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Regional Malaria Elimination Initiative Honduras

Baseline Measurement (2019-20)

July 2020

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Acronyms

BMGF - Bill & Melinda Gates Foundation
CAPI - Computer-assisted personal interview
CHAI - Clinton Health Access Initiative
Col-vol - *Colaborador voluntario* (volunteer collaborator)
COMISCA - Council of Ministers of Central America and the Dominican Republic
CSF - Carlos Slim Foundation
DTI-R - Detection, Diagnosis, Treatment, Investigation, and Response
ICD - International Classification of Diseases
IDB - Inter-American Development Bank
IHME - Institute for Health Metrics and Evaluation
IRS - Indoor residual spraying
ITN - Long-lasting insecticide-treated nets
LQAS - Lot Quality Assurance Sampling
MRR - Medical record review
PAHO - Pan American Health Organization
RBA - Results-based aid
RDT - Rapid diagnostic test
RMEI - Regional Malaria Elimination Initiative
SIS - *Sistema Integral de Salud*
TBF - Thick blood film

Executive summary

Introduction

The Regional Malaria Elimination Initiative (RMEI) is a regional public-private partnership administered by the Inter-American Development Bank (IDB) seeking to accelerate progress toward malaria elimination in Mesoamerica, the Dominican Republic, and Colombia. The Initiative focuses its resources on integrating evidence-based interventions aimed at reducing to zero the number of malaria cases in participating countries. The Institute for Health Metrics and Evaluation (IHME) is the independent external evaluator for the Initiative.

RMEI baseline measurement

The RMEI baseline measurement was designed to measure the status of key indicators to capture performance along the trajectory of the "Detection, Diagnosis, Treatment, Investigation, and Response (DTI-R)" management strategy. These include the supply of inputs for diagnosis and treatment, the proportion of suspected cases tested for malaria, the timeliness of detection and treatment of confirmed cases, the frequency and quality of reporting of cases and laboratory production, and the coverage of vector control interventions carried out in households at risk of infection.

IHME designed survey instruments based on the Initiative indicator manual and findings from the fact-finding visit to distinct points of the health system in Honduras, with input from the Secretary of Health. The measurement included a health facility survey consisting of interview, observation, and records review components and a Lot Quality Assurance Sampled (LQAS) household survey in the catchment area of selected health facilities. The health facility survey sample was selected among eligible primary care facilities in malaria focus areas of Honduras. Hospitals and administrative headquarters associated with selected primary care facilities in the public health service network were included in the sample to capture inter-facility pipelines for patient care (e.g., referrals), malaria diagnosis (e.g., thick blood film slides sent away for diagnosis by facilities without a laboratory), and notification and surveillance.

Data collection completed for the Honduras baseline measurement is summarized in Table E1. The information sought as a part of the measurement varied by facility type.

Table E1: Honduras data collection summary

Point of data collection	Number completed	Measurement completed
Ambulatory health facilities with/without malaria microscopy	36	Health facility questionnaire and observation
		Medical record review of suspected cases of malaria
		Treatment stock
		Laboratory supplies/reports
		Household measurement in catchment area
Hospitals	6	Health facility questionnaire and observation
		Medical record review of suspected cases of malaria
		Treatment stock
		Laboratory supplies/reports
Suspected malaria cases reviewed	*860*	
Municipal health units	12	Aggregate case and laboratory production reporting
Regional health units/regional laboratories	5	Record review of confirmed cases of malaria
		Stock of treatment and diagnostic supplies
		Laboratory supplies and reporting
		Laboratory certification and quality control

Point of data collection	Number completed	Measurement completed
Confirmed malaria cases reviewed	*539*	
National malaria reference laboratory	1	Laboratory supplies and reporting
		Laboratory certification and quality control
Communities	33	Coverage of vector control interventions
		Fever cases with malaria test
		Treatment of confirmed malaria cases
Households interviewed	*848*	

Summary of results

Malaria prevention

In order to protect the populations most at risk of malaria infection, the public health system in Honduras conducts vector control interventions such as the distribution of long-lasting insecticide-treated mosquito nets (ITNs) and the application of insecticide to interior walls of dwellings through indoor residual spraying (IRS). These activities may be carried out as part of an intervention plan based on the risk of transmission in a given zone, or in response to a recent malaria case or outbreak. Coverage of vector control interventions was measured in the LQAS survey. The interview respondent in each household was asked whether the interior walls of the home were sprayed with insecticide to protect against mosquitoes during the year prior to the day of the survey. Respondents were also asked how many treated and untreated mosquito nets their household owned. In the case they owned nets, interviewers recorded a detailed roster of which household member slept under each net the previous night. Individuals were considered to be protected when IRS had been applied to their home in the last year or when they slept under an ITN the night before the survey. Household members who did not sleep in the home the night before the survey and visitors to the household the night before the survey were excluded from the calculation. Table E2 shows intervention coverage according to the expectation in each community.

Table E2: Individuals protected by vector control measures (IRS or ITN), LQAS survey

Vector control reported	Communities	Used treated net	House sprayed
Nets	8	69.3%	4.4%
Spray	13	10.7%	46.4%
Both	4	55.9%	48.2%
None	8	4.7%	35.4%

Detection of malaria cases

In order to detect and treat malaria, facilities must have certain basic supplies and equipment on hand. During the health facility observation, survey personnel sought to observe each of these basic inputs according to the facility type. Equipment was checked to see if it was functioning. Stock of laboratory reagents and malaria medications was reviewed for the three months prior to the date of the survey to check for stockouts. Table E3 shows the results for each category of supplies for eligible facilities.

Table E3: Stock of inputs for malaria service provision, health facility observation

	N	n	%	95% CI
Antimalarial medications	42	10	23.8	(13 - 39)
Sampling and biosafety equipment	30	30	100	(-)
Sample submission forms	30	29	96.7	(79 - 100)
Rapid diagnostic tests (RDTs) for onsite testing	31	12	38.7	(23 - 57)
Microscopy equipment	29	29	100	(-)

	N	n	%	95% CI
Equipment for staining and testing	29	23	79.3	(60 - 91)
Reagents for staining	29	14	48.3	(31 - 66)
Units with all required equipment and medications	**53**	**10**	**18.9**	**(10 - 32)**

The measurement sought to estimate the proportion of suspected malaria cases receiving a test from two different sources: the community survey and the medical record review in health facilities that provide primary care services. During the household interview, respondents were asked if each member of the household had experienced a fever in the two weeks prior to the survey. Each individual reporting a fever was asked about the presence of concurrent respiratory, urinary, and skin symptoms that suggest the fever was caused by a condition other than malaria infection. Respondents reporting these symptoms were not considered to meet the case definition for suspected malaria and were excluded from the indicator calculation. Respondents meeting the case definition were asked if they received a blood test from any medical provider during the illness. Those reporting a blood draw were considered to have received a malaria test.

The medical record review provides a comparable indicator of passive case detection as measured in health facilities. A sample of attentions for patients presenting with fever or other eligible diagnoses was drawn from registries from the calendar year 2018. Survey personnel sought to observe all records available in the facility for each selected attention, such as medical charts, attention sheets, and laboratory records, and extracted information related to the illness episode. Cases that did not meet the suspected case definition for malaria because they had one of a list of exclusion diagnoses presumed to cause the fever were excluded from the calculation. Cases meeting the suspected case definition for malaria were checked for any evidence that a malaria test, whether rapid diagnostic test (RDT) or thick blood film (TBF), was ordered or carried out.

The results of both case detection indicators are shown in Table E4.

Table E4: Suspected malaria cases with test, LQAS survey and medical record review

	N	n	%	95% CI
Fevers with any blood sample (LQAS survey)	67	29	43.3	(32 - 55)
Suspected case with malaria test (medical record review)	801	67	8.4	(7 - 10)

Diagnosis of malaria cases

The RMEI baseline measurement also included a review of confirmed cases of malaria based on the case notification and investigation forms available at the health region headquarters. The review captured all cases from 2018 with records found at regional headquarters included in the sample. The indicator for timely diagnosis of malaria compares the date of initiation of fever or other symptoms with the date of diagnosis (if the patient received both an RDT and a TBF, the indicator is calculated using the earlier diagnosis date) as shown in Table E5. Cases with diagnosis two days or less after symptom initiation are considered to have timely diagnosis. Cases with fever/symptom initiation date or diagnosis date not registered are not considered to have timely treatment initiation.

Table E5: Diagnosis within two days, Confirmed case review

	N	n	%	95% CI
Cases diagnosed within 48 hours of onset	521	140	26.9	(23 - 31)
3 days	521	49	9.4	(7 - 12)
4-5 days	521	94	18	(15 - 22)
6-7 days	521	60	11.5	(9 - 15)
Over 7 days	521	110	21.1	(18 - 25)
Indicator result: Cases diagnosed within 48 hours of onset*	521	140	26.9	(23 - 31)

*18 cases excluded due to suspected inscription/data entry error (<-7 day or >30 day window)

Treatment of malaria cases

The review of confirmed malaria cases also captured all available information about malaria treatment administered to patients from case investigation forms or treatment logs. The indicator for timely treatment of malaria compares the date of diagnosis (if the patient received both an RDT and a TBF, the indicator is calculated using the earlier diagnosis date) with the date of treatment initiation (Table E6). Cases for which the first dose of the appropriate treatment was given one day or less after diagnosis are considered to have timely treatment initiation. Cases with diagnosis date, treatment initiation date, or *Plasmodium* species not registered are not considered to have timely treatment initiation.

Table E6: Treatment within one day, Confirmed case review

	N	n	%	95% CI
Correct treatment administered for species	538	469	87.2	(84 - 90)
First dose treatment within 24 hours of diagnosis*	521	340	65.3	(61 - 69)
Correct treatment administered within 24 hours of diagnosis*	521	325	62.4	(58 - 66)

*17 cases excluded due to suspected inscription/data entry error (<-7 day or >30 day window)

The indicator for complete, supervised treatment of malaria identifies the cases with evidence that all doses of the appropriate treatment scheme were administered to the patient, and that at least one dose was supervised by any health care provider (Table E7). Cases with *Plasmodium* species, type of medication administered, or number of treatment administrations not registered are not considered to have complete treatment.

Table E7: Complete and supervised treatment, Confirmed case review

	N	n	%	95% CI
Adequate treatment and number of doses administered	538	169	31.4	(28 - 35)
Evidence of at least one supervised dose	538	108	20.1	(17 - 24)
Indicator Result: Complete treatment with supervision	538	63	11.7	(9 - 15)

Malaria reporting and surveillance

The RMEI health facility survey included a review of malaria case and laboratory production reports and laboratory quality control reports from the year 2018 to measure adherence of each facility to reporting and quality control standards as defined through the Initiative. Field personnel conducted an audit of all malaria case reports from 2018 stored at primary and secondary level facilities in the sample. They then sought to observe all 12 monthly reports or all 52 weekly reports for the year 2018. Next, surveyors sought to find the reports corresponding to a randomly selected month (or 4 weeks), and captured detailed information from this report, such as the number of malaria cases reported (or whether zero cases were reported) and the date sent or received as listed on the report (or as listed in a logbook of official correspondence sent and received in facilities that use such a book). An analogous process was

completed for laboratory production reports and reports of the indirect quality control (slide cross-checking) exercise in facilities with microscopic diagnostic capacity. A report of the 2018 annual direct quality control (slide panel) exercise with feedback from the reference laboratory was also sought in each facility with malaria microscopy, and a report of external microscopy certification from the Pan American Health Organization was sought in the national reference laboratory.

The results for reports from the year 2018 complete with quality standards are shown in Table E8.

Table E8: Reporting for malaria surveillance and diagnosis quality control, health facility observation

	N	n	%	95% CI
Malaria case reporting to standard	29	4	13.8	(5 - 32)
Laboratory production reporting to standard	21	0	0	(-)
External quality control: 2018 National Lab Evaluation form observed	1	1	100	(-)
Facilities passing direct quality control (DQC) component	28	2	7.1	(2 - 25)
Facilities passing indirect quality control (IDQC) component	28	1	3.6	(0 - 22)

Key findings

The results of the Honduras baseline measurement suggest several opportunities for RMEI to strengthen practices on the trajectory to malaria elimination. First, even when activities like treatment of malaria patients or laboratory quality control are conducted to standard, a sufficient record of the activity carried out is not always maintained at the relevant health facility, which complicates measurement of performance and timeliness. Enhancing record keeping will thus lead to improved results that better reflect high-quality work carried out on the ground. Electronic systems have the capacity to improve information availability, but in order to be effective, adoption of these systems must account for the strengths and weaknesses of existing paper-based systems.

The measurement found evidence of local and regional variation in practices for malaria detection and notification. While different strategies may be necessary in zones with different levels of malaria transmission or risk, it is important to ensure a shared understanding of goals and adherence to standard at the local level when such standards have been established. Furthermore, this understanding of the strategy and the role of each contributor must extend beyond the malaria and vector control programs and diagnosis networks to include primary health care providers who play an increasingly important role in detection and management of cases as Honduras draws closer to malaria elimination.

Chapter 1: Introduction

1.1 Overview

The Regional Malaria Elimination Initiative (RMEI) is a regional public-private partnership administered by the Inter-American Development Bank (IDB) seeking to accelerate progress toward malaria elimination in Mesoamerica, the Dominican Republic, and Colombia. One of its defining features is the application of a results-based aid (RBA) model that relies on performance measurement and enhanced transparency and accountability. The Initiative focuses its resources on integrating evidence-based interventions aimed at reducing to zero the number of malaria cases in participating countries. RMEI is funded by the Bill & Melinda Gates Foundation (BMGF), the Global Fund to Fight AIDS, Tuberculosis, and Malaria, the Carlos Slim Foundation (CSF) and each of the participating country governments. The Initiative is implemented in close coordination with the Pan American Health Organization (PAHO), the Council of Ministers of Central America and the Dominican Republic (COMISCA), the Project Mesoamerica, Clinton Health Access Initiative (CHAI), and other regional partners. The Institute for Health Metrics and Evaluation (IHME) is the independent external evaluator.

Interventions aim to build on the malaria control and elimination activities ongoing for several decades in Honduras, and harness partnerships with PAHO, CHAI, and the Global Fund. RMEI's approach seeks to eliminate malaria in humans, the main reservoir of the parasite, through surveillance and "Detection, Diagnosis, Treatment, Investigation, and Response (DTI-R)" interventions. A hallmark intervention of the Initiative, as many countries in the region enter the elimination phase of their malaria programs, was to carry out micro-stratification of geographic areas vulnerable and receptive to malaria transmission. In Honduras, active, residual, and inactive foci were defined, and each municipality was assigned to a stratum 1 through 4B, as seen in Table 1.1. This exercise was completed prior to the baseline measurement and served as a basis for defining the study area and selecting the sample. Municipalities will be redefined with updated stratum classification in subsequent points on the Initiative as their level of importation risk and number of autochthonous cases evolves. The malaria program in Honduras carries out household-level vector control interventions such as indoor residual spraying (IRS) and distribution of long-lasting insecticide-treated nets (ITNs) which are to be expanded and monitored as a part of the Initiative. Other interventions focus on providing training, disseminating standards for clinical care, improving record-keeping with medical providers country-wide, and improving surveillance capacity by reviewing existing practices, expanding use of digital information systems, and standardizing reporting for case detection.

Table 1.1: Honduras malaria stratification: Definition and distribution of strata

Stratum	Number of municipalities	Definition
1	98	Non-receptive
2	108	Receptive, no autochthonous cases, no risk of importation
3	6	Receptive, risk of importation, no autochthonous cases
4	86	Receptive, presence of autochthonous cases in last 3 years

In Honduras, malaria burden has dropped in recent years, though transmission persists in several regions, in particular in the north and east of the country. In 2018, the reference year for the baseline measurement, Honduras had 639 confirmed cases of malaria according to national public health surveillance data provided by the Secretary of Health. Honduras has historically depended on a vertically integrated malaria program that operates in close coordination with programs for other vector-transmitted diseases, and receives grant support from the Global Fund. Honduras has an established network of community health volunteers called *"colaboradores voluntarios"* ("col-vol", volunteer collaborator) who collaborate in case detection in communities with active malaria transmission and with limited access to health services. In the malaria elimination phase, Honduras will transition malaria detection and case management to be more closely horizontally integrated within the public primary care system, increasingly

relying on passive detection of cases at health facilities and eventually shifting responsibility to primary care providers to administer treatment and follow-up care.

1.2 Components of the RMEI baseline measurement

The objective of the RMEI baseline measurement is to compile a detailed picture of malaria health services in each participating country, including information about readiness to eliminate malaria through the support of the Initiative. The measurement is designed around a set of indicators that participating countries and implementation partners negotiate as a part of RMEI DTI-R management strategy. These include the supply of inputs for diagnosis and treatment, the proportion of suspected cases tested for malaria, the timeliness of detection and treatment of confirmed cases, the frequency and quality of reporting of cases and laboratory production, and the coverage of vector control interventions carried out in households at risk of infection. Indicators for Honduras are listed in full in Appendices A and B. Subsequent measurement rounds will assess whether countries are reaching the indicator targets set through the Initiative and evaluate the results of specific interventions.

The baseline measurement includes a health facility survey (interview and observation), a review of medical records for suspected and confirmed cases of malaria, and a household survey conducted in communities served by health facilities in the sample. This report summarizes the data and findings of the RMEI baseline measurement conducted by IHME.

The health facility survey involves the following components:

- an interview with the administrator of the facility about the services provided there (general facility characteristics, infrastructure, and human resource composition, supply logistics, infection control, and provision of services related to malaria diagnosis and treatment),
- an observation of supplies, equipment, and pharmaceutical stock present in the facility,
- an observation of laboratory supplies and equipment, laboratory production and case notification reports in facilities with malaria diagnostic capacity,
- a review of medical records of suspected malaria cases (case definition detailed in Chapter 6),
- a review of paper case notification and case investigation forms for confirmed malaria cases at selected regional headquarters.

The facility survey, observation, and record review is designed to collect information on facility preparedness for detecting and treating malaria cases, as well as the quantity and quality of malaria care services provided in the baseline time period. Importantly, health facility data collection captures changes produced by interventions at the level of the health services access point, which may foretell changes in population health outcomes.

The household survey is designed to collect information on malaria detection, prevention practices, and knowledge in malaria focus areas of Honduras from a randomly selected group of households in each surveyed community. Respondents are asked questions about their background, dwelling conditions, knowledge and use of behaviors to prevent malaria, illness and care-seeking history, and other questions that will be helpful to policy makers and administrators in controlling and seeking to eliminate malaria. Community data collection permits the observation of health status, knowledge of malaria, access to health care, and uptake of interventions and practices that prevent malaria infection.

1.3 Fact-finding and data collection scope

In order to refine the survey instruments and prepare for sample selection and data collection, IHME and IDB conducted a joint multi-day fact-finding visit in three regions of Honduras in May 2019. During the exploratory visit, the team visited a range of health facilities and col-vol posts in endemic and non-endemic areas. The goal of the visit was to learn:

- the local practices for detection and treatment of malaria

- the structure of the health system for malaria care
- the procedures for case notification and channels for data reporting
- the nature of community and prevention activities
- the sources of subnational variation in systems or service provision.

The trip also helped to define sampling methodology and framed expectations about measurement challenges for each indicator, insufficient data availability, and potential gaps in systems and procedures that must be addressed in order to meet Initiative targets and to reach malaria elimination.

The set of indicators defined and negotiated for the baseline measurement necessitates data collection at several distinct points of the health system. The findings from the fact-finding visit determined the points of service visited to measure the indicators, the sources of information reviewed at each unit, and the sample size dedicated to each type of unit. In Honduras, the sample includes primary care facilities, hospitals, municipal health offices, regional health offices, and regional and national reference laboratories. Households within the catchment area of primary care facilities selected to the sample were interviewed for the community survey. Table 1.2 shows the information collected at each point.

Table 1.2: Points of data collection for baseline measurement

Type of health unit	Measurement completed
Ambulatory health facilities with/without malaria microscopy	Health facility questionnaire and observation
	Medical record review of suspected cases of malaria
	Treatment stock
	Laboratory supplies/reports
	Household measurement in catchment area
Hospitals	Health facility questionnaire and observation
	Medical record review of suspected cases of malaria
	Treatment stock
	Laboratory supplies/reports
Municipal health unit	Aggregate case and laboratory production reporting
Regional health unit	Record review of confirmed cases of malaria
	Stock of treatment and diagnostic supplies
Regional and national labs	Laboratory supplies and reporting
	Laboratory certification and quality control
Households	Coverage of vector control interventions
	Fever cases with malaria test
	Treatment of confirmed malaria cases

Another point of care critical to systems of malaria detection and treatment in Honduras is the *"colaborador voluntario"* (col-vol). These volunteer community health workers provide fever screening and malaria testing via rapid diagnostic test or thick blood film (TBF or "gota gruesa") preparation, out of their own homes or around their communities. Col-vol posts were considered for inclusion in the measurement sample, because col-vols prepare TBF slides, keep registers of patients tested, and sometimes store and administer treatment for confirmed malaria cases. However, because col-vols do not manage their own supply stocks, keep records of patient care, nor have primary responsibility for case investigation and follow-up, the col-vol post is not eligible for inclusion in the RMEI indicators. All the necessary records to be reviewed for a patient with malaria detected by a col-vol, or with treatment supervised by a col-vol, will be filed at a health facility or vector control office rather than at the col-vol's home and these records are captured within the existing sampling frame. Further, col-vol posts are costly to reach because they are intended to serve communities without an easily accessible health facility, and col-vols may not keep regular hours since they are volunteers and not health system employees. Confirmed cases of malaria

detected by a col-vol were included in the review of medical records, as paperwork for cases detected at any service point is always filed at the regional health unit, where review took place, in Honduras.

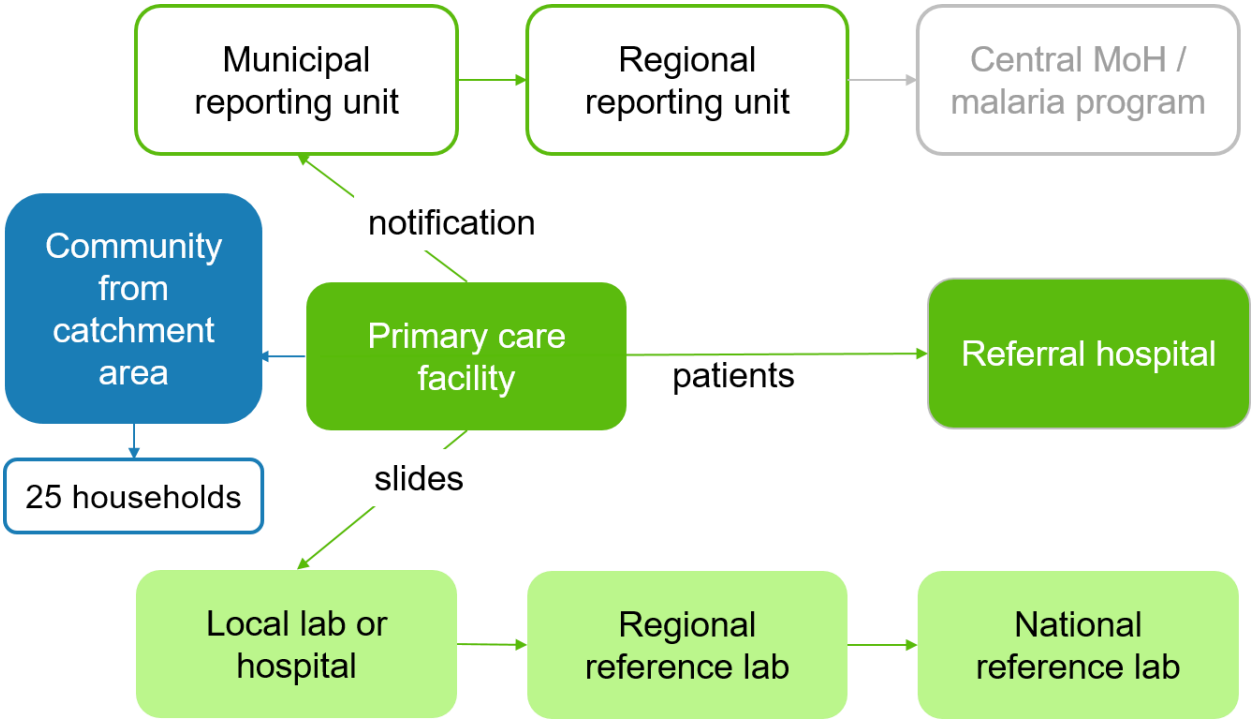
Chapter 2: Survey Methodology

2.1 Sample selection and description

The RMEI baseline measurement aims to measure performance of the health system in zones that play an important role in malaria prevention, detection, and treatment. Since malaria activities are more intensive in endemic and vulnerable areas, the sample is targeted toward presenting representative estimates for the focus areas identified for interventions through the Initiative. Since the Initiative aims to eliminate malaria, its success depends on reducing the burden in zones with high malaria transmission. We expect to return to some of these zones in future measurement rounds to monitor changes in practice. In Honduras, the sample is made up of facilities and communities in malaria strata 3 and 4 (see strata definitions in Table 1.1). We focused on zones with autochthonous malaria cases in order to maximize our sample size from these zones.

The set of indicators defined and negotiated for the baseline measurement necessitates data collection at several distinct points of the health system. To draw the sample, we selected a primary care facility (*"unidad de atención primaria de salud," "centro integral de salud," "policlínico"* and *"servicio materno-infantil"*) at random as the primary sampling unit, and then selected the other health services linked with it in malaria service provision, such as hospitals, reference laboratories, and administrative units responsible for notification and reporting, as depicted in Figure 2.1. The communities we selected for the household survey are within the catchment areas of the selected primary care facilities.

Figure 2.1: RMEI-Honduras baseline health system structure



2.1.1 Health facility sample selection

In Honduras, malaria stratification was completed at the municipality level. Primary care facilities in municipalities classified as malaria stratum 3 or malaria stratum 4 were eligible to enter the sampling frame, with priority to facilities serving communities with vector control measures (ITN distribution or IRS) implemented. Because patients with fever may seek care at any health facility, but only a fraction of these facilities has microscopy capacity, the sample of primary care facilities was drawn separately for facilities

with and without microscopy. This ensured a sufficient denominator to measure indicators for laboratory inputs, equipment, and reporting. The sample was thus selected in four sampling strata: with and without microscopy capacity in malaria stratum 4, and with and without microscopy capacity in malaria stratum 3. Across Honduras, only six municipalities are classified as malaria stratum 3.

The sampling frame was built based on referral networks and facility lists provided by the Honduras Secretary of Health. Each health facility eligible to be selected for the sample was assigned to a malaria stratum 1 through 4 based on its municipality. We assigned each administrative unit (*"sede municipal", "región sanitaria"*) to the maximum stratum found in its service area (regions with any municipalities in stratum 4 are therefore assigned to stratum 4).

The initial sampling frame for the health facility survey is the list of facilities that provide primary care services for malaria. In order to ensure necessary information is captured for all indicators, for each selected facility we included the ancillary units from the reporting chain (municipal offices, regional offices and labs, and referral hospitals) associated with a selected primary care facility for measurement, up to a fixed sample size defined to balance budget considerations with statistical power for analysis. For example, once a local-level ambulatory facility was selected at random, several related units were identified for inclusion (or for random selection, if more than one qualifies). These include the hospital to which it refers severe malaria cases, the reference laboratory responsible for its microscopy quality control, and the regional headquarters where confirmed malaria cases from the facility are investigated and filed. More detail on sample selection procedures and sample size considerations is in Appendix C.

This sample selection strategy minimizes the need for sample stratification while maximizing the opportunity to track care and surveillance activities from the point of service to the central level, and thus to identify gaps in malaria service provision and surveillance. Additionally, the selection strategy allows for a random sample of facilities to be included in the measurement for supplies and equipment, testing of suspected cases, and reporting sent from the local level, but remains cost-effective by concentrating visits to regional offices to review confirmed cases of malaria and household measurement in the zones with the most autochthonous transmission.

2.1.2 Substitutions within the sample

We selected two backup facilities per municipality in case sampled facilities could not be interviewed due to security or logistic concerns. When replacement was required, we replaced with a facility of the same level, with the same diagnostic capacity, and within the same municipality or a neighboring municipality when possible. If substitutes were not available in the same municipality, we replaced with a randomly selected facility from the same malaria stratum. In the Honduras baseline, three primary care facilities, one hospital, and one municipal unit were replaced during data collection. Where replaced units were planned for the community survey, the community survey was carried out in a locality associated with the replacement facility rather than the original facility.

One primary care facility was replaced due to a long-term interruption in service provision at the facility - it was not open or staffed during the data collection team's visit. Another primary care facility was replaced because it was found that the community had no health facility but rather was served only by a col-vol post (ineligible for inclusion in the study). In both cases, the community survey was carried out in the catchment areas of the replacement facilities, rather than the originally selected facilities. One primary care facility was replaced because it was found to provide attention and laboratory services collaboratively with an adjacent facility, also in the sample. The unit that provided only maternal and infant care was replaced with another facility selected at random from the study area, and the partner unit that provided all types of ambulatory care was surveyed. Household data collection was completed for both facilities before the facility replacement took place, so a 33rd community was added to the household sample, associated with the replacement facility.

One hospital in the sample was replaced with a regional hospital selected at random from the study area because the originally selected hospital was found to provide exclusively tertiary-level maternal and neonatal care. One municipal unit was replaced with a unit selected at random in another region, because

no municipal-level unit existed in the selected municipality, rather primary care facilities were managed directly by the health region. In addition, the laboratory modules could not be completed at one primary care facility due to long-term absence of the laboratory staff person (no one else in the facility could inform about practices nor had access to laboratory records). The final sample totals 60 facilities (as originally planned), and 33 communities rather than the originally sampled 32 communities.

2.1.3 Community and household sample selection

One community was selected for the Lot Quality Assurance Sampling (LQAS) household survey from the catchment area of each of the 32 primary care facilities selected to the facility sample in malaria stratum 4. Within the selected catchment area, a community that had received ITN or IRS interventions since the start of 2018 was selected at random among all communities with vector control interventions, as determined by the facility staff and community selection module during data collection. If no communities received vector control interventions or intervention status was unknown, a community was selected at random among all communities in the catchment area. Field staff used an automated survey module to enter information about eligible communities in the catchment area, usually provided by vector control technicians at each selected facility. The module automated the selection of one eligible community and provided the random and calculated inputs (random starting point, calculated skip interval) for field random selection of households.

Twenty-five households in each surveyed community were selected systematically for the interview using field random sampling techniques. The random sampling unit was the dwelling, and all households living in a selected dwelling were eligible for the survey. The interview was responded by the head of household or another adult member of the household knowledgeable about household characteristics. Absent and refused households were replaced with a randomly selected alternate household. Revisits to selected households are not part of the LQAS survey protocol; any selected household that could not be completed the day of the survey was replaced with an alternate. The visit results among selected and replacement households are shown in Table 2.1.

Table 2.1: Result in households selected for survey, unweighted proportions

	N	n	%	95% CI
Status of selected and replacement households				
Complete	1247	848	68	(65 - 71)
Members absent	1247	263	21.1	(19 - 23)
Refused	1247	66	5.3	(4 - 7)
Unoccupied dwelling	1247	59	4.7	(4 - 6)
Other	1247	11	0.9	(0 - 2)

2.1.4 Confirmed case review sample selection

For confirmed cases of malaria, the sample was designed to include review of all confirmed cases from 2018 in the selected regional headquarters serving stratum 4. Field staff collected information from all documents available at the regional headquarters, including case notification and investigation forms, lab records, and treatment follow-up forms. Table 2.2 shows the number of cases expected at each regional headquarters in the sample (based on counts of cases by municipality in the microstratification data provided to IHME), and the number of case reviews completed during data collection.

Table 2.2: Confirmed case collection

Región Sanitaria	Confirmed cases according to stratification documentation	Confirmed cases captured during collection
Colón	99	102
El Paraíso	39	34
Gracias a Dios	248	216
Islas de la Bahía	124	113
Yoro	73	74
Total	583	539

2.1.5 Suspected case medical record review sample selection

For suspected cases of malaria (fever and other complaints and diagnoses meeting the case definition), a random sample of eligible attentions from 2018 was selected for medical record review (MRR). The total budgeted quota of record reviews was divided equally among the primary care facilities and hospitals selected to the sample. Eligible attentions were identified in-facility using attention registries or diagnosis databases. The sample was selected for full review using a systematic manual sampling technique as detailed in Appendix C. Field staff collected information from all documents available at the health facility, including daily attention registries, medical records or attention forms, and lab records. Table 2.3 shows the total number of suspected cases reviewed (852), the number of cases selected based on diagnosis or principal complaint but found to be ineligible based on final diagnosis (81), and the cases selected and requested at facilities for which no paperwork could be located for review (935). Sampling for suspected cases of malaria was completed at many health facilities using the ATA (*atenciones ambulatorios*) registry. For 935 cases, the visit noted in the ATA registry could not be successfully located or the medical record was found to be empty. In many facilities in Honduras, all eligible cases from the entire year 2018 were selected for review, because there were relatively few attentions with eligible diagnoses recorded.

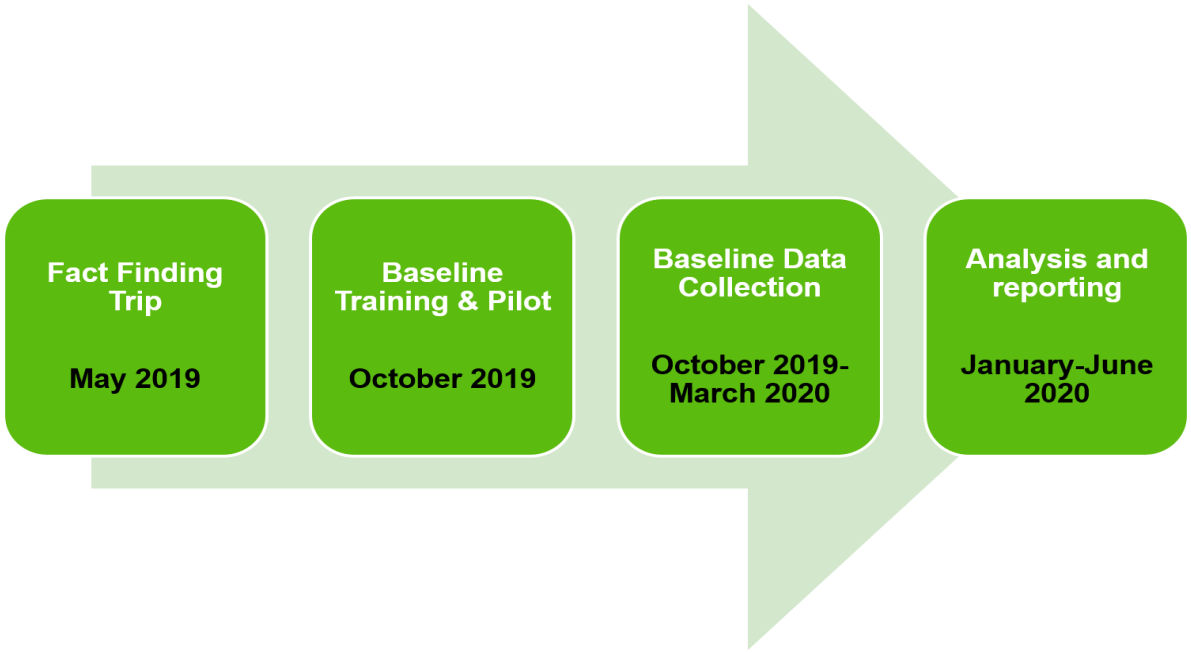
Table 2.3: Suspected case collection

	#
Total suspected cases selected for review	1868
Suspected cases selected but could not be located for review	935
All suspected cases screened for eligibility	933
Ineligible suspected cases discarded	81
Eligible suspected cases collected	852

2.2 Survey implementation

In Honduras, baseline data was collected between October 2019 and March 2020. The timeline of baseline measurement activities is shown in Figure 2.2.

Figure 2.2: RMEI-Honduras baseline timeline



2.2.1 Data collection instruments

Questionnaires were initially developed in English, and then translated to Spanish. To best reflect the issues most relevant to the region under study and the local language, we revised the Spanish-language questionnaires following input from key stakeholders and at the conclusion of the pilot studies (described below). Study areas included a substantial proportion of indigenous populations, many of them also Spanish speakers. In order to allow the participation of non-Spanish speakers in the survey, the data collection team was prepared to contract local interpreters proficient in Garifuna, Chortis, Lenca, Paya, Tol, and Jicaque as required.

All surveys were conducted using a computer-assisted personal interview (CAPI), programmed using SurveyCTO and installed onto tablets. CAPI supports skip patterns, inter-question answer consistency, and data entry ranges. CAPI reduces survey time by prompting only relevant questions, maintains a logical answering pattern across different questions, decreases data entry errors, and permits rapid data verification remotely. Field team leaders monitored the implementation of the survey and reported feedback. Data collection using CAPI allowed data to be transferred instantaneously once a survey was completed via a secure link to IHME. IHME monitored collected data on a continuous basis and provided feedback. Suggestions, surveyor feedback, and any approved modifications were incorporated into the survey instruments and readily transmitted to the field.

2.2.2 Survey content

The health facility survey includes several modules. An interview with the facility director records information about facility characteristics, services provided, and personnel employed by the facility. Observation modules are organized by room or category to facilitate visits to the rooms where care is provided to patients, the pharmacy, the laboratory, and other areas. An additional module is used to capture information about the catchment area of the facility and to select the community to be enumerated in the household survey.

The MRR Module is a format for capturing the data recorded in a patient's medical chart, including from the clinical provider's notes or from malaria testing, notification, or case investigation forms that may be stored with or apart from the record. The MRR is not an interview, but a data collection method where the

surveyor reviews the record and transfers the relevant information into the digital form. The questionnaire is filled out once per medical record selected to the sample of suspected malaria cases or to the sample of confirmed malaria cases. The Quotas Module is used to capture information about the manual sample selection process in each facility.

The households selected to the LQAS survey sample are visited and interviewed using a Household Questionnaire. The Household Questionnaire includes a listing of basic demographic information for household members, and collects information on housing characteristics such as type of water source, sanitation facilities, quality of flooring, ownership of durable goods, and ownership and use of mosquito nets. The household questionnaire records knowledge and practices for malaria prevention, as well as history of recent illness for all members of the household. The LQAS survey also includes a summary module filled once per community that includes GPS coordinates of the community (GPS waypoints are not collected at the household level to protect respondent confidentiality) and totals of households visited and surveyed.

2.2.3 Training and supervision of data collectors

IHME led training sessions and pilot surveys in health facilities and households in Honduras between October 21 and October 26, 2019. The local agency contracted for data collection in Honduras, UNIMER, hired four doctors, five nurses, and two field supervisors who we trained to conduct surveys in households and health facilities and to review medical records. The training included content of each survey, proper conduct of the survey, in-depth review of the instrument, and hands-on training on the CAPI software, as well as interview practice among participants. Surveyors participated in a two-day pilot where they applied the health facility questionnaire, conducted observation exercises, and practiced medical record sampling and review for suspected and confirmed cases of malaria, as well as household sample selection and interviews. Representatives from IHME, IDB, and the Honduras Secretary of Health provided oversight during pilot exercises. IHME and UNIMER held debriefing and re-training sessions with surveyors post-pilot and provided continued training during the first week of data collection in communities and health facilities. UNIMER continued providing retraining throughout data collection to maintain homogeneity and quality standards of the data collection teams over time. During a supervisory trip from November 18-22, 2019, an IHME staff member observed active household and health facility data collection and provided feedback to data collectors.

2.2.4 Data analysis and report writing

IHME conducted data analysis using STATA versions 14 and 15 and R versions 3 and 4. This report provides data summaries for the baseline measurement in health facilities and households in Honduras. The estimates from the household surveys are weighted by the inverse probability of selection (see details in Appendix C) and account for clustering in variance calculations, except where explicitly noted otherwise. IHME calculated RMEI indicators in accordance with the Indicator Manual provided by IDB and previously negotiated with the Honduras Secretary of Health.

2.2.5 Ethical considerations

The study received authorization from by the Honduras Secretary of Health to conduct data collection in health facilities and by local authorities to collect data in communities. The study was approved, receiving non-human subjects research determination by the Institutional Review Board of the University of Washington given that no personally identifiable information was collected as a part of any of the survey modules. All respondents to the household survey, and the senior responsible staff member at participating health facilities, signed informed consent forms prior to data collection. Signed consent forms were collected and managed by UNIMER, the in-country data collection partner, and this information was not transmitted to IHME for privacy reasons.

Chapter 3: Malaria Knowledge, Attitudes, and Practices in Household Survey

This chapter provides a descriptive summary of basic demographic, socioeconomic, and environmental characteristics, as well as knowledge and behaviors for malaria prevention, of the households interviewed for the RMEI-Honduras Baseline LQAS Survey in households. As noted in Chapter 2, the household measurement in Honduras was conducted entirely in malaria stratum 4. All estimates reported in this chapter are weighted by the inverse probability of selection (see details in Appendix C) and account for clustering in variance calculations, except where otherwise noted. For this reason, many proportions reported are not equal to the ratio of numerator to denominator.

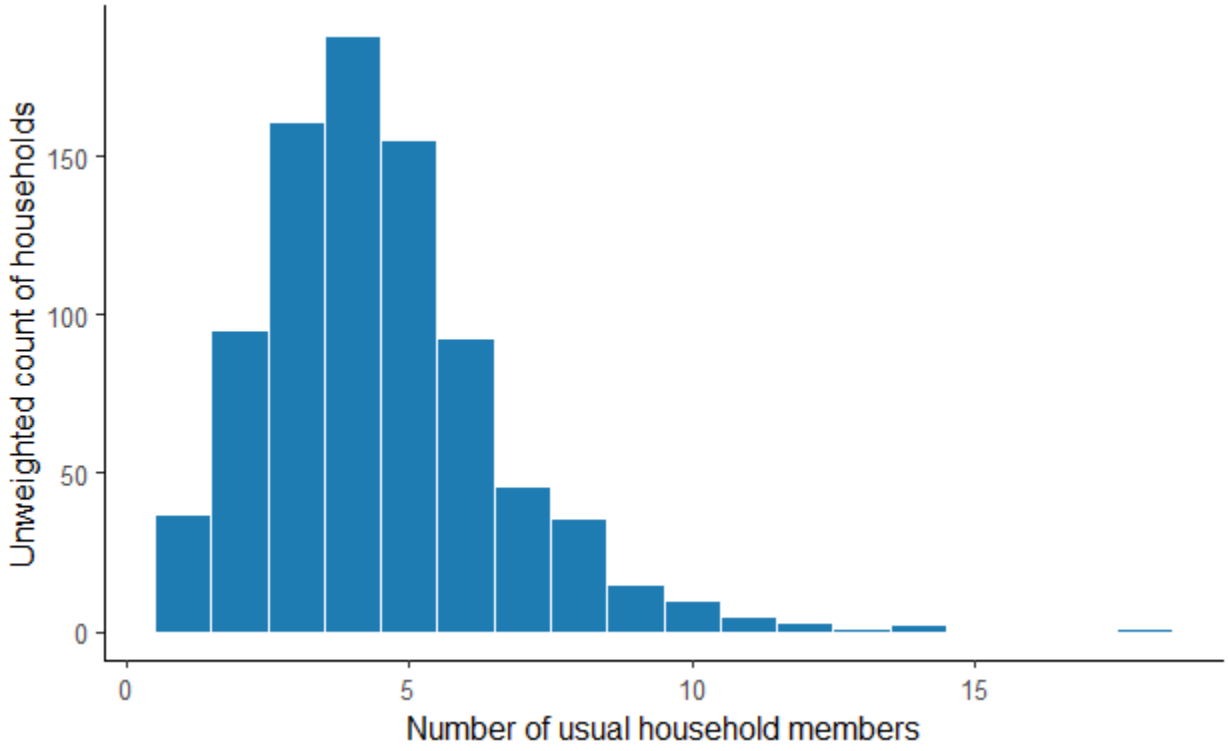
3.1 Characteristics of participating households

This section includes results for composition of surveyed households, physical characteristics of dwellings they inhabit, household assets, and proximity to health facilities.

3.1.1 Household composition and household member characteristics

A total of 848 households in the Honduras baseline survey completed the interview. The unweighted distribution of the number of members by household is shown in Figure 3.1. The survey sample for Honduras has a median household size of 4 and an unweighted average household size of 4.5.

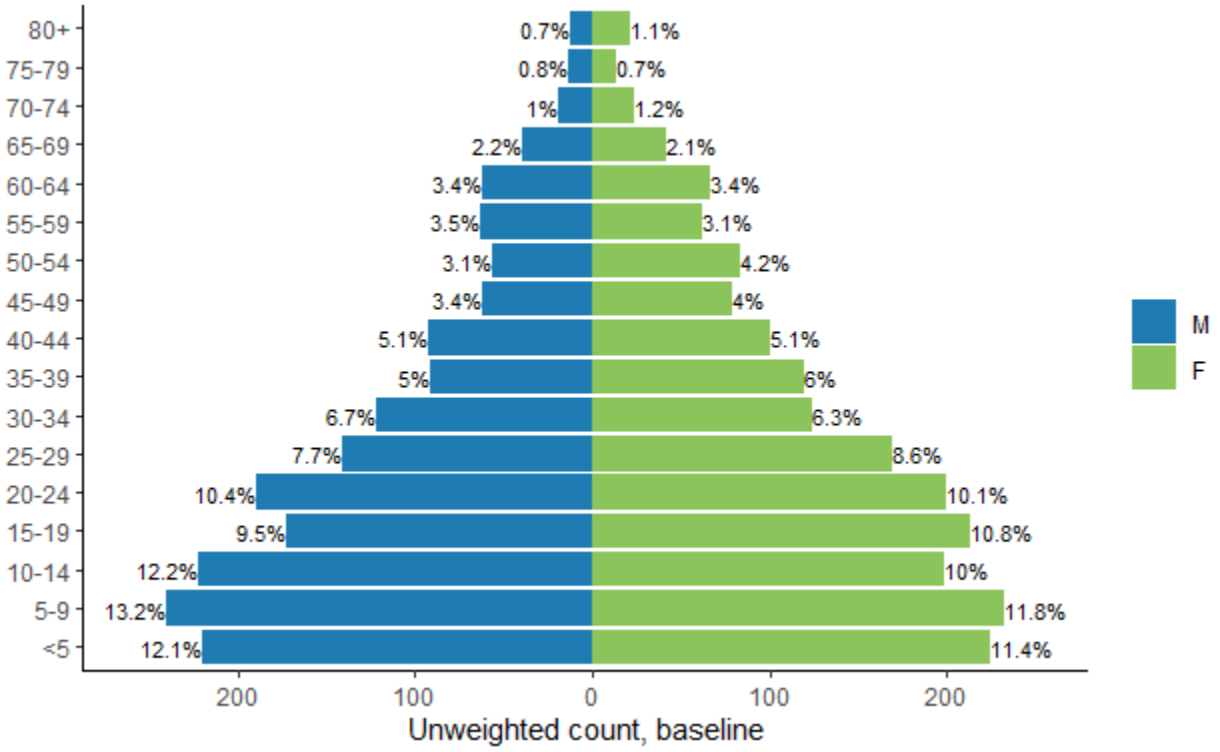
Figure 3.1: Household size, unweighted percent distribution



The unweighted distribution of the de facto household population in the surveyed households in Honduras by five-year age groups and by sex is shown in Figure 3.2. Honduras has a larger proportion of its population in the younger age groups than in the older age groups. Figure 3.2 indicates that in the baseline, 35% of the population in the baseline is under age 15 years, more than half (60%) of the

population is in the economically productive age range (15-64), and the remaining 5% is age 65 and above.

Figure 3.2: Age and sex of household sample, unweighted percent distribution of usual members by 5-year age groups



The respondent was asked to indicate education level, languages spoken, and ethnic identity for all usual household members aged 15 or older. Respondents could indicate multiple languages spoken or ethnic identities. The results are shown in Table 3.1, Table 3.2, and Table 3.3 respectively. In Honduras, 9% of household members had no formal schooling, and 51.6% completed only primary education. Ninety-three percent speak Spanish and 23.2% speak Miskito. Twenty-three percent identify as ethnically Miskito.

Table 3.1: Education of household members age 15 and older

	N	n	%	95% CI
Education level of household members age 15 and older				
No schooling or pre-school only	2455	233	9	(7 - 11)
Primary	2455	1292	51.6	(45 - 58)
Secondary	2455	474	18.9	(16 - 23)
University	2455	107	5.1	(3 - 9)
Specialty	2455	3	0.1	(0 - 0)
Baccalaureate degree	2455	302	13.6	(10 - 18)
Don't know	2455	41	1.5	(1 - 2)
Decline to respond	2455	3	0.1	(0 - 1)

Table 3.2: Languages spoken by household members age 15 and older

	N	n	%	95% CI
Languages spoken by household members age 15 and older				
Spanish	2455	2179	93	(86 - 97)
Miskito	2455	930	23.2	(11 - 42)
English	2455	127	6.7	(2 - 20)
Garifuna	2455	84	1.5	(0 - 6)
Jicaque	2455	2	0.1	(0 - 0)
Chortis	2455	0	0	(-)
Lenca	2455	0	0	(-)
Paya	2455	0	0	(-)
Tol	2455	0	0	(-)
Other	2455	4	0.1	(0 - 0)
Don't know	2455	24	1.2	(1 - 2)
Decline to respond	2455	1	0	(-)

Table 3.3: Indigeneity of household members age 15 and older

	N	n	%	95% CI
Indigenous group affiliation of household members age 15 and older				
Miskito	2450	916	23	(11 - 41)
None	2450	276	15	(7 - 30)
Garifuna	2450	109	2.3	(1 - 8)
Lenca	2450	4	0.2	(0 - 1)
Paya	2450	4	0.1	(0 - 1)
Tol	2450	1	0.1	(0 - 1)
Chortis	2450	0	0	(-)
Jicaque	2450	1	0	(-)
Other	2450	198	10.8	(7 - 16)
Don't know	2450	928	48	(33 - 63)
Decline to respond	2450	13	0.6	(0 - 1)

3.1.2 Dwelling characteristics

The quality of building materials used in houses is related to malaria protection for those living within. Dwellings that offer more protection have no slits or gaps where mosquitoes can enter, glassed or screened-in windows, and closed eaves. Field personnel observed building materials as a part of the survey. In Honduras, as seen in Table 3.4, Table 3.5, and Table 3.6, most homes are built with walls of cement block, sheet metal (zinc/alucin) roofs, and cement sheet/board floors.

Table 3.4: Exterior wall material as observed

	N	n	%	95% CI
Main material of exterior walls of dwelling				
Cement block	848	370	53.8	(43 - 65)
Plywood	848	280	20.5	(12 - 33)
Uncovered adobe	848	123	15.8	(10 - 24)
Polished wood	848	36	3.6	(2 - 8)
Brick/covered adobe	848	11	2	(1 - 5)
"Bahareque"/wattle-and-daub (mud plaster and cane)	848	11	1.7	(1 - 6)
Stone with lime/cement	848	7	0.8	(0 - 2)

	N	n	%	95% CI
Palm/bamboo	848	3	0.3	(0 - 1)
Prefabricated material	848	1	0.2	(0 - 2)
Other	848	6	1.2	(0 - 3)

Table 3.5: Roofing material as observed

	N	n	%	95% CI
Main material of roof of dwelling				
Sheet metal (zinc/Alucin)	848	724	85.1	(77 - 91)
Clay tile	848	44	6.8	(3 - 16)
Concrete	848	20	3.5	(2 - 7)
Thatch/palm leaf/cane	848	44	2.3	(1 - 7)
Cement fiber/asbestos sheet	848	11	1.3	(1 - 2)
Cement tile	848	2	0.4	(0 - 2)
Cardboard/waste material	848	2	0.3	(0 - 1)
Other	848	1	0.2	(0 - 2)

Table 3.6: Flooring material as observed

	N	n	%	95% CI
Main material of floor of dwelling				
Cement sheet/board	848	391	53.3	(44 - 63)
Wood planks	848	247	17.6	(10 - 30)
Ceramic tiles	848	86	13.2	(10 - 18)
Cement brick or tile	848	40	6.3	(4 - 10)
Earth/sand	848	33	3.8	(2 - 8)
Parquet or polished wood	848	36	3	(1 - 6)
Granite/stone	848	10	1.9	(0 - 7)
Mud brick	848	3	0.5	(0 - 1)
Not observed	848	2	0.4	(0 - 2)

Many houses (39.9%) have open roof eaves. Most have no glass in windows (64%), screens in windows (65.9%), nor screens in doors (84%).

Table 3.7: Open or closed roof eave as observed

	N	n	%	95% CI
Open gap between wall and roof eave	848	396	39.9	(32 - 48)

Table 3.8: Glass in windows as observed

	N	n	%	95% CI
Do windows have glass panes?				
None	848	600	64	(55 - 72)
Yes, in all windows	848	193	29	(22 - 37)
Yes, but only in some windows	848	51	6.5	(5 - 9)
There are no windows in the house	848	4	0.6	(0 - 2)

Table 3.9: Screens in windows as observed

	N	n	%	95% CI
Do windows have screens?				
None	848	619	65.9	(58 - 73)
Yes, in all windows	848	160	25.1	(19 - 33)
Yes, but only in some windows	848	66	8.6	(7 - 11)
There are no windows in the house	848	3	0.4	(0 - 1)

Table 3.10: Screens in doors as observed

	N	n	%	95% CI
Do doors have screens?				
None	848	743	84	(76 - 90)
Yes, in all doors	848	60	9.5	(6 - 16)
Yes, but only in some doors	848	45	6.4	(4 - 9)

Aedes mosquitoes, which spread arboviruses like dengue, zika, and chikungunya, breed in small deposits of water like puddles, flowerpots, and old tires. *Anopheles* mosquitoes, which spread malaria, breed in water bodies like lagoons, rivers, and canals. After the interview, field personnel observed the surroundings of each surveyed dwelling for potential breeding areas. Table 3.11 shows that while 51.3% of homes had clean surroundings without standing water on the day of the survey, 15.2% had natural water bodies within or bordering the yard.

Table 3.11: Maintenance of dwelling surroundings as observed

	N	n	%	95% CI
Status of yard/surroundings of dwelling				
Clean, no trash or standing water	848	415	51.3	(45 - 58)
Trash, tires, or other refuse present, but no standing water	848	175	24	(18 - 32)
Yes, puddles	848	158	17.1	(13 - 23)
Yes, pond or other natural water body	848	190	15.2	(11 - 21)
Yes, water collected in trash, tires, or other small containers	848	70	8.6	(6 - 12)
Other	848	3	0.5	(0 - 2)

Table 3.12 shows the principal water source of the household as reported by the respondent; 69.5% of households have water piped to their house. The most common type of sanitation facility is a flush toilet (40.4% of households), as seen in Table 3.13.

Table 3.12: Principal water source

	N	n	%	95% CI
Main source of drinking water				
Piped into dwelling	848	458	69.5	(53 - 82)
Protected dug well	848	114	10.4	(6 - 18)
Unprotected dug well	848	60	4.3	(2 - 9)
Tube well or borehole	848	44	4	(2 - 9)
Surface water (river/dam/lake/pond/stream/canal/irrigation channel)	848	50	2.8	(1 - 9)
Rainwater	848	48	2.5	(1 - 6)
Public tap/standpipe	848	42	2.4	(1 - 5)
Large jug of purified water	848	9	1.1	(1 - 2)

	N	n	%	95% CI
Piped to yard/plot	848	3	0.5	(0 - 2)
Unprotected spring	848	3	0.5	(0 - 3)
Bottled water	848	4	0.5	(0 - 2)
Other	848	11	1.3	(1 - 3)
Don't know	848	2	0.2	(0 - 1)

Table 3.13: Type of sanitation facility used

	N	n	%	95% CI
Type of toilet used				
Flush toilet	848	261	40.4	(30 - 52)
Pour flush toilet	848	206	27.2	(21 - 35)
Pit latrine	848	209	19.7	(14 - 27)
No facility/bush/field	848	142	9.3	(5 - 17)
Hanging latrine	848	15	1.4	(1 - 3)
Dry latrine	848	1	0.1	(0 - 1)
Other	848	13	1.7	(0 - 6)
Don't know	848	1	0.1	(0 - 1)

Each respondent was asked which fuels they usually use for cooking (some households use more than one fuel type), and the results are shown in Table 3.14. Most households do their cooking in the house (Table 3.15).

Table 3.14: Cooking fuel source

	N	n	%	95% CI
Principal cooking fuel				
Wood	848	547	56	(44 - 67)
Gas tank	848	366	48.9	(37 - 61)
Electricity	848	82	13.8	(8 - 23)
No food cooked in household	848	5	0.8	(0 - 2)
Charcoal	848	4	0.5	(0 - 1)
Straw/shrubs/grass	848	0	0	(-)
Agricultural crop	848	0	0	(-)
Other	848	1	0	(-)
Don't know	848	1	0	(-)

Table 3.15: Cooking location

	N	n	%	95% CI
Where cooking is done				
In the house	843	563	67.7	(60 - 74)
In a separate building	843	151	16.7	(13 - 22)
Outdoors	843	127	15.6	(11 - 22)
Other	843	2	0.1	(0 - 0)

3.1.3 Household wealth

Ownership of farmland and livestock, along with possession of durable consumer goods, indicate a household's socioeconomic status. Respondents were asked how many of each listed item the household (or household members) possessed. Table 3.16 and Table 3.17 show the proportion of households with at least one of each item. Many households (79.7%) have electricity. Of the 290 households that own

livestock, most own poultry (86.3% of households, as in Table 3.17). Table 3.18 shows the proportion of households with agricultural land.

Table 3.16: Household assets

	N	n	%	95% CI
Electricity	847	563	79.7	(68 - 88)
Radio	844	314	38.7	(32 - 45)
Sound system	845	258	36.2	(30 - 43)
Television	845	493	69.8	(60 - 78)
Home telephone	845	21	3.5	(2 - 7)
Mobile phone	845	697	88.9	(83 - 93)
Refrigerator	845	432	63.6	(53 - 73)
Washing machine	845	97	15.8	(9 - 26)
Computer	845	85	14.2	(10 - 21)
Electric fan	845	424	62.6	(51 - 73)
Air conditioner	845	54	9.1	(5 - 15)
Watch	844	305	40.6	(35 - 46)
Guitar	845	28	3.4	(2 - 5)
Bike	845	301	42	(34 - 50)
Motorcycle or scooter	845	267	35.3	(29 - 42)
Animal-drawn cart	845	8	0.8	(0 - 2)
Car	845	90	15.3	(10 - 22)
Truck	845	7	1.2	(1 - 3)
Motor boat	845	40	3.3	(2 - 7)
Bank account	813	218	32.3	(25 - 41)

Table 3.17: Livestock ownership

	N	n	%	95% CI
Cattle	290	74	21.2	(14 - 31)
Horses, donkeys or mules	290	64	20.9	(14 - 30)
Goats or sheep	290	16	5.7	(3 - 10)
Chickens or other poultry	289	253	86.3	(79 - 91)
Pigs	291	126	35.5	(25 - 48)

Table 3.18: Ownership of agricultural land

	N	n	%	95% CI
Does any member of the household own, rent, or share agricultural land?				
No	848	638	79.4	(74 - 84)
Yes, own	848	125	11.2	(8 - 15)
Yes, rent	848	40	5	(3 - 9)
Yes, share	848	28	2.4	(1 - 5)
Don't know	848	8	0.7	(0 - 2)
Decline to respond	848	9	1.3	(0 - 3)

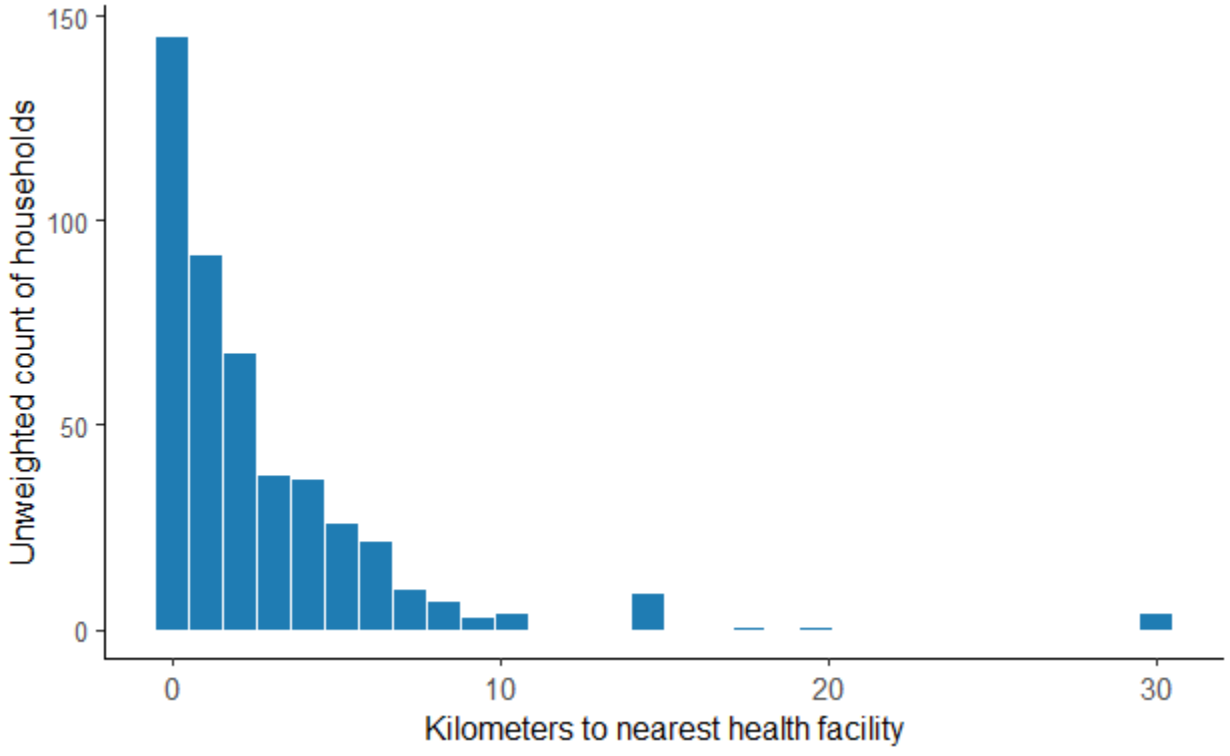
As a part of the interview, respondents estimated their monthly household income (including money earned by all members of the household and received from other sources such as public benefits or remittances). Though some households are hesitant to report their income, the estimates as reported are shown in Table 3.19.

Table 3.19: Monthly household income, all sources

	N	n	%	95% CI
Monthly household income, Honduras Lempira (HNL)				
Less than 1000 HNL	848	86	5.6	(3 - 9)
1001 - 2000 HNL	848	130	11.8	(8 - 17)
2001 - 3000 HNL	848	92	9.8	(7 - 13)
3001 - 4000 HNL	848	70	9.4	(7 - 13)
4001 - 5000 HNL	848	55	8.9	(6 - 13)
5001 - 6000 HNL	848	44	5.9	(4 - 8)
6001 - 7000 HNL	848	12	1.8	(1 - 3)
7001 - 8000 HNL	848	31	5	(3 - 8)
More than 8000 HNL	848	88	12.5	(8 - 18)
Don't know	848	135	15	(12 - 19)
Decline to respond	848	105	14.2	(11 - 18)

The interview also asked respondents the distance (km) to the health facility nearest their home. Long distances and travel times to health establishments can discourage households in remote locations from seeking medical care. Figure 3.3 shows the unweighted distribution of distances reported in the survey. The survey sample for Honduras has an unweighted average distance of 1 kilometers to the nearest health facility.

Figure 3.3: Distance to nearest health facility, unweighted percent distribution



3.2 Malaria knowledge

Respondents were asked a series of questions to assess their knowledge about malaria causes and prevention strategies. This section summarizes the results.

3.2.1 Disease knowledge

As Table 3.21 shows, most respondents had heard of malaria before (90.3%). Respondents were asked the cause of malaria (Table 3.22) and the mode of transmission of malaria (Table 3.23) and interviewers could register more than one response. Most respondents are aware of the role of mosquitoes in malaria transmission.

Table 3.21: Malaria awareness

	N	n	%	95% CI
Heard of illness called malaria	812	697	90.3	(86 - 93)

Table 3.22: Knowledge of cause of malaria

	N	n	%	95% CI
In your opinion, what causes malaria?				
Mosquito bites	697	535	78.3	(73 - 83)
Dirty surroundings	697	35	4.6	(3 - 7)
Anopheles mosquito bite	697	26	3.6	(2 - 6)
Stagnant water	697	22	3.1	(2 - 5)
Weedy surroundings	697	11	1.6	(1 - 3)
Eating dirty food/drinking dirty water	697	6	1.3	(1 - 3)
Cold or changing weather	697	2	0.5	(0 - 2)
Malaria parasite (plasmodium)	697	2	0.1	(0 - 1)
Contaminated air	697	1	0.1	(0 - 0)
Other	697	17	2.5	(2 - 4)
Don't know	697	110	15.2	(12 - 19)

Table 3.23: Knowledge of malaria transmission

	N	n	%	95% CI
How is malaria transmitted?				
By mosquitoes	697	571	81.6	(77 - 85)
Stagnant water	697	14	2.4	(1 - 4)
Poor personal hygiene	697	10	1.5	(1 - 4)
Contaminated air	697	6	1	(0 - 2)
Eating dirty food/drinking dirty water	697	1	0.1	(0 - 1)
Passes from one person to another	697	2	0	(-)
Other	697	5	0.8	(0 - 3)
Don't know	697	114	16.8	(13 - 21)

Respondents were also asked the main sign or symptom of malaria and more than one response could be registered (Table 3.24). Many respondents recognize fever as a key symptom. Throughout the question series about malaria knowledge, however, there were some respondents who indicated they did not know how to respond to the questions, as displayed in the tables. Table 3.25 shows the combinations of symptoms that are most common during a malaria illness, which were not commonly reported together by respondents.

Table 3.24: Knowledge of malaria symptoms

	N	n	%	95% CI
Main sign or symptom of malaria known				
Fever	697	498	73.3	(69 - 77)
Headache	697	353	48.2	(42 - 55)
Body ache or joint pain	697	246	37	(31 - 44)
Chills	697	238	30.5	(25 - 36)
Nausea and vomiting	697	88	12.7	(10 - 16)
Body weakness	697	42	6.4	(4 - 9)
Pale eyes or skin	697	31	5.4	(3 - 8)
Dizziness	697	29	4	(2 - 7)
Loss of appetite	697	19	2.9	(2 - 5)
Diarrhea	697	15	2.1	(1 - 4)
Sweating	697	15	1.6	(1 - 4)
Cough	697	5	0.6	(0 - 2)
Other	697	28	5.2	(3 - 8)
Don't know	697	103	14.6	(12 - 18)

Table 3.25: Multiple common symptoms of malaria known

	N	n	%	95% CI
Fever and chills	697	193	27.7	(24 - 31)
Fever and sweating	697	7	1	(0 - 2)
Fever, chills, and sweating	697	6	0.9	(0 - 2)

Respondents were asked how many people in their own community they knew who had had malaria during the last year. Most did not report to know anyone who had malaria in the last year (Table 3.26).

Table 3.26: Knowledge of community transmission

	N	n	%	95% CI
In your community, during the last year, how many people do you know who had a case of malaria?				
None	697	496	75.7	(67 - 83)
One person	697	50	6.1	(4 - 10)
2-4 people	697	52	5.6	(4 - 9)
5-10 people	697	17	1.9	(1 - 4)
11-100 people	697	7	1	(0 - 3)
Don't know	697	75	9.7	(7 - 14)

3.2.2 Knowledge of malaria messages

Malaria programs and public health systems carry out education campaigns to help people who live in areas with malaria transmission know how to protect themselves from the disease, and what to do if they become sick. Respondents were asked to list the messages they had heard about malaria in the last year, and interviewers sorted their answers among the available responses in the survey. In all, 29.8% had heard messages about malaria during the last year. Of those who had heard messages, the specific information heard is detailed in Table 3.27. Some of the responses indicate that people may confuse messages about preventing dengue or other arboviruses with malaria prevention messages. However, many had learned to seek medical attention for fevers and about using a mosquito net.

Next, respondents were asked to indicate whether or not they had heard malaria messages from each source in a list of media. The sources and the proportion of those who had heard messages through

each, among respondents who had heard any messages about malaria in the past year, are in Table 3.28.

Table 3.27: Malaria messages heard in last year

	N	n	%	95% CI
Messages seen or heard in last year				
Eliminate breeding sites/clean up trash	222	108	49.6	(43 - 56)
If have fever go to health facility	222	64	30.1	(24 - 37)
Malaria kills	222	31	11.8	(7 - 19)
Sleep under an insecticide-treated mosquito net	222	25	10.4	(6 - 17)
Sleep under a net every night to protect yourself against malaria	222	19	9.1	(5 - 16)
Nets are used to protect from mosquitoes	222	21	8.9	(6 - 14)
Anopheles mosquitoes transmit malaria by biting people at night	222	5	2.4	(1 - 6)
Wash nets only when they are dirty	222	4	2.2	(1 - 6)
Treatment for severe malaria is available free of charge	222	3	1.8	(1 - 6)
Always test before treating malaria	222	3	1.7	(0 - 6)
Dry nets in the shade, not in direct sunlight	222	1	0.8	(0 - 5)
Don't wash nets more than 4 times per year	222	1	0.4	(0 - 3)
Be sure to tuck the borders of the net under the mattress	222	1	0.4	(0 - 3)
Treat malaria with ACTs	222	1	0.3	(0 - 2)
Other	222	22	10.5	(7 - 16)
Don't know	222	22	10.4	(6 - 16)
Decline to respond	222	2	0.4	(0 - 2)

Table 3.28: Source of malaria messages

Source of messages, among those who heard them	N	n	%	95% CI
On the radio	222	73	31.8	(23 - 41)
On TV	222	89	43.5	(35 - 53)
On a poster or billboard	221	21	9.7	(6 - 14)
From a community health worker	222	82	34.1	(27 - 42)
From personnel at a health facility	222	107	47.7	(40 - 55)
At a community event	222	66	29.6	(24 - 36)
At school	221	24	10.1	(6 - 17)
On the internet or social media	222	28	14.9	(9 - 23)
Somewhere else	221	2	1	(0 - 5)

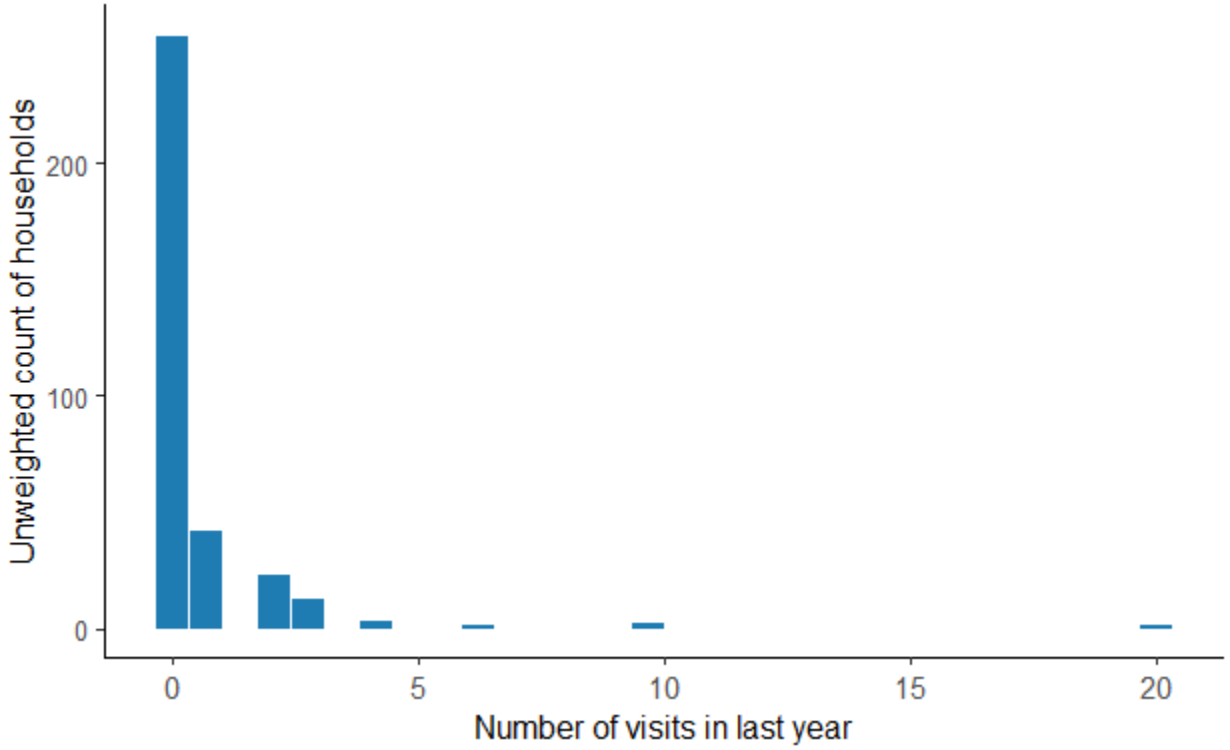
3.2.3 Knowledge of community resources

A key component of malaria detection in many regions in Honduras is the volunteer collaborator program. Volunteer collaborators (*colaboradores voluntarios*), or “col-vols”, are community members who are trained to carry out malaria detection activities such as screening, taking blood samples for thick blood film or rapid tests, and referring patients to health facilities or to community-based vector control technicians. They also sometimes oversee malaria treatment after a malaria case has been confirmed. In the Honduras baseline survey, 41.5% of households know of a col-vol in their community. Of those who knew of a col-vol, 33% reported receiving a home visit by that volunteer during the year before the date of the survey (Table 3.29). The number of visits received from the col-vol is shown in Figure 3.5.

Table 3.29: Knowledge of col-vols

	N	n	%	95% CI
Know of col-vol in own community	708	367	41.5	(30 - 54)
Visited by col-vol in last year	361	107	33	(26 - 41)

Figure 3.5: Number of visits from col-vols in last year



Malaria testing and treatment is provided free of charge through the Secretary of Health in Honduras, and 77% of respondents are aware of this benefit (Table 3.30). Because cost and knowledge of where services are available may be barriers to seeking care, the survey asked respondents where someone could access testing and treatment. Respondents could indicate multiple health facility types they knew provided the service, and interviewers classified them according to the options in the survey. A majority of households knew that they could seek malaria care at primary care facilities (Table 3.31, Table 3.32). Col-vol knowledge by department is shown in Table 3.33. The baseline measurement was not designed to produce representative estimates at the department level, so results by department should be interpreted with discretion.

Table 3.30: Knowledge of free-of-cost malaria healthcare

	N	n	%	95% CI
Aware malaria diagnosis and treatment are provided free by the government	629	471	77	(72 - 81)

Table 3.31: Knowledge of where to go for malaria testing

	N	n	%	95% CI
Where can someone go to be tested for malaria?				
Public Sector: Government primary level health center	697	553	79.1	(71 - 85)
Public Sector: Government hospital	697	156	24.9	(17 - 35)
Col-Vol	697	118	12.2	(9 - 17)
Private medical sector: Private hospital/clinic	697	54	10.1	(6 - 16)
Public Sector: Fieldworker/Community Health Worker	697	25	3.5	(1 - 8)
Private medical sector: Private doctor	697	16	3	(2 - 5)
Other private sector	697	2	0.5	(0 - 2)
Public Sector: mobile clinic	697	1	0.2	(0 - 2)
Other public sector	697	1	0.1	(0 - 1)
Private medical sector: Pharmacy	697	1	0.1	(0 - 1)
Private medical sector: mobile clinic	697	0	0	(-)
Traditional healer	697	1	0	(-)
Other	697	18	3.2	(2 - 6)
Don't know	697	21	2.6	(1 - 5)

Table 3.32: Knowledge of where to go for malaria treatment

	N	n	%	95% CI
Where can someone receive treatment for malaria?				
Public Sector: Government primary level health center	665	573	85.1	(77 - 91)
Public Sector: Government hospital	665	167	26.6	(18 - 37)
Col-Vol	665	90	11.1	(8 - 15)
Private medical sector: Private hospital/clinic	665	36	6.6	(4 - 11)
Public Sector: Fieldworker/Community Health Worker	665	24	2.8	(1 - 5)
Private medical sector: Pharmacy	665	7	1.7	(1 - 3)
Private medical sector: Private doctor	665	9	1.6	(1 - 3)
Other public sector	665	3	0.7	(0 - 5)
Public Sector: mobile clinic	665	1	0.2	(0 - 2)
Traditional healer	665	1	0.2	(0 - 2)
Private medical sector: mobile clinic	665	0	0	(-)
Other private sector	665	0	0	(-)
Other	665	5	1.1	(0 - 4)
Don't know	665	9	1.7	(1 - 4)

Table 3.33: Knowledge of col-vols by department

	N	n	%	95% CI
Atlántida (1 community)				
Know of col-vol in own community	11	2	18.2	(18 - 18)
Visited by col-vol in last year	2	1	50	(50 - 50)
Col-vols conduct testing for malaria	23	1	4.3	(4 - 4)
Col-vols provide treatment for malaria	23	2	8.7	(9 - 9)
Colón (5 communities)				
Know of col-vol in own community	113	48	41.2	(31 - 52)

	N	n	%	95% CI
Visited by col-vol in last year	48	15	32.4	(20 - 48)
Col-vols conduct testing for malaria	129	12	7.4	(3 - 18)
Col-vols provide treatment for malaria	127	11	7.7	(5 - 13)
Cortés (2 communities)				
Know of col-vol in own community	46	2	5.4	(2 - 14)
Visited by col-vol in last year	2	0	0	(-)
Col-vols conduct testing for malaria	46	4	6.3	(1 - 34)
Col-vols provide treatment for malaria	44	0	0	(-)
Gracias a Dios (13 communities)				
Know of col-vol in own community	274	217	72.5	(52 - 87)
Visited by col-vol in last year	212	71	41.2	(28 - 56)
Col-vols conduct testing for malaria	212	67	27	(14 - 46)
Col-vols provide treatment for malaria	191	47	24	(18 - 31)
Islas de la Bahía (2 communities)				
Know of col-vol in own community	43	16	44.5	(18 - 75)
Visited by col-vol in last year	16	6	37.9	(36 - 39)
Col-vols conduct testing for malaria	49	6	14.6	(7 - 28)
Col-vols provide treatment for malaria	46	2	5.6	(2 - 14)
Olancho (6 communities)				
Know of col-vol in own community	127	41	27.3	(8 - 63)
Visited by col-vol in last year	41	5	17.2	(8 - 33)
Col-vols conduct testing for malaria	132	15	10.2	(4 - 22)
Col-vols provide treatment for malaria	130	16	11.8	(7 - 19)
Valle (1 community)				
Know of col-vol in own community	23	8	34.8	(35 - 35)
Visited by col-vol in last year	8	2	25	(25 - 25)
Col-vols conduct testing for malaria	22	1	4.5	(5 - 5)
Col-vols provide treatment for malaria	21	4	19	(19 - 19)
Yoro (3 communities)				
Know of col-vol in own community	71	33	47.2	(30 - 66)
Visited by col-vol in last year	32	7	29.5	(21 - 40)
Col-vols conduct testing for malaria	84	12	11.2	(8 - 16)
Col-vols provide treatment for malaria	83	8	7.2	(2 - 21)

3.3 Risk factors for malaria

Certain lifestyles, professions, and living conditions raise an individual's risk for malaria infection. Traveling may expose people to infection if they move from an area with relatively less malaria transmission, to an area with more transmission. Travel by individuals also raises the risk that malaria transmission could be re-introduced to receptive areas where it has been interrupted. Few households reported members who migrated for work (Table 3.34). Among individuals in surveyed households, 14.4% reported travel outside the community in the last two weeks (Table 3.35). According to respondents, most household members did not participate in any of the risk activities listed in Table 3.36 in the two months prior to the survey.

Table 3.34: Temporal migration within surveyed households

	N	n	%	95% CI
At least one member migrates seasonally	848	88	12.1	(8 - 18)
At least one member migrates weekly	847	68	8.2	(5 - 13)

Table 3.35: Recent travel by individuals in surveyed households

	N	n	%	95% CI
Individual traveled outside community in last 2 weeks	3789	554	14.4	(12 - 18)

Table 3.36: Exposure to risky activities by individuals in surveyed households

	N	n	%	95% CI
Individuals participating in malaria risk activities				
None of these	3791	2718	76.7	(73 - 80)
Cultivating crops or working in the fields	3791	715	14.3	(11 - 18)
Gathering firewood in the forest	3791	243	5.3	(4 - 7)
Working in trade	3791	128	4	(3 - 5)
Working in fishing	3791	189	3.2	(2 - 6)
Collecting shellfish	3791	91	1.7	(1 - 4)
Sleeping outdoors overnight	3791	30	0.7	(0 - 1)
Working in timber/lumber industries in the forest	3791	10	0.3	(0 - 1)
Working in a mine	3791	3	0.1	(0 - 0)
Producing charcoal	3791	0	0	(-)
Don't know	3791	12	0.4	(0 - 1)
Decline to respond	3791	2	0.1	(0 - 0)

Respondents were also asked what can be done to protect against malaria (Table 3.37), and what practices they follow in their own households (Table 3.38). The respondent replied in free form, and the interviewer classified the answers according to the options in the survey. The responses again show evidence of some conflation of malaria prevention measures with arbovirus prevention measures, though many responses also referred to use of mosquito nets or other practices that protect against all mosquito vectors. Only 4.3% of households said they do not use any malaria prevention measures at home.

Table 3.37: Protective measures known by household

	N	n	%	95% CI
Methods known to protect against malaria				
Eliminate mosquito breeding areas (tires, bottles, or others)	583	347	58.5	(52 - 65)
Keep house surroundings clean	583	183	30.5	(26 - 36)
Cut the grass around the house	583	129	22	(17 - 29)
Clean water storage tanks with bleach	583	108	21.6	(16 - 28)
Sleep under a mosquito net	583	135	19	(13 - 27)
Avoid mosquito bites	583	67	12.9	(10 - 16)
Use insect repellent	583	55	11.8	(7 - 18)
Fumigate or spray house with insecticides	583	53	10.6	(8 - 15)
Use mosquito coils	583	33	6.3	(4 - 10)
Fill in puddles (stagnant water)	583	29	5	(3 - 7)
Add bleach temephos (Abate) to the water tank	583	20	4	(2 - 8)
Put mosquito screens on the windows	583	14	2.7	(1 - 5)

	N	n	%	95% CI
Sleep under an insecticide-treated mosquito net	583	18	2.1	(1 - 4)
Take preventive medication	583	7	1.6	(1 - 4)
Can't be prevented	583	4	1	(0 - 3)
Other	583	15	3.1	(2 - 6)
Don't know	583	48	8.6	(6 - 12)
Decline to respond	583	1	0.1	(0 - 1)

Table 3.38: Protective measures used by household

	N	n	%	95% CI
Primary methods used in household to protect against malaria				
Eliminate mosquito breeding areas (tires, bottles, or others)	583	345	59.4	(54 - 65)
Keep house surroundings clean	583	199	34	(28 - 40)
Cut the grass around the house	583	140	24.7	(20 - 30)
Clean water storage tanks with bleach	583	120	23.5	(18 - 29)
Sleep under a mosquito net	583	115	15.7	(11 - 22)
Fumigate or spray house with insecticides	583	65	13	(9 - 19)
Use mosquito coils	583	53	9.2	(6 - 14)
Fill in puddles (stagnant water)	583	43	7.3	(5 - 10)
Avoid mosquito bites	583	42	7.1	(5 - 10)
Add bleach or temephos (Abate) to the water tank	583	25	5.2	(3 - 8)
Use insect repellent	583	22	4.5	(2 - 8)
Does nothing to protect from malaria	583	28	4.3	(3 - 7)
Put mosquito screens on the windows	583	12	2.2	(1 - 4)
Sleep under an insecticide-treated mosquito net	583	15	1.8	(1 - 4)
Take preventive medication	583	5	0.9	(0 - 3)
Organize community cleaning work days	583	3	0.5	(0 - 2)
Other	583	48	9.3	(6 - 14)
Don't know	583	13	2.7	(2 - 4)
Decline to respond	583	1	0.1	(0 - 1)

Chapter 4: Vector control activities

This chapter provides a descriptive summary of vector control measures used in the households selected for the RMEI-Honduras Baseline LQAS Survey. As noted in Chapter 2, the household measurement in Honduras was conducted entirely in malaria stratum 4. All estimates reported in this chapter are weighted by the inverse probability of selection (see details in Appendix C) and account for clustering in variance calculations, except where otherwise noted. For this reason, many proportions reported are not equal to the ratio of numerator to denominator.

4.1 Vector control measures carried out in Honduras households

Vector control plans in Honduras included offering IRS and ITN measures to households in various communities in malaria-endemic areas. The interventions are usually planned for each year as a part of the annual malaria strategy with input from local and central level vector control technicians and funding partners. Interventions are planned and budgeted to cover a full community at the same time, with a set goal for acceptance or uptake rate. Intervention plans can sometimes be dynamic to malaria transmission, for example in the case of reactive measures to a new outbreak.

In Honduras, the community sample was designed to capture data from 32 communities with vector control measures implemented during 2019. Health facilities were listed for selection to the sample based on whether interventions were carried out in the communities in their service area according to data received from the central-level Secretary of Health. According to these data, 495 communities across 11 departments should have received spraying, and 313 communities (in rural areas of Gracias a Dios and Islas de la Bahía departments) should have received net distribution. However, because the intervention data are organized by locality and not by health facility, and because the health service network received from the Secretary of Health did not include the names of the localities served by each health facility, the pairing of the intervention data to corresponding health facilities in the service network had to rely on matches of locality name or mapping via name-based online searches. This was the best available method but known to be imperfect.

According to data collected at the local-level health facilities via the Community Selection Module, only 19 of 33 communities surveyed had vector control interventions carried out. There are a few feasible explanations for the discrepancy in the 14 communities with no record of recent interventions: the assumption about which facility served a given target community may have been incorrect, and the selected facility may have served no communities with interventions; the intervention activity may have been planned in a selected community, but not yet carried out at the date of the survey; or the intervention activity may have been planned and carried out, but the health facility staff was not aware of it. We expect that each of these scenarios explains a portion of the discrepancies, as some of the 14 communities had intervention measures observed at the household level, while others did not.

4.2 Mosquito net use

As a part of the interview, respondents were asked how many mosquito nets their household owns. Then, for each net reported, the interviewer requested to observe the net (noting the brand and condition in the survey) and went through a series of questions about each net, including where it came from, how it is cared for, and who used the net the previous night. In the case that the respondent declined to show the net, questions on net brand and condition were asked to the respondent directly.

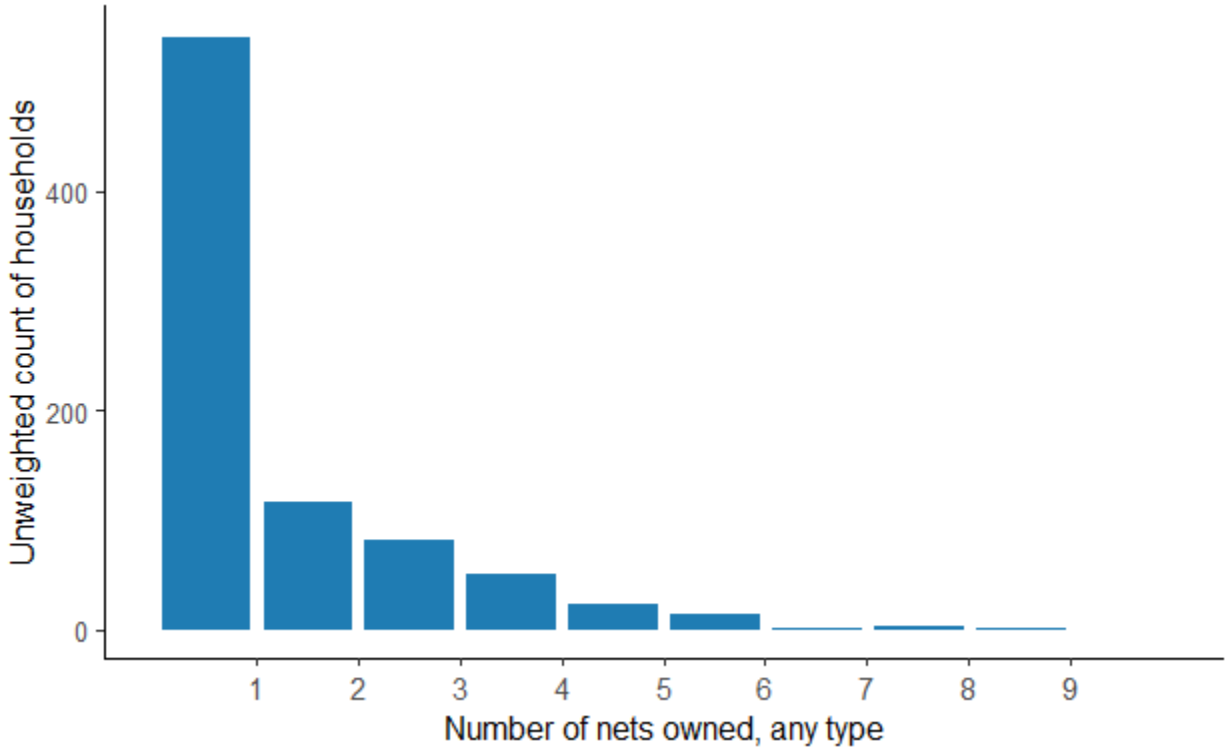
4.2.1 Ownership of nets by surveyed households

As Table 4.1 shows, 38.8% of households own at least one treated or untreated mosquito net. The number of nets owned (regardless of type) is shown in Figure 4.1.

Table 4.1: Ownership of mosquito nets by households

	N	n	%	95% CI
Households with at least one mosquito net	846	417	38.8	(28 - 51)

Figure 4.1: Number of nets owned by households, unweighted count



Respondents were asked where they obtained each mosquito net. As shown in Table 4.2, most nets treated with insecticide were obtained from health personnel, in a facility or in the community. Most untreated nets were purchased in a store (86.3%, in Table 4.3).

Table 4.2: Source of insecticide-treated nets

	N	n	%	95% CI
Source of net				
Government health facility	818	491	60	(57 - 63)
Vector control or malaria program	818	271	33.1	(30 - 36)
Community health worker or Col-Vol	818	43	5.3	(4 - 7)
Shop/market	818	1	0.1	(0 - 1)
Other	818	3	0.4	(0 - 1)
Don't know	818	9	1.1	(1 - 2)

Table 4.3: Source of untreated nets

	N	n	%	95% CI
Source of net				
Shop/market	299	258	86.3	(82 - 90)
Other	299	23	7.7	(5 - 11)
Don't know	299	18	6	(4 - 9)

In addition to the insecticide treatment wearing off after a period of years, the fabric of mosquito nets also deteriorates over time and is prone to damage. A net with holes, especially large holes, does not protect as well as an intact net. The condition of nets observed directly by field personnel is shown in Table 4.4, and the condition of nets that respondents declined to show to field personnel is shown in Table 4.5.

Table 4.4: Condition of observed nets

	N	n	%	95% CI
Condition of mosquito net as observed				
No holes	630	469	74.4	(71 - 78)
Only thumb-sized holes	630	115	18.3	(15 - 21)
At least one fist or head-sized hole	630	38	6	(4 - 8)
Net never used	630	7	1.1	(1 - 2)
Don't know	630	1	0.2	(0 - 1)

Table 4.5: Reported condition of nets not observed

	N	n	%	95% CI
Condition of mosquito net as reported				
No holes	487	368	75.6	(72 - 79)
Only thumb-sized holes	487	65	13.3	(11 - 17)
At least one fist or head-sized hole	487	16	3.3	(2 - 5)
Net never used	487	12	2.5	(1 - 4)
Don't know	487	26	5.3	(4 - 8)

Insecticide-treated nets should be washed infrequently, and should not be dried in direct sunlight, which goes against common housekeeping practices in the region. Figure 4.2 shows how many times insecticide-treated nets have been washed since acquired (if more than 20 times, 20 is indicated). Table 4.6 shows how the respondent reported drying each net after washing.

Figure 4.2: Care of insecticide-treated nets - washing (unweighted count)

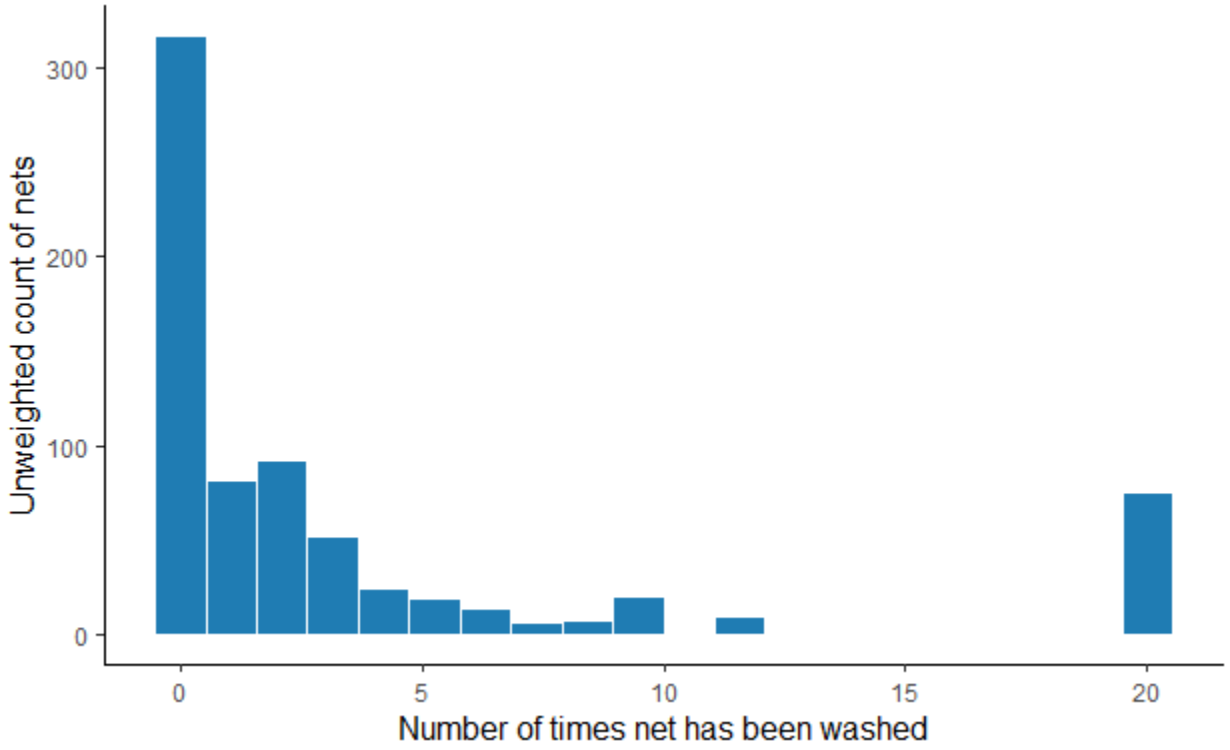


Table 4.6: Care of insecticide-treated nets - drying

	N	n	%	95% CI
Method of drying net				
In the shade	408	248	60.8	(56 - 65)
In the sun	408	127	31.1	(27 - 36)
Indoors	408	33	8.1	(6 - 11)

4.2.2 Use of nets by individuals in surveyed households

In order for the household to be fully protected, all household members should sleep under an insecticide-treated net for the entire night. Table 4.7 shows the reported use of nets on the night prior to the survey. Among all usual household members who slept in the house the previous night, 18.9% were reported to have slept under a mosquito net treated with insecticide. Among children under age 5 who were usual members of the household and slept there the previous night, 22% were reported to have slept under a net treated with insecticide.

Table 4.7: Use of net for sleeping previous night

	N	n	%	95% CI
Total				
Slept under treated net	3649	1125	18.9	(11 - 32)
Slept under untreated net	3649	429	12.1	(8 - 17)
Under 5				
Slept under treated net	428	139	22	(12 - 37)
Slept under untreated net	428	87	22	(15 - 32)
Pregnant				

	N	n	%	95% CI
Slept under treated net	38	10	17.9	(8 - 37)
Slept under untreated net	38	6	17.6	(6 - 42)
Reported usually sleeping under net during pregnancy	37	16	33.3	(15 - 59)

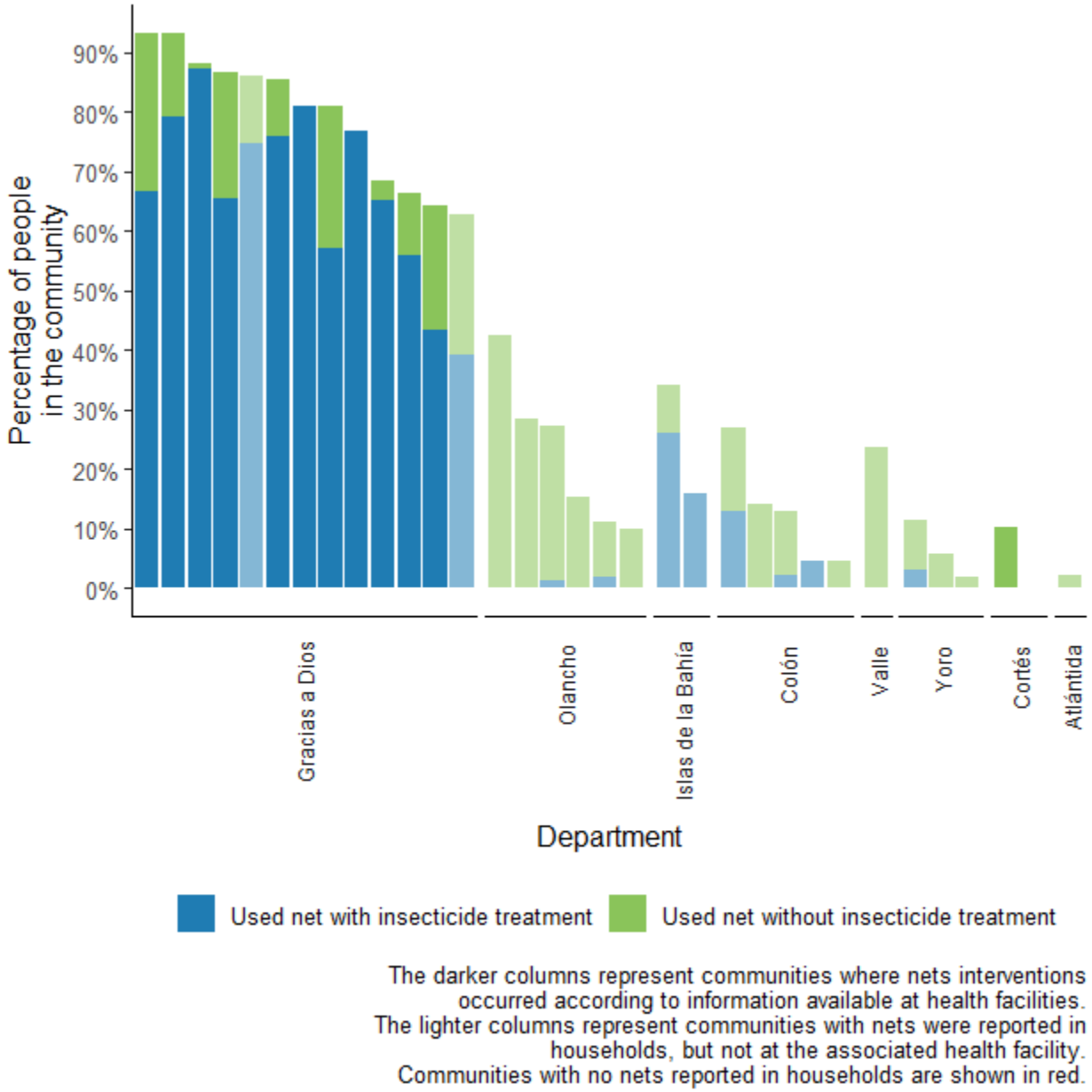
When households had nets that were not used the previous night, or reported that not all household members slept under a net, they were asked why they do not sleep under a mosquito net. The reasons given are shown in Table 4.8. Most frequently, households reported they did not have enough mosquito nets for all members to use. When respondents specified an “other” response, they often claimed they do not like mosquito nets without explaining why.

Table 4.8: Reasons for not using net

	N	n	%	95% CI
Reasons for not sleeping under mosquito net				
Don't have enough nets	165	49	26.2	(18 - 37)
Too hot	165	24	17.7	(11 - 28)
Net too expensive	165	10	6	(2 - 14)
Feel closed in/afraid	165	10	5.8	(3 - 12)
Usual user(s) did not sleep here last night	165	16	5.8	(2 - 13)
Not necessary, using fan instead	165	8	5.6	(3 - 11)
No mosquitoes	165	9	4.8	(2 - 10)
Sleep in a hammock and available mosquito nets do not work	165	4	4.7	(1 - 25)
Extra net/more nets available than sleeping areas	165	9	4.4	(2 - 11)
Net too small	165	5	3.7	(1 - 9)
Saving net for later	165	6	2.9	(1 - 8)
Net too old/torn	165	3	2.8	(1 - 9)
It is bad for the skin, it causes irritation	165	7	2.3	(1 - 6)
Don't like smell/insecticide is too strong	165	2	1.8	(0 - 7)
Net not available last night/net being washed	165	1	1.2	(0 - 8)
Not necessary, using mosquito repellent instead	165	1	1.2	(0 - 8)
Net too dirty	165	1	0.5	(0 - 4)
Other	165	13	13	(5 - 31)
Don't know	165	8	4.7	(2 - 10)
Decline to respond	165	6	4.6	(2 - 13)

Figure 4.3 shows by department the proportion of individuals who slept in the household the previous night using a mosquito net in each of the communities surveyed. The communities expected to receive the net intervention are highlighted in darker colors. In Honduras, the communities that received the net intervention, according to local vector control staff at the corresponding health facility in the sample, had more insecticide-treated net use than the communities that did not receive the intervention. Untreated net use is notable in some communities. The baseline measurement was not designed to produce representative estimates at the department level, so results by department should be interpreted with discretion.

Figure 4.3: Net use by department and community



4.3 Indoor Residual Spraying

The other key vector control intervention of the Initiative is to offer to spray the interior walls of the dwelling against mosquitoes (usually with deltamethrin or a comparable insecticide). Insecticide application is usually carried out by staff or contractors of the vector control program every 4 to 6 months during the intervention time frame. The interviewer asked respondents if their household had been offered insecticide application to the interior of the dwelling during the last year. As seen in Table 4.9, 41.2% of households were offered IRS, and spraying was carried out in 89% of the households where it was offered. The interviewer also asked to see evidence of the most recent spray application, such as a sticker, house card, or chalk mark left by the vector control personnel. Such evidence was observed in

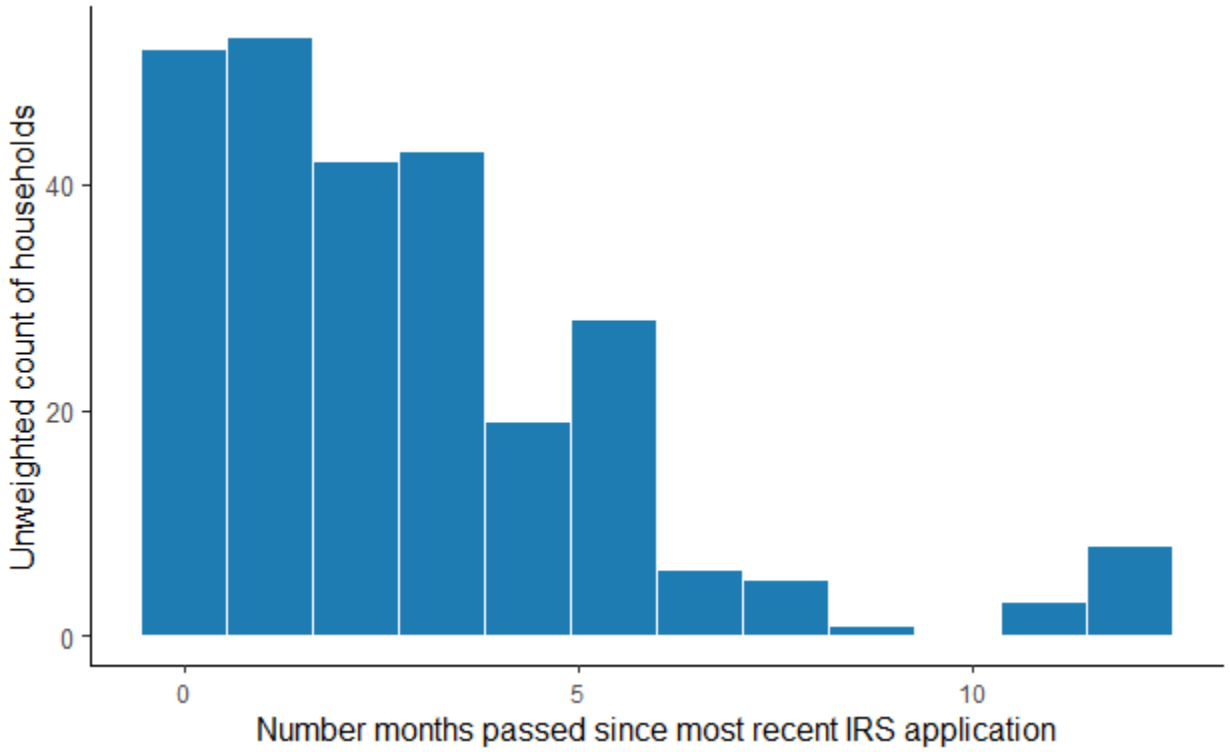
only 10.2% of households that received IRS. The response “don’t know” was given to the question about observing evidence of IRS completion in 9 households.

Table 4.9: Households offered and accepting spraying

	N	n	%	95% CI
Offered indoor residual spraying	837	308	41.2	(30 - 54)
Accepted indoor residual spraying	306	278	89	(81 - 94)
Evidence observed (card, sticker, mark)	269	33	10.2	(4 - 24)

Respondents were asked how long ago the most recent spraying occurred. The results in Figure 4.4 suggest that spraying is carried out at least every six months in most cases.

Figure 4.4: Number of months since most recent spraying occurred



Respondents who were offered IRS, but whose house was not sprayed, were asked why the spraying was not carried out, an uncommon circumstance. The results are shown in Table 4.10. Some “other” responses given included allergy to the spraying chemical and not having mosquitoes around the house.

Table 4.10: Reasons for not accepting spraying

	N	n	%	95% CI
Reason house was not sprayed				
No one was at home	28	6	21	(11 - 37)
Dangerous for children	28	3	11.9	(3 - 36)
Didn't have time/visit time was not convenient	28	2	9.3	(4 - 21)
Attitude of personnel	28	1	4.6	(1 - 26)
Not effective to prevent mosquito bites	28	1	1	(0 - 8)
Other	28	13	42.1	(29 - 57)
Don't know	28	4	15.8	(4 - 44)

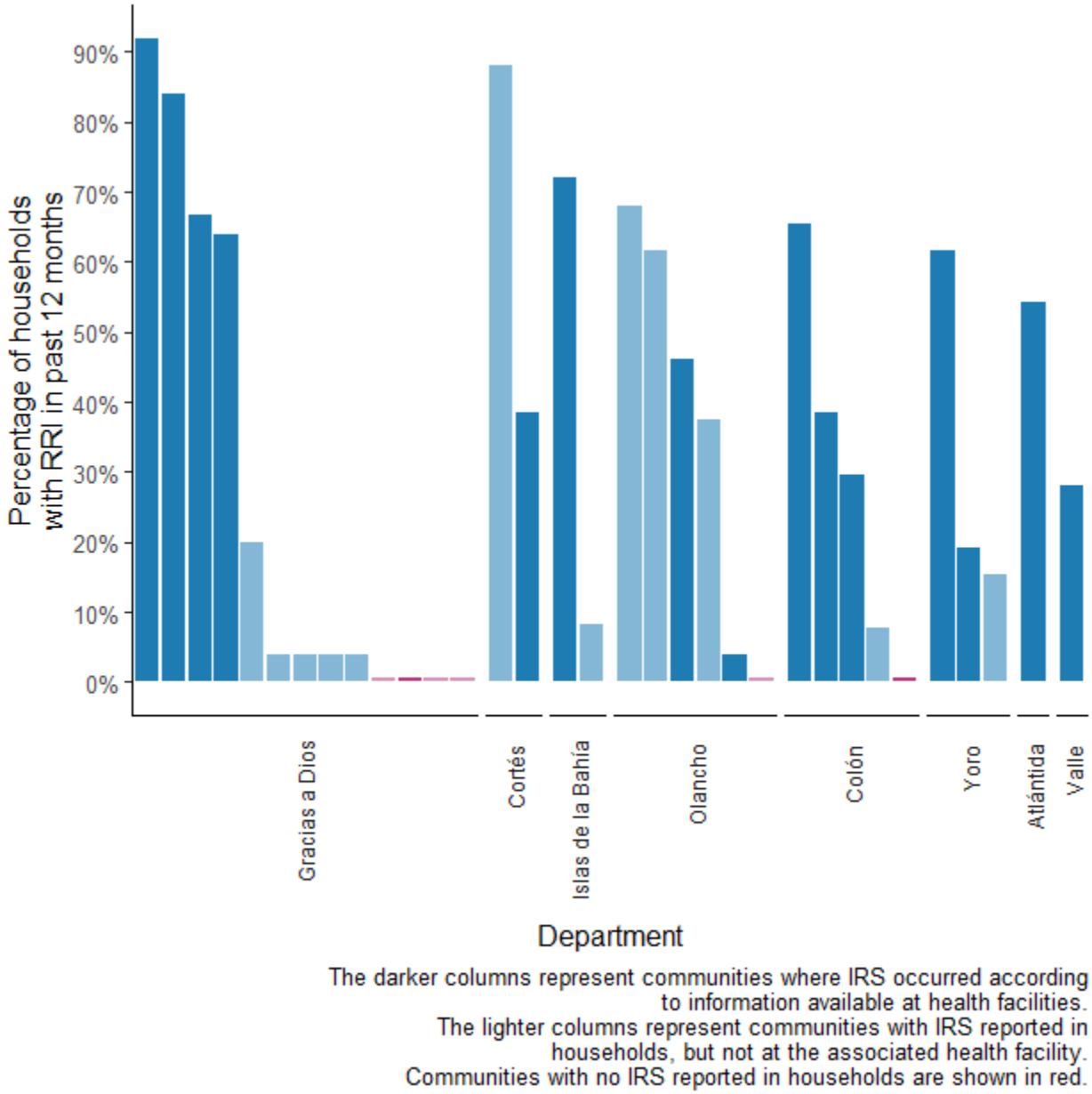
Households receiving IRS were asked whether they washed, painted, or plastered any walls since the most recent application (which diminishes the effectiveness of the insecticide), as shown in Table 4.11.

Table 4.11: Post-spraying practices

	N	n	%	95% CI
Walls painted since last IRS	278	19	8.3	(5 - 14)
Walls washed since last IRS	278	30	9.2	(5 - 16)
Walls plastered since last IRS	277	5	1.9	(1 - 5)

Figure 4.5 shows by department the proportion of households that received IRS in each of the communities surveyed. The communities expected to receive the IRS intervention according to vector control staff at the corresponding health facility are highlighted in darker colors. The measured coverage of IRS is quite high in some communities not expected to receive it, and below 50% in some communities that were expected to receive it. Several factors could contribute to this mismatch. First, personnel at the local health facility may not be informed about vector control activities planned and carried out from the regional or central level. Second, respondents may have confused IRS with other insecticide interventions such as fogging, though application to interior walls was emphasized in the conduct of the survey.

Figure 4.5: Indoor residual spraying by department and community



4.4 Indicator 6.01: Vector control coverage

Individual-level coverage by one of the two interventions was negotiated as an indicator for RMEI. The indicator is measured on the subset of usual household members who slept in the house the night prior to the survey (because net use is measured for the night prior to the survey) in the communities identified at the local level as targeted for vector control interventions. Individuals are considered covered if they slept under an insecticide-treated net the previous night, or if their home had indoor residual spraying applied within the last 12 months, regardless of which intervention was planned for the community where they reside (there was evidence of both types of interventions in many target communities, as seen in Table 4.12). Table 4.13 shows the indicator results, with 53.1% of individual usual household members in target

communities covered by one of the two interventions. The breakdown of the indicator by department is shown in Table 4.14.

Table 4.12: Vector control received by reported intervention

Vector control reported	Communities	Used treated net	House sprayed
Nets	8	69.3%	4.4%
Spray	13	10.7%	46.4%
Both	4	55.9%	48.2%
None	8	4.7%	35.4%

Table 4.13: Vector control indicator

	N	n	%	95% CI
Usual household members in vector control communities who slept in house last night	2960	2819	95.4	(94 - 97)
Slept under insecticide treated net	2819	1086	24.2	(13 - 40)
House sprayed with mosquito treatment past 12 months	2779	922	36.5	(25 - 49)
Omitted from household spraying calculations due to 'do not know' responses	2819	40	1.2	(0 - 3)
'DK' responses included in indicator because they slept under treated net	40	19	43.1	(14 - 78)
Received either vector control to standard	2798	1713	53.1	(40 - 66)

Table 4.14: Vector control indicator: result by department

	N	n	%	95% CI
Received either vector control to standard				
Atlántida	89	45	50.6	(51 - 51)
Colón	434	142	32.9	(18 - 52)
Cortés	99	42	42.4	(42 - 42)
El Paraíso	1559	1227	80.6	(73 - 87)
Islas de la Bahía	107	79	73.8	(74 - 74)
Olancho	186	46	24	(4 - 69)
Valle	114	30	26.3	(26 - 26)
Yoro	210	102	35.5	(20 - 56)
Total	2798	1713	53.1	(40 - 66)

Chapter 5: Malaria Diagnostic Capacity

This chapter provides a descriptive summary of the health facilities surveyed for the RMEI-Honduras Baseline Heath Facility Survey and the malaria diagnostic services they provide.

5.1 Characteristics of health facility sample

As previously described, the health facility sample included 60 facilities of various types as shown in Table 5.1. Thirty-six of the surveyed facilities provide primary level care, and 6 are secondary level services, though they may also provide primary attention as demanded. The remaining facilities in the sample are administrative units: municipal headquarters (*sedes municipales*) that manage local malaria reporting and vector control programming, and regional headquarters (*regiones sanitarias*) that manage stock, reporting, and malaria programming for the entire department. The measurement included regional reference labs at the selected regional units as well as the national malaria reference lab.

Table 5.1: Health facility survey sample by facility type

	Facility Type	#
Primary care	UAPS/Cesar	19
	Cesamo/CIS	15
	Polyclinic	2
Secondary care	Servicio Materno-Infantil	1
	Area Hospital	3
	Regional Hospital	2
Administrative unit/ National Lab	Regional Headquarters	5
	Municipal Headquarters	12
	National Reference Laboratory	1
Total		60

The health facility interview includes questions about services provided in the facility as summarized in this chapter. The facility director or other responsible party (e.g., the head doctor in an ambulatory facility, the administrative or medical director of a hospital, and the head of surveillance or vector control programs at an administrative facility). When conducting the survey, interviewers are trained to emphasize that all questions need not be answered by a single respondent and encourage the primary respondent to invite colleagues who know the topic best to contribute to answering for each section (e.g., human resources personnel, head of nursing, laboratory staff).

All attention facilities in the sample provided services from Monday through Friday. A smaller number were open on the weekends (Table 5.3). Eleven percent of primary care units and 100% of secondary care units had services open 24 hours (Table 5.4).

Table 5.3: Workweek of facility

	N	n	%	95% CI
Primary care units: Days of the week service is provided				
Monday	36	36	100	(-)
Tuesday	36	36	100	(-)
Wednesday	36	36	100	(-)
Thursday	36	36	100	(-)
Friday	36	36	100	(-)
Saturday	36	3	8.3	(3 - 23)
Sunday	36	3	8.3	(3 - 23)
Secondary care units: Days of the week service is provided				

	N	n	%	95% CI
Monday	6	6	100	(-)
Tuesday	6	6	100	(-)
Wednesday	6	6	100	(-)
Thursday	6	6	100	(-)
Friday	6	6	100	(-)
Saturday	6	6	100	(-)
Sunday	6	6	100	(-)

Table 5.4: Hours of operation

	N	n	%	95% CI
Primary care units: Hours of operation				
Open less than 24 hours	36	32	88.9	(73 - 96)
Open 24 hours	36	4	11.1	(4 - 27)
Secondary care units: Hours of operation				
Open 24 hours	6	6	100	(-)

Survey respondents indicated the type and number of personnel employed at the health facility. Table 5.5 shows the proportion of facilities that employ at least one of each personnel type. Physicians are employed at 72.2% of primary level facilities and at all secondary level facilities. In terms of laboratory diagnosis, microbiologists are employed at 22.2% and lab technicians at 30.6% of primary care units. Only 5.6% of primary level units employ epidemiology personnel, and 17.1% employ other statistics personnel, important functions for malaria notification and reporting.

Table 5.5: Facility personnel

	N	n	%	95% CI
Primary care units				
General physician	36	26	72.2	(55 - 85)
Pediatrician	36	1	2.8	(0 - 18)
Nutritionist /dietician	36	0	0	(-)
Pharmacist	36	0	0	(-)
Auxiliary nurse	36	35	97.2	(82 - 100)
Practical nurse	35	19	54.3	(37 - 70)
Registered nurse	36	13	36.1	(22 - 53)
Professional midwife	36	8	22.2	(11 - 39)
Social worker	36	1	2.8	(0 - 18)
Microbiologist (laboratory)	36	8	22.2	(11 - 39)
Lab technician	36	11	30.6	(17 - 48)
Dispenser at pharmacy	36	16	44.4	(29 - 61)
Epidemiology personnel	36	2	5.6	(1 - 20)
Other personnel specific for statistics and reporting	35	6	17.1	(8 - 34)
Secondary care units				
General physician	6	6	100	(-)
Pediatrician	6	5	83.3	(35 - 98)
Nutritionist /dietician	6	0	0	(-)
Pharmacist	6	5	83.3	(35 - 98)
Auxiliary nurse	6	6	100	(-)
Practical nurse	6	6	100	(-)

	N	n	%	95% CI
Registered nurse	6	6	100	(-)
Professional midwife	6	1	16.7	(2 - 65)
Social worker	6	4	66.7	(26 - 92)
Microbiologist (laboratory)	6	5	83.3	(35 - 98)
Lab technician	6	6	100	(-)
Dispenser at pharmacy	6	6	100	(-)
Epidemiology personnel	6	5	83.3	(35 - 98)
Other personnel specific for statistics and reporting	6	5	83.3	(35 - 98)
Municipal headquarters				
Epidemiology personnel	12	2	16.7	(4 - 49)
Other personnel specific for statistics and reporting	12	7	58.3	(30 - 82)
Health region				
Epidemiology personnel	5	4	80	(30 - 97)
Other personnel specific for statistics and reporting	5	5	100	(-)

5.2 Rapid diagnostic tests

Rapid diagnostic tests (RDT) are used in Honduras in order to shorten the wait for a malaria test result, particularly in health facilities without microscopic diagnosis. The RDT is a cassette-type test prepared with a drop of capillary blood and the result is ready within an hour. The rapid tests procured in Honduras distinguish between *P. falciparum* and *P. vivax* malaria infections. When a blood sample is taken for an RDT, a thick blood film (TBF) slide is routinely prepared for microscopic diagnosis as well, since the rapid test does not measure parasite density. The slide may be examined at the facility where the patient sought care, or may be sent to a facility with a lab or microscopy post for examination.

5.2.1 Rapid diagnostic test practices

In Honduras, 33.3% of primary care facilities store RDTs, and 50% provide testing with RDTs (Table 5.6). In 36.1% of primary care facilities, personnel test with RDTs inside the facility, and personnel conduct testing in the community in 44.4% of facilities (Table 5.7). Testing in the community is most often conducted only in reaction to a positive malaria case (47.8% of facilities that conduct testing in the community), as shown in Table 5.8.

Table 5.6: Rapid diagnostic testing according to interview and observation

	N	n	%	95% CI
Primary care units				
Unit stores RDTs	36	12	33.3	(20 - 51)
Unit conducts RDT testing	36	18	50	(34 - 66)
Secondary care units				
Unit stores RDTs	6	1	16.7	(2 - 65)
Unit conducts RDT testing	6	2	33.3	(8 - 74)
Municipal headquarters				
Unit stores RDTs	12	3	25	(8 - 56)
Unit conducts RDT testing	12	4	33.3	(13 - 63)
Health region				
Unit stores RDTs	5	4	80	(30 - 97)
Unit conducts RDT testing	5	4	80	(30 - 97)

Table 5.7: Rapid diagnostic testing practices (interview)

	N	n	%	95% CI
Primary care units				
Do health personnel perform rapid diagnostic testing for malaria in this facility?	36	13	36.1	(22 - 53)
Do health personnel in this facility perform rapid diagnostic testing for malaria in the community?	36	16	44.4	(29 - 61)
Secondary care units				
Do health personnel perform rapid diagnostic testing for malaria in this facility?	6	2	33.3	(8 - 74)
Do health personnel in this facility perform rapid diagnostic testing for malaria in the community?	6	0	0	(-)
Municipal headquarters				
Do health personnel perform rapid diagnostic testing for malaria in this facility?	12	4	33.3	(13 - 63)
Do health personnel in this facility perform rapid diagnostic testing for malaria in the community?	12	4	33.3	(13 - 63)
Health region				
Do health personnel perform rapid diagnostic testing for malaria in this facility?	5	4	80	(30 - 97)
Do health personnel in this facility perform rapid diagnostic testing for malaria in the community?	5	3	60	(19 - 90)

Table 5.8: Community rapid diagnostic testing frequency

	N	n	%	95% CI
Frequency of rapid diagnostic testing in the community				
Only in reaction to a positive malaria case	23	11	47.8	(28 - 68)
At least once per month	23	4	17.4	(6 - 39)
Daily	23	2	8.7	(2 - 30)
At least once per week	23	2	8.7	(2 - 30)
At least once per quarter	23	1	4.3	(1 - 26)
Other	23	3	13	(4 - 34)

Respondents at facilities that reported using both RDTs and microscopic diagnosis methods were asked which of the two methods are more commonly used. While 42.3% of facilities reported using both RDT and microscopy routinely for the same patient, 46.2% reported taking only a TBF sample routinely (Table 5.9).

Table 5.9: More commonly used testing method among facilities that report use of both RDTs and microscopy

	N	n	%	95% CI
For malaria diagnosis, is it most common to take a thick blood film only, use an RDT only, or take both samples (thick blood film and RDT) for diagnosis?				
Only thick blood film used more commonly	26	12	46.2	(28 - 65)
Both RDT and thick blood film: Samples are routinely taken for both tests at the same time	26	11	42.3	(25 - 62)
Only RDT used more commonly	26	2	7.7	(2 - 27)
Don't know	26	1	3.8	(1 - 24)

Respondents at facilities that reported using both RDTs and microscopic diagnosis methods were asked if they must wait for confirmation with microscopic diagnosis before beginning malaria treatment.

According to the norm, treatment can be initiated with a positive RDT diagnosis. However, 77.8% of primary care facilities and 50% of secondary care facilities that used RDTs reported that they require confirmation by TBF examination in order to start treatment (Table 5.10).

Table 5.10: Microscopy confirmation of RDT results, attention units conducting RDT

	N	n	%	95% CI
Do you require a positive thick blood film test as confirmation after a positive RDT to start malaria treatment?				
Primary care units	18	14	77.8	(53 - 92)
Secondary care units	2	1	50	(5 - 95)

5.2.2 Rapid diagnostic testing as measured in medical record review

The health facility survey included a record review of confirmed cases of malaria to evaluate diagnosis and case management practices, and a review of suspected cases of malaria (patients presenting with fever). Chapters 6 and 7 discuss the results in detail. The review captured whether each case from the year 2018 included in the sample received a rapid diagnostic test based on case notification and investigation paperwork stored at the regional headquarters (for confirmed cases) and based on patient charts, attention registries, and lab records at selected health facilities (for suspected cases). As seen in Table 5.11, 44% of confirmed cases reviewed had evidence of an RDT, and 1.1% of suspected cases reviewed had evidence of receiving an RDT.

Table 5.11: Rapid diagnostic testing observed in medical record review

	N	n	%	95% CI
RDT observed in record				
Confirmed cases	539	237	44	(40 - 48)
Suspected cases	852	9	1.1	(1 - 2)

5.2.3 Stock of rapid diagnostic testing inputs

The health facility survey included an observation by field personnel of inputs and equipment for malaria diagnosis. The recommended *P. falciparum* + *P. vivax* card test was observed in 33.3% of primary care facilities. No rapid tests were observed the day of the survey in 66.7% of primary care facilities (Table 5.12).

Table 5.12: Rapid diagnostic test supply observed

	N	n	%	95% CI
Primary care units				
P. falciparum rapid detection card equipment observed	36	4	11.1	(4 - 27)
P. falciparum + P. vivax rapid detection card equipment observed	36	12	33.3	(20 - 51)
None of these rapid detection cards observed	36	24	66.7	(49 - 80)
Secondary care units				
P. falciparum rapid detection card equipment observed	6	1	16.7	(2 - 65)
P. falciparum + P. vivax rapid detection card equipment observed	6	1	16.7	(2 - 65)
None of these rapid detection cards observed	6	5	83.3	(35 - 98)
Municipal headquarters				
P. falciparum rapid detection card equipment observed	12	1	8.3	(1 - 43)
P. falciparum + P. vivax rapid detection card equipment observed	12	3	25	(8 - 56)
None of these rapid detection cards observed	12	9	75	(44 - 92)

	N	n	%	95% CI
Health region				
P. falciparum + P. vivax rapid detection card equipment observed	5	4	80	(30 - 97)
None of these rapid detection cards observed	5	1	20	(3 - 70)

As shown in Table 5.13, 44.4% of primary care facilities, 33.3% of secondary care facilities, 25% of municipal headquarters, and 80% of health regions routinely store RDTs.

Table 5.13: Rapid diagnostic test routine storage (questionnaire)

	N	n	%	95% CI
Primary care units: Does this facility routinely store any malaria rapid diagnostic tests (RDTs)?				
No, delivered when services are being provided	36	1	2.8	(0 - 18)
No, picked up from another facility	36	4	11.1	(4 - 27)
Yes, stores malaria rapid diagnostic tests (RDTs)	36	16	44.4	(29 - 61)
None of the above	36	14	38.9	(24 - 56)
Don't know	36	1	2.8	(0 - 18)
Secondary care units: Does this facility routinely store any malaria rapid diagnostic tests (RDTs)?				
No, delivered when services are being provided	6	1	16.7	(2 - 65)
No, picked up from another facility	6	0	0	(-)
Yes, stores malaria rapid diagnostic tests (RDTs)	6	2	33.3	(8 - 74)
None of the above	6	3	50	(16 - 84)
Municipal headquarters: Does this facility routinely store any malaria rapid diagnostic tests (RDTs)?				
No, delivered when services are being provided	12	1	8.3	(1 - 43)
No, picked up from another facility	12	2	16.7	(4 - 49)
Yes, stores malaria rapid diagnostic tests (RDTs)	12	3	25	(8 - 56)
None of the above	12	5	41.7	(18 - 70)
Don't know	12	1	8.3	(1 - 43)
Health region: Does this facility routinely store any malaria rapid diagnostic tests (RDTs)?				
No, delivered when services are being provided	5	1	20	(3 - 70)
No, picked up from another facility	5	0	0	(-)
Yes, stores malaria rapid diagnostic tests (RDTs)	5	4	80	(30 - 97)
None of the above	5	0	0	(-)

5.3 Malaria microscopy

The gold standard for malaria diagnosis is by microscopy. A TBF sample is prepared on a laboratory slide, stained, then examined under a microscope for presence of malaria parasites. The preparation of the slide is simple and is carried out by nurses or lab technicians depending on facility practices. Slides are also prepared in the field by vector control technicians and volunteer collaborators (col-vols). Trained microscopists can identify the parasite density as well as the parasite species in a blood sample prepared correctly. After initiating antimalarial treatment, the parasite density of an infected patient will begin to decrease and eventually drop to zero.

5.3.1 Microscopic diagnosis practices

In Honduras, all facilities in the sample are expected to have the capacity to prepare TBF slides. In the health facility interview and observation, 86.1% of primary care facilities were found to take TBF samples. Administrative units often have this capacity as well, when the unit has vector control technicians affiliated (58.3% of municipal offices and 40% of health regions, as in Table 5.14). The health facility survey (interview and observation) determined microscopic diagnostic capacity at 41.7% of primary care facilities, 50% of secondary care facilities, 50% of municipal offices, and 80% of health regions.

Table 5.14: Microscopy and thick blood film sampling according to interview + observation

	N	n	%	95% CI
Primary care units				
Unit takes thick blood film samples	36	31	86.1	(70 - 94)
Unit has microscopy capacity	36	15	41.7	(27 - 59)
Secondary care units				
Unit takes thick blood film samples	6	6	100	(-)
Unit has microscopy capacity	6	3	50	(16 - 84)
Municipal headquarters				
Unit takes thick blood film samples	12	7	58.3	(30 - 82)
Unit has microscopy capacity	12	6	50	(24 - 76)
Health region				
Unit takes thick blood film samples	5	2	40	(10 - 81)
Unit has microscopy capacity	5	4	80	(30 - 97)

According to the interview alone and as seen in Table 5.15, 78% of all facilities (regardless of type) have personnel that take TBF samples in-facility, and 52.5% have personnel that take TBF samples in the community.

Table 5.15: Thick blood film sampling according to interview

	N	n	%	95% CI
Health personnel in this facility take thick blood film samples in-facility	59	46	78	(65 - 87)
Health personnel take thick blood film samples in the community	59	31	52.5	(40 - 65)

As shown in Table 5.16 and regardless of facility type, 67.4% of facilities conduct initial diagnosis of malaria according to the interview. Facilities that do not conduct initial diagnosis either do not have microscopic diagnostic capacity, or they exclusively examine already-diagnosed slides for quality control (such as some regional laboratories and at the national laboratory). Of those 31 facilities that report conducting initial diagnosis, 71% also examine samples taken by community health workers or volunteer collaborators, and 22.6% sometimes send slides elsewhere for initial diagnosis (for example, when the sole laboratorist is on leave). Among the 15 facilities that do not conduct initial diagnosis, 93.3% send samples to another facility for initial diagnosis.

Among all 21 facilities that send samples to another facility (sometimes or always), 57.1% report sending them to another health care facility, while 42.9% report sending them directly to the regional laboratory for initial diagnosis (Table 5.17).

Table 5.16: Microscopy capacity in facility according to interview

	N	n	%	95% CI
Thick blood film samples examined for initial diagnosis of malaria in-facility	46	31	67.4	(52 - 80)
Thick blood film samples taken by community health workers (health promotors/volunteer collaborators) examined for malaria in-facility	31	22	71	(52 - 84)
Samples sometimes sent elsewhere for initial diagnosis of malaria, among facilities with capacity	31	7	22.6	(11 - 41)
Samples sent elsewhere for initial diagnosis of malaria, among facilities without capacity	15	14	93.3	(63 - 99)

Table 5.17: Samples sent elsewhere: location

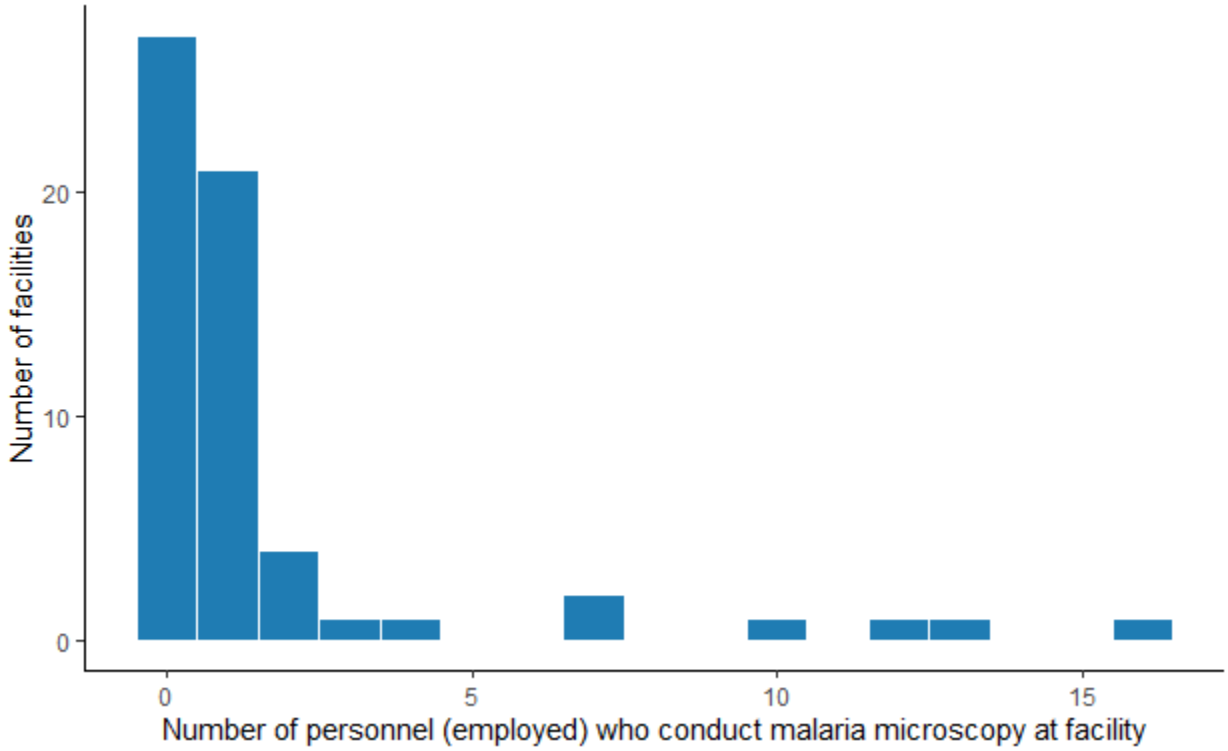
	N	n	%	95% CI
Location of initial diagnosis				
Another health facility	21	12	57.1	(35 - 76)
Regional laboratory	21	9	42.9	(24 - 65)

Facilities that reported conducting initial diagnosis (regardless of facility type) were asked about the personnel responsible for examining slides, and respondents could indicate more than one type. In 51.6% of facilities there is at least one malaria microscopist, 48.4% of facilities have at least one microbiologist who conducts malaria diagnosis, and 54.8% have other lab personnel that read malaria slides (Table 5.18). Figure 5.2 shows the number of employed personnel of all personnel types who conduct malaria diagnosis at each facility in the sample.

Table 5.18: Personnel responsible for malaria microscopy testing

	N	n	%	95% CI
Personnel responsible for TBF examination				
Other lab technician	31	17	54.8	(37 - 72)
Malaria microscopist	31	16	51.6	(34 - 69)
Microbiologist (laboratory)	31	15	48.4	(31 - 66)

Figure 5.2: Diagnostic personnel employed by facilities

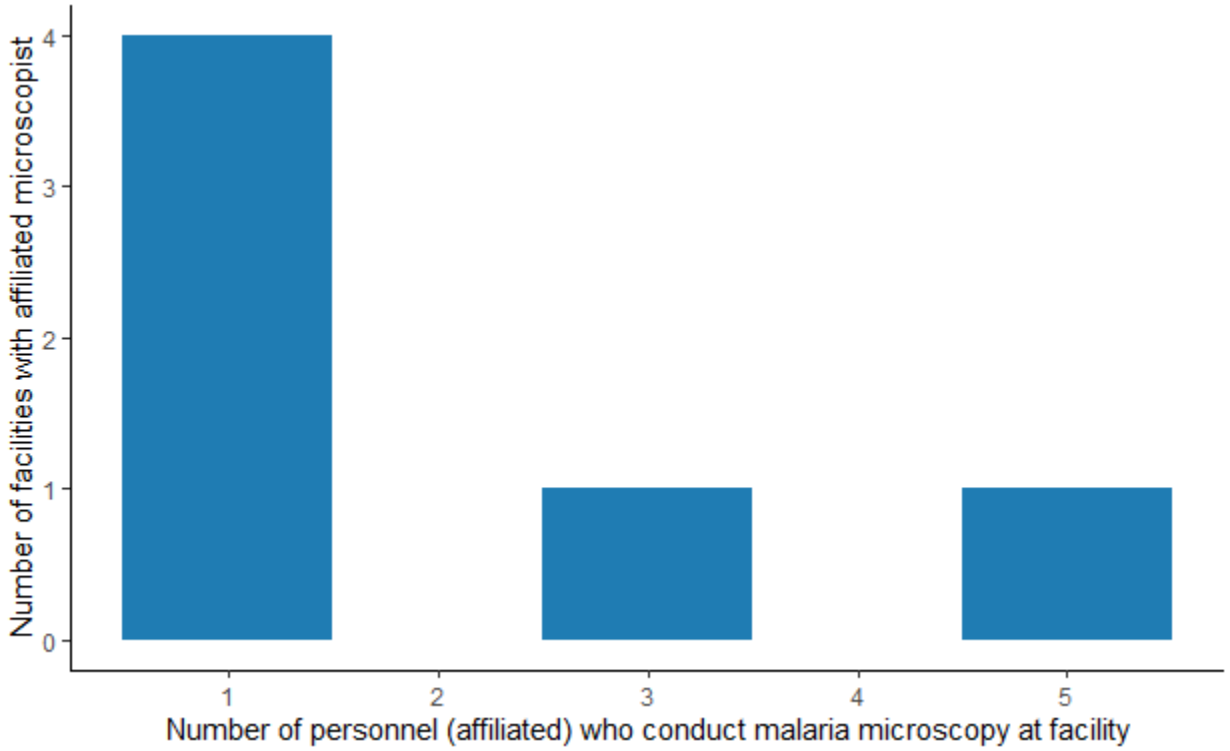


The health facility survey also asked about any affiliated personnel (employed by another institution rather than by the facility directly) who conduct malaria diagnosis. Only 10% of facilities had affiliated personnel involved in diagnosis (Table 5.19). Figure 5.3 shows the number of affiliated diagnostic personnel at each of the Six facilities reporting affiliates.

Table 5.19: Diagnostic personnel not employed but working in facility

	N	n	%	95% CI
Affiliated microscopists work at but are not employed by facility	60	6	10	(4 - 21)

Figure 5.3: Diagnostic personnel affiliated to facilities



5.3.2 Indicator 7.01: Supplies and equipment for malaria testing and treatment

In order to be able to detect and treat malaria, facilities must have certain basic supplies and equipment on hand. The indicator negotiated for RMEI considers whether these required basic inputs were observed at the facilities in the sample. The requirements vary by facility type, as detailed in Table 5.20.

Table 5.20: Indicator P7.01: Required components by facility type

Component	Primary level (36)	Secondary level (7)	Administrative Units / National Lab (18)
Medications (basic)	All		
Medications (severe malaria)		All	
Medications (CQ resistant)		All	
Sampling equipment	All		
Forms for sending samples	All		
Equipment for on-site diagnosis (RDT)	Stratum 4		
Microscopy equipment	If reported microscopy capacity		
Staining and sample reading equipment	If reported microscopy capacity		
Staining reagents	If reported microscopy capacity		

The indicator results are shown in Table 5.21. Only 18.9% of all the facilities in the sample had all of the inputs required for the corresponding facility type. Table 5.22 shows, for comparison, the results in malaria stratum 4 versus malaria stratum 3.

Table 5.21: Indicator P7.01: Equipment and medications

	N	n	%	95% CI
Antimalarial medications	42	10	23.8	(13 - 39)
Medications for basic treatment: Chloroquine	36	13	36.1	(22 - 53)
Medications for basic treatment: Primaquine (5 or 15 mg tablets)	36	15	41.7	(27 - 59)
Medication for treatment of severe malaria: Quinine / Artesunate	6	2	33.3	(8 - 74)
Medication for treatment of chloroquine-resistant malaria: Artemisinin derivatives (artemeter + lumefantrine)	6	0	0	(-)
No stockout of chloroquine or primaquine in past 3 months	36	10	27.8	(15 - 45)
Sampling and biosafety equipment	30	30	100	(-)
Disposable gloves	30	30	100	(-)
Lancets	30	30	100	(-)
Microscope slides (frosted or non-frosted)	30	30	100	(-)
Sample submission forms	30	29	96.7	(79 - 100)
Rapid diagnostic tests (RDTs) for onsite testing	31	12	38.7	(23 - 57)
Microscopy equipment	29	29	100	(-)
Binocular microscope (with 100x retractable lens)	29	29	100	(-)
Cell counter (manual or automatic)	29	29	100	(-)
Equipment for staining and testing	29	23	79.3	(60 - 91)
Immersion oil	29	29	100	(-)
Staining tray/ container	29	28	96.6	(78 - 100)
Laboratory stopwatch	29	29	100	(-)
Container for mixing dye/ stain	29	28	96.6	(78 - 100)
Pipettes/ droppers/ syringes	29	23	79.3	(60 - 91)
Reagents for staining	29	14	48.3	(31 - 66)
GIEMSA solution (or alternative: Methylene blue + Solution A + Solution B + Methanol)	29	28	96.6	(78 - 100)
Buffer solution or buffered water	29	18	62.1	(43 - 78)
No stockout of reagents in past 3 months	29	14	48.3	(31 - 66)
Units with all required equipment and medications	53	10	18.9	(10 - 32)

Table 5.22: Comparison: result by facility stratification

	N	n	%	95% CI
P7.01 Equipment Indicator				
Stratum 3	5	0	0	(-)
Stratum 4	48	10	20.8	(11 - 35)
Total	53	10	18.9	(10 - 32)

5.3.3 Stock of microscopy inputs and equipment

The observation module of the health facility survey checked stock of sample-taking and microscopy supplies and equipment. Each item in the observation list had to be observed by the surveyor, checked

for functionality, in the case of equipment, and recorded to the electronic module. Table 5.23 and Table 5.24 show the proportion of facilities where each item for sample-taking and microscopy, respectively, was observed on the day of the survey. Some supplies for sample-taking (Alcohol swabs, Cotton-wool swabs, Acetone or Acetone alcohol (antiseptic), Needles, Vacutainer-type needles, Capillary tubes) were sought for observation only in facilities with a microscopy post or laboratory.

Table 5.23: Sample-taking supplies observed

	N	n	%	95% CI
Disposable gloves	50	50	100	(-)
Lancets	50	50	100	(-)
Syringes (for taking blood)	50	40	80	(66 - 89)
Sharps box	50	44	88	(75 - 95)
Microscope slides (not frosted)	50	33	66	(52 - 78)
Frosted microscope slides	50	37	74	(60 - 85)
Alcohol swabs	35	13	37.1	(23 - 54)
Cotton-wool swabs	35	13	37.1	(23 - 54)
Acetone or Acetone alcohol (antiseptic)	35	13	37.1	(23 - 54)
Needles	35	14	40	(25 - 57)
Vacutainer-type needles	35	7	20	(10 - 37)
Capillary tubes	35	27	77.1	(60 - 88)

Table 5.24: Microscopy equipment and supplies observed, among all facilities reporting microscopy capacity

	N	n	%	95% CI
Lens-cleaning tissues	29	25	86.2	(68 - 95)
Spare bulbs (for microscopes)	29	12	41.4	(25 - 60)
Spare fuses (for microscopes)	29	5	17.2	(7 - 36)
Immersion oil	29	29	100	(-)
Oil immersion lens-cleaning solution	29	5	17.2	(7 - 36)
Staining rack	29	28	96.6	(78 - 100)
Drying rack (or sheet)	29	27	93.1	(75 - 98)
Measuring cylinder/disposable graduated cylinder	29	17	58.6	(40 - 75)
Glass or plastic bottles with a lid, that do not allow the passage of light	29	11	37.9	(22 - 57)
Filter paper (or other input to act as filter paper)	29	24	82.8	(64 - 93)
Slide holders or wooden dowels	29	26	89.7	(72 - 97)
Containers for mixing dye or stain	29	27	93.1	(75 - 98)
Concave staining surface	29	4	13.8	(5 - 32)
Staining tray/sheet/container	29	25	86.2	(68 - 95)
Glass petri dish	29	3	10.3	(3 - 28)
Plastic petri dish	29	10	34.5	(19 - 54)
Syringes	29	15	51.7	(34 - 69)
Disposable droppers	29	15	51.7	(34 - 69)
Test tubes with screw caps	29	20	69	(50 - 83)
Test tubes without caps (glass or plastic)*	9	4	44.4	(17 - 76)
Safety glasses (including the over-spectacle type)	29	12	41.4	(25 - 60)
Gowns	29	19	65.5	(46 - 81)
Markers	29	25	86.2	(68 - 95)
Detergents	29	25	86.2	(68 - 95)

	N	n	%	95% CI
Timer in laboratory	29	20	69	(50 - 83)

*Only observed when test tubes with screw caps were not observed.

Each microscope present at facilities in the sample was observed separately for characteristics. The number of microscopes at each facility is detailed in Figure 5.4. The observed characteristics, by microscope, are shown in Table 5.26.

Figure 5.4: Functional microscopes per facility

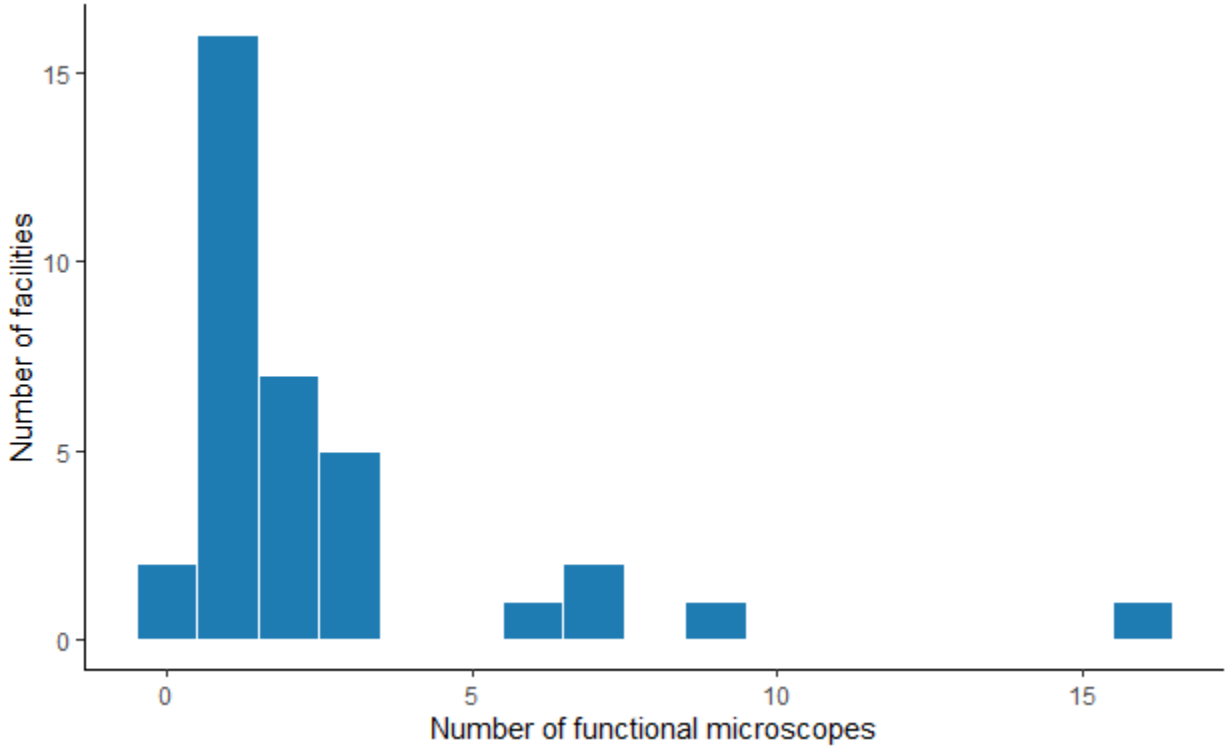


Table 5.26: Microscope characteristics among all observed microscopes

	N	n	%	95% CI
Is this a binocular microscope?	90	90	100	(-)
Is this a light microscope?	90	90	100	(-)
Is this a fluorescence microscope?	90	12	13.3	(8 - 22)
Is this a dark field microscope?	90	16	17.8	(11 - 27)
Is this a solar power microscope?	90	1	1.1	(0 - 7)
Lens observed: 4x	90	87	96.7	(90 - 99)
Lens observed: 10x	90	89	98.9	(93 - 100)
Lens observed: 20x	90	3	3.3	(1 - 10)
Lens observed: 40x	90	89	98.9	(93 - 100)
Lens observed: 100x	90	90	100	(-)
Lens observed: 1000x	90	0	0	(-)
Does the binocular microscope have an oil immersion lens?	90	89	98.9	(93 - 100)

Chapter 6: Malaria Case Detection and Diagnosis

Crucial to any malaria elimination program is quick detection of new malaria cases. Quickly administering treatment to the patient and enacting reactive activities in the community to search for additional cases and to monitor and control vector populations can interrupt the chain of transmission. In Honduras, active case detection is carried out by vector control personnel both through planned activities and in response to malaria cases confirmed in areas without ongoing transmission. Passive case detection relies on health facilities to suspect and test for malaria in patients who present with fever or other malaria symptoms, and is a key component of malaria program strategy in the elimination phase.

In Honduras, clinical and community health personnel are trained to suspect and test for malaria in patients with high fever in zones with local transmission or among patients who have traveled to those zones. Other signs that suggest malaria are history of recent fever, chills, and sweating, particularly in an alternating pattern. In addition, zones with ongoing or recent transmission may have volunteer collaborators (*colaboradores voluntarios*, or “col-vols”) based in localities with difficult access to health facilities. Community members experiencing fever or other malaria symptoms can seek out the col-vol, who will take a blood sample if he or she suspects the patient may have malaria.

6.1 Active case detection and outreach

As a part of the health facility interview, respondents were asked about vector control personnel and community health workers affiliated with the facility. Many primary care facilities had at least one vector control technician or community health worker affiliated, all of whom were involved in malaria service provision. Vector control personnel and volunteer collaborators were also usually affiliated to municipal and regional headquarters (Table 6.1).

Table 6.1: Affiliated malaria personnel

	N	n	%	95% CI
Primary care units				
Vector control personnel	35	24	68.6	(51 - 82)
Community health workers/volunteer collaborators	36	31	86.1	(70 - 94)
Community health workers/volunteer collaborators involved in malaria activities (such as vector control, diagnosis, case detection, or treatment)	31	31	100	(-)
Other personnel involved in malaria diagnosis or treatment	36	2	5.6	(1 - 20)
Secondary care units				
Vector control personnel	6	0	0	(-)
Community health workers/volunteer collaborators	5	0	0	(-)
Community health workers/volunteer collaborators involved in malaria activities (such as vector control, diagnosis, case detection, or treatment)	0	0		-
Other personnel involved in malaria diagnosis or treatment	6	1	16.7	(2 - 65)
Administrative units & National Lab				
Vector control personnel	18	15	83.3	(58 - 95)
Community health workers/volunteer collaborators	18	12	66.7	(42 - 85)

	N	n	%	95% CI
Community health workers/volunteer collaborators involved in malaria activities (such as vector control, diagnosis, case detection, or treatment)	12	12	100	(-)
Other personnel involved in malaria diagnosis or treatment	18	3	16.7	(5 - 42)

As shown in Table 6.2, 77.8% of primary care facilities and 94.1% of administrative units reported that facility personnel participate in active searches for malaria. Some administrative units also reported storing mosquito nets for distribution (35.3%) and employing personnel involved with indoor residual spraying (70.6%). Educational campaigns about malaria were conducted by 88.2% of administrative units.

Table 6.2: Active case detection and community activities

	N	n	%	95% CI
Primary care units				
Conducts active search for malaria cases	36	28	77.8	(61 - 89)
Stores insecticide-treated mosquito nets for distribution in the community	36	2	5.6	(1 - 20)
Performs indoor residual spraying	36	15	41.7	(27 - 59)
Conducts educational campaigns about malaria in the community	36	33	91.7	(77 - 97)
Other malaria outreach activities	35	25	71.4	(54 - 84)
Secondary care units				
Conducts active search for malaria cases	6	0	0	(-)
Stores insecticide-treated mosquito nets for distribution in the community	6	1	16.7	(2 - 65)
Performs indoor residual spraying	6	0	0	(-)
Conducts educational campaigns about malaria in the community	6	0	0	(-)
Other malaria outreach activities	6	1	16.7	(2 - 65)
Administrative units (excluding national lab)				
Conducts active search for malaria cases	17	16	94.1	(67 - 99)
Stores insecticide-treated mosquito nets for distribution in the community	17	6	35.3	(16 - 60)
Performs indoor residual spraying	17	12	70.6	(45 - 88)
Conducts educational campaigns about malaria in the community	17	15	88.2	(62 - 97)
Other malaria outreach activities	17	13	76.5	(51 - 91)

Facilities that reported participation in active search for malaria cases were asked about how active case detection activities are planned in the community. As shown in Table 6.3, many facilities (regardless of facility type) reported they do active case detection after there is a case of malaria in the catchment area (72.7% of facilities). Among the 6.8% of facilities that reported doing active search according to direction from health authorities, 66.7% said the direction came from the regional level (Table 6.4).

The breakdown of health facilities that complete active case detection after there is a case of malaria in the catchment area and health facilities that schedule active case detection on a periodic basis are shown by department in Figure 6.1 and Figure 6.2.

Table 6.3: Determinants of active case detection

	N	n	%	95% CI
When do you search for suspected malaria cases in your catchment area?				
After there is a case of malaria in the catchment area	44	32	72.7	(57 - 84)
On a scheduled periodic basis	44	17	38.6	(25 - 54)
When events (market, celebrations, vacations) are happening in the community	44	4	9.1	(3 - 22)
When directed from health authorities	44	3	6.8	(2 - 20)
Based on seasonality	44	2	4.5	(1 - 17)
Other	44	3	6.8	(2 - 20)

Table 6.4: Active case detection direction from health authorities

	N	n	%	95% CI
Agency/level that orders the active search				
Regional level	3	2	66.7	(14 - 96)
Local malaria management team	3	1	33.3	(4 - 86)
Decided at this facility	3	1	33.3	(4 - 86)

Figure 6.1: Active case detection completed after there is a case of malaria in the catchment area of the health facility, by facility type and stratification

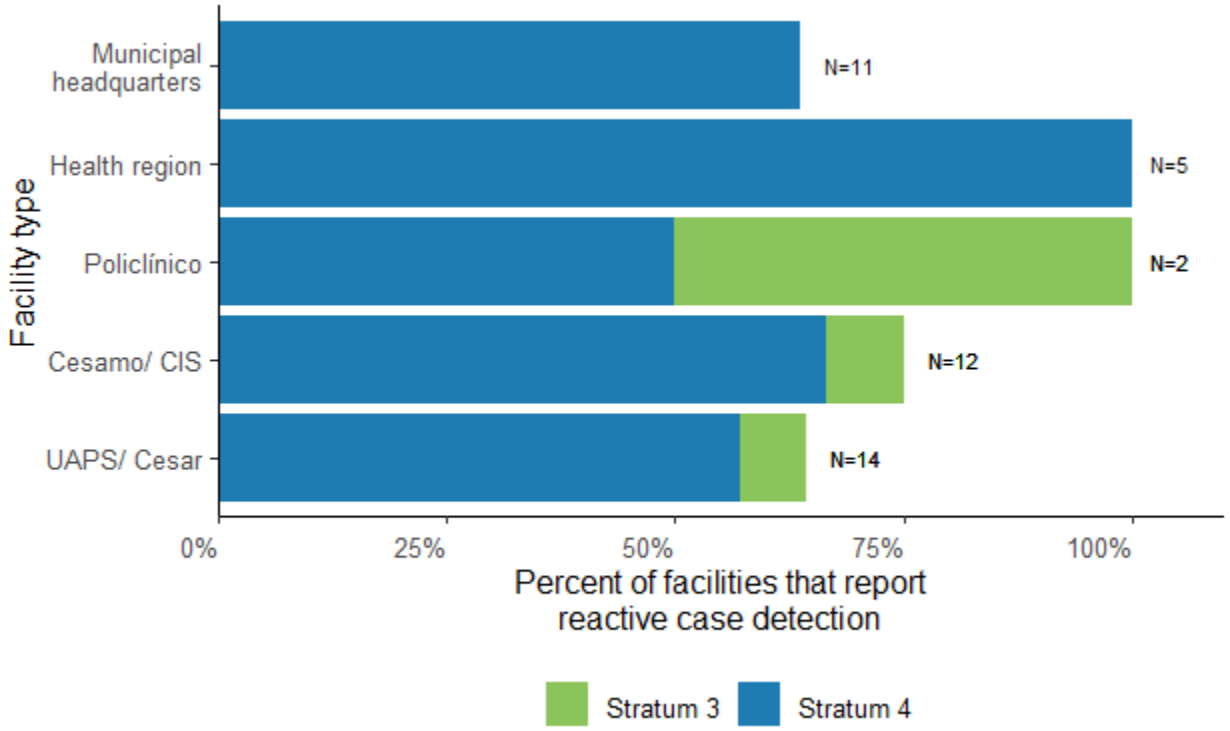
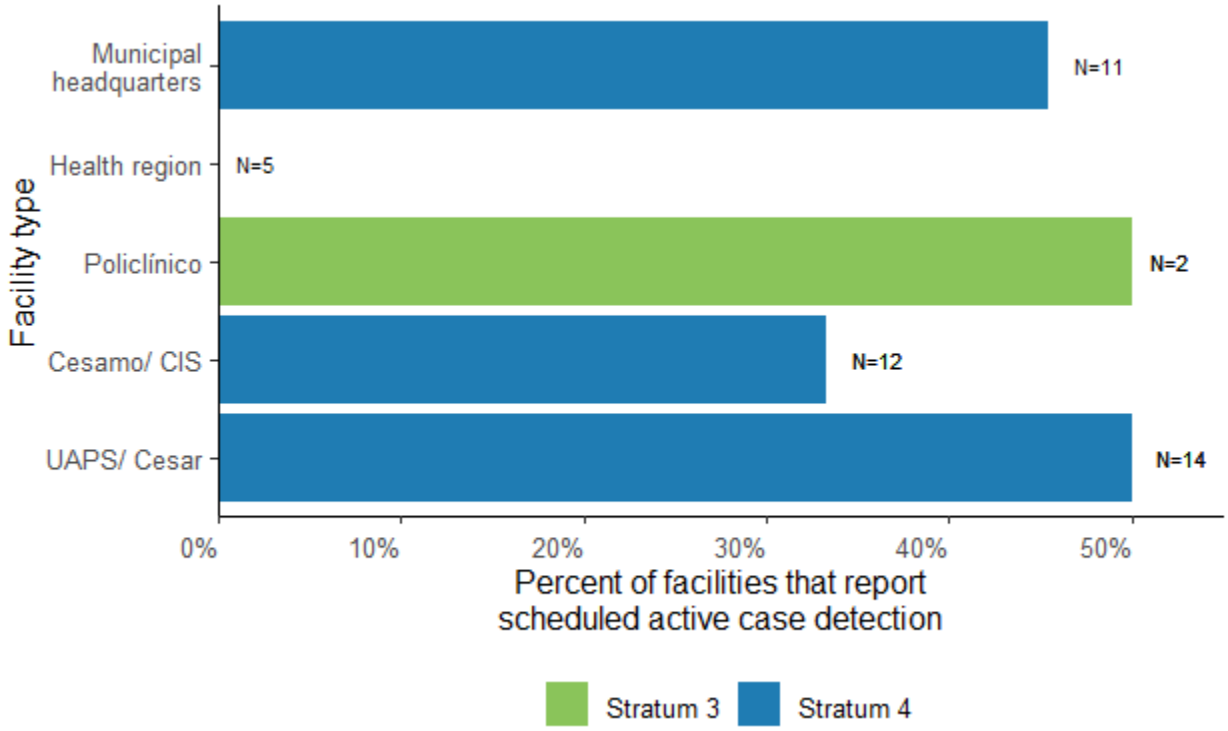


Figure 6.2: Active case detection scheduled on a periodic basis, by facility type and stratification



The facilities that reported storing mosquito nets were asked how the nets are distributed, and could list more than one method. The results are summarized in Table 6.5.

Table 6.5: Community net distribution

	N	n	%	95% CI
Mode of treated net distribution				
Personnel from this health facility distributes the nets in the community	9	4	44.4	(17 - 76)
Vector control personnel distributes the nets in the community	9	4	44.4	(17 - 76)
Routinely offered to patients visiting the health facility	9	1	11.1	(1 - 52)
Other	9	1	11.1	(1 - 52)

Respondents were also asked a series of questions about malaria detection activities in the community and referrals from community health workers. Among facilities that administer malaria treatment, 47.2% of primary care units and 16.7% of secondary care units received referrals from col-vols or other community health workers to treat malaria. Diagnosis activities were common, with 63.9% of primary care facilities receiving referrals for malaria testing, 50% of primary care units taking TBF samples in the community, and 44.4% of primary care units taking RDTs in the community.

Table 6.6: Community malaria activities - questionnaire

	N	n	%	95% CI
Primary care units				
Do you receive referred patients from community health workers or volunteer collaborators for malaria testing?	36	23	63.9	(47 - 78)
Do you receive referred patients from community health workers or volunteer collaborators for malaria treatment?	36	17	47.2	(31 - 64)
Do health personnel take thick blood film samples in the community?	36	18	50	(34 - 66)
Do health personnel in this facility perform rapid diagnostic testing for malaria in the community?	36	16	44.4	(29 - 61)
Do community health workers or volunteer collaborators receive malaria rapid tests from this facility for use in the community?	36	13	36.1	(22 - 53)
Secondary care units				
Do you receive referred patients from community health workers or volunteer collaborators for malaria testing?	6	2	33.3	(8 - 74)
Do you receive referred patients from community health workers or volunteer collaborators for malaria treatment?	6	1	16.7	(2 - 65)
Do health personnel take thick blood film samples in the community?	6	0	0	(-)
Do health personnel in this facility perform rapid diagnostic testing for malaria in the community?	6	0	0	(-)
Do community health workers or volunteer collaborators receive malaria rapid tests from this facility for use in the community?	6	1	16.7	(2 - 65)
Administrative units (excluding national lab)				
Do you receive referred patients from community health workers or volunteer collaborators for malaria testing?	17	10	58.8	(35 - 79)
Do health personnel take thick blood film samples in the community?	17	13	76.5	(51 - 91)
Do health personnel in this facility perform rapid diagnostic testing for malaria in the community?	17	7	41.2	(21 - 65)
Do community health workers or volunteer collaborators receive malaria rapid tests from this facility for use in the community?	17	6	35.3	(16 - 60)

6.2 Passive case detection practices (health facility questionnaire)

Personnel in health facilities are trained to suspect and test for malaria in patients who present with fever or other symptoms to the facility, known as passive case detection. Patients presenting with clinical signs that meet the definition of a suspected malaria case will have a sample taken, usually of capillary blood, to prepare a TBF slide and sometimes to perform a rapid diagnostic test as well. If the *Plasmodium* parasite is detected via rapid test or microscopy, treatment with the first-line regimen corresponding to the parasite species begins and the case is notified to local vector control personnel and to the regional health authority. If the health facility the patient visits does not have microscopic diagnostic capacity, or if the patient visits a col-vol for testing, the TBF slide is sent, along with a suspected case notification form filled by the provider who took the sample, to a nearby lab for testing, transported by vector control technicians who either visit on a regular basis (usually at least weekly) for pickup or who are notified by

phone that a slide is ready for testing. The slide is tested by the lab, and in the case that malaria is confirmed, vector control personnel are notified so that they can locate the patient and begin to administer treatment.

During the health facility interview, respondents in facilities that reported conducting malaria tests were asked who decides whether a patient will receive a diagnostic test for malaria, and could indicate more than one personnel type. Table 6.7 shows that doctors order the test in 74.2% of primary care facilities and 100% of secondary care facilities, and nurses order the test or take the sample at triage in 35.5% of primary care facilities and 16.7% of secondary care facilities. Text responses entered for “other” in primary care units include: nurse during consult, other technical or auxiliary staff, and all febrile patients automatically receive test.

Table 6.7: Malaria testing by facility personnel among facilities conducting testing

	N	n	%	95% CI
Primary care units: Who decides whether a patient presenting at this facility will receive a malaria test?				
Nurse at triage or pre-clinic	31	11	35.5	(21 - 54)
Doctor during consult	31	23	74.2	(56 - 87)
Lab staff or microscopy staff	31	4	12.9	(5 - 30)
Other	31	7	22.6	(11 - 41)
Secondary care units: Who decides whether a patient presenting at this facility will receive a malaria test?				
Nurse at triage or pre-clinic	6	1	16.7	(2 - 65)
Doctor during consult	6	6	100	(-)
Lab staff or microscopy staff	6	0	0	(-)
Other	6	0	0	(-)

Next, respondents were asked to mention what criteria are used to determine whether a patient gets a malaria test, at triage (Table 6.8) and at consult (Table 6.9). The respondent answered with the criteria they use at the facility and the interviewer marked the corresponding options in the survey without reading them aloud. In both triage and consult, high fever was an important criterion that determined testing (100% and 93.3% respectively) and chills was also frequently mentioned (in 69.2% of facilities at triage). Few respondents mentioned travel history as a determining factor for malaria testing.

Table 6.8: Malaria testing criteria at triage

	N	n	%	95% CI
What criteria must a patient meet in order to get a blood sample taken for malaria test during triage or pre-clinic?				
High fever	13	13	100	(-)
Chills	13	9	69.2	(40 - 88)
General malaise	13	3	23.1	(7 - 53)
History of recent fever	13	2	15.4	(4 - 46)
Sweating	13	2	15.4	(4 - 46)
Fever for more than 3 days	13	1	7.7	(1 - 41)
Fever without nonspecific digestive symptoms (vomiting, abdominal pain, loss of appetite)	13	1	7.7	(1 - 41)
Other	13	3	23.1	(7 - 53)

Table 6.9: Malaria testing criteria at consultation

	N	n	%	95% CI
What criteria must a patient meet in order for the doctor to order a malaria test during the consultation?				
High fever	30	28	93.3	(76 - 98)
Chills	30	11	36.7	(21 - 55)
General malaise	30	6	20	(9 - 39)
History of recent fever	30	5	16.7	(7 - 35)
Sweating	30	5	16.7	(7 - 35)
History of recent travel to areas with endemic malaria	30	5	16.7	(7 - 35)
Fever without nonspecific digestive symptoms (vomiting, abdominal pain, loss of appetite)	30	4	13.3	(5 - 31)
Prior history of malaria	30	1	3.3	(0 - 21)
Other	30	7	23.3	(11 - 42)

6.3 Fever cases with blood test (LQAS)

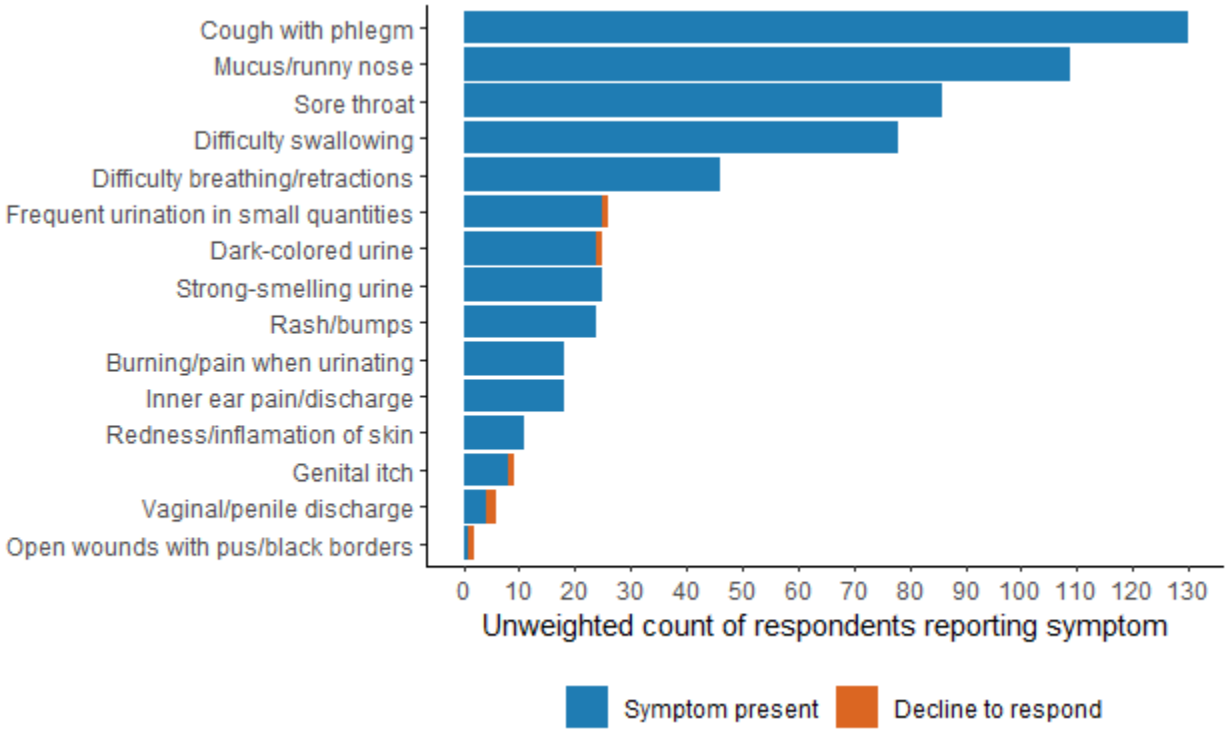
In the community survey (LQAS), interviews with households included questions about history of fever during the two weeks prior to the survey for all usual members of the household. The estimates from the LQAS survey reported in this section are not weighted due to the very small size of the sub-sample of eligible fevers.

If the primary interview respondent reported that a household member had a recent fever, the interviewer asked to speak to the person who had the fever, or in the case that a child or adolescent had a fever, with the child's primary caregiver. If the person with the fever was not available and the primary respondent knew the details of their recent fever, that person was permitted to respond on behalf of the fever patient. The respondent answered questions about other symptoms suffered during the febrile illness and whether and where they sought medical attention. As seen in Table 6.10, 7% of the individuals whose households were selected for the LQAS survey experienced a fever during the two weeks prior to the date of the survey. However, not all patients with fever need to be tested for malaria according to suspected case definitions: patients with respiratory symptoms, urinary symptoms, or skin symptoms suggesting an infection unrelated to malaria will receive a clinical diagnosis and treatment without needing to test to rule out malaria. Of the 265 respondents who reported experiencing fever, the majority experienced other symptoms that suggested a condition other than malaria. Only 67 people, or 25.3% of the individuals reporting fever, were free of other symptoms excluding them from having to receive a malaria test. The simultaneous symptoms reported by respondents who experienced a recent fever are detailed in Figure 6.3.

Table 6.10: Eligible fever cases reported in LQAS household survey

	N	n	%	95% CI
LQAS respondents	3839	3839	100	(-)
Fever cases in the last two weeks	3769	265	7	(6 - 8)
Fever without exclusion symptoms	265	67	25.3	(20 - 31)

Figure 6.3: Exclusion symptoms experienced by respondents reporting fever



6.3.1 Indicator 2.02: Fever cases with blood test (household)

Because it may be difficult for community members to know or remember which specific blood tests were ordered or carried out by a medical professional they visited, individuals who reported that a blood sample was taken during their illness are considered to have had a malaria test for the purpose of the indicator.

All respondents reporting fever without exclusion symptoms were asked whether, during the illness, a blood sample was taken from their finger, heel, earlobe, or vein. As shown in Table 6.11, 43.3% of respondents with an eligible fever (with no exclusion symptoms) had a blood sample taken.

Table 6.11: Indicator 2.02: Fevers with blood sample

	N	n	%	95% CI
Fever cases in past two weeks	3769	265	7	(6 - 8)
Fevers with no exclusion symptoms	265	67	25.3	(20 - 31)
Omitted due to 'do not know' responses	67	0	0	(-)
Fevers with any blood sample	67	29	43.3	(32 - 55)
Capillary blood test	67	19	28.4	(20 - 38)
Venal blood test	67	23	34.3	(23 - 48)

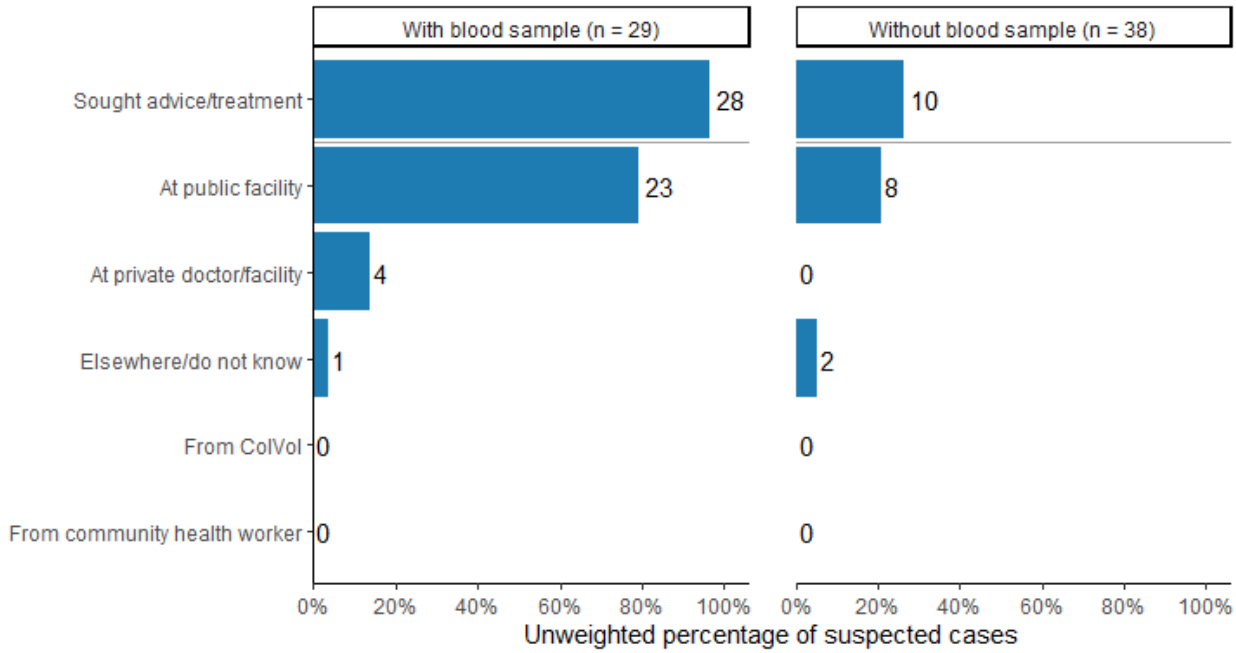
Respondents who reported a blood sample draw were asked whether their blood was tested for malaria, and if so, the result of the test. As seen in Table 6.13, 55.2% of respondents with a blood sample reported a malaria test, and 81.2% of those who had the malaria test reported a negative result.

Table 6.13: Result of blood tests, LQAS fevers

	N	n	%	95% CI
Blood tested for malaria	29	16	55.2	(34 - 75)
Result of malaria test				
Negative malaria	16	13	81.2	(55 - 94)
Don't know	16	3	18.8	(6 - 45)

Figure 6.4 shows care-seeking behavior among respondents with fever. Respondents with fever who reported receiving a blood test are shown in the left panel, and respondents with fever who did not receive a blood test in the right panel. Most of those who received a blood test sought treatment at a public health facility.

Figure 6.4: Treatment sought by respondents with fever cases



The calculation for Indicator 2.02 is presented in Table 6.14 both excluding cases with symptoms suggesting an illness other than malaria (43.3%) and including all fever cases reported from the past two weeks (32.2%).

Table 6.14: Indicator 2.02: Fevers with blood sample, with and without exclusion symptoms

	N	n	%	95% CI
Fevers (with no exclusion symptoms) with any blood sample	67	29	43.3	(32 - 55)
All fevers with any blood sample	264	85	32.2	(26 - 39)

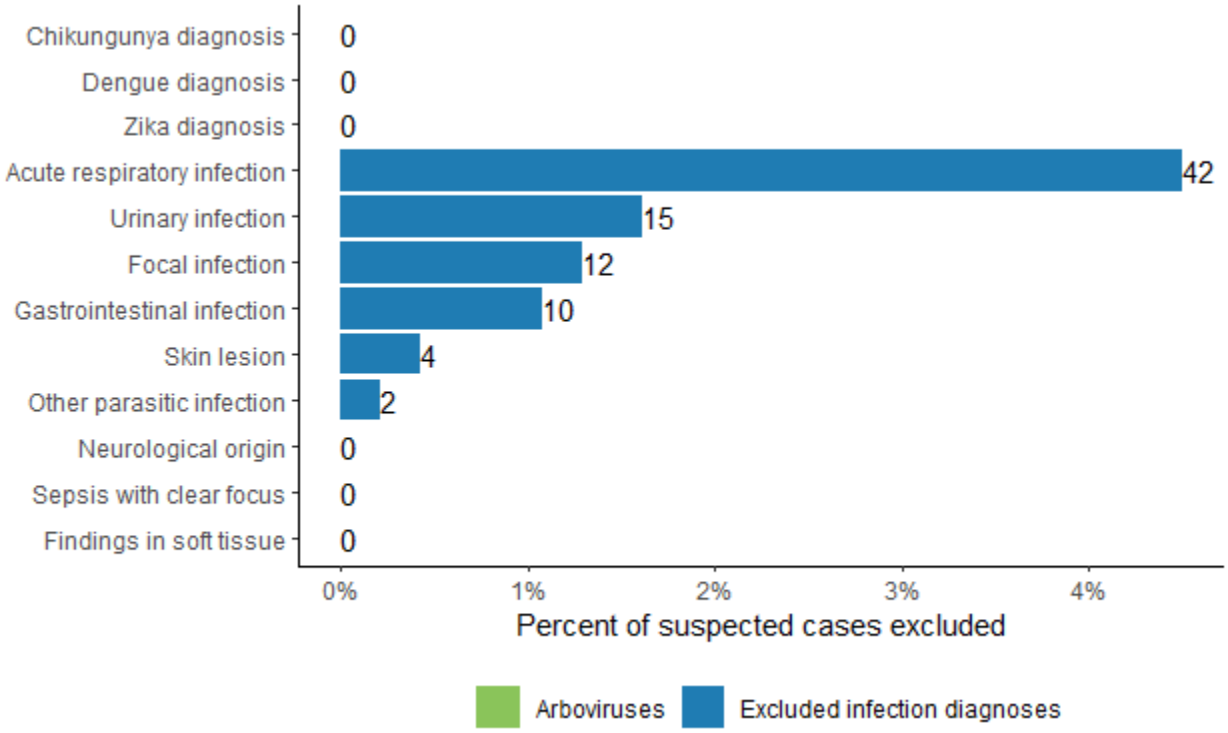
6.4 Suspected malaria cases with parasitological test (medical record review)

For a clinical comparison to the indicator measured in the LQAS survey, the health facility survey included a review of medical records of patients with fever or other malaria symptoms (suspected cases of malaria). In each facility that provided care to patients, field personnel selected eligible patient visits based on attention registries or diagnosis databases according to the process described in Chapter 2 and Appendix C. The eligible time window for review was the calendar year 2018. Suspected cases with an eligible diagnosis or principal complaint (details in Appendix B, Indicator 2.01) were selected at random,

and all relevant records of the patient's visit were sought out for completion of a chart review module. For each case, field staff reviewed attention registries, laboratory records, and patient medical records as available and entered information related to the diagnosis, symptoms, and lab tests to the electronic survey module. No information that could identify the patients was collected. Surveyors noted that a disproportionate amount of eligible cases were in children, because unspecified fever is not an acceptable final diagnosis for adult patients in Honduras.

Some of the sampled records were eligible to be selected based on information on the attention registry, such as a primary or initial diagnosis from the inclusion list, but upon review of the full chart, were found to be ineligible due to a diagnosis of another identified infection with clear cause or a diagnosis of arbovirus with a positive viral test result documented. The frequency of diagnoses of exclusion among cases ruled ineligible after sample selection is shown in Figure 6.5. Each of these ineligible records was replaced with an alternate record selected to a back-up sample in order to ensure completion of the total quota for medical record reviews in each facility. In some primary care facilities, field personnel found an inadequate number of eligible attentions from the year 2018 to meet the quota, and all eligible cases from 2018 were reviewed.

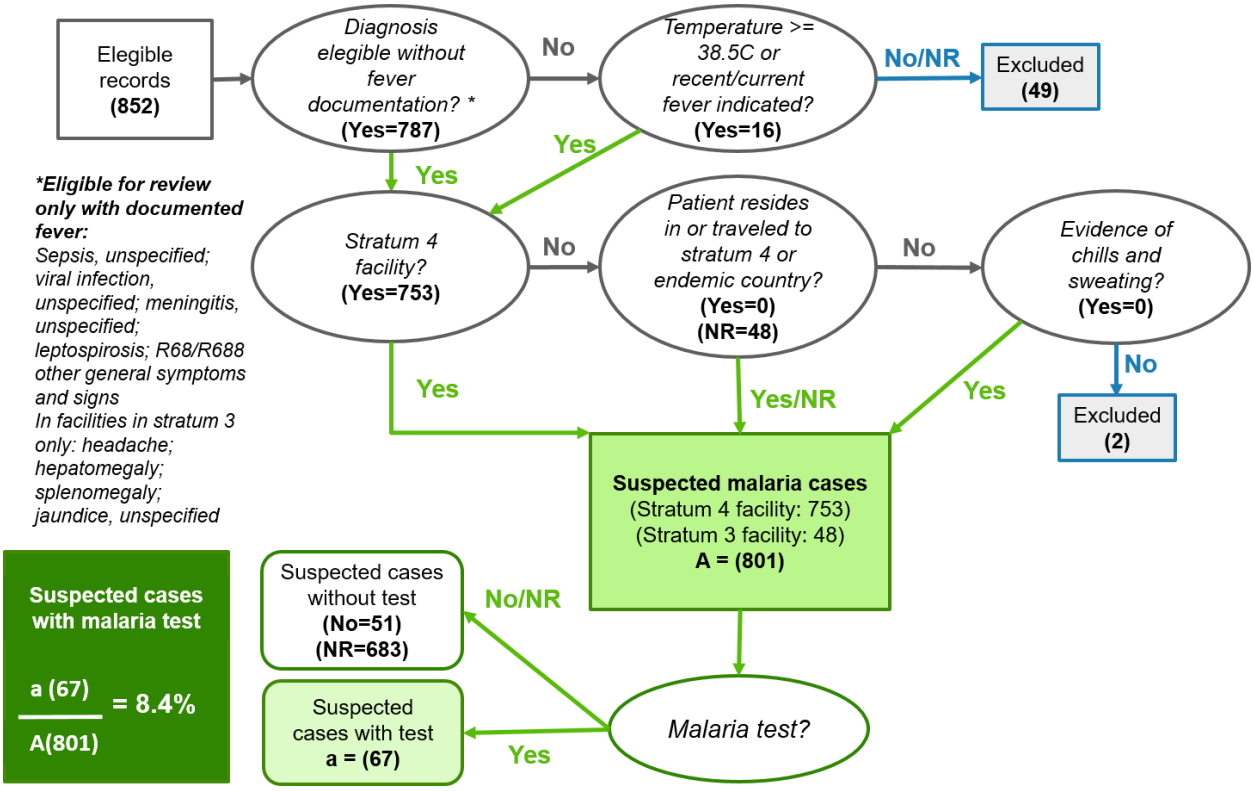
Figure 6.5: Exclusion diagnoses for review of suspected malaria cases



6.4.1 Indicator 2.01: Suspected malaria cases with parasitological test (medical record review)

IHME conducted a second eligibility review of the data collected from medical records in order to identify the cases eligible for inclusion in indicator 2.01 (suspected cases with malaria test) according to a decision algorithm shown in Figure 6.6. Facilities in malaria stratum 4 are subject to a different suspected malaria case definition than facilities in malaria stratum 3, where patients presenting with fever do not require a test to rule out malaria unless they traveled to an endemic area or show other malaria symptoms like chills and sweating. Additionally, certain inclusion diagnoses only meet the suspected case definition (that is, malaria should be ruled out before making a clinical diagnosis of another condition) if the patient presented with fever or had a history of recent fever. Thus, additional ineligible records were identified and excluded from the indicator during the eligibility review.

Figure 6.6: Eligibility of suspected cases reviewed for Indicator 2.01



In total in Honduras, 801 of the 852 suspected cases reviewed were eligible for consideration in indicator 2.01.

For the purposes of the indicator, cases with evidence that a malaria test was ordered or that a sample was taken, as well as cases with a malaria test result registered, were considered to have had a parasitological test. The test could be a rapid diagnostic test or thick blood film, and some patients had evidence of both tests in the record. As shown in Table 6.16, 8.4% of patients with suspected malaria had evidence that a malaria test was received. Of these 67 patients with evidence of a test, 13.4% received an RDT and 91% a TBF. For comparison, Table 6.17 shows the results by malaria stratum and Figure 6.7 shows the results by department. The baseline measurement was not designed to produce representative estimates at the department level, so results by department should be interpreted with discretion.

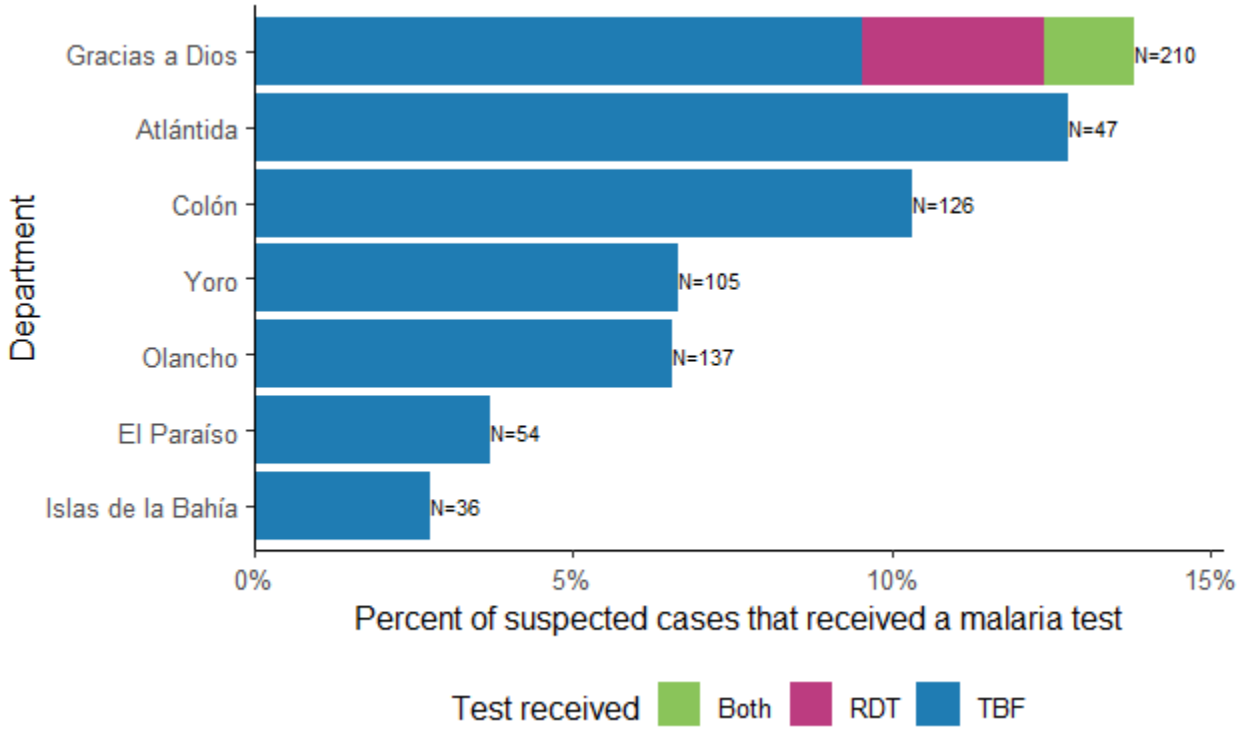
Table 6.16: Indicator 2.01: Suspected cases with malaria test

	N	n	%	95% CI
Suspected case with malaria test	801	67	8.4	(7 - 10)
Rapid diagnostic test	67	9	13.4	(7 - 24)
Thick blood film	67	61	91	(81 - 96)

Table 6.17: Comparison: result by facility stratification

	N	n	%	95% CI
Suspected cases with malaria test				
Stratum 3	48	0	0	(-)
Stratum 4	753	67	8.9	(7 - 11)
Total	801	67	8.4	(7 - 10)

Figure 6.7: Comparison: result by department



6.5 Malaria diagnosis (medical record review)

Early diagnosis of malaria is essential to interrupt transmission in a timely manner and to ensure the patient receives treatment before illness becomes more severe or complicated. The health facility survey included a record review of confirmed malaria cases. At regional headquarters selected to the sample, field personnel reviewed all paper records of confirmed malaria cases from the year 2018 stored at those units as described in Chapter 2. All case records that were stored at the regional headquarters were sought out and considered for the review, including case notification forms, case investigation forms, and any patient charts, laboratory records, or treatment forms filed at the regional headquarters. Figure 6.8 shows that the majority of confirmed malaria case reviews used both the M-1 case notification form and the M-7 case investigation form. Examples of these forms are shown in Figure 6.9 for reference of the content included from these data sources.

Figure 6.8: Sources of confirmed case medical record review

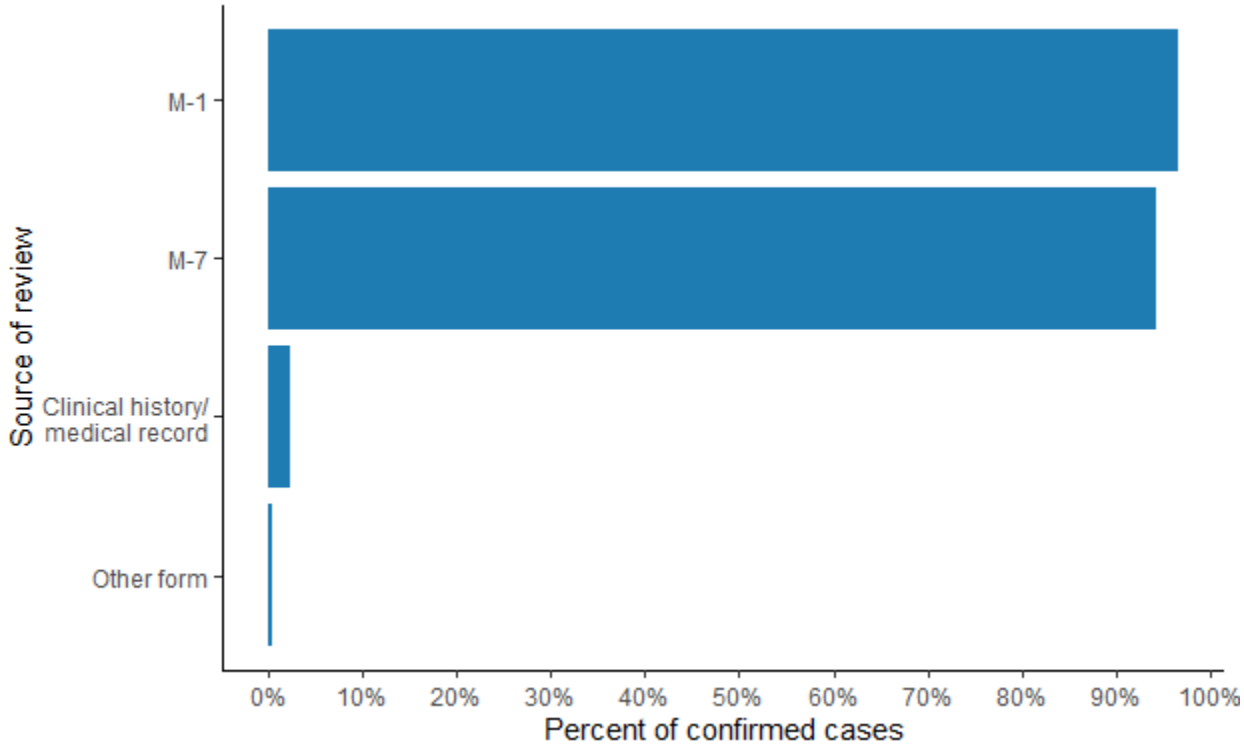
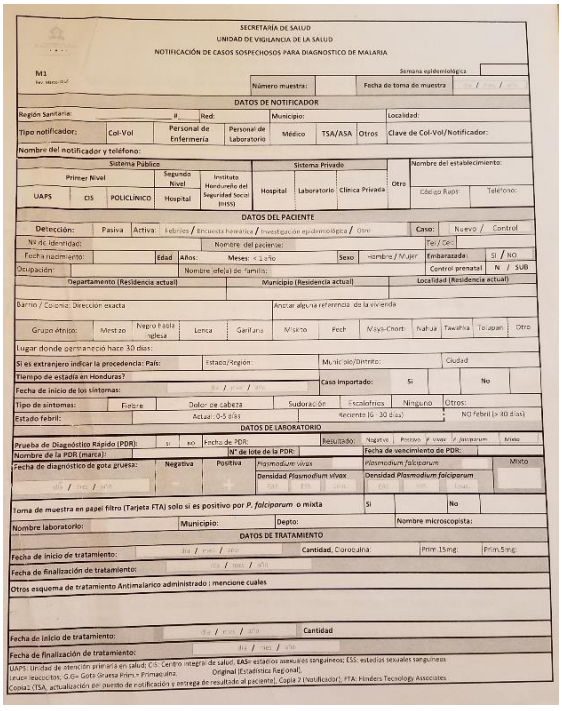
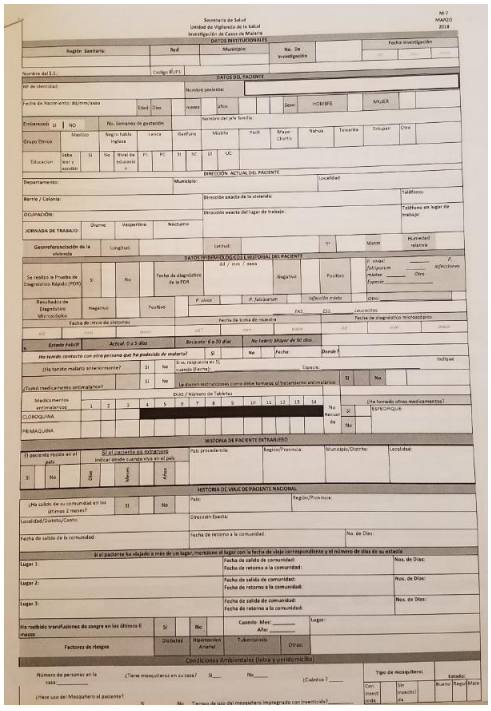


Figure 6.9: M-1 blank case notification form and M-7 blank case investigation forms

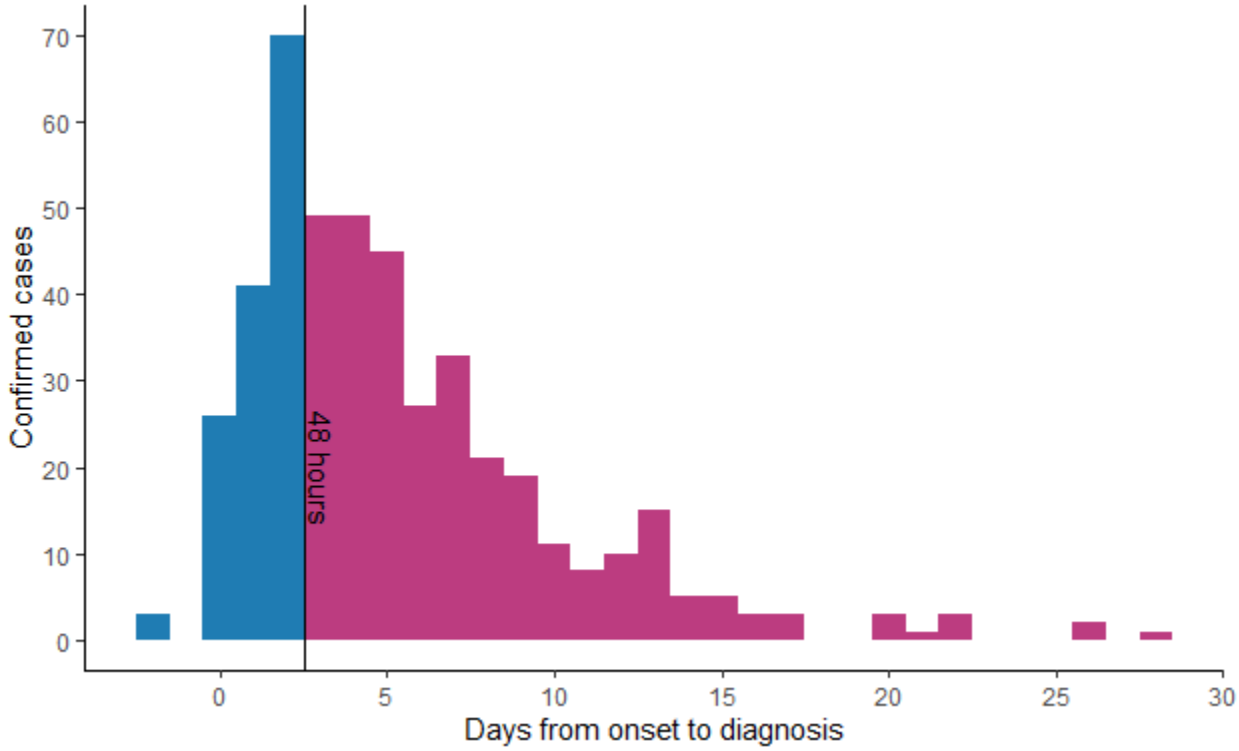

SECRETARÍA DE SALUD
UNIDAD DE VIGILANCIA DE LA SALUD
NOTIFICACIÓN DE CASOS SOSPECHOSOS PARA DIAGNOSTICO DE MALARIA



As a part of each record review module, field staff recorded the date of symptom onset, date of fever onset, and date of diagnosis from the M-1 and M-7 forms. Figure 6.10 shows the number of days from

fever onset (or onset of other malaria symptoms, if date of fever onset was not recorded) to the date of diagnosis. If diagnosis was recorded more than seven days before or more than 30 days after fever onset, the case is excluded from the indicator because of the suspicion of recording error (on the investigation form or in the survey module). This suspected error affected 18 cases which are excluded from the figure. In 3 cases, diagnosis was recorded before symptom onset which is a plausible scenario for cases tested through active case detection or for other reasons where testing was recommended before symptoms presented.

Figure 6.10: Time from symptom onset to diagnosis



The personnel who performed the diagnosis of these confirmed malaria cases are reported in Table 6.18 (diagnosis by RDT) and Table 6.19 (diagnosis by TBF). Many records did not have the personnel recorded (34.6% for records with RDT diagnosis and 15.3% for records with TBF diagnosis). The personnel most commonly recorded as collecting a RDT were microscopists (34.6%) and community health workers (18.6%). The personnel most commonly recorded as preparing TBFs were microscopists (63.8%) and other lab technicians (10.8%).

Table 6.18: Personnel who performed diagnosis of confirmed cases, RDT

	N	n	%	95% CI
Who took the RDT?				
Not registered	237	82	34.6	(29 - 41)
Microscopist	237	82	34.6	(29 - 41)
Community Health Worker (CHW)	237	44	18.6	(14 - 24)
Vector Control staff	237	8	3.4	(2 - 7)
Nurse	237	6	2.5	(1 - 6)
Lab tech/ microbiologist	237	3	1.3	(0 - 4)
Doctor	237	1	0.4	(0 - 3)
Other	237	11	4.6	(3 - 8)

Table 6.19: Personnel who performed diagnosis of confirmed cases, TBF

	N	n	%	95% CI
Who took the TBF?				
Microscopist	489	312	63.8	(59 - 68)
Not registered	489	75	15.3	(12 - 19)
Lab tech/ microbiologist	489	53	10.8	(8 - 14)
Community Health Worker (CHW)	489	21	4.3	(3 - 7)
Doctor	489	9	1.8	(1 - 4)
Vector Control staff	489	8	1.6	(1 - 3)
Nurse	489	4	0.8	(0 - 2)
Other	489	7	1.4	(1 - 3)

6.5.1 Indicator 4.02: Time to diagnosis for confirmed cases (medical record review)

Diagnosis within two days (48 hours) of symptom onset was negotiated as an indicator for RMEI. As shown in Table 6.20, 86.9% of confirmed case records in Honduras had both fever/symptom onset and diagnosis dates registered. Only 26.9% were diagnosed within 48 hours of fever/symptom onset, and 21.1% were diagnosed more than a week after fever/symptom onset.

Table 6.20: Indicator 4.02: Fever/symptom onset to diagnosis within 48 hours

	N	n	%	95% CI
Total confirmed malaria cases	539	539	100	(-)
Excluded due to suspected inscription/data entry error (<-7 day or >30 day window)	539	18	3.3	(2 - 5)
Denominator: Confirmed cases with valid dates	521	521	100	(-)
Fever/symptom onset date registered	521	499	95.8	(94 - 97)
Diagnosis date registered	521	471	90.4	(88 - 93)
Both dates registered	521	453	86.9	(84 - 90)
Diagnosis before onset (presumptive)	521	3	0.6	(0 - 2)
Cases diagnosed within 48 hours of onset	521	140	26.9	(23 - 31)
3 days	521	49	9.4	(7 - 12)
4-5 days	521	94	18	(15 - 22)
6-7 days	521	60	11.5	(9 - 15)
Over 7 days	521	110	21.1	(18 - 25)
Indicator result: Cases diagnosed within 48 hours of onset	521	140	26.9	(23 - 31)

Figure 6.11 shows the same indicator results in a graphic format.

Figure 6.11: Indicator 4.02: Cases categorized

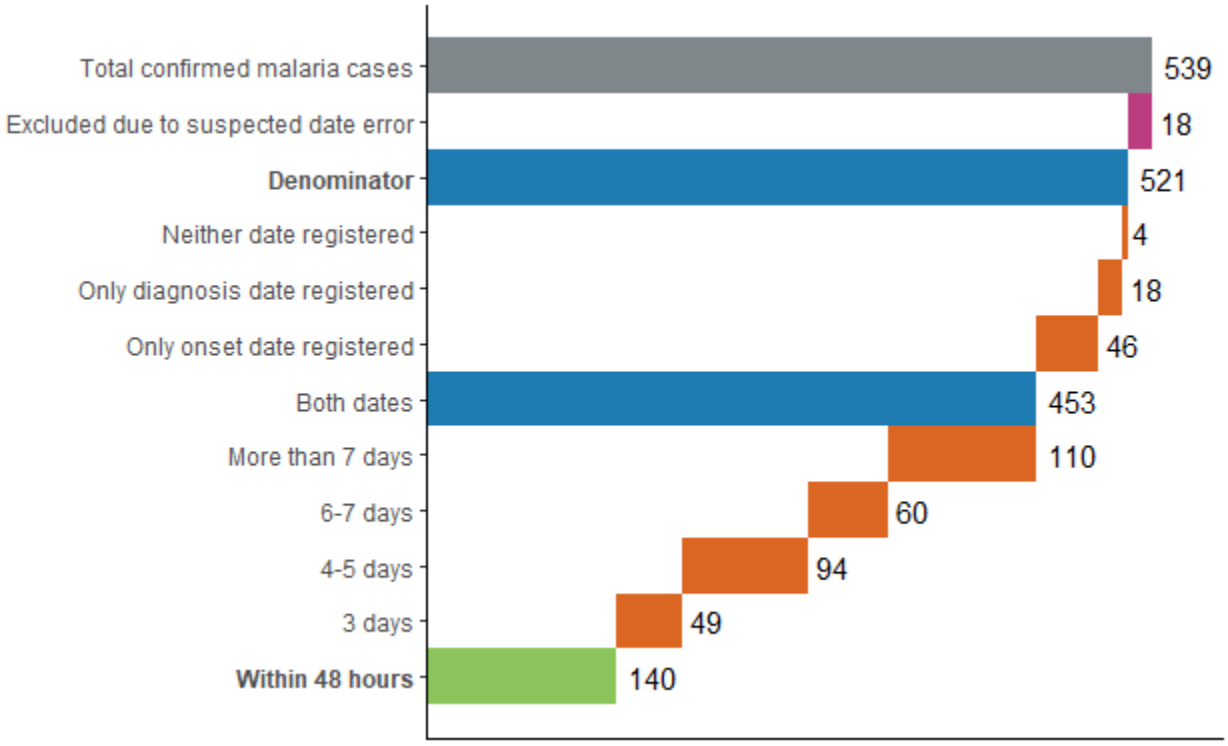


Table 6.21 shows indicator 4.02 by department and Table 6.22 shows the indicator by diagnosis type. Cases in Gracias a Dios (47.1%) and cases diagnosed by RDT (46.8%) were more likely to be diagnosed within 48 hours of symptom onset.

Table 6.21: Comparison: result by facility department

	N	n	%	95% CI
Diagnosis within 48 hours of symptom onset				
Colón	97	16	16.5	(10 - 25)
El Paraíso	32	2	6.3	(2 - 22)
Gracias a Dios	208	98	47.1	(40 - 54)
Islas de la Bahía	112	14	12.5	(8 - 20)
Yoro	72	10	13.9	(8 - 24)
Total	521	140	26.9	(23 - 31)

Table 6.22: Comparison: result by diagnosis test

	N	n	%	95% CI
Diagnosis within 48 hours of symptom onset				
RDT	156	73	46.8	(39 - 55)
TBF	315	67	21.3	(17 - 26)
No test date registered	50	0	0	(-)
Total	521	140	26.9	(23 - 31)

6.5.2 Indicator E2.04: Time to notification for confirmed cases (medical record review)

Notification within 24 hours of diagnosis was negotiated as an indicator for RMEI. All confirmed cases of malaria were expected to have a notification report, but as shown in Figure 6.12 not all collected cases had a reviewed notification form and not all notification forms had a date recorded for when notification occurred. Cases without notification date registered were not considered to have been notified within 24 hours. As shown in Table 6.23, 20.4% of confirmed case records in Honduras had both diagnosis and notification dates registered. Only 15.6% were notified within 24 hours of diagnosis.

Figure 6.12: Confirmed cases: source of notification information

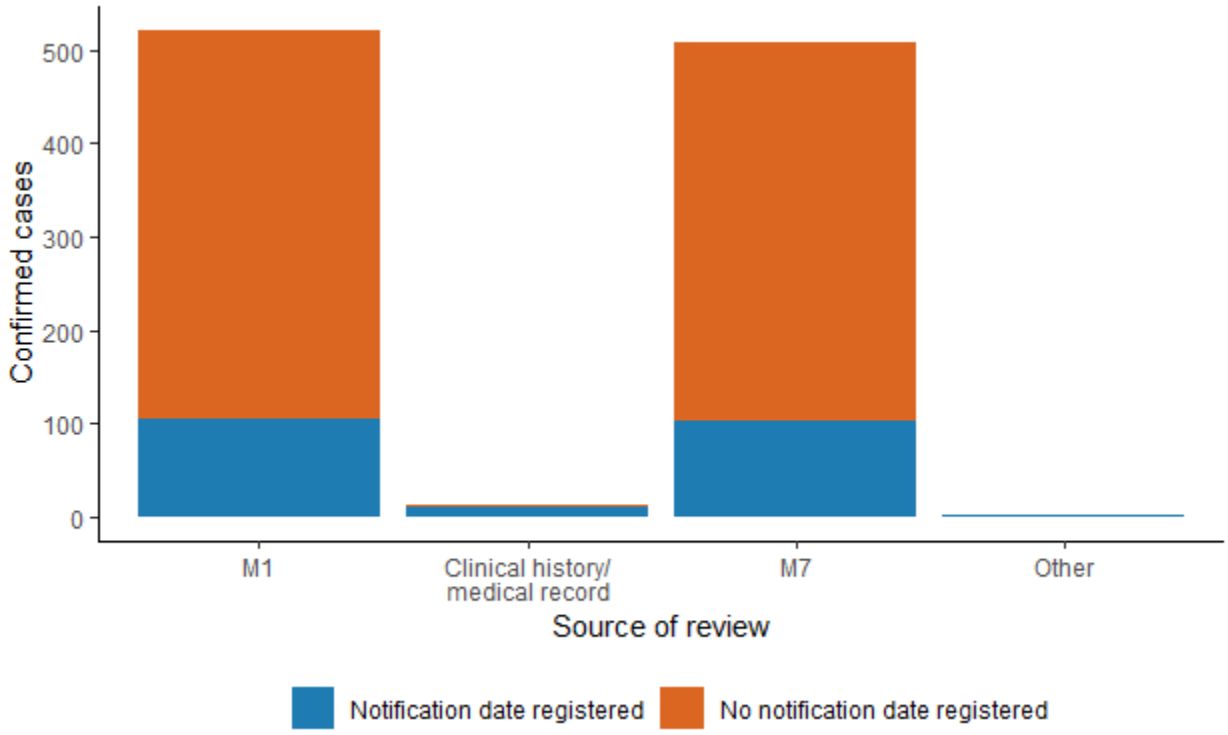


Table 6.23: Indicator E2.04: Notification within 24 hours of diagnosis

	N	n	%	95% CI
Diagnosis date registered	539	489	90.7	(88 - 93)
Notification date registered	539	115	21.3	(18 - 25)
Both dates registered	539	110	20.4	(17 - 24)
Excluded due to suspected inscription/data entry error (<-7 day or >30 day window)	539	6	1.1	(0 - 2)
Notification within 24 hours of diagnosis	533	83	15.6	(13 - 19)

Chapter 7: Malaria treatment

In Honduras, routine malaria treatment is managed by the vector control program. At the fact-finding visit, IHME learned that primary care facilities and even col-vols may stock a small amount of chloroquine and primaquine in order to administer the first dose upon diagnosis of a new malaria case, but vector control personnel see to the remaining doses, usually delivering them to the patient's home. Supervision of ingestion of all doses is the norm in most regions of Honduras in order to ensure each patient completes the radical cure. In some cases, col-vols may assist with delivery and supervision of some doses, for example on the weekend or in very remote areas without vector control personnel based in the locality. Occasionally the patient may be expected to visit a health facility in order to receive medication or follow-up malaria tests instead of receiving services through home visits, and to treat severe malaria or chloroquine-resistant *P. falciparum*, the patient may be admitted to the hospital. The survey results in the following sections align to some extent with these expectations, though they suggest substantial variation in administration and supervision practices by facilities (or at least in knowledge of standard practices by personnel in health facilities that may diagnose malaria cases infrequently).

7.1 Treatment administration practices

The health facility interview includes questions about malaria service provision (in all health facilities and administrative units except the national reference laboratory). Respondents listened to the list of activities shown in Table 7.1 and were asked to indicate whether personnel at the facility provide each service (yes or no). Many facilities report that they prescribe treatment via their own pharmacies (44.4% of primary care facilities), supervise treatment at the facility (41.7% of primary care facilities), and that facility personnel supervise treatment in the community, as in home visits (52.8% of primary care facilities).

Table 7.1: Services provided by facilities for malaria treatment

	N	n	%	95% CI
Primary care units: Services provided for malaria treatment				
Prescribe treatment to pharmacy at this facility	36	16	44.4	(29 - 61)
Provide prescription to external pharmacy	36	3	8.3	(3 - 23)
Give medication to take at home (unsupervised)	36	2	5.6	(1 - 20)
Supervise ingestion (in the facility)	36	15	41.7	(27 - 59)
Supervise ingestion (in the community)	36	19	52.8	(36 - 69)
Call or visit the home to ask if treatment was taken (without supervising ingestion)	36	3	8.3	(3 - 23)
None of the above	36	1	2.8	(0 - 18)
Other	36	4	11.1	(4 - 27)
Don't know	36	1	2.8	(0 - 18)
Secondary care units: Services provided for malaria treatment				
Prescribe treatment to pharmacy at this facility	6	3	50	(16 - 84)
Provide prescription to external pharmacy	6	1	16.7	(2 - 65)
Give medication to take at home (unsupervised)	6	2	33.3	(8 - 74)
Supervise ingestion (in the facility)	6	1	16.7	(2 - 65)
Administrative units (excluding national lab): Services provided for malaria treatment				
Prescribe treatment to pharmacy at this facility	17	4	23.5	(9 - 49)
Provide prescription to external pharmacy	17	1	5.9	(1 - 33)
Supervise ingestion (in the facility)	17	4	23.5	(9 - 49)
Supervise ingestion (in the community)	17	7	41.2	(21 - 65)

	N	n	%	95% CI
Call or visit the home to ask if treatment was taken (without supervising ingestion)	17	2	11.8	(3 - 38)
None of the above	17	6	35.3	(16 - 60)
Other	17	1	5.9	(1 - 33)

In countries nearing malaria elimination, it is important to supervise all doses of treatment to ensure the patient completes the radical cure. If the respondent reported that personnel supervise ingestion in-facility, the interviewer asked how many doses are supervised at the facility. At 60% of facilities that supervise treatment regardless of type, all doses are supervised at the facility, and at 30% of these facilities only the first dose is supervised in-facility (Table 7.2). Respondents at facilities that supervise some but not all doses in-facility were asked who is responsible for administering the remaining doses (Table 7.3). In 57.1% of the facilities that did not administer all doses in-facility, treatment was administered by community health workers or col-vols, and it was prescribed to the patient to take at home in 28.6% of cases.

Table 7.2: Doses supervised in-facility

	N	n	%	95% CI
Doses supervised in-facility				
Only the first dose	20	6	30	(14 - 53)
Only some doses	20	1	5	(1 - 29)
All doses	20	12	60	(37 - 79)
Don't know	20	1	5	(1 - 29)

Table 7.3: Personnel responsible for subsequent administrations

	N	n	%	95% CI
Administration of subsequent doses				
Treatment is administered by community health workers or volunteer collaborators at the patient's home	7	4	57.1	(22 - 86)
Patient was prescribed medication to take at home	7	2	28.6	(7 - 68)
Treatment is supervised at the patient's home by health facility personnel	7	0	0	(-)
Treatment is administered by vector control personnel at the patient's home	7	0	0	(-)
Other	7	2	28.6	(7 - 68)

All facilities that provide malaria care were asked if personnel ever administer malaria treatment before a positive test result, and only 3.9% replied that they do. Respondents reported that community personnel administer presumptive treatment in only 5.2% of facilities.

Table 7.4: Presumptive treatment

	N	n	%	95% CI
Do clinical staff in this facility ever give antimalarial treatment for suspected malaria without waiting for a positive malaria test result? (Among facilities that provide treatment services on-site)	51	2	3.9	(1 - 15)
Do community health workers, volunteer collaborators, or vector control personnel associated with this facility ever treat suspected malaria without waiting for a positive malaria test result? (Among all facilities excluding national lab)	58	3	5.2	(2 - 15)

7.2 Storage and stock of antimalarial medications

The health facility survey included an observation of antimalarial medications in stock on the day of the survey and of stock records for the three months prior (in all health facilities and administrative units except the national reference laboratory). First, the respondent (typically the pharmacist or pharmacy technician) was asked if the facility routinely stocks any antimalarial medications. As shown in Table 7.5, 50% of primary care facilities, 66.7% of secondary care facilities, and 41.2% of regional and municipal headquarters reported stock of antimalarials.

Table 7.5: Facility types reporting stock of antimalarials

	N	n	%	95% CI
Facilities reporting antimalarial stock in past 3 months				
Primary care units	36	18	50	(34 - 66)
Secondary care units	6	4	66.7	(26 - 92)
Administrative units (excluding national lab)	17	7	41.2	(21 - 65)

Next, the respondent was asked to respond whether or not the facility stocks each of a list of antimalarial medications including those shown in Table 7.6. Among the facilities that reported stocking any antimalarials, the most common pharmaceuticals were chloroquine (94.4% primary care facilities, 100% of secondary care facilities, and 71.4% of administrative units with any antimalarials) and primaquine (94.4% of primary care facilities, 100% of secondary care facilities, and 100% of administrative units with any antimalarials). Any drugs that were reported to be stocked were then sought for observation by survey personnel. The drug presentation was registered and the surveyor checked the expiration date to see if at least one dose of the medication was valid on the day of the survey. As seen in Table 7.7, no doses or only expired doses of chloroquine were observed in 19.2% of primary care facilities that stock chloroquine, and no doses or only expired doses of primaquine were observed in 7.1% of primary care facilities that stock primaquine, suggesting challenges in maintaining supply or replacing expired stock. As malaria case numbers have decreased in Honduras, many facilities may not use up their supply of chloroquine and primaquine before it expires, creating new challenges to effectively manage pharmaceutical supply from regional and central levels to avoid excess waste and ensure valid doses are accessible where new malaria cases may be diagnosed.

Table 7.6: Reported stock of antimalarials

	N	n	%	95% CI
Primary care units				
Has this facility stocked any antimalarials for at least one day over the past three months?	36	18	50	(34 - 66)
Chloroquine	18	17	94.4	(68 - 99)
Primaquine	18	17	94.4	(68 - 99)
Secondary care units				
Has this facility stocked any antimalarials for at least one day over the past three months?	6	4	66.7	(26 - 92)
Chloroquine	4	4	100	(-)
Primaquine	4	4	100	(-)
Artesunate	4	2	50	(12 - 88)
Administrative units & National Lab				
Has this facility stocked any antimalarials for at least one day over the past three months?	17	7	41.2	(21 - 65)
Chloroquine	7	5	71.4	(32 - 93)
Primaquine	7	7	100	(-)

Table 7.7: Antimalarials observed in facility, among those reporting stock

	N	n	%	95% CI
Chloroquine tablets observed				
At least one observed and valid	26	21	80.8	(61 - 92)
At least one observed, but none valid	26	4	15.4	(6 - 35)
Not observed	26	1	3.8	(1 - 24)
Primaquine tablets observed				
At least one observed and valid	28	26	92.9	(75 - 98)
At least one observed, but none valid	28	2	7.1	(2 - 25)
Not observed	28	0	0	(-)
Artesunate tablets observed				
Not observed	2	1	50	(5 - 95)
At least one observed, but none valid	2	1	50	(5 - 95)
Artesunate suppositories observed				
Not observed	2	1	50	(5 - 95)
At least one observed, but none valid	2	1	50	(5 - 95)
Injectable artesunate observed				
At least one observed and valid	2	2	100	(-)

The health facility interview also asked about antimalarial medication stock and administration. Table 7.8 shows some discrepancies with Table 7.5 - facility directors more often reported antimalarial medications in stock than could be confirmed with pharmacy staff, indicating that facility authorities may not be aware of pharmaceutical stock-outs or of changing strategies for treatment storage as malaria transmission decreases.

Table 7.8: Antimalarials medications stored, questionnaire

	N	n	%	95% CI
Questionnaire: Does this facility store medications to treat malaria?				
Primary care units	36	21	58.3	(41 - 73)
Secondary care units	6	4	66.7	(26 - 92)
Administrative units (excluding national lab)	17	11	64.7	(40 - 84)

Because most health facilities do not store medications to treat severe malaria or chloroquine-resistant malaria, the interview asked how a patient with severe or resistant malaria receives treatment (Table 7.9). Most facilities (regardless of type) informed that the patient is referred to a location that stores medication (66.1% of facilities).

Table 7.9: Antimalarial delivery for severe or chloroquine-resistant cases

	N	n	%	95% CI
If a case of severe or drug-resistant malaria is detected in this facility, how does the patient get special antimalarial medication that is not stored here?				
Patient is referred to a location that stores medication	59	39	66.1	(53 - 77)
Treatment is delivered to this health facility by vector control or malaria program staff	59	8	13.6	(7 - 25)
Treatment is delivered to the patient's home by vector control or malaria program staff	59	0	0	(-)
Other	59	8	13.6	(7 - 25)
Don't know	59	4	6.8	(2 - 17)

The interview also asked about how antimalarial supplies are managed. As seen in Table 7.10, 52.4% of primary care facilities generally order their own antimalarials. Among those primary care facilities that do

not determine their own antimalarial supplies, most frequently the supply is determined by the local vector control or malaria program personnel (Table 7.11).

Table 7.10: Determination of malaria medication needs

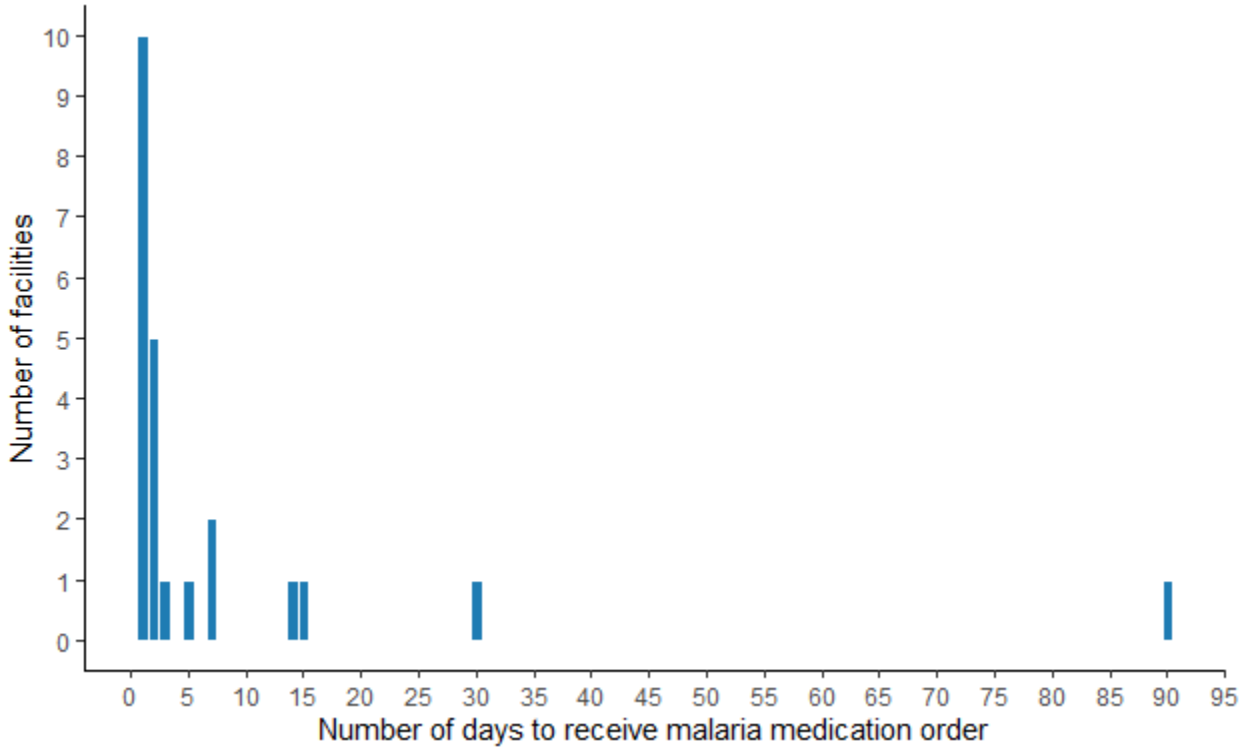
	N	n	%	95% CI
Primary care units: How is the quantity of malaria medication needed by this facility determined?				
Facility determines quantity and orders	21	11	52.4	(31 - 73)
Quantity determined elsewhere	21	8	38.1	(20 - 60)
Both methods used	21	2	9.5	(2 - 32)
Secondary care units: How is the quantity of malaria medication needed by this facility determined?				
Facility determines quantity and orders	4	4	100	(-)
Quantity determined elsewhere	4	0	0	(-)
Both methods used	4	0	0	(-)
Administrative units (excluding national lab): How is the quantity of malaria medication needed by this facility determined?				
Facility determines quantity and orders	11	7	63.6	(33 - 86)
Quantity determined elsewhere	11	4	36.4	(14 - 67)
Both methods used	11	0	0	(-)

Table 7.11: Determination of malaria medication needs: authority

	N	n	%	95% CI
Primary care units: Who determines the quantity of malaria medication that are given to this facility?				
Local vector control or malaria program personnel	10	5	50	(22 - 78)
Regional supply or logistics management office	10	4	40	(15 - 71)
Regional vector control or malaria program	10	1	10	(1 - 48)
Secondary care units: Who determines the quantity of malaria medication that are given to this facility?				
Local vector control or malaria program personnel	0	0		-
Regional vector control or malaria program	0	0		-
Regional supply or logistics management office	0	0		-
Administrative units (excluding national lab): Who determines the quantity of malaria medication that are given to this facility?				
Regional supply or logistics management office	4	3	75	(23 - 97)
Regional vector control or malaria program	4	1	25	(3 - 77)
Local vector control or malaria program personnel	4	0	0	(-)

Figure 7.1 shows the usual number of days between ordering and receiving antimalarials as reported at facilities that order their own antimalarial medications.

Figure 7.1: Days to receive ordered malaria medication



The interview also asked about recent shortages of antimalarial medication and how they are handled. Most facilities that stock antimalarials reported that they always or almost always receive the expected quantities of antimalarial medications (Table 7.12). As seen in Table 7.13, if there is a shortage, many facilities reported that it is handled through a special order (81% of primary care facilities that stock antimalarials).

Table 7.12: Medication order reliability

	N	n	%	95% CI
Primary care units: During the past 6 months, have you always, almost always, or almost never received the amount of each medicine that you ordered (or that you are supposed to routinely receive)?				
Always	21	14	66.7	(44 - 84)
Almost always	21	6	28.6	(13 - 51)
Almost never	21	0	0	(-)
Don't know	21	1	4.8	(1 - 28)
Secondary care units: During the past 6 months, have you always, almost always, or almost never received the amount of each medicine that you ordered (or that you are supposed to routinely receive)?				
Always	4	3	75	(23 - 97)
Almost never	4	0	0	(-)
Almost always	4	0	0	(-)
Don't know	4	1	25	(3 - 77)
Administrative units (excluding national lab): During the past 6 months, have you always, almost always, or almost never received the amount of each medicine that you ordered (or that you are supposed to routinely receive)?				
Always	11	9	81.8	(48 - 96)
Almost never	11	1	9.1	(1 - 45)
Almost always	11	1	9.1	(1 - 45)

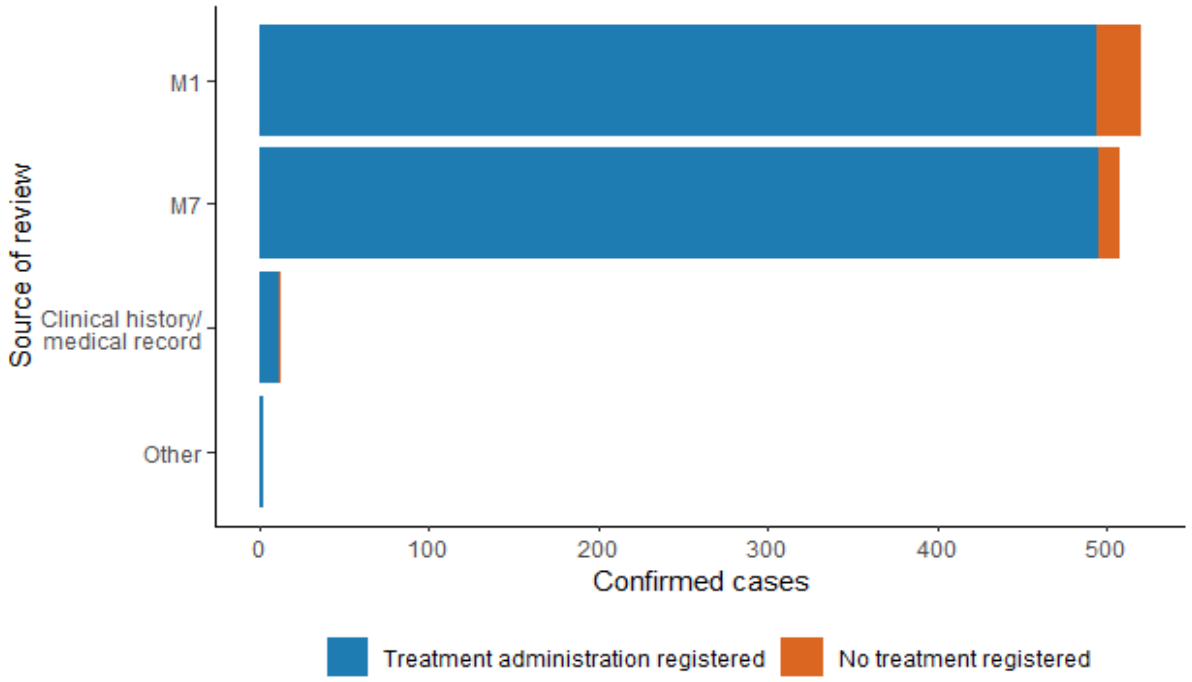
Table 7.13: Malaria medication shortages

	N	n	%	95% CI
Primary care units: If there is a shortage of a specific malaria medication between routine orders, what is the most commonly used procedure in this facility?				
Special order	21	17	81	(58 - 93)
Patients are advised to purchase elsewhere	21	1	4.8	(1 - 28)
Borrow from another health facility	21	4	19	(7 - 42)
Secondary care units: If there is a shortage of a specific malaria medication between routine orders, what is the most commonly used procedure in this facility?				
Special order	4	2	50	(12 - 88)
Borrow from another health facility	4	2	50	(12 - 88)
Administrative units (excluding national lab): If there is a shortage of a specific malaria medication between routine orders, what is the most commonly used procedure in this facility?				
Special order	11	9	81.8	(48 - 96)
Borrow from another health facility	11	4	36.4	(14 - 67)

7.3 Confirmed cases: Time to treatment initiation

According to the targets of malaria elimination programs, the first dose of antimalarial treatment should be administered to the patient no later than 24 hours after diagnosis in order to interrupt community transmission as rapidly as possible. The review of confirmed malaria cases captured the dates of diagnosis and of treatment initiation and completion, as well as the medications administered, dosage, and the number of doses provided. Figure 7.2 shows that both the M-1 case notification form and the M-7 case investigation form were observed in most confirmed case reviews, and the majority of the forms had some treatment information registered. Both forms have space to register diagnosis date and treatment initiation date. Where dates are registered for both a rapid diagnostic test and a microscopic diagnosis, the earlier date is considered.

Figure 7.2: Confirmed cases: source of treatment information



Antimalarial treatment is prescribed according to the test result. In Honduras, first-line regimens of chloroquine and primaquine are used for both *Plasmodium vivax* malaria and *Plasmodium falciparum* malaria without chloroquine resistance (including all locally transmitted *P. falciparum* cases in the Central American region). For imported *P. falciparum* or mixed infection cases from countries with chloroquine resistance, an artemisin-based regimen is used. Honduras saw a case of *P. ovale* during 2018, which must be treated according to the *P. vivax* regimen. As seen in Table 7.14, 94.6% of *P. vivax* cases had the correct regimen registered, and 88.7% of *P. falciparum* cases had the correct regimen registered. 38 of the cases reviewed did not have parasite species registered on any of the forms reviewed, and thus the corresponding regimen could not be identified. These cases are not considered to have had the correct treatment regimen administered, because of the failure to register the species.

Table 7.14: Confirmed cases: Appropriate treatment by parasite species

	N	n	%	95% CI
Total cases with adequate treatment for species	538	469	87.2	(84 - 90)
P. vivax with adequate treatment for species	446	422	94.6	(92 - 96)
P. falciparum (non-resistant) with adequate treatment for species	53	47	88.7	(77 - 95)
Mixed cases (non-resistant) with adequate treatment for species	0	0		-
Chloroquine-resistant area P. falciparum/mixed cases treated correctly	0	0		-
P. ovale cases treated correctly	1	0	0	(-)
Species not registered	538	38	7.1	(5 - 10)

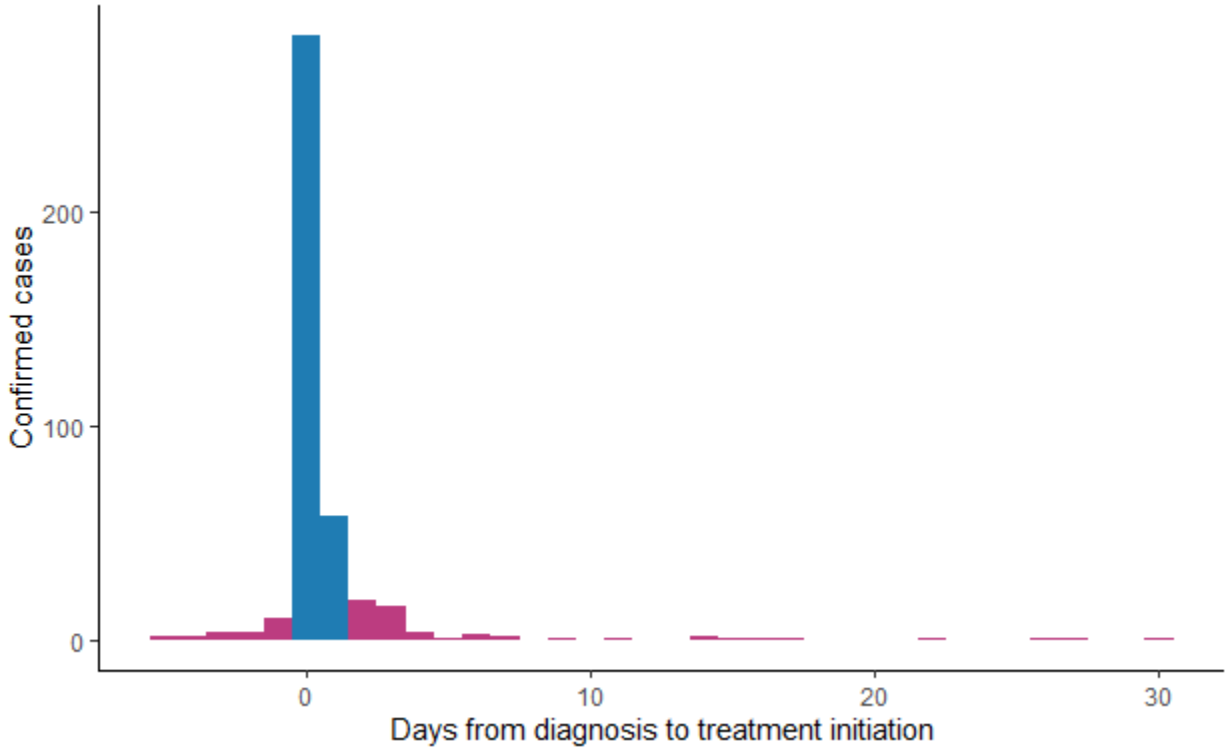
Table 7.15 shows the timing of administration of the first dose of antimalarial treatment. In 3.2% of the cases reviewed, both diagnosis and treatment date were registered. Evidence of any antimalarial treatment within one day of diagnosis was found in 65.3% of cases reviewed.

Table 7.15: Confirmed cases: Treatment timeliness

	N	n	%	95% CI
Diagnosis date registered	538	488	90.7	(88 - 93)
Treatment start date registered	538	479	89	(86 - 91)
Both dates registered	538	435	80.9	(77 - 84)
Excluded due to suspected inscription/data entry error (<-7 day or >30 day window)	538	17	3.2	(2 - 5)
Any treatment within 24 hours of diagnosis	521	340	65.3	(61 - 69)

Figure 7.3 shows the number of days from the date of diagnosis to the date of treatment initiation. Cases with treatment initiation on the same day of diagnosis or one day after are shown in blue. Cases with treatment initiation before diagnosis (by RDT or microscopy) are not considered timely, because presumptive treatment is contrary to the norm in Honduras. If treatment initiation was recorded more than seven days before or more than 30 days after diagnosis, the case is excluded from the indicator because of the suspicion of recording error (on the investigation form or in the survey module). This suspected error affected 17 cases which are excluded from the figure.

Figure 7.3: Confirmed cases: diagnosis to treatment initiation time frame



An indicator negotiated for RMEI measures the proportion of cases with the first dose of antimalarial treatment administered within one day of diagnosis, as shown in Table 7.16. Among the cases reviewed, 87.2% had the antimalarial treatment corresponding to the parasite species registered correctly on the forms. In 65.3% of the cases, the first dose of any treatment was registered as administered within one day (24 hours) of diagnosis, and in 62.4% of the cases, the first dose of the appropriate treatment was registered as administered within one day of diagnosis. For comparison, Table 7.17 shows the result by department and Table 7.18 shows the result by the diagnosis type.

Table 7.16: Indicator 4.01: Timely treatment initiation

	N	n	%	95% CI
Total malaria cases (omitting 1 death on day of diagnosis)	539	538	99.8	(99 - 100)
Correct treatment administered for species	538	469	87.2	(84 - 90)
Diagnosis and treatment dates registered	538	435	80.9	(77 - 84)
Excluded due to suspected inscription/data entry error (<-7 day or >30 day window)	538	17	3.2	(2 - 5)
First dose treatment within 24 hours of diagnosis	521	340	65.3	(61 - 69)
Correct treatment administered within 24 hours of diagnosis	521	325	62.4	(58 - 66)

Table 7.19: Comparison: result by department

	N	n	%	95% CI
Timely treatment initiation				
Colón	100	68	68	(58 - 76)
El Paraíso	31	12	38.7	(23 - 57)
Gracias a Dios	208	148	71.2	(65 - 77)

	N	n	%	95% CI
Islas de la Bahía	110	55	50	(41 - 59)
Yoro	72	42	58.3	(47 - 69)
Total	521	325	62.4	(58 - 66)

Table 7.20: Comparison: result by diagnosis type

	N	n	%	95% CI
Timely treatment initiation				
RDT	157	118	75.2	(68 - 81)
TBF	314	207	65.9	(60 - 71)
No test date registered	50	0	0	(-)
Total	521	325	62.4	(58 - 66)

7.4 Confirmed cases: Adequate and complete treatment

In order to ensure radical cure with chloroquine and primaquine, patients must take medication daily for a period of 3-14 days, even though symptoms may start to subside within a few days of treatment initiation. In Honduras, the national norm requires treatment according to parasite species, following these regimens:

- For *P. vivax* cases and *P. ovale* cases: 3 days of chloroquine and 7 or 14 days of primaquine
- For *P. falciparum* cases without documented resistance to chloroquine: 3 days of chloroquine and one day of primaquine
- For mixed infections cases without documented resistance to chloroquine: 3 days of chloroquine and 7 or 14 days of primaquine
- For imported *P. falciparum* cases from areas with documented resistance to chloroquine: 3 days of artemisinin-based treatment (artemether + lumefantrine) and one day of primaquine
- For severe malaria cases: If IV treatment with artesunate started, when completed: 3 days of artemisinin-based treatment (artemether + lumefantrine)

7.4.1 Completion of malaria treatment

The Honduras malaria case investigation form includes space to register the administration of up to three days of chloroquine and up to 14 days of primaquine. However, the data from the form must be entered to the electronic database within 72 hours of diagnosis, which often means a copy of the form is sent to the regional headquarters with three or fewer days of treatment administration registered. Alternately, personnel responsible for treatment administration may mark all the boxes in advance, presuming that treatment will be completed and taking advantage of the opportunity for it to be registered as such in the electronic system. Due to these observed inconsistencies, the treatment completion data collected from case investigation forms during the medical record review are unreliable, and estimates presented for treatment completion, including for indicator 4.03, may therefore be biased either upward or downward.

Table 7.21 shows treatment completion by parasite species as registered on the forms observed at the regional headquarters. Thirty-nine of the cases reviewed did not have the parasite species registered, so the corresponding treatment scheme could not be identified and thus treatment is considered incomplete. *P. vivax* cases had evidence of complete treatment in 33.4% of cases, and 37.7% of *P. falciparum* cases had evidence of complete treatment. Considering the cases with incomplete treatment registration because of the failure to record species, 31.4% of all reviewed cases had recorded evidence of adequate and complete treatment.

Table 7.21: Confirmed cases: Complete treatment by malaria species

	N	n	%	95% CI
Total cases with adequate treatment complete	538	169	31.4	(28 - 35)
P. vivax cases with adequate treatment complete	446	149	33.4	(29 - 38)
P. falciparum (non-resistant) with adequate treatment complete	53	20	37.7	(26 - 51)
Mixed cases (non-resistant) with adequate treatment complete	0	0		-
Chloroquine-resistant area P. falciparum/mixed cases with adequate treatment complete	0	0		-
P. ovale cases with adequate treatment complete	1	0	0	(-)
Species not registered	539	39	7.2	(5 - 10)

Adequate and complete antimalarial treatment with supervision was negotiated as an indicator for RMEI. Cases with evidence of at least one dose of antimalarial treatment supervised are considered to have treatment supervