22%)	616	9%	3 (11%)	16 (59%)	8 (30%)	27	2%
10-14	377 (33%)	484 (42%)	281 (25%)	1142	17%	24 (24%)	39 (38%)	39 (38%)	102	7%
15-19	431 (34%)	510 (41%)	309 (25%)	1250	19%	93 (28%)	117 (35%)	122 (37%)	332	22%
20-44	949 (41%)	892 (38%)	499 (21%)	2340	35%	348 (39%)	279 (31%)	271 (30%)	898	61%
45 and above	246 (43%)	232 (41%)	91 (16%)	569	9%	46 (43%)	37 (35%)	23 (22%)	106	7%
Total	2383 (36%)	2890 (43%)	1411 (21%)	6684	100%	517 (35%)	496 (34%)	466 (32%)	1479	100%

Note: two cases with no travel history had missing information on age.

Among outpatients with information on history of fever and time to treatment, 8% had reported fever within the last 24 hours and about 24% sought prompt treatment in the last 24 hours (Table 6). No major differences were detected among the different age groups.

Table 6: Onset of fever and promptness to treatment in the last 24 hours for all individuals included in the analysis (RDT-positive or negative with travel history or RDT-positive without

travel history) in 133 health posts of six malaria elimination districts, Amhara Region, October 2014–October 2016

	Fever within the last 24 hours*			Promptness to treatment in the last 24 hrs.		
Age Group	Yes	No	Total	Yes	No	Total
< 5	44 (6%)	710 (94%)	754	92 (25%)	281 (75%)	373
5-9	60 (10%)	535 (90%)	595	155 (25%)	471 (75%)	626
10-14	83 (7%)	1081 (93%)	1164	279 (22%)	995 (78%)	1274
15-19	112 (7%)	1474 (93%)	1586	368 (22%)	1314 (78%)	1682
20-44	290 (8%)	3188 (92%)	3478	957 (25%)	2814 (75%)	3771
45 and above	57 (8%)	693 (92%)	747	157 (19%)	649 (81%)	806
Total	646 (8%)	7681 (92%)	8327	2008 (24%)	6524 (76%)	8532

*Note: Though there were 9055 transcribed data records, only hose with complete information were included in the analyses. *Fever variable was not recorded for all patients.*

The overall mean age of all recorded and transcribed OPD patients was 22.2 (SD 14.1), and there were significant differences between males (22.7 (SD 13.6)) and females (20.7 (SD 15.4)). Figure 3 below shows the age distribution of outpatients with and without travel history and by sex.

Figure 3: Histogram plots of age of OPD visitors recorded and transcribed (n=9044) by sex and travel history in 133 malaria elimination districts, Amhara Region, Ethiopia, 2014–2016

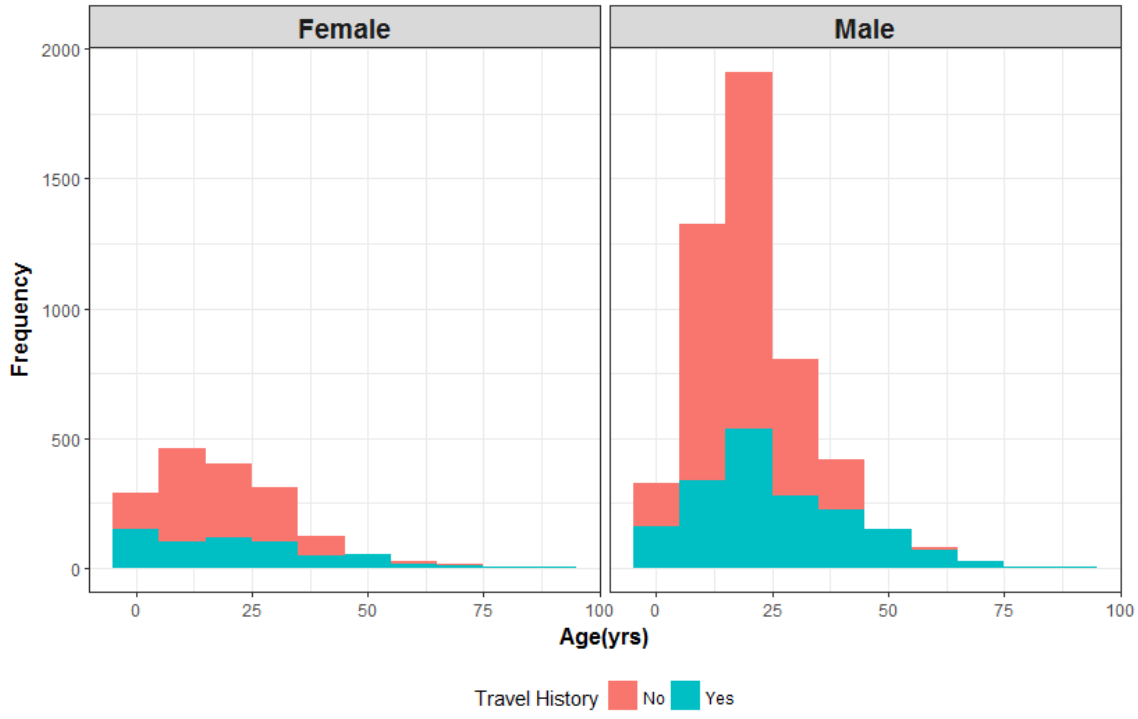
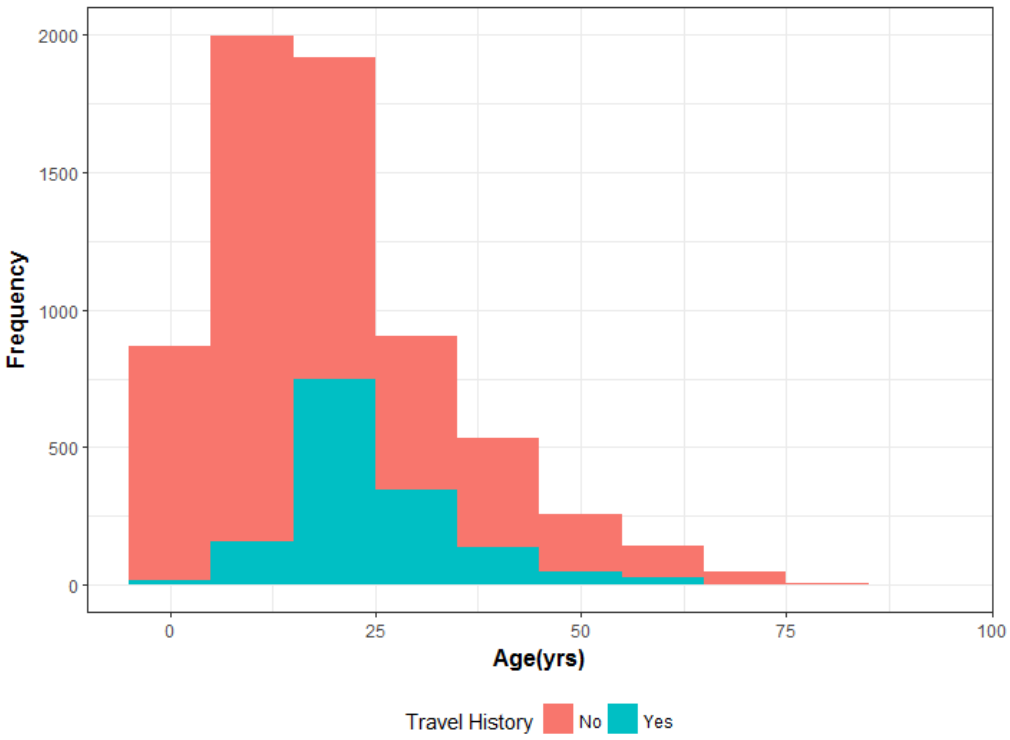
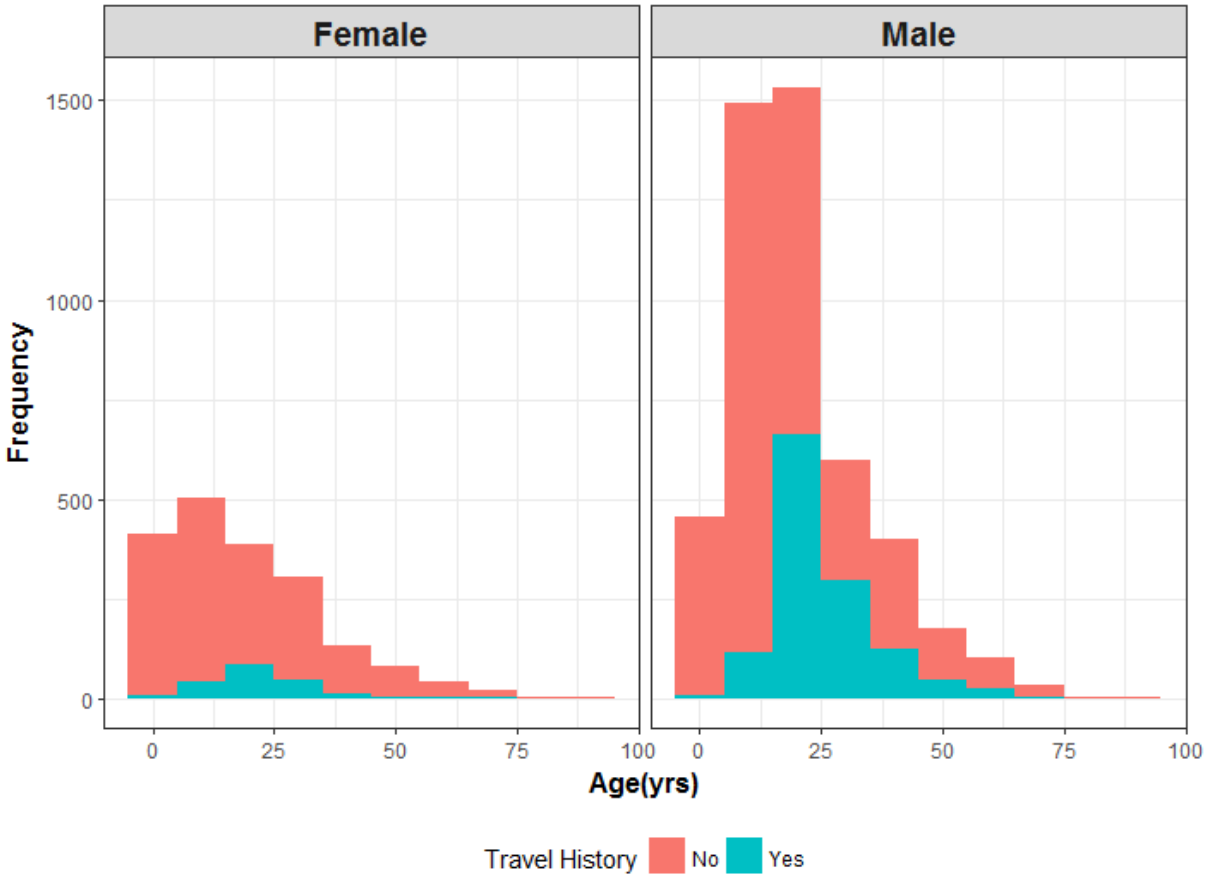


Figure 4: Age histogram plots of RDT-positive malaria cases by travel history, Amhara Region, Ethiopia, 2014–2016



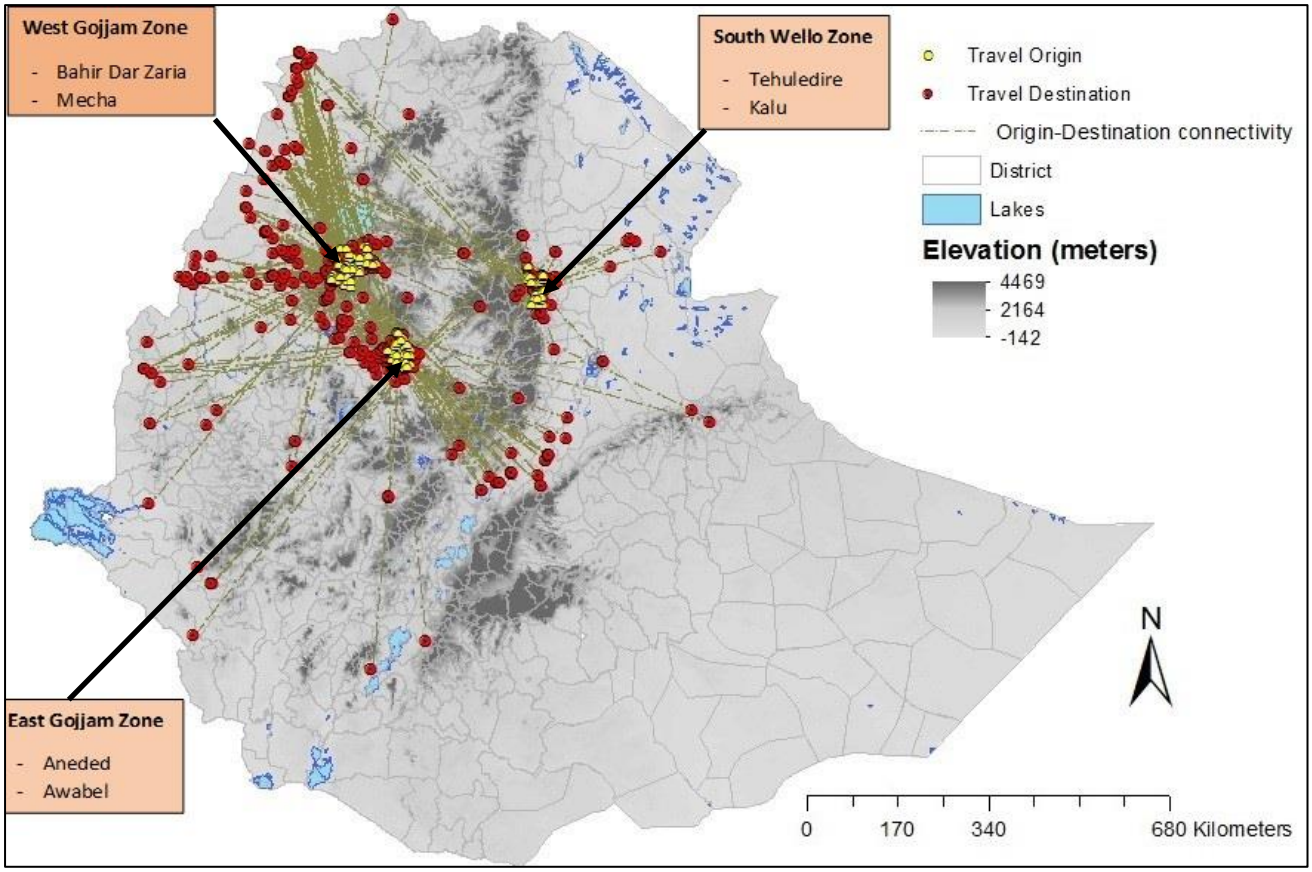
The overall mean age of RDT-positive malaria cases (n=8155) was 20.8. (SD 12.9) years. In RDT-positive cases with travel history it was significantly higher (25.1 (SD 10.7 years)) than in RDT-positives with no travel history (20.6 (SD 14.8 years)). Similarly, the mean age difference between RDT-positive males (21.4 (SD 13.9 years)) compared to females (20.0 (SD 15.4 years)) was also statistically significant. Figure 5 shows histogram plots of the age of RDT-positive malaria cases by sex and travel history.

Figure 5: Histogram plots of the age of RDT-positive malaria cases (n=8155) by sex and travel history in six malaria elimination districts, Amhara Region, October 2014–October 2016



Figures 6 and 7 show location travel patterns between and within a district in Amhara Region and other regions in Ethiopia. Of the total 2,371 patients who had travel history in the previous month, about 87% had destination location record (i.e., either region, zone, woreda or kebele destination). Geo-reference coordinates of destination locations were then manually recorded from multiple sources, mainly from census village and district maps of the country (CSA, 2007).

Figure 6: Location of migrant workers' permanent residence (yellow color), destination place (red color), and their connectivity (green dotted line) with altitude overlay in six malaria elimination districts, Amhara Region, October 2014–October 2016

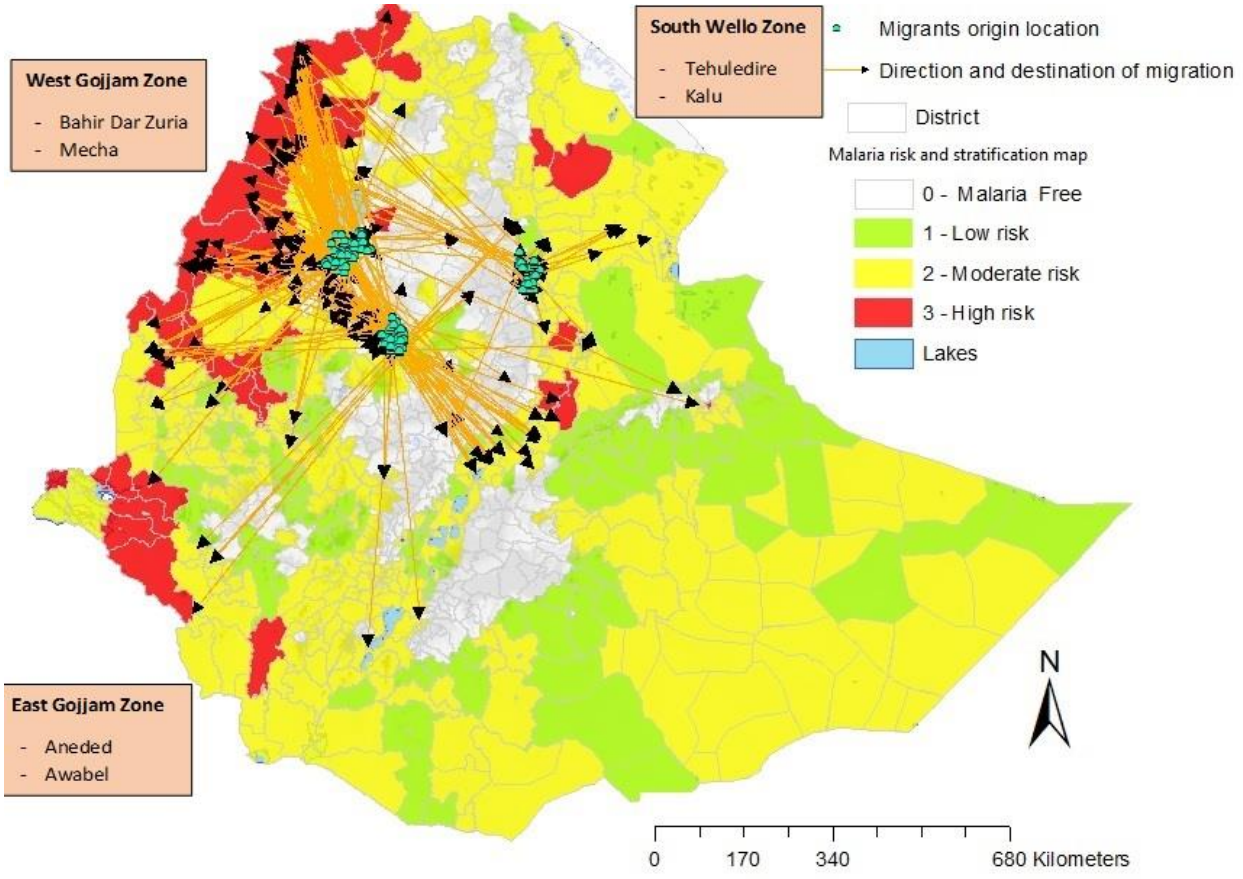


Note: several migrant workers from the same or different residences can travel to the same destination location.

Of the total 2,068 travelers, 69% traveled within the Amhara Region while 31% traveled to other regions such as Tigray (19%), Oromia (6%), Benishangul-Gumiz (5%), Afar (3%), SNNPR (2%), and Gambella (1%) (Figure 6). The destination locations for 33% of travelers were large agricultural farms located in the western lowlands along the border with Sudan. Of these, around 29% were from Mecha and 6.4 % were from Bahir Dar Zuria districts. Approximately 43% of travelers moved to different villages within their home district. The majority of travelers (65–70%) from Aneded and Awabel districts traveled to local, agriculturally rich farms in the districts near Malgash and Dima villages, respectively. Almost all travelers from Tehuledire and Kalu traveled to the Afar region, such as Chifra, Dubti, and neighboring areas. Generally, the movement patterns of seasonal agricultural workers appear to differ according to location of origin, distance, and presence of large agricultural farms.

Recently, kebeles close to the Nile Valley are becoming big agricultural farms and several seasonal agricultural laborers from highland locations are being attracted to these farm areas. Similarly, most destination locations in the western lowlands are largely agricultural farms that attracts seasonal migrant workers from mid- and highland areas with low to moderate malaria transmission. As a result, many of these seasonal migrant workers return with untreated malaria infections until they get treatment services at health facilities back at home.

Figure 7: Movement direction and destination of seasonal migrant workers from six malaria elimination districts in relation to the different levels of malaria risk (categorized as high, moderate, low and free) in Ethiopia, October 2014–October 2016



Source: This district-based malaria risk and stratification map in Ethiopia was developed by PATH/MACEPA and FMOH, February 2017 (FMOH Malaria Program Review document, 2017).

Definition of malaria risk:

- High: districts with >100 annual parasite incidence (API) per 100,000 population.
- Moderate: districts with ≤5 and ≥100 API per 100,000 population.
- Low: districts with >0 and <5 API per 100,000 population.

As seen in Figure 7, most travelers move to the western lowlands located along the Sudan border, which are categorized as high malaria risk (API >100 per 100,000 population). These western development corridors are general considered as sources of malaria infection for most mid- and high-altitude areas not only for the malaria elimination project districts in Amhara Region but also for other similar districts in the country. Current and future trends also indicate an increasing flow of seasonal migrant workers to the currently expanding large agricultural development farms in the western lowlands and to river valleys with irrigation farms.

Key findings

Of the total 9,044 recorded patients, 75% were males and 42% were adults aged 20–44 years.

18% of the total 8,163 RDT-positives for malaria patients had a travel history within the past 30 days.

85% of the total 2,368 travelers were males and 61% of the total travelers were adults (85% males versus 15% female).

62% of the total RDT-tested travelers were positive for malaria. The percentage of *P. vivax* infections was higher among non-traveling patients than travelers.

About 65–70% of travelers from Aneded and Awabel districts traveled to few kebeles within each district and the neighboring districts Basoliben and Gozamin.

77% of travelers (607/787) from Mecha and Bahir Dar Zuria districts traveled to the western agricultural Humera, Mirab Arnachiho Metema, Quara, Jawi, Pawi, Dangur Mankush, Guba, Assosa areas.

Travelers from Tehuledire and Kalu districts traveled toward the east, mainly to districts of the neighboring Afar region such as Chifra, Dubti, and Assayita.

Most destination locations were high malaria risk areas and comprised large agricultural farms that attracted a high influx of seasonal laborers. Hence, returning travelers with untreated infections were likely to introduce malaria infections into their resident communities.

Objective 2: Map and update information on basic characteristics of all agricultural farms in Metema and Gende Wuha, Amhara Region, Ethiopia

Design and methods

A comprehensive list of all farms in Metema was provided by the Metema District Health Office—however, it did not include the GPS coordinates. There were 285 agricultural farms visited by surveillance assistants assigned to source area districts (see Figures 6 and 7) who collected geo-reference coordinates and basic characteristics of farms using a short standardized farm mapping and assessment questionnaire in ODK collect with Smartphones. Additional data was obtained from 102 farms which included: GPS location, maximum number of employees, the size of the farm (hectares), infrastructure (sleeping conditions, health facilities, malaria prevention techniques, etc.), and type of crop. To be included in this assessment, the farm had to be an agricultural farm in the source area (Metema). Farms that were non-crop farms such as animal fattening or husbandry were excluded.

Summary of findings

Of the 285 farms surveyed, 73.3% were less than 100 hectares in size.

On average, 146 employees (range 2–2,000) were hired per farm for weeding, 135 employees for harvesting (range 4–1,500), and only 35 employees for planting (range 1–450) (see Table 7 and Figure 11).

Regarding the type of crop grown by the farm, 95.1% of the farms grew sesame, 58.8% grew cotton, 59.8% grew sorghum, while 2% grew cowpea, and 1% grew teff (see Table 7).

Figure 8: Map of farms in Metema indicating size* of farm and number of employees hired

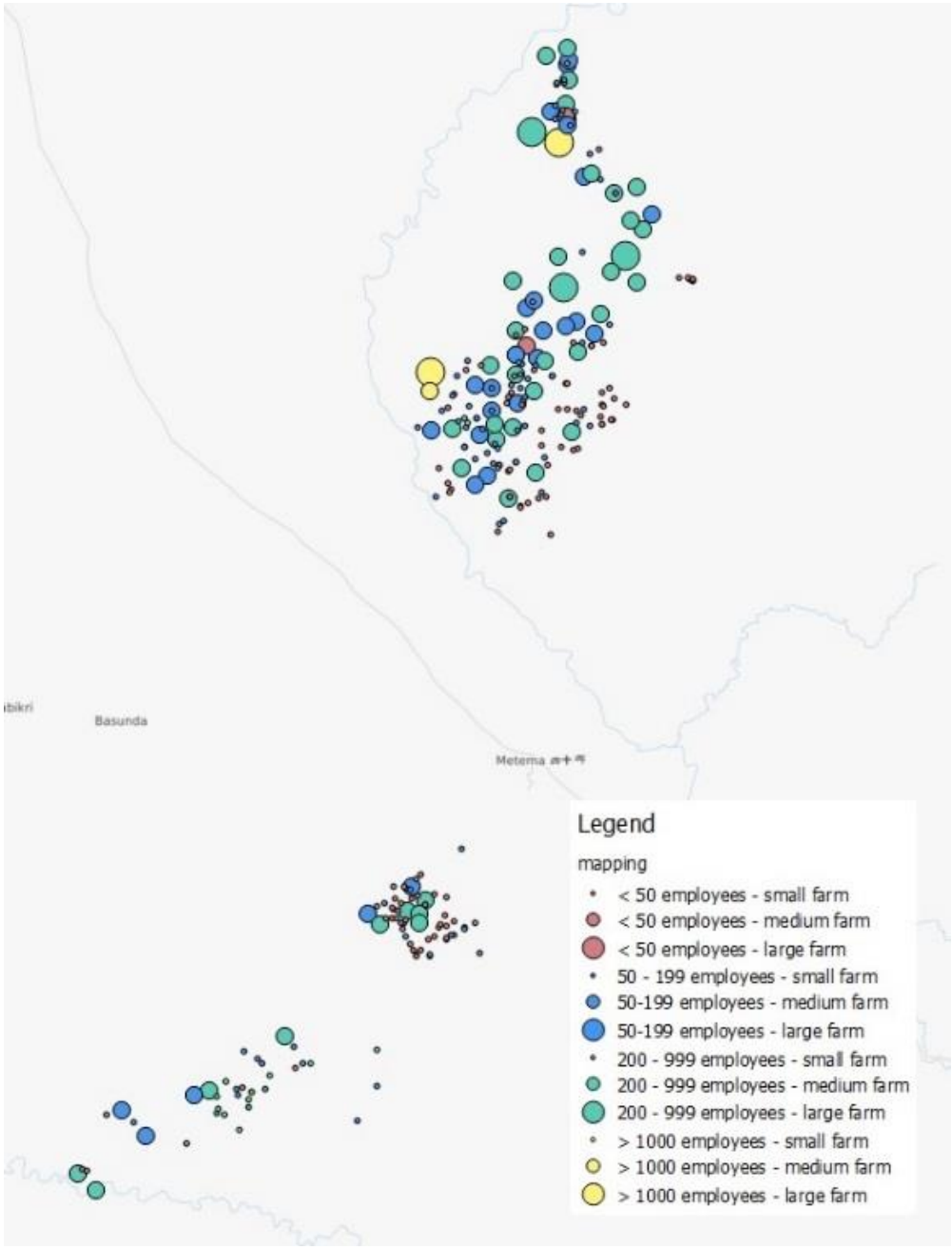


Figure 9: Close-up map of farms in Northern Metema indicating size* of farm and number of employees hired

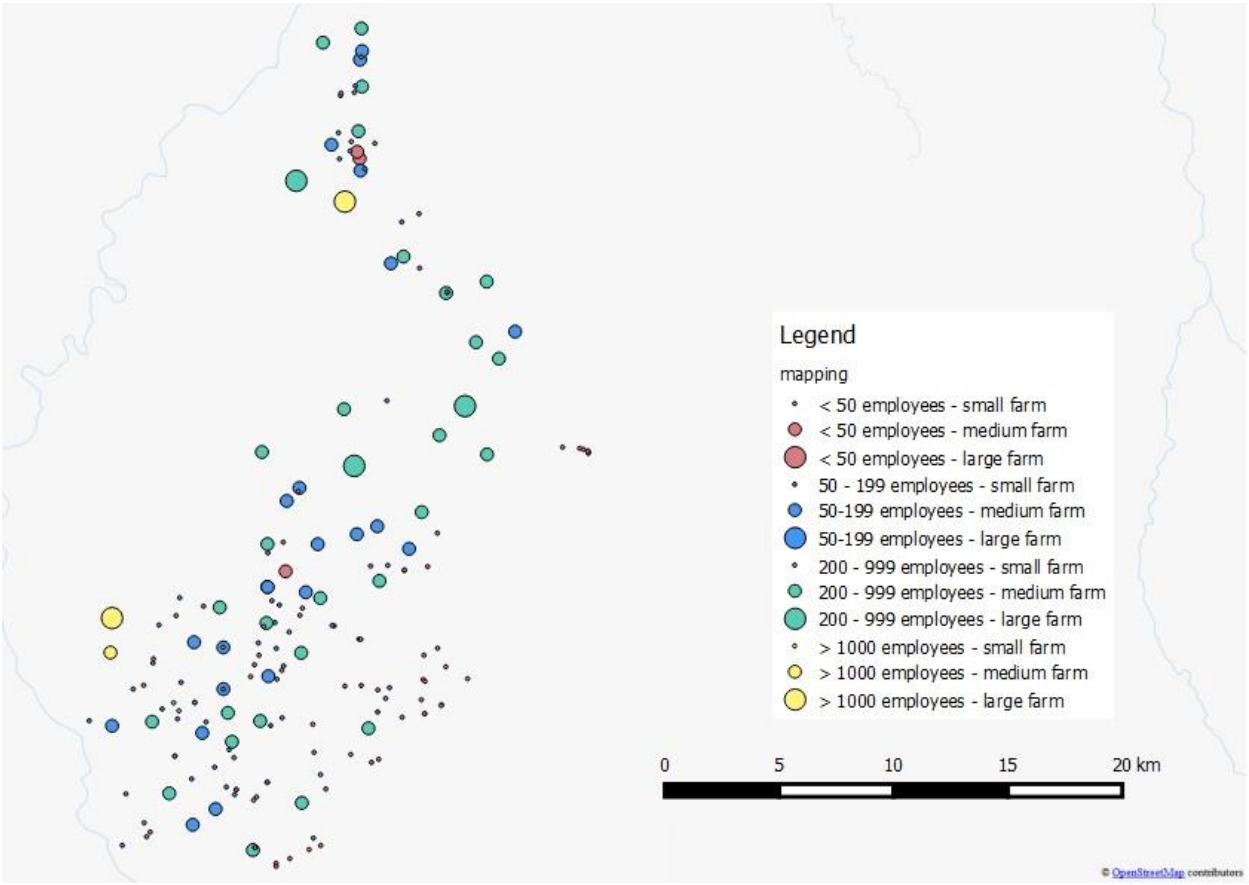
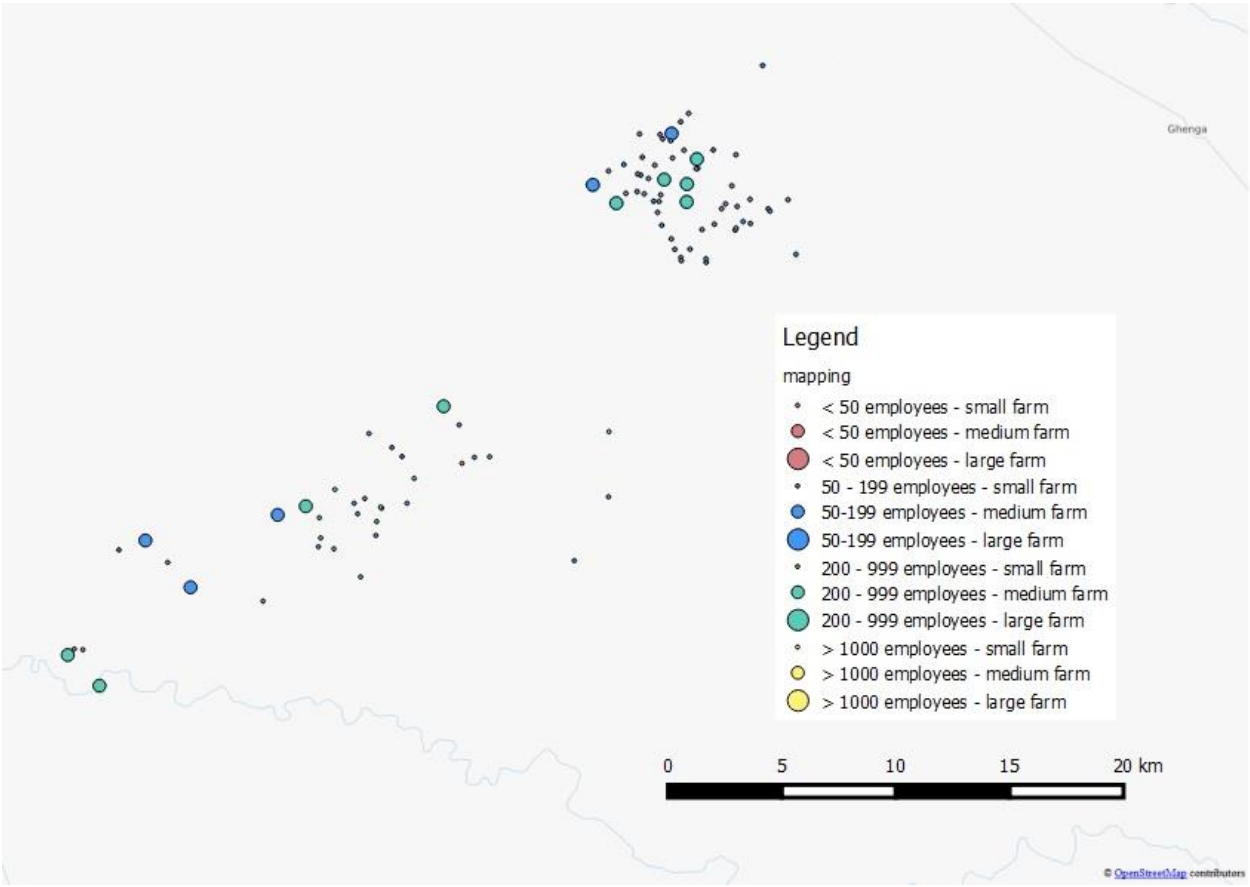


Figure 10: Close-up of map of farms in Southern Metema indicating size* of farm and number of employees hired

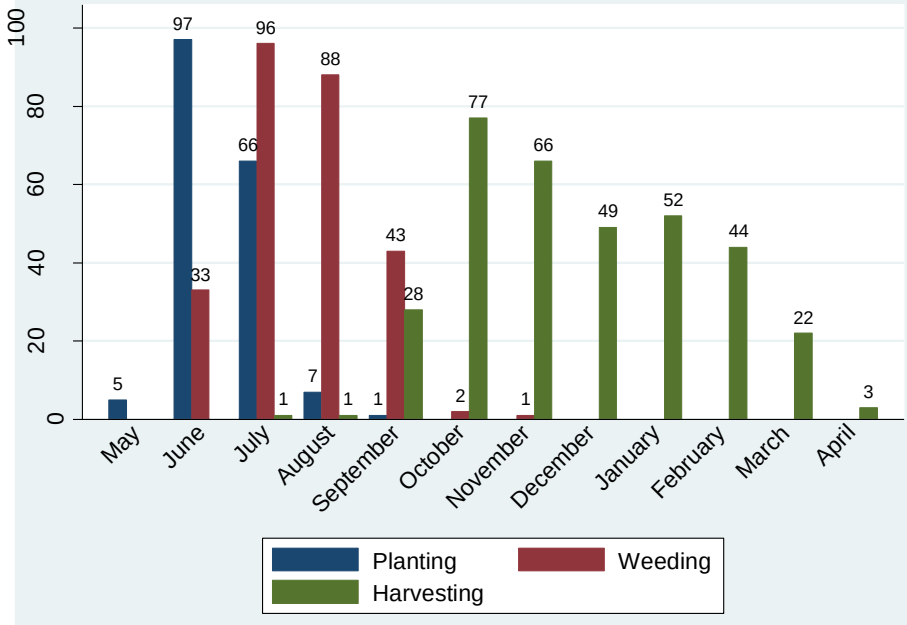


*Small farm = less than 100 hectares; medium farm = 100–499 hectares; large farm = more than 500 hectares

Table 7 Type of crops and general hiring information for planting, weeding, and harvesting at the peak season (102 farms)

	Farms with less than 50 employees (N=21)	Farms with 50 – 199 employees (N=39)	Farms with 200 - 999 employees (N=39)	Farms with more than 1000 employees (N=3)	Total (N=102)
Crop n (% (n/N))					
Sesame	20 (95.2)	38 (97.4)	36 (92.3)	3 (100.0)	97 (95.1)
Cotton	4 (19.0)	23 (59.0)	31 (79.5)	2 (66.7)	60 (58.8)
Sorghum	7 (33.3)	23 (59.0)	28 (71.8)	3 (100.0)	61 (59.8)
Cowpea	--	--	2 (5.1)	--	2 (2.0)
Teff	1 (4.8)	--	--	--	1 (1.0)
Number of farms who hire migrant workers n (% (n/N))					
Planting	21 (100.0)	39 (100.0)	39 (100.0)	3 (100.0)	102 (100.0)
Weeding	21 (100.0)	39 (100.0)	39 (100.0)	3 (100.0)	102 (100.0)
Harvesting	21 (100.0)	39 (100.0)	39 (100.0)	3 (100.0)	102 (100.0)
Number of employees hired n (average hired per farm (range))					
Planting	163 (12: 2-34)	1316 (36: 2-330)	4633 (119: 3-1300)	652 (217: 32-500)	6764 (35: 1-450)
Weeding	652 (21: 2-40)	5662 (69: 2-400)	18411 (192: 4-700)	6913 (864: 40-2000)	31638 (146: 2-2000)
Harvesting	697 (22: 4-70)	5549 (67: 6-200)	18406 (190: 5-1000)	5120 (640: 20-1500)	29772 (135: 4-1500)

Figure 11: Number of farms hiring laborers to plant, weed, and harvest and number of workers hired (n=102)



Objective 3: Identify potential malaria prevention and control strategies to be implemented at the farms

Design and methods

Of the 308 agricultural farms visited by surveillance assistants, 102 farms answered additional questions, including those regarding sleeping conditions, health facilities, and malaria prevention techniques. Surveillance assistants assigned to source area districts used a standardized farm assessment questionnaire (Annex 1) in ODK Collect with smartphones. As with Objective 2, to be included in this assessment the farm had to be an agricultural farm in the source area (Metema). Farms that were non-crop farms, such as animal fattening or husbandry farms, were not included in the subsample.

Summary of findings

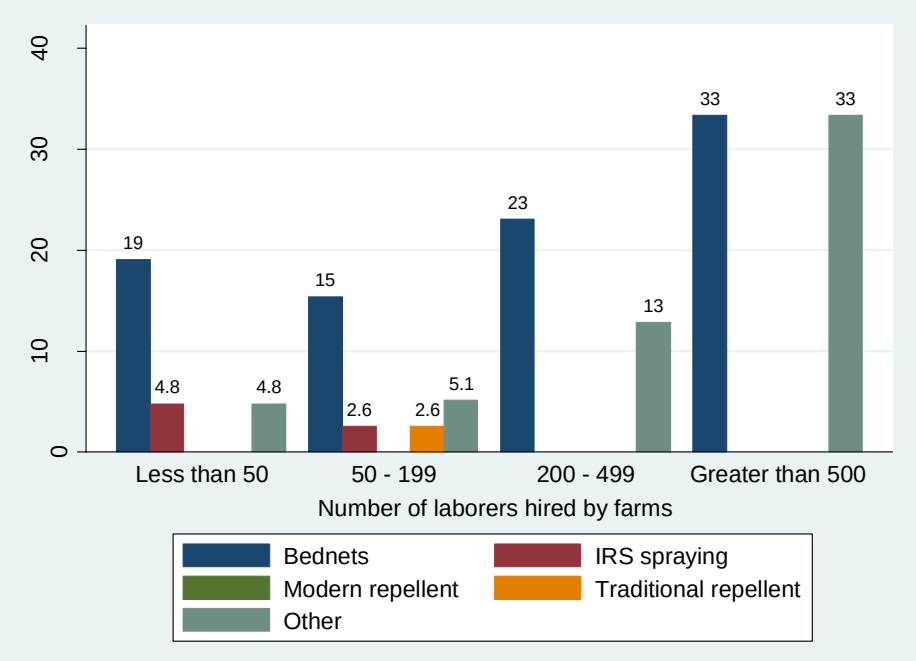
Only 24.5% of the farms conducted malaria control practices such as providing bednets, spraying, and sleeping quarters (see Table 8). 19.6% of the farms provided bednets, 2% sprayed sleeping quarters (there has not been a public IRS campaign but some farms spray permanent employee shelters), 1% offered traditional repellents, and 8.8% offered other malaria prevention techniques.

Formal healthcare was available at 30.4% of the farms, and of that 3.9% had access to an onsite temporary clinic, 9.8% had access to a temporary offsite health clinic, and 16.7% had access to a permanent offsite health clinic (see Tables 9–12).

Table 8 Migrant worker living conditions and malaria control methods practiced on the farms

	Farms with less than 50 employees (N=21)	Farms with 50 – 199 employees (N=39)	Farms with 200 - 999 employees (N=39)	Farms with more than 1000 employees (N=3)	Total (N=102)
Farms conducting malaria control practices n (%)	4 (19.0)	7 (17.9)	12 (30.8)	2 (66.7)	25 (24.5)
Migrants sleeping quarters n (% (n/N))					
Inside	20 (95.2)	38 (97.4)	39 (100.0)	2 (66.7)	99 (97.1)
Outside	1 (4.8)	1 (2.6)	--	1 (33.3)	3 (2.9)
Type of indoor housing n (% (n/N))					
Standard house	--	2 (5.1)	--	--	2 (2.0)
Temporary plastered shelter	--	--	1 (2.6)	--	1 (1.0)
Temporary un-plastered shelter	12 (57.1)	27 (69.2)	27 (69.2)	2 (66.7)	68 (66.7)
Corrugated iron sheet house	--	2 (5.1)	8 (20.5)	1 (33.3)	11 (10.8)
Tent	7 (33.3)	4 (10.3)	2 (5.1)	--	13 (12.7)
Other	2 (9.5)	7 (17.9)	3 (7.7)	--	12 (11.8)
Types of malaria control practices used n (% (n/N))					
Provide and distribute bednets to workers	4 (19.0)	6 (15.4)	9 (23.1)	1 (33.3)	20 (19.6)
Repellent	--	--	--	--	--
IRS of migrant quarters paid by farmer	1 (4.8)	1 (2.6)	--	--	2 (2.0)
Traditional repellent	1 (4.8)	--	--	--	1 (1.0)
Other	1 (4.8)	2 (5.1)	5 (12.8)	1 (33.3)	9 (8.8)
Hanging Bednet possible n (% (n/N))					
Yes	15 (71.4)	30 (76.9)	28 (71.8)	2 (66.7)	75 (73.5)
No	6 (28.6)	9 (23.1)	11 (28.2)	1 (33.3)	27 (26.5)

Figure 12: Type of malaria control practices offered to the migrant workers by the 25 farms that are currently offering them (%)



Note: "Other" refers to source reduction activities such as drainage, filling, clearing, etc.

Table 9 General information regarding informal and formal healthcare services

	Farms with less than 50 employees (N=21)	Farms with 50 – 199 employees (N=39)	Farms with 200 - 999 employees (N=39)	Farms with more than 1000 employees (N=3)	Total (n=102)
Informal "Healthcare" farm camp based illegal vendors					
Access to Informal healthcare n (% (n/N))					
Yes	8 (38.1)	14 (35.9)	16 (41.0)	2 (66.7)	40 (39.2)
No	13 (61.9)	25 (64.1)	23 (59.0)	1 (33.3)	62 (60.8)
Informal healthcare services n (% (n/N))					
Malaria diagnosis	0 (0.0)	1 (2.6)	1 (2.6)	2 (66.67)	4 (3.9)
Malaria treatment	8 (38.1)	14 (35.9)	15 (38.5)	2 (66.67	39 (38.2)
Other	2 (9.5)	2 (5.1)	5 (12.8)	0 (0.0)	9 (8.8)
Mean cost per visit for informal healthcare (Ethiopian birr)	81.25	52.5	93.4	25	73.25
Formal Healthcare					
Access to formal healthcare n(%)					
Yes	7 (33.3)	6 (15.4)	16 (41.0)	2 (66.7)	31 (30.4)
No	14 (66.7)	33 (84.6)	23 (59.0)	1 (33.3)	71 (69.6)
Type of formal healthcare available n(%)					
Onsite Temporary Clinic	0 (0.0)	0 (0.0)	2 (5.1)	2 (66.7)	4 (3.9)
Offsite Health Clinic: Temporary	1 (4.8)	3 (7.7)	6 (15.4)	0 (0.0)	10 (9.8)
Offsite Health Clinic: Permanent	6 (28.6)	3 (7.7)	8 (20.5)	0 (0.0)	17 (16.7)

Table 10 Information regarding onsite temporary healthcare

	Farms with less than 50 employees (N=0)	Farms with 50 – 199 employees (N=0)	Farms with 200 - 999 employees (N=2)	Farms with more than 1000 employees (N=2)	Total (N=4)
Onsite temporary healthcare					
Mean minutes to onsite temp healthcare	--	--	2.5	12.5	7.5
Malaria diagnosis available	--	--	1 (50.0)	1 (50.0)	2 (50.0)
Malaria treatment available	--	--	2 (100.0)	1 (50.0)	3 (75.0)
Mean cost per visit	--	--	0	0	0

Table 11 Information regarding offsite temporary healthcare

	Farms with less than 50 employees (N=1)	Farms with 50 – 199 employees (N=3)	Farms with 200 - 999 employees (N=6)	Farms with more than 1000 employees (N=0)	Total (N=10)
Offsite Temporary Healthcare					
Malaria diagnosis available	1 (100.0)	3 (100.0)	6 (100.0)	--	10 (100.0)
Malaria treatment available	1 (100.0)	2 (66.7)	6 (100.0)	--	9 (90.0)
Mean cost of per visit	80	103.3	41.7	--	64
Mean minutes to healthcare	60	56.7	38.3	--	46
Mean cost of travel to healthcare	0	16.7	1.7	--	6

Table 12 Information regarding offsite permanent healthcare

	Farms with less than 50 employees (N=6)	Farms with 50 – 199 employees (N=8)	Farms with 200 - 999 employees (N=8)	Farms with more than 1000 employees (N=0)	Total (N=17)
Offsite Permanent Healthcare					
Malaria diagnosis available	6	3 (7.7)	8 (20.5)	--	17 (16.7)
Malaria treatment available	6	2 (5.1)	8 (20.5)	--	16 (15.7)
Mean cost of visit	8.33	0 (0.0)	62.5	--	32.5
Mean minutes to healthcare	145	153.3	153.8	--	150.6
Mean cost of travel to healthcare	18.3	36.7	50	--	36.5

Objective 4: Identify potential malaria interventions to be implemented at farms

Purpose and objectives

To understand migration, work conditions, knowledge of malaria, current malaria treatment, current malaria prevention activities, proposed intervention, and future malaria prevention activities.

Design and methods (FGD)

Five FGDs and 14 KIIs were conducted at the source region in Metema. To be eligible for participation in an FGD, all potential recruits had to be a seasonal worker for at least one month in the previous growing season at a subset of farms included in Objective 3 and over the age of 18. All interviews were conducted over four weeks from September 3 to October 5. In the five focus groups, 44 migrant workers participated with groups consisting of 7–10 participants. KIIs were conducted with seven farm managers/owners, two health worker/officers, one labor association representative, one administrative official, one environmental and land protection officer, and one labor and social affairs officer.

An experienced facilitator and note-taker led the FGDs using the topic guides and followed best practices for FGDs. The FGDs were all conducted in Amharic. All FGDs were recorded with a digital audio recorder and were documented by a note-taker. Prior to the beginning the FGD, each discussant verbally consented to participate and to be recorded. Discussants were also informed that they were free to ask questions related to the study as well as overall malaria control and prevention activities.

Following the FGDs, the facilitator and note-taker reviewed raw notes and audio recordings and then drafted summary notes; they then translated the Amharic notes into English. Members of the Seattle team then reviewed and analyzed the summary notes using Ethnograph. Thematic analysis was conducted by comparing responses between groups and by applying pre-defined and emergent codes to identify and sort themes in the data.

Summary of findings (FGDs and KIIs)

This section summarizes FGD findings and organizes them according to themes corresponding to the topic guides. More detailed findings with quotations from FGD participants are in Annex 2.

Migration patterns

Among the findings related to migration patterns:

- All of the migrant workers interviewed stated that they arrived at the camps in July or August.
- Some migrant laborers returned home during the holiday (Ethiopian New Year) and returned for the harvest season.
- Students did not return for the harvest.
- Once the harvest was complete, migrant laborers generally returned home in November.
- The majority of migrants stated that they worked on several farms during the season, and only two migrants stated that they stayed at the same farm.

Working/sleeping conditions

Most migrant laborers stated that they did not come to Metema for anything other than work and to make money. Only a few stated that they were provided with a shelter of corrugated iron and mud, the majority slept in grass thatched hamlets or slept outside.

Knowledge of malaria

All migrant laborers knew what malaria was and almost all stated that they had had malaria in the past.

The majority of the migrant laborers stated that they received medication (three listed Coartem) from the farm manager when they felt malaria-like symptoms without being tested for malaria. Only one responded that they sought immediate treatment at a health post.

When migrant laborers purchased medication from the farm managers it was deducted from their pay.

Many migrants and key informants stated that the health facility was too far away to reach at the first sign of symptoms and only if a case was severe did individuals seek treatment.

Current malaria prevention practices

Among current malaria prevention practices noted:

- Half of the migrant laborers did not use any malaria prevention materials.
- Half stated that they used a bednet or used a friend's bednet.
- One migrant reported that the sleeping quarters had been sprayed.
- The majority of migrant laborers did not know about repellents.

Preferred malaria prevention practices

When asked, half of the migrant laborers responded that they preferred bednets because bednets protected them from mosquitos and scorpions and they could take the bednets with them from farm to farm.

Half of the migrant workers preferred both bednets and repellents, saying they liked repellents because repellents protected them while working at night and while sleeping outside.

Two migrant laborers wished that there was proper water drainage to remove mosquito breeding grounds.

When asked about their preferred malaria prevention at home, half stated bednets, half stated spraying, some stated clean and drain water, some stated repellents, and some stated test and treat.

Everyone agreed that there is a critical need to provide malaria prevention materials to migrant laborers working in Metema. However, the number of migrants and the remoteness and size of the region makes any intervention difficult and expensive to administer. Additionally, there is not agreement on who would be responsible for these activities.

Two KIIs suggested farms should provide bednets and repellents to its workers while all six farm managers stated that they could not afford the cost of supplying the materials. Five farm managers suggested that migrant laborers could buy a bednet upon arrival and that it would be deducted from their pay. All six farm managers agreed that they would participate if the government issued bednets or repellents to the migrant laborers. Two KIIs stated that the government should provide bednets to the migrants, although one government official stated that around 300,000 migrants come to the area, making mass bednet distribution difficult to execute properly.

Three KIIs suggested setting up temporary mobile clinics and stationary clinics in strategic locations for the migrant laborers to visit. The Metema district health officer stated that they have started implementing this but another participant stated that the nurses were inexperienced and they did not reach many migrants.

Proposed intervention

All of the migrants who responded to the question about the feasibility of the test and treat intervention at the farms or in their home kebeles stated that they thought the intervention would work.

All migrants who responded also agreed that they would comply and many indicated that the majority of other migrant workers would comply as well.

Farm owners also expressed interest in conducting interventions such as mass test and treat at the farms for all migrant workers.

Improvements

Five KIIs suggested that farm owners should be responsible for providing migrant laborers' basic necessities such as clean water, toilets, and shelter.

Four KIIs suggested that the migrant laborers form an association that would advocate for their rights and provide them with a place to air grievances and mistreatment.

Objective 5: Evaluate feasibility and acceptability of implementing a strategy to clear malaria from returning seasonal migrant workers in their home kebeles

Purposes and objectives

A community strategy to clear malaria from returning seasonal migrant workers was implemented in four kebeles. Upon their return from the farms, workers were referred to the health post or to the surveillance assistant in the area to be tested for malaria and treated if positive. To inform the design of the intervention (how the migrant workers would be identified, who would do the testing and treatment, etc.), focus group discussions and key informant interviews were conducted with key community stakeholders prior to implementation. The strategy was then implemented in October 2016, when the migrant workers started to return from the farms. Shortly after implementation, more qualitative work was done to understand the acceptability by the migrant workers and lessons learned during the implementation that could be used to improve the strategy.

Design and methods (FGDs)

Four FGDs were conducted before the intervention that included community leaders, women's development army members, health extension workers, surveillance assistants, teachers, and students from four villages in the spread areas. Two FGDs and 4 KIIs were conducted after the intervention. FGD participants included HEWs, teachers, students, and surveillance assistants. The KIIs were conducted with four community leaders.

Community-based surveillance activity

Using a novel social behavior change and communication (SBCC) concept, which enables communities to create videos and printed materials with targeted messages, the project rolled out this tool in schools and community organizations to:

- Improve community behavioral change toward best utilization of malaria prevention and control interventions.
- Establish community ownership of village-level malaria surveillance by enabling schools and the health development army 1:5 community networks to track and refer migrant returnees and febrile patients to the health post.

Summary of findings (FGDs)

This section summarizes FGD findings and organizes them according to themes corresponding to the topic guides. More detailed findings with quotations from FGD participants are in Annex 2.

Pre-intervention

Through FGDs, individuals suggested identifying migrants through ID cards, activities conducted during community gatherings such as festivals or church functions, Health Development Army (HDA), and awareness campaigns at the school. All participants expressed acceptance and agreed that the intervention was necessary in order to work toward malaria elimination.

Regarding who should administer the intervention, two suggested that health extension workers carry out the intervention, one person suggested health centers, and one person suggested the HEWs and SAs in health stations.

On the subject of migrants who might be hesitant about the intervention, all suggested an awareness campaign that targeted family members and community awareness about the health risks. Concerns that were raised by the FDG participants included: time frame of the intervention, shortage of the drug, proper training of the HDA, trust in RDT validity, lack of understanding of the intervention with migrants, stigma carry-over from HIV testing, lack of willingness of migrants to participate if they are not ill, remote regions, and other commitments of the HDA.

Additional suggestions from the FGDs included: screening at the schools, working with investors at the farm level, and removal of malaria breeding sites.

These findings did not change the planned intervention at the home kebeles because the findings validated the initial design.

HDAs referred 35% of the migrant laborers and febrile patients to the health post for testing, and 67% of the positive cases were detected by the HDAs (1:5 community networks). Nineteen percent of the migrant laborers and febrile patients were referred from schools, but none of those cases were positive. Forty-six percent of the migrant laborers and febrile patients were self-referred and 33% of the positive cases were from this group (see Tables 13 and 14).

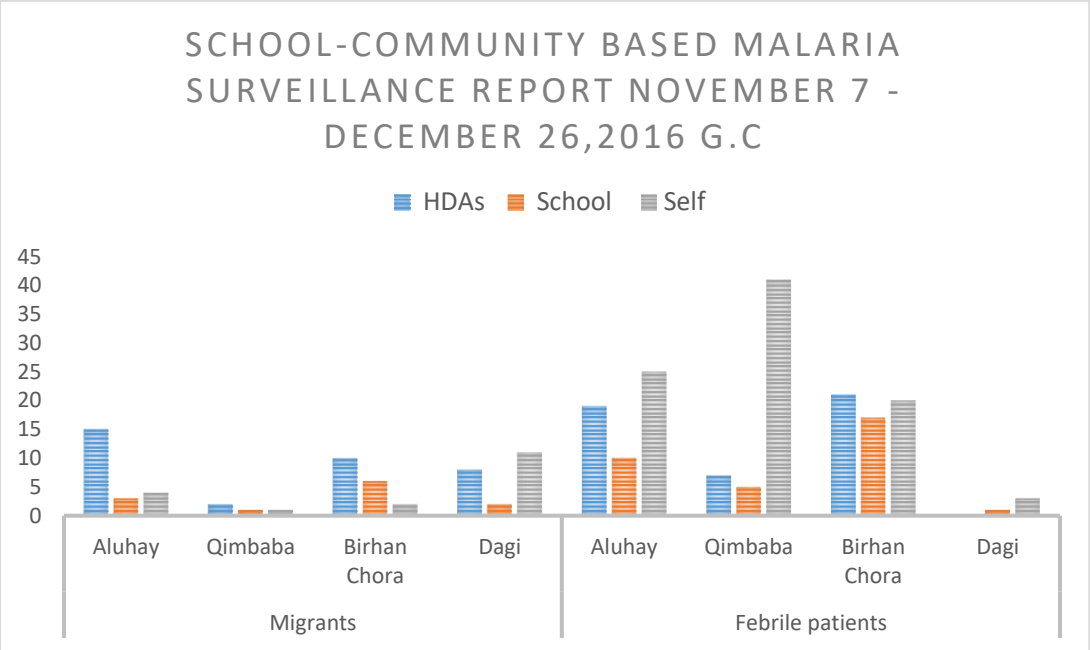
Table 13: Number of migrants and febrile patients RDT-tested and who referred them to the health post, November 7–December 26, 2016

District	Patient Type	Village	Number of patients RDT-tested and whom they were referred by.			
			HDAs	School	Self-referral	Total
Bahir Dar Zuria	Migrant	Aluhay	15	3	4	22
Bahir Dar Zuria		Qimbaba	2	1	1	4
Mecha		Birhan Chora	10	6	2	18
Mecha		Dagi	8	2	11	21
Migrant Totals			35 (54%)	12 (18%)	18 (28%)	65 (100%)
Bahir Dar Zuria	Febrile Patient	Aluhay	19	10	25	54
Bahir Dar Zuria		Qimbaba	7	5	41	53
Mecha		Birhan Chora	21	17	20	58
Mecha		Dagi	0	1	3	4
Febrile Patient Totals			47 (28%)	33 (20%)	89 (53%)	169 (100%)
Overall Totals			82 (35%)	45 (19%)	107 (46%)	234 (100%)

Table 14: RDT results from migrant laborers and febrile patients who were referred to the health post, November 7–December 26, 2016

District	Patient Type	Village	Number of positive RDT individuals and who referred them to the health post									Totals
			HDAs			School			Self-referral			
			PF	PV	Mixed	PF	PV	Mixed	PF	PV	Mixed	
Bahir Dar Zuria	Migrant	Aluhay	6	0	0	0	0	0	2	0	0	8
Bahir Dar Zuria		Qimbaba	0	0	0	0	0	0	0	0	0	0
Mecha		Birhan Chora	1	0	0	0	0	0	0	0	0	1
Mecha		Dagi	1	1	0	0	0	0	0	2	0	4
Migrant Totals			8 (61%)	1 (8%)	0	0	0	0	2 (15%)	2 (15%)	0	13 (100%)
Bahir Dar Zuria	Febrile Patient	Aluhay	0	0	0	0	0	0	0	0	0	0
Bahir Dar Zuria		Qimbaba	0	0	0	0	0	0	0	0	0	0
Mecha		Birhan Chora	0	0	0	0	0	0	0	0	0	0
Mecha		Dagi	0	0	0	0	0	0	0	0	0	0
Febrile Patient Totals			0	0	0	0	0	0	0	0	0	0
Overall Totals			8 (61%)	1 (8%)	0	0	0	0	2 (15%)	2 (15%)	0	13 (100%)

Figure 13: Number of migrants and febrile patients referred to the health post by district and referral, November 7–December 26, 2016



Post-intervention

All participants believed that the intervention or parts of the intervention worked and that it was necessary and important to eliminate malaria.

During the community-based intervention, 20% of migrants given an RDT test were positive and 0% of febrile individuals tested were positive. Given that this intervention is less labor intensive and yields high RDT positivity it should be considered for future work. Additionally, the intervention should focus mainly on migrant laborers over febrile individuals.

All participants except one (who thought that the focus should be on MTAT) agreed that the intervention should be carried out in the future.

Overall, 21 participants expressed a high acceptance of the intervention.

Some of the benefits listed included: students and HDAs were helpful in targeting and bringing in identified returnees and febrile individuals, dedication from community, and implementation of a tracking system.

Through focus groups with migrant laborers, two stated that they heard about the intervention from the HDA, one from a teacher, one from an HEW, six from SAs, one from a friend, and one did not know about the intervention.

Problems identified

Through FDGs and KIIs, the following problems were identified by community members:

- Monitoring and evaluation was needed from the coordinating body.
- Remote regions were difficult to reach.
- There was a delay in migrant return.
- There was unused potential in the schools.

- There were few migrants in some of the intervention areas.
- There were no incentives for administering bodies.
- The project was rushed.
- There was a lack of training.
- There was a shortage of RDTs and medication.
- Some migrants questioned the validity of the RDT test.

Migrant laborers identified the following problems:

- Closed health posts.
- Implementation difficult in remote areas.
- Lack of RDT/medicines at the health posts.

Suggestions for improvements

Suggestions to improve the intervention included:

- Every stakeholder should be evaluated.
- There should be better monitoring and evaluation from the coordinating body.
- There should be a better provision of materials (RDTs and medicine).
- Discussions with district officials should be held on how to implement the intervention.
- The focus could be on MTAT instead of this intervention.
- Microphones should be supplied during awareness campaigns.
- Awareness activities should not all occur on one day but should be spread out over multiple days.
- Videos should be shown to all community members, not just students.
- The videos were too heavy on dialogue.
- All HEWs should be trained to do awareness activities.
- All malaria drugs, not just Coartem, should be made available.
- Interventions should target source areas
- The focus should be on prevention.

Migrant laborers suggested the following improvements to the intervention and malaria elimination:

- Bednet distribution could be improved
- Mosquito breeding sites could be drained.
- Medicine and tests should be readily available.
- IRS spraying.
- There could be more local job training, which might lead to less migration.
- There should be more outreach through HDA and HEWs since many migrants found out about the intervention through friends.

Sustainability of the project

Eight participants suggested that a key to making the project sustainable was involving the community in promoting the intervention. One participant stated that they worried people would forget the importance of the intervention if promotion were not continued. Five migrants stated interest in the continuation of community awareness activities and of the intervention.

Conclusions and recommendations

Source areas

Everyone agreed that there was a critical need to provide malaria prevention interventions to migrant laborers working in Metema District. However, the number of migrants and the remoteness and size of the region made any intervention difficult and expensive to administer. Additionally, there was no agreement on who should be responsible for these activities. However, farm owners recognize the importance of having a healthy and productive work force, hence a strategy of advocating for them to take on some of the costs of these interventions needs to be explored further.

We recommend that bednets be distributed to migrant workers upon arrival at the farm, given that 73.5% of farms have the ability to hang bednets (from the farm assessment survey) and that most migrant workers believed that bednet use was the best strategy for malaria prevention at the farms and were willing to use them. However, most farm owners were not willing to pay for the nets and it is unlikely that most workers would be willing to pay for them, so providing them for free would achieve the highest coverage.

However, funding remains the key issue for all these interventions and a mass bednet distribution would probably be a complicated investment for the FMOH because of cost and the unpredictable movement of migrant workers (migrants work on multiple farms through the season). Alternatively, a zerofly fence or mosquito net screen could be used to cover any opening in shelter and/or sleeping areas.

A number of migrant workers commonly worked at night due to high temperatures in the daytime, hence the use of personal protection measures like Attractive Toxic Sugar Bait (ATSB) and repellents should be promoted and encouraged.

Most farm areas are the source of malaria infections as they have relatively high malaria transmission. Taking aggressive and epidemiologically sound intervention measures (such as mass drug administration, single low-dose primaquine, universal coverage of bednets, etc.) in the indigenous communities who live near the farms other than the regular intervention approaches is required to reduce transmission.

Over 70% of migrants reported a lack of access to formal healthcare at the onset of malaria-like symptoms while working at the farms. Health posts were too far away and they only would go if they exhibited severe symptoms. Thus, setting up mobile clinics or deploying nurses or community health workers (either by farm owners and/or Government) in the farm areas would give migrants the opportunity to seek more formal healthcare, and in a timely manner.

Many migrants reported dissatisfaction with their working conditions and were unaware of their rights. It would be beneficial to create an association where migrant workers could report malfeasances against them such as payment discrepancies, provisions, access to quality malaria prevention drugs, etc.

Spread areas (home kebeles)

Community-based intervention to identify, test, and treat migrant workers upon return to their home kebele and febrile individuals

Many migrants travel back and forth between the farm and their home kebele. Many return home during September after the weeding season to either return to school and/or celebrate the Ethiopian New Year, before going back to the farm for the harvest season. We therefore recommend the community-based intervention to span a longer time period and cover the whole period during which migrant workers move to and from the farms. Also, it is worthwhile to conduct a specific assessment on whether test and treat on farms might be more effective.

From focus group discussions, it was determined that HDAs are already overwhelmed with all their current responsibilities. Therefore, it may be best to focus on increasing community awareness, especially with family members of migrant workers, of the importance of testing and treating returning workers. This encompasses reaching a wider number of individuals including family members and remote regions.

During the community-based intervention, 20% of migrants given an RDT test were positive and 0% of febrile individuals tested were positive. Given that this intervention is well accepted, relatively easy to implement, and yields high RDT positivity, it should be considered for future work. Additionally, the intervention should focus mainly on migrant laborers over febrile individuals, who would usually already seek care at the health post.

During the test and treat intervention for returning migrant workers in the home kebeles, some migrant workers questioned the validity of the negative RDT results given that they still had what they considered to be “malaria symptoms.” Thus, social behavior change and communication should be strengthened and improved to build trust in the validity of malaria RDT testing.

Some migrants reported that health posts in their home kebeles were closed when they went to participate in the intervention or that they did not have enough malaria medication for treatment. In order for such an intervention to work and to encourage participation, it is vital to ensure that health post hours are clearly posted and communicated, and that there are enough RDTs and antimalarial drugs in stock.

Annex 1: Full Objective 4 Findings

Responses have been edited for clarity.

Employment

Most migrants come to the Metema region from the Gonder, Welo, and Gojjam areas at the beginning of Hamle (July).

> *Migrant workers are defined as those who work seasonally at farms in this area and who come from some other places. Mostly they come from Gonder, Welo, and from Gojjam areas. [District agriculture office bureau representative from Metema]*

Students and migrants who are closer to home will return home at the end of the weeding season (Nehase/August) for school and the Ethiopian New Year. Those migrants who are not in school return to the region at the end of September.

> *"Most of us come to the farms beginning from Hamle [July], and some of us return back to our home at the beginning of September where the weeding work ends and classes begin. [Those who are students work in the farm sites during the weeding season only.] Those who don't have an education move back with their families for the holiday, and stay there until the end of September [Meskerem], then return back for the harvesting work. [Migrant laborer FGD participant from Dembia]*

> *Returning back to home during harvest season is common among the majority of seasonal workers. Only a few workers, who come from distant areas of the country, stay in these farm areas until the end of the final harvest time; the majority of us return home to our family, to pass the New Year holiday, and will come back to the farm sites for harvesting work. [Migrant laborer FGD participant from Maksegnite]*

During the peak season, the majority of migrant laborers work at multiple camps, including eleven of the participants.

> *The majority of the seasonal workers usually work at more than one farm site during both weeding and harvesting seasons, while a few work at only one farm site. I usually work in two or three farm sites. We move from one work site to the other in search of better payment. [Migrant laborer FGD participant from Dembia]*

Two migrant focus group participants stayed at only one farm.

> *I work in only one farm site. For someone who wants to stay in this camp, there is always work. That's why I have been here for the whole summer, rather than moving to some other camps. In fact, most of the seasonal workers move from one farm to the other. [Migrant laborer FGD participant from Semada]*

The hiring of migrant laborers is conducted through an informal agreement. This agreement determines the land that will be worked, as well as the payment.

> *The agreement between the farm managers or owners and the seasonal workers is verbal, and there is no formal registration conducted. Rather, after they finish their*

contracted work, we write down their name and the amount of money they should be paid, and give them a paper [wesyla], which is a kind of check to collect their payment from the nearest town […] but in the future, we are thinking of conducting a formal registration in order to make them eligible for paying tax on their income. [Farm owner from Delelo]

Usually we employ seasonal workers on contractual basis. There is no formal registration or written agreement; it is an oral agreement […] He assigns a plot of land—which we call "Gual"—and negotiate on the payment, and give them a contract agreement. When a worker finishes the given Gual [plot of land], the manager checks if the work accomplished the work; if the worker wants to continue working and taking other Gual, he negotiates again with the manager on the payment, and continues his work. Finally, when he completes the assigned work, the farm manger gives them a payment paper [wesyla]—a kind of a check—stating the name of the worker, the amount of Gual he worked, and the amount of money to be paid. They take their payment from the nearest town—usually from Metema Yohannis. [Farm owner from Delelo]

This informal system can leave migrant laborers at risk of being taken advantage of by the farm managers, though this was never brought up in any of the focus group discussions with migrant laborers.

The problem of delaying and avoiding payment for the work done: there are investors who disappear from the place after they hire and conduct the agricultural activity on their farm. [Metema district administration office head]

There is a problem of not giving the payment for work on time, and also denying the oral contractual agreement as there is no written agreement between the two parties: the seasonal workers and farm owners. [Labor association representative from Metema]

All of the migrants expressed concerns regarding the conditions on the farms. Still, all of them stated that they did not have any additional expectations that the farms would provide more than work.

I have never expected something to be given to me by the farm in relation to my health. We don't have the culture of asking about the rights we have. We mostly work in contractual agreements with the kobrares [farm managers]. Whether the food is good or not, it doesn't matter to us; the basic thing for us is the availability of work and the payment we are offered for weeding or harvesting activities that we accomplish as per our agreement. [Migrant laborer FGD participant from Salha]

The majority of seasonal workers didn't come here with expectations of getting better living conditions. What we expect is availability of work and money we get from the work we accomplish. [Migrant laborer FGD participant from Semada]

Many farms provide sleeping spaces, which are used predominately during the rainy season; during the dry season, many migrant laborers prefer to sleep outside. Of the migrants interviewed, two stated that they were provided with a shelter of corrugated iron and mud, eleven slept in grass-thatched hamlets, and four slept outside.

There is a house made from corrugated iron and mud, which we all sleep inside. The house has the capacity for up to 150 people in a congested way, and we sleep

inside—especially in the rainy season. When there is no rain, we sleep outside under the shelter of trees. [Migrant laborer FGD participant from Misrak Belesa]

Sleeping places or houses arranged by farm owners are not standardized. They are grass-thatched simple shelters. Most of the time we sleep outdoors, especially when it's not a rainy season. The grass-thatched shelters arranged by farm owners are not convenient. [Migrant laborer FGD participant from Alem Ketema]

Half of the participants reported that the shelters provided were inadequate or overcrowded, which exposed the workers to communicable diseases.

The proportion of the accommodation [shelter] is not equivalent to the size of the laborers who work in the camp. In most cases, the migrant workers are forced to spend their night in the farm area or sleep outdoors. [District agriculture office bureau representative from Metema]

We sleep in a crowded way and we even can be exposed to various communicable diseases. [Migrant laborer FGD participant from Dembia]

Some farms reported providing additional benefits to their workers such as flour, latrines, and water.

Some of the services the investor [farmer] is requested to provide are: 1) appropriate and quality food, 2) shelter, 3) clean water, 4) shower and toilets, 5) provision of malaria nets, especially in the summer, 6) hiring of health professionals, 7) agriculture professionals, and 8) provision of medicine. Based on this criteria, surveillance will be taken by the investment committee twice a month. Those investors who get less than 45% will be given a warning for the first time, in order to correct within a short period of time. If there is no change by the next surveillance time, the investment license will be discarded or there will be serious sanctions. [Environmental protection and land management head from Metema]

However, some migrant laborers and key stakeholders in the region admit that these provisions are sub-standard.

I was provided with very dirty flour, and friends showed me how to make porridge from the given flour. I got sick and my friends treated me. I wasn't able to eat that porridge for many days, and later became accustomed to it […] Drinking water provided for workers is very unhygienic and not treated with chemicals; sleeping places are unclean and unconducive to sleeping. Flour that we are provided to prepare porridge or bread, and what we used as wat [sauce] are also not conducive to eating. [Migrant laborer FGD participant from Maksegnite]

The problem of the investors being committed to providing the basic services: the food and the water provided for the workers are not up to the standards set by the investment committee. [District agriculture office bureau representative from Metema]

One of the problems is that migrant laborers do not know their rights, nor do they know where to turn to when they are being taken advantage of by the farms.

The other problem is that there is no organized body, like a Workers Association, and we don't know the concerned government office to whom we can report our

problems on a formal basis and get solutions. [Migrant laborer FGD participant from Semada]

When the investors take the license to invest in the area, there are certain responsibilities and preconditions that he/she accepts as mandatory. One of the basic things the investor should provide for the migrant farmer is conducive working and living conditions, including the protection of their health; these rights are violated in most cases. [Health office representative from Metema]

Knowledge about their rights—when the right of the migrant is violated, they prefer shifting to another farm site rather than reporting and standing up for their right. And there are gaps between different stakeholders in responding to the questions raised. [Environmental protection and land management head from Metema]

Malaria

All of the migrant laborers were familiar with malaria and malaria symptoms.

Malaria is very common and frequent during the rainy season in all farm sites in this area, and I believe that every one of us has experienced its severity at least one time while working here in the farm sites. Headache, fever, shivering, sweating, and severe back pain are the common symptoms of malaria that I know and have experienced several times while working in this area. [Migrant laborer FGD participant from East Belesa]

All of the migrant laborers interviewed knew about malaria, and many stated they had had malaria or malaria-like symptoms in the past. The majority of migrants went to the farm manager to obtain malaria treatment for symptoms, and three of them mentioned taking Coartem.

We know symptoms of malaria and whenever we feel those signs we seek medical treatment. Actually, what we first do is to report our sickness to the Kobrare [farm managers] and ask for malaria treatment drugs. [Migrant laborer FGD participant from Dabat]

Even we know that selling chloroquine is illegal, though we sell it in order to protect the life of our employees. [Farm owner from Delelo]

If migrant laborers obtain malaria treatment through the farm manager, the cost of the medication is deducted from their pay. One migrant laborer reported paying a higher price for the drug than what the drug store would charge.

Some farm managers have drugs known as Coartem, and they give them to us with a fee that will be reimbursed from our payment. They charge us, unfairly, more money than what the drug stores charge. For instance, for malaria drugs that priced 30 birr [local currency], they charge us 100 to 120 birr. As we have no other choice, we pay the unfair amount they charge us. [Migrant laborer FGD participant from Maksegnit]

I have no onsite health clinic in my farm camp. I bought some medicines such as Paracetamol, Chloroxine, and Coartem, and provided them for the sick workers with credit that will be reimbursed from their payment. Because we buy these medicines from the pharmacy with our own money, I will not give them for free; as paid

workers, they have to pay for it. In fact, I provide time off for seriously sick workers to recover from illness, but I will not pay him for time off. [Farm owner from Tumet]

One migrant laborer questioned the drug quality.

The tablets have some kind of warnings by themselves. It asserts that the tablets must be kept in cool, dry places. Most of the camps put the tablets in a way that they are exposed to sunlight, and they may buy something expired. Most of the seasonal migrants don't have the awareness and just take the tablet given by the farm managers [kobrare]. [Migrant laborer FGD participant from Misrak Belsa]

Only one migrant laborer reported seeking treatment at the health post at the onset of symptoms.

I prefer moving to the nearest health station as fast as I can to get treatment when I experience some sign of malaria. [Migrant laborer FGD participant from Addis Zemen]

Most migrants stated that they do not seek professional treatment unless it becomes serious.

Though it doesn't happen significantly, when the case is severe, we move to the health stations in the town with the help of our friends [Migrant laborer FGD participant from Dembia]

Two farmers reported assisting with transporting a severely ill laborer into town.

I also assist them in providing transport to and from the nearest health clinic for seriously sick workers. [Farm owner from Tumet]

Many migrants reported that they do not seek professional medical treatment because they do not need professional help or cannot access medical assistance.

We use tablets when we feel the symptoms of malaria. I don't need any laboratory test to know my disease is malaria, since I specifically know by the symptoms and changes in my body temperature, and my condition when I am at the beginning stage of being ill. Even if I need to be tested, there is no access to laboratory-equipped clinics or health centers here in the farm areas. [Migrant laborer FGD participant from Dembia]

Lack of health facilities in the farm and nearest camp: when they are exposed to malaria and other health problems, they have the problem of getting treatment, as there is no health professional accessible in the nearest area. [District agriculture office bureau representative from Metema]

Due to lack of clinics, most workers did not get timely treatment at farm sites unless they travel to nearby towns where they can get treatment services from public or private clinics. [Migrant laborer FGD participant from Alem Ketema]

Temporary healthcare clinics have been set up to address a variety of health issues in central areas. These clinics have struggled to keep up with demand, but further expansion of the clinics is currently in progress.

The construction of health stations in central areas that are accessible for the work sites: until now the temporary health posts don't have the manpower and the equipment needed to treat severe and complicated cases. The construction of health

stations will decrease the mortality that occurs as a result of inaccessibility of the health station, and the transport problem of taking the patients to the health stations in the towns like Gendeweha and Mettema. [Health office representative from Metema]

The managers of the camp provide us a place to build the temporary health station while we build the post by ourselves. The camps provide us with food and one liter of oil per month. There is one bed made of the local sticks to be used for patients who come to our health post. We don't provide treatment in the post, as we don't have the space and the equipment; rather, we provide them with the tablets and transport from the post. Since those who have experience hesitate to come to work as a seasonal health worker, mostly there are fresh clinical nurses who don't have exposure to providing treatment. [Health worker from Metema]

Prevention

According to the farm assessment survey, only 24.5% of farm owners provide malaria prevention.

I didn't provide musiya [bednets] for seasonal workers because the cost of bednets is expensive and I can't afford the expense. Some seasonal workers bring their own musiya and use it. [Farm owner from Delelo]

One migrant reported that some farm owners provided malaria prevention to permanent employees.

The kobraris [farm manager] and those workers who work on a permanent basis have malaria nets, but we temporary workers are not provided with the necessary prevention equipment. [Migrant laborer FGD participant from Dembia]

All six farm owners expressed concern about the additional cost of providing bednets for all migrant laborers.

As I have mentioned, providing bednets for large number of workers (around 2,000) that we have employed at one time costs us a lot of money that we can't afford; thus I will not agree on this issue. If LLINs [bednets] are provided by the government or health office, we will happy to facilitate their distribution/provision and control their proper utilization by the seasonal workers. As this will support us, we can design ways that help us to control and manage the nets to be returned back when a worker completes his work and leaves the farm site. [Farm owner from Delelo]

Some migrant laborers bring their own bednet that is shared with friends.

Very few seasonal workers used bednets that they bring on their own and usually used in a group—one bednet for two or three. [Migrant laborer FGD participant from Baja]

There have been bednet distribution programs in previous years, but providing bednets to every migrant laborer would be challenging due to the sheer number and volume of workers.

The workers are not experienced with asking for their rights, except for their payment. There have been attempts to distribute LLINs [bednets] to the agricultural

farms through the farm managers, and the workers were hesitant to ask for the bednets as their right […] from the farm managers, though the nets are given to them for free by the government. [Metema district administration office head]

However, the treatment is given more emphasis than prevention as a result of different reasons. Every year around 300,000 migrant workers come to the work sites, and it is difficult to a provide LLIN [bednet] for every individual migrant who comes to the worksite, as he will take them back to his house when he returns back home, which necessitates the provision of the LLIN again in the coming years, making the LLIN provision financially unaffordable for the government. [Health office representative from Metema]

Some of the migrant workers stated that they preferred bednets because they protect them from scorpions as well as mosquitos.

I think it's better to give us the musiya [bednets], as they protect as from both malaria and scorpions. [Migrant laborer FGD participant from Dembia]

The bednets are a very crucial way of preventing malaria in our case. Not only does it prevent us from malaria, but also from scorpions, which are very problematic in this farm area. [Migrant laborer FGD participant from Dembia]

A few migrant workers expressed concerns about bednets.

Bednets are made for one person, and within our context, it will be impossible for everyone to use his own net, as there will be a shortage of sleeping spaces. [Migrant laborer FGD participant from Semada]

Most individuals interviewed for this study had not heard of repellent.

So far I didn't heard of repellents that could be used for mosquito prevention, and I didn't provide it to the workers. If the repellents [bug spray] were provided by the Bureau of Health, I would cooperate in providing them to migrant workers accordingly. [Farm owner from Lominat]

There is a gap in knowledge in the use of the malaria prevention materials, especially how they can use the repellant, as most of them don't have the knowledge. [Health office representative from Metema]

When repellants were explained, many expressed interest in this prevention tool.

I think that the repellants are the most convenient way of preventing malaria, due to our nature of mobility from one camp to the other, and also due to our work nature—especially during harvesting season […] [Migrant laborer FGD participant from Addis Zemen]

Mostly we do the harvesting at night time. Thus, the use of repellant, especially at the time of harvesting, is not a matter of choice. Even for the whole year when there is no rain, we prefer sleeping outdoors, which necessitates the use of repellants. [Migrant laborer FGD participant from Semada]

One migrant expressed concerns with using only repellents.

The other concern I have about the repellant is that the mosquito may bite us in a part of the body on which we don't use repellants. [Migrant laborer FGD participant from Esta]

Other malaria prevention techniques

A few laborers expressed concern with the environment's ability to spread disease.

I think there is a need for cleaning the environment and avoiding places where the anopheles mosquitos breed. [Migrant laborer FGD participant from Dembia]

A few farms had recently sprayed migrant sleeping quarters.

However, the manager sometimes simply sprayed IRS in the grass-thatched shelters that we used for sleeping. [Migrant laborer FGD participant from Chelga]

Most farms did not spray because of the cost, or because spraying would be ineffective due to the structure of migrant quarters.

For seasonal workers sleeping, I arranged two temporary hamlets made of grass and which can accommodate about 20 seasonal workers at one time. So far, we used IRS spraying by health workers from the woreda [district] only for one time. I didn't spray in the hamlets before at my own cost because I thought that it was expensive. [Farm owner from Delelo]

So far we didn't use IRS to spray in the hamlets because we didn't think of its necessity, as the hamlets are thatched and not suitable for IRS. [Farm owner from Delelo]

Migrant laborers favored a combination approach to combating malaria in their homes.

In our home kebeles, the use of musiya [bednets] is the most convenient, as the family is stable and everybody can sleep under the bednet. [Migrant laborer FGD participant from Salha]

Use of IRS spraying, bednets, and repellents would be the most influential to prevent the spread of malaria among our families and community members. [Migrant laborer FGD participant from Alem Ketema]

To prevent the spread of malaria to our family or our community from infected migrant workers, what helps most is testing and treating the workers before and after returning home. Besides this, using bednets, IRS spraying in our homes and at each of the households in the community, and cleaning wet and damp areas can also help to prevent malaria spread. [Migrant laborer FGD participant from Alem Ketema]

To me, to prevent the spread of malaria to our family or our community from infected migrant workers, what helps most is testing and treating the workers before they returned home and after returning home, and using bednets, IRS spraying in our homes and at each of the households in the community, cleaning our surroundings (wet and damp areas), etc. [Migrant laborer FGD participant from Chilga]

Intervention

All migrant laborers responded positively when asked if they thought the proposed test and treat intervention at the home village [kebele] would work.

> *Yes, it can work. As it is known, a majority of the migrant seasonal workers are highly affected by malaria while working here, and as for my view, it is nice if we are screened and treated as we return home after the end of harvest work. [Migrant laborer FGD participant from Chilga]*

> *Yes, I have faith in the planned kind of intervention, it is very workable if implemented as you said. Testing and treating at farms or at certain central places before migrant workers returned back to their homes, as well as screening them and their families for malaria and providing treatment, is good strategy to stop the spread of malaria. [Migrant laborer FGD participant from Azezo]*

The migrant laborers were not the only ones who expressed interest in this intervention—farm owners also expressed interest.

> *As the intended testing and treatment is for the health of seasonal workers whose labor we used, we will cooperate with the implementing agency as much as we can for the planned testing and treatment work. I personally believe that if seasonal workers are healthy, we also benefit, so we support the testing/treatment work that will help the workers to become a healthy and dynamic force. Our farm site is found in a central place and we can support and provide place for testing and treatment, and facilitate the intervention as much as we can. [Farm owner from Delelo]*

All migrant laborers, farm owners, and key stakeholders expressed interest and perceived acceptability.

> *No question! I and all other seasonal workers will comply to be tested for malaria and get treatment after returning to our homes. [Migrant laborer FGD participant from East Belesa]*

> *We are 100% committed to voluntarily work with other stakeholders who work on malaria. Without the migrant workers, nothing will be fruitful in the investment area, which necessitates protection of their rights in a more sustainable way. [Environmental protection and land management head from Metema]*

> *As the planned testing and treatment help seasonal workers to be healthy, I am willing to cooperate as much as I can. I am happy if the seasonal workers benefit from the testing and treatment and get healthy. We also need to have a healthy labor force. So I am willing to support and facilitate the testing/treatment work as much as I can. [Farm owner from Delelo]*

Future interventions

Suggested future interventions included free bednet distribution through the government.

> *As for me, instead of providing the LLIN [bednet] or repellents for the seasonal migrants for free, I suggest that we make them aware of proper use of bednets or*

repellents and provide them with a reasonable price through purchase at the farms from the farm. I, as an investor, don't have any intention of investing a penny for providing repellant and LLINs. Rather, providing the repellant through credit can be one option, so that it will be deducted from their payment. [Farm owner from Delelo]

Healthcare clinics

Arranging health posts or clinics in the farm sites is very essential to preventing the spread of malaria to migrant workers while working at the farms. [Migrant laborer FGD participant from Alem Ketema]

1) There is a need for selecting a place that is accessible to most camps and building a health station there—especially places like Delelo with camps concentrated at the center, there is a need for building a health station that has manpower and materials to treat patients efficiently. 2) There is a need for monitoring of the health workers in the temporary health stations; there is a tendency of not working seriously and moving to towns frequently from the side of the temporary health workers. Thus, there is a need for creating ways of controlling the health workers' availability and commitment to their work. 3) The facilities and different kind of drugs should be provided for the temporary health station; the basic problem in the health station is the lack of different drugs like Coartem. [Health office representative from Metema]

Some of the challenges to providing malaria intervention programs include the vast size of the region, and the number of migrants.

1) The size of the investment area: the vastness of the investment area and getting relatively near position for the treatment and prevention work is the basic challenge, as it will be difficult to cover all the places and the investment areas, which in most cases are inaccessible. 2) The size of the migrant laborer population: this can be considered as an opportunity, as we will get the chance to give awareness and treatment for large numbers of individuals at one place. On the other hand, it's the greatest challenge, as it incurs a high amount of resources to work on interventions for the overall population. [District agriculture office bureau representative from Metema]

Other tools for improvement

Two ways the government can improve working conditions for migrant laborers include imposing sanctions upon farmers and investors who do not provide proper living quarters and other benefits, and creating a coalition of government agencies that work together.

The government should be responsible for creating conducive conditions for the nongovernmental organizations that work on malaria and other health issues in the area of investment. Moreover, the government should impose strong sanctions on those investors who are working below the standards set by the woreda [district] investment committee. The government should provide prevention mechanisms, like malaria nets, for the daily laborers. [District agriculture office bureau representative from Metema]

Creation of a partnership between the government bodies that are working toward eliminating malaria from the area with the NGOs that are willing and capable of

giving technical and financial help for the actions undertaken in the area. [Health office representative from Metema]

One additional way that migrants can help themselves is to create their own association that fights to protect their rights.

For the change to happen, there are expectations from the side of the workers: 1) knowing their rights and responsibilities—they should know their rights and responsibilities and fight for them; 2) signing written agreements—there is a need for signing a written agreement as per the recommendation of the labor and social affairs office; 3) when the investors give them equipment like nets, they should protect the materials as their own, and return them on time; and 4) they should not only care for the money that they get—rather, they should consider health and other things when they sign an agreement with the employers. [District agriculture office bureau representative from Metema]

Migrant workers: the migrant workers should also should have to organize and establish their own association and be actively involved in the works that are done to protect their rights, as well as malaria prevention work that is done for them. [Labor association representative from Metema]

Awareness about their rights: most of them are not aware of their rights, as they don't have the educational background and the exposure that help them know their rights. Moreover, most of them come here in order to get money and they don't pay attention to other services that they need, and they don't report to the labor affairs office unless there is problem with payment. [Labor and social affairs officer representative from Metema]

Annex 2: Full Objective 5 Findings

Responses have been edited for clarity.

Pre-intervention (design)

Through focus group discussions (FGDs) with community members, several methods were suggested for identifying migrant laborers when they returned from the farms. Two members suggested administration/identification cards.

> *The migrants come to the kebele administration for various reasons such as getting an identification card and other reasons. Thus, we can screen them before they move out. [Community leader from Berhan Chora]*

One member suggested using community festivals and other social events to identify returned migrant laborers.

> *There are different social festivities that most of the communities are involved in. In these places and situations we can screen who is not there from the community members easily. Moreover, most of the migrants who move to seasonal migration promise to do something for our local church if they arrive safely, which helps us screen those who have the intention of migration and those who return back from there. [Health development army member from Berhan Chora]*

Some participants suggested identification through the health development army (HDA).

> *There are around 16 development army members in our kebele. We have meeting sessions frequently. All development army members have a list of individuals who live in there locality and they can easily detect when someone is missed. [Community leader from Dagi]*

> *Every development army can get the information from their locality when someone migrates to work as an agricultural laborer and returns. We have contact with every household in the local area that we are assigned to for different kinds of purposes. If the assignment is given, we can trace and find the individual migrants who live in our locality. [Health development army member from Dagi]*

Two participants suggested using schools.

> *In the summertime there are many students who migrate from this area. Most of them don't come [to school] on the actual date of registration, which is around August 27 as they are there on the farms working. So we can easily detect those students who come and make them eligible for the test and treatment. If it's necessary, the school can prepare an orientation session to create awareness for the students. [Teacher from Dagi]*

> *In our school there are around 2,000 students. Half of the students at working age move for work, especially at the summer time. Thus, the test and treatment should also include schools as they are also susceptible for the malaria epidemic. Teachers can screen and send those students who have the experience of migrating in the*

previous summer to the health station where the test and treatments are given. [Teacher from Berhan Chora]

One participant suggested using an awareness campaign.

The creation of an awareness campaign for the society and letting the community be a key player is decisive. We all can participate in the awareness creation campaign while the community takes the initiative of sending the migrants for the treatment and test work. [Teacher from Qimbaba]

Two participants thought that the awareness campaign should be targeted at the school level.

In our school there are around 1,000 students which will help us reach around 1,000 households if we use the students. In every household we have around five individuals on average, which means we reach around 5,000 individuals in the kebele through the students. So using students for awareness creation and bringing the migrants for the test and treatment is the best option we have. [Teacher form Alohay]

In our area there is a perception that if someone is not very sick and sleepy he is not affected by malaria. Thus, the first thing to do should be the creation of awareness for different stakeholders, which the students can also involve. The responsibility should also be given for a specific stakeholder in order to conduct the awareness creation, screening, and other activities in a more responsible way. Teachers and students can become an active participant and facilitators in the intervention. [Student from Qimbaba]

When asked who should reach out to the migrants, two participants stated the HDA should be responsible.

The women's development army can do this work easily. Every development army member can mobilize and bring those migrants who live in there locality. There are 40 households within [the reach of] every health development army member who can help us cover all the households easily and make the intervention more inclusive. [Health development army member from Berhan Chora]

The women health development army is vital and the best structure to approach the migrant workers. The work of the health extension worker, surveillance assistant, community leader, students, and teachers should be the creation of awareness and serve as a bridge between the migrants and the health development army. The development army members know the migrant and their families in their surroundings, which help to create conducive rapport for the intervention. [Surveillance assistant from Qimbaba]

Two participants thought that every authority member should be involved.

We should involve every authority in the kebele in the campaign. There should be a chain between the 1 to 5 cells, health development army to the kebele administrator. There are 385, 1 to 5 groups which can be used intensively for this campaign. [FG102]

One participant suggested using schools, as they have been used for previous health campaigns.

The school had been used for campaigns until now for different purposes. For this project the information about the campaign can be dispersed efficiently. [Student from Alohay]

Two participants thought that students should be used to reach out to migrant workers.

In every house we go to there is at least one student so if we can create awareness for the students and use them in the community mobilization one can have such a great result. The kebele and cluster administration can work with the students in the screening process. [Health extension worker from Berhan Chora]

If the awareness is created for the students about the objective of the intervention, they can make their families believe and bring the migrants in their surroundings to the health posts. [Student from Dagi]

When asked how to deal with migrant workers who may be reluctant to participate in the intervention, four participants suggested an awareness campaign that targets family members and the community with an emphasis on health risk to the individual and those around them.

We know every family member in the kebele. We should work in collaboration with them when there is this kind of exceptional response from the side of the migrant. [Health extension worker from Alohay]

The family can play a crucial role in persuading the migrant to take the test and treatment. So our aim should be creating awareness for the family of the migrant so that they can push and pressurize the migrant to test. [Health development army member from Qimbaba]

One individual suggested using communal action toward those who do not participate.

For those who hesitate to come for the test and treatment one should have a communal action toward them as they are a threat to public health. They are residents of the kebele and they should be abided by the lows forwarded by the administration in collaboration with the community. [Community leader from Alohay]

When asked who should administer the campaign, two participants stated the health extension workers (HEWs).

We are the responsible person to provide the test and treatment. I don't think the intended test and treatment is complicated for us. If there are exceptional cases of migrants then we will refer to the appropriate center to take the test. [Health extension worker from Berhan Chora]

I think we should give the test and treatment. When we encounter severe and complicated cases we will refer to the nearest health station. We are the ones who know the community members and we will have a big role in persuading the migrant to take the test. [Health extension worker from Alohay]

One thought the HDA should work with the HEW.

We help the health worker by referring and bringing the migrant to the health posts. [Health development army member from Dagi]

One stated that the surveillance assistant (SA) with the HEW should administer the intervention.

> *For the test and treatment the health extension worker and I myself are eligible for providing the test. The health station is very far from our kebele, which makes it difficult to give the test there. [Surveillance assistant from Alohay]*

One participant suggested that the health station should administer the treatment instead of the health post.

> *We should make the health station, not the health post, the center of test and treatment. As there is equipment for treatment and testing in the health station; the migrants should be prescribed to take the test and treatment there. [Health extension worker from Qimbaba]*

Concerns/suggestions

The FDGs were asked if they had any concerns regarding the intervention. One participant stated a lack of time to implement the intervention.

> *In our kebele, in average 300–400 individuals migrate seasonally to work […] the malaria disease they bring to the society is one of the basic health problems though it's decreasing significantly as a result of the work done by PATH-MACEPA. One of the basic things that may retard us from our plan is if we don't have the time frame to work on the intervention. [Community leader from Berhan Chora]*

Two stated a lack of medication.

> *The basic problem is shortage of medicine. If this problem is continued it will create dissatisfaction on the intervention from the side of the migrants. There should also be a focus on eliminating the places where the vector breeding is conducted. [Surveillance assistant from Dagi]*

One stated proper training.

> *Everybody suggests the involvement of the health development army in the intervention. My fear is if we let them do the work without providing them training. Thus, we should first provide training for those who are involved in the intervention. [Community leader from Berhan Chora]*

One stated lack of confidence in the rapid diagnostic test (RDT) result.

> *The problem is that they don't trust the test provided in the health posts. Especially they are not happy when they believe that they have the symptoms while the test results show negative. So they may not like the test using RDT. [Surveillance assistant from Dagi]*

One participant mentioned a lack of understanding and potential stigma around previous HIV testing.

> *Before, when there is any kind of campaign for test, they [the migrants] relate it with the HIV/AIDS test and they may not feel comfortable. What we need is to create awareness intensively to confirm the migrants that the test is only for malaria. [Health development worker from Dagi]*

A participant stated that there might be some hesitation from migrants who do not feel ill and do not show any symptoms.

> *The problem we encounter, especially from the side of the migrants, should also be considered. There is a conception of someone who can walk and work as healthy and they may think the test and the treatment unnecessary if they don't have the symptoms. [Teacher from Qimbaba]*

Two individuals stated that the timing of the intervention needs to be aligned with the return of the migrants.

> *One of the basic problems we may encounter is the pattern in which the migrants come to their local community. They may not all come at once and we should have a follow-up intervention which lasts for months. [Surveillance assistant from Alohay]*

> *They may come at night time and we may not be aware of their existence in the community. Thus, the family of the migrant is [important] in playing the role of reporting and bringing the migrant to the health posts. [Health extension worker from Alohay]*

One person stated that remote regions would be difficult to reach.

> *One of the problems we encounter is the difficulty of the kebele topography to reach especially remote clusters of the kebele. The other problem is especially in relation to the motivation and the perception of the development army and other agents in taking the work seriously as a responsible stakeholder. [Community leader from Qimbaba]*

One participant stated the HDA may have other conflicting commitments.

> *The major problem can be the pressure on the health development army as they also have other missions from the kebele, their own private life, and burdens which may retard them from using their maximum effort for this campaign. [Health development army member from Qimbaba]*

Several participants had suggestions on how to improve the proposed intervention. One stated that the intervention should not cost the migrants anything.

> *There should not be any cost for the intended test and treatment. The migrants may hesitate to take the test if there is payment for card and laboratory. MACEPA should take all the responsibility in facilitating and providing the necessary equipment for the intervention. [Health development army member from Qimbaba]*

Three participants suggested focusing the campaign at the community level and including family members of migrants so they can persuade them to participate in the intervention.

> *There are always leaders and followers. The followers may hesitate but we as leaders should take the initiation to take the migrant to the health stations for the test and treatment. Moreover, one can push forward by creating awareness for the wife of the migrant and urge her to take some measure if he hesitates to go and take the test and treatment. The wife of the migrant may have more power than the health development army in persuading the returnee. [Health development worker from Berhan Chora]*

One participant suggested working with the investors at the farm level.

> *The work that is done here may not be enough to tackle the problem in a more sustainable way. MACEPA should also work with investors in the source area and involve them in taking data about the migrants who come there for work. It will be vital if the organization brings a list of individuals who go to the farming areas from our kebele by merging the different list provided by the investors. [Teacher from Qimbaba]*

One individual stated that there should be a focus on malaria breeding sites as well.

> *There should be interventions that focus on screening places that are favorable for the breeding of malaria vectors. There should also be interventions that target the source area of malaria, especially the irrigation farming areas of the region. [Health extension worker from Berhan Chora]*

Overall, the intervention was perceived positively. All the participants stated that they thought migrant laborers would participate in the project.

> *They will be glad and voluntary for the test and treatment works intended. If there is hesitancy from some returnees then we can do home to home explanation and awareness creation about the goal of the intervention. In our experience, they mostly come even before they move to ask for quarter that they can use when they are sick in the work place. They have the awareness and they come immediately to the health station when they see the symptoms in their body. [Health extension worker from Berhan Chora]*

> *They will accept the intervention delightfully. Now-a-days there is awareness about how malaria can be a threat for their life. We are creating a society that says yes to HIV /AIDS tests, let alone for malaria. [Health extension worker from Qimbaba]*

All participants also thought the intervention was necessary.

> *The planned intervention is vital for our kebele as there are a lot of malaria patients. This intervention will help the migrants get treatment immediately, decrease the mortality rate of the area caused by malaria, and also break the transfer cycle of the disease. [Community Leader from Dagi]*

Post-intervention

Overall intervention

The test and treat intervention at the home kebeles took place in four districts. There were several awareness campaigns that took place at the schools and in the community.

> *The intervention was done through the different structures in the kebele, including the kebele and hamlet administrators, HDA [health development army], 1:5 network, and schools (through teachers). Through these agents, the message was conveyed that any returning migrants and febrile patients should go to a health post and take the free malaria test and treatment. [Health extension worker from Berhan Chora]*

Overall, the process of the intervention was very miscellaneous and prolific. We used a video presentation through a projector, and drama and speaking through the queue program that the school has every morning. The teachers who take training were also providing additional awareness in every class they enter in order to empower students to bring migrants and febrile patients to test and treatment. There was also peer-to-peer awareness creation between the students and teachers. [Teacher from Qimbaba]

The majority of participants had a positive view of the overall intervention.

I have a decent attitude and appreciation for this malaria test and treatment intervention because it targets preventing transmission of malaria infection, which is one of our most crucial health problems. As you may know, our kebele is one of the leading among other Mecha Woreda [district] kebeles that is most affected by malaria infection. Therefore, from my general observation and assessment, I can say that this recently implemented malaria test and treatment for returning migrant workers and other febrile individuals of the community was fundamental in preventing transmission of malaria infection that will break out following the arrival of migrant workers to their home kebeles. So if these malaria test and treatment services are properly and effectively provided to returning migrant workers and febrile individuals, without any doubt, it helps to protect the beneficiaries, their family members, as well as overall community members from malaria infection. [Key informant interview with a community leader from Berhan Chora]

The intervention is very crucial. However, because of the outbreak of conflict in the country, there was fear in many potential migrants of moving for work, and they prefer staying in their home area, which led to the disparity between the expected number of migrants to be benefited from the project and the actual returnee migrants from the intervention. [Surveillance officer from Dagi]

Many stressed the importance of the intervention.

The intervention is very crucial as it helps us know our health condition and protect ourselves and family members from the disease. Especially in the previous times there were lot of people who die because of the disease, and we must curb this problem from its source. [Migrant from Qimbaba]

This is such a visionary intervention because it will detect the threat that the migrants impose on the society by bringing the malaria vector from the worksites. We hope through the intervention, one can eradicate malaria from the area. [Migrant from Dagi]

Returning migrant laborers stated that they had experienced malaria symptoms or that many around them became sick while working in the fields.

Occurrence of malaria when we work in the farm site is just a routine thing that everyone is exposed to. The farm manager provides us with the tablets without any kind of test and we take it, as we don't have any other possibility. Then we will halt taking the medicine immediately after we feel the tablet is no longer needed. [Migrant from Berhan Chora]

Yes, I was infected many times by malaria. I just take the tablet that I take from here or seek medical treatment in the nearest town when the tablet didn't work. But most migrants take the tablet immediately after they see symptoms in their body and get cured. [Migrant from Dagi]

Many participants stated that the intervention overall was accepted by the community.

Because of the work conducted by the HDAs [health development armies] and students, now the migrants are coming by themselves, as they are already aware of the existence of test and treatment in the health post for free. As we have the HDAs in every area of the kebele, it's easy to detect who comes and goes for working in malaria-prone areas. [Surveillance officer from Berhan Chora]

The intervention is down-to-earth and applicable. Providing the chance for test and treatment—not only for the return migrants, but also for the whole community—makes this project exceptional and appreciated by the community. [Surveillance officer from Alohay]

Two students and two teachers also stated that the awareness campaign targeted at the school level was accepted and stated they would continue spreading the information.

We will continue working with the HEW [health extension workers] in our kebele. It's easy for us to spread the information to our families rather than the HEW going house-to-house and losing their energy that can be used for other purposes. [Student from Alohay]

Migrant laborers also expressed that the intervention was acceptable to them as well.

I was happy for knowing that this intervention intends the migrants as a target in the first place. I also want my other friends to get this kind of chance when they return home. [Migrant from Alohay]

There is no one who forces us to come here. Everyone cares about his health, and it's a must to be involved in this kind of activity that is intended for the public health. [Migrant from Berhan Chora]

One health extension worker expressed frustration about getting migrants to participate in the intervention.

There had been excellent work done by the HDAs [health development armies] to mobilize the society. However, getting migrants was frustrating and only two migrants had been involved in the ongoing intervention. [Health extension worker from Qimbaba]

One benefit mentioned by community members and migrants was that money could be reinvested elsewhere.

The test and treatment work that is provided freely is very significant for our kebele. The migrants were testing and getting treatment by paying money to the local clinic while this project will help them re-invest their money into something more useful and valuable. This is also very accessible and makes the migrant keen to come and test, as it only asks little effort. [Health development army member from Alohay]

Another benefit of targeting schools with the awareness campaign was that students began sharing the information with their family members.

> *We have been providing the awareness creation in the school. We really appreciate the project for providing focus for the school by understanding how schools can play a big role in the health issues of the community. Now our students are disseminating the information they gain from us and bringing many febrile and migrants to the health posts. [Teacher from Alohay]*

Migrant laborers were identified through community events or gatherings.

> *We ask them who referred them to come to the health post and take a malaria test. Most of them come by themselves by hearing from the awareness creation conducted in the church. [Surveillance officer from Alohay]*

> *We advertise the intervention through posters and other ways to create awareness and we think that we create the awareness about the need of the intervention in the community. The society is very voluntary and collaborative in the whole process of the intervention. [Surveillance officer from Dagi]*

Through focus group discussions (FGDs) with returning migrant laborers, all were asked how they had heard about the intervention. Two stated that they had heard of it through the HDA.

> *The HDA [health development army member] is the one who came to our house and told me there is test and treatment in the health post. She knows that I have a migration history, so she urges me to come here and take the test immediately. I just come here, take the test, and get treated by the HEW [health extension worker]. [Migrant from Qimbaba]*

One stated through his or her teacher.

> *Our teacher […] is the one who referred me to the health post to take the test and treatment. Even she didn't believe that I would go take the test; consequently, she came with me up to the health post. I was having some symptoms and I was happy to come and take the test. [Migrant from Qimbaba]*

One through an HEW.

> *The HEW [health extension worker] was telling people to take the test and treatment for free if we have any symptoms. I just took the advice and came immediately, as I was having some fever. [Migrant from Qimbaba]*

One through a friend.

> *My friends told me that there is test and treatment provided for those who return from farming in other areas and I was happy to come here and become the beneficiary of the intervention. [Migrant from Dagi]*

Six through an SA.

> *The surveillance officer […] is the one who told us to come and take the treatment. [All of the participants have the same answer.] [Migrant from Alohay]*

One did not know about the intervention but came to the health post because she was feeling ill.

I came here by myself for some other treatment. I was not aware that the malaria test and treatment is given for free. But when I hear it's for free, I just come and take the test. Taking a malaria test in this area was a habit before a while. But now because of the prevention work the government has undergone, there are only a few cases in our area and the number of infected persons decreases consequently. [Migrant from Qimbaba]

Problems encountered

While many expressed their support for the intervention and some stated that they did not encounter any problems…

There is no problem we encounter. They know it's for the sake of themselves and they have a positive perception of the test and the treatment work. [Health development army member from Alohay]

…others stated problems they experienced during the intervention. Three people stated that some migrants questioned the validity of the test.

They hate when we say that they are negative. They assert that they know their health problem and it is malaria whether the RDT [rapid diagnostic test] shows positive or negative. They attempt to get the medicine in whatever way they can, as it is for free. [Health extension worker from Alohay]

I asked the health extension worker about those things that I didn't understand about the test. Especially she told me that I am free [of malaria], but I know the symptoms of malaria very well and I know that I am somehow sick, so these two things clash with each other, which led me to question the testing. [Migrant from Berhan Chora]

Five migrants wanted the drugs even though they were negative.

They don't want us to say you are healthy. Rather, they just want us to prescribe medicine even if they are negative for malaria. However, we refer them to the health station to take some other tests, like typhoid, as that has similar symptoms with malaria. [Surveillance officer from Berhan Chora]

I also took the test and they told me I am free [of malaria]. I was taking the tablet by myself, and maybe that's why the malaria was not detected in my blood. Though they told me that I am free, I don't think so and I wish they could give me the medicine whatever the case. [Migrant from Berhan Chora]

Seven people mentioned difficulty in finding migrants.

The problem of not getting enough migrants involved in the test and treatment work is the basic headache for our work. [Surveillance officer from Dagi]

…two individuals involved in the campaign stated that this was due to the terrain.

The topography of the kebele is the headache of the surveillance officers, especially in relation to mobilizing the HDAs [health development armies] in very distant clusters of the kebele. But the surveillance officer and the HDAs try their best to work

closely and solve the problems that we encounter in the awareness creation campaign. [Health development army member from Qimbaba]

One migrant worker expressed the need to make clear when health professionals are working.

There is a need for follow-up on the HEW [health extension workers] and professionals working at the health post. I came here to search for them many times, but their door was closed and you need to figure out a supervision mechanism that shows whether the health professionals are working or not. [Migrant from Dagi]

Four people mentioned that finding migrants was difficult due to due to delayed rains in the region, increased employment opportunities in the home kebeles, and the threat of conflict in the farming region.

1) Because of the current problem in the country, there is fear from the side of the potential migrants to go too far away to agricultural plantations. 2) Because of the employment opportunity created through the small-scale enterprises, there is a tendency to work here and earn a living rather than migrating. 3) Because of the weather and other reasons, the returning time of most migrants from the agricultural plantations is delayed in comparison to the previous years. [Surveillance officer from Qimbaba]

This malaria test and treatment work was properly conducted as it was designed and planned. Except for the scantiness in number of migrant workers who travel to farms during this harvesting season from our kebele, the planned test and treatment activities were carried out efficiently, so I have no any other concerns regarding how this intervention was conducted. [Key informant interview with a community leader from Qimbaba]

Two migrants and two health workers stated there was a lack of RDTs and medication at the health post.

The intervention work was very tiresome for us because of the shortage of RDTs [rapid diagnostic tests] that we encounter, and I walk to the nearest health station to bring RDTs. We also have shortage of medicine and even now we don't have medicine available in our stock, which delays us from bringing more migrants and febrile people to our health post. Even the nearest health station doesn't want to give us the medicine and the RDTs because of the bureaucratic system. But one can say that the awareness and the perception of the community is changed at a significant level. [Surveillance officer from Alohay]

The unavailability of medicine in the health post should be solved, since it's leading us to move to the other health stations as they have the medicine. [Migrant from Alohay]

Two participants stated that there needed to be more monitoring and evaluation of the project and those who were coordinating it.

There should be monitoring and support; those who coordinate the project at regional and national levels should be given enough consideration. [Teacher from Dagi]

There was no follow-up from the project coordinators on the teachers who take the training and whether they give the training for the students or not. Moreover, health extension workers should be given programs in the schools to make students aware. [Health extension worker from Dagi]

One participant stated that the project felt rushed and should have been given more time.

There is rush in the project. After we took the training for the intervention, we were not given any time and we were not having time to facilitate the drama. For the future, the project should have organized planning systems in order to conduct the project activities smoothly. Moreover, up to now, the project was focusing on the treatment work rather than the prevention, and I advise emphasis to be given for the prevention at the source and the spread areas. [Health extension worker from Qimbaba]

Suggestions

Several suggestions were made to improve the current campaign and some provided additional services that should be added. Three individuals stated that the campaign should be lengthened due to the fact that not all migrant laborers had returned from the fields.

So, I can say that this malaria test and treatment activities were effectively performed as per the plan employing the above mentioned schemes. Although many migrant workers are not yet returned to their home, those who returned early and number of febrile individuals have been participated and benefited from the test and treatment services. [Key Informant Interview with a Community Leader from Alohya]

The test and treatment work should continue in the health post for longer time so that other migrants can also become beneficiary when they come here. [Migrant from Alohay]

Two migrants stated that the awareness campaign should be scaled up into the national malaria prevention strategy in order to reach more individuals.

The awareness creation and screening should also be done, not only in the town, but also the remote areas of the kebele where most of the migrant workers reside. Most of us hear the intervention through our friends rather than the HDA [health development army] or the HEW [health extension worker], so there is a need for spreading the awareness creation work. Even the awareness should be given in the local churches where most of the residents come to attend. [Migrant from Dagi]

The awareness creation and the intervention should be sustained as part of the government malaria prevention strategy. There are a lot of migrants who come from work but still didn't come to the health post as they don't have information. Thus, the tracking and the screening work of the migrants should continue intensively. [Migrant from Dagi]

One individual stated that PATH should create a monitoring and evaluation system and that there should be a review of all participating members.

There should be personal and group evaluation on the work that is conducted by every stakeholder involved in the intervention work. Moreover, the monitoring and visiting system should be created by PATH so that those who work at national and

regional offices come to the local context and initiate the local community for more work. Now one can say that there is no monitoring and evaluation of the work that we do both in the intervention and awareness campaign. [Health extension worker from Qimbaba]

One health worker stated that the trainings should be given to all health extension workers instead of the teachers and have them be in charge of the awareness campaign.

The training at the first place should not be given for the teachers; rather, training all health extension workers [there are four in the health post] and letting them do the awareness creation will be more fruitful. Teachers should have the mandate of facilitating the training plan, and let us do our job. [Health extension worker from Dagi]

One participant thought that the focus should be on MTAT instead of the current intervention.

Rather than doing repetitive intervention in the area, MTAT [mass test and treat] should be applied to make the problem of malaria extinct. [Surveillance officer from Alohay]

Another participant suggested that more medications should be offered at the health post.

The medicine in the health post should be diverse, rather than giving Coartem every time the patients come here. The project should make medicine available for every type of malaria detected in the returnee migrants and febrile people. [Health development army member from Berhan Chora]

One participant stated that the focus should be on prevention and not treatment and suggested a malaria vaccine.

The intervention should not only focus on treatment; rather, prevention should be included. Moreover, there is a need for bringing malaria vaccines, which are significant and one step ahead toward eradicating malaria. [Health extension worker from Berhan Chora]

Three participants suggested including prevention work into the current intervention such as bednets, spraying, and draining vector breeding areas.

Prevention work should be strengthened, including the provision of malaria nets and public environmental protection to delay the malaria breeding. [Migrant from Qimbaba]

One migrant suggested that there be a focus on creating jobs in the home kebeles so people do not have to migrate to the farms for work.

Entrepreneurship and job opportunity: providing job opportunities at home will help the migrants stay in this area and delay the transfer of the malaria epidemic from one area to another. [Migrant from Berhan Chora]

To improve the awareness campaign at the school level it was suggested using microphones and extending the awareness campaign from one day to multiple days.

There are a lot of things that we should do in order to increase the efficiency and the success of the intervention work. 1) Microphones should be available by the project

when the teachers and the HEW [health extension workers] work on awareness creation. 2) The awareness creation work should not be a one-day activity; rather, there should be continuous progressive work in different ways. [Teacher from Alohay]

Sustainability and continuation

While there were some problems and some suggestions for improvement, overall all participants, except one, stated that they thought the intervention should continue.

Whether this project exists or not, it's our duty to continue working on the prevention and treatment of malaria. Thus, we will try to make our exertion to make the project sustainable until malaria becomes vanished from our area. [Health extension worker from Qimbaba]

The education and the awareness provided is very crucial for the society to protect against malaria. We pledge that it's in the best interest of the society for this project to continue. As HDAs [health development armies], we are the representatives of the community, and whether we get personal benefit from the project or not, we should continue working. [Health development army member from Qimbaba]

One member was concerned that if the intervention did not continue, people would quickly forget what they had learned.

I hope we will use the model that PATH-MACEPA uses for other health campaigns. But the farmers will forget everything they learnt from the campaign unless and otherwise we continue the awareness creation campaign in a more regular way. [Surveillance officer from Alohay]

Two participants suggested scaling the project up to a national level campaign.

The campaign should not only be applicable in our kebeles, but also other surrounding kebeles, as there is also need from their side. They suggest about involvement in the campaign when we met for different things. [Health development army member from Alohay]

Sustaining the project is a national issue and it's not a matter of choice. We are happy to help in the interventions undergone to eradicate malaria, as it's a major health issue in our kebele. [Teacher from Alohay]

All participants, except one, also stated that they would support similar interventions in their districts.

This type of malaria test and intervention is beneficial to our community; so I am one hundred percent willing to support if similar types of intervention will be conducted in our kebele. [Key informant interview with a community leader from Dagi]

Because our community benefited from this kind of intervention, I am ready to support in any way if similar types of intervention will be conducted in our kebele. [Key informant interview with a community leader from Alohay]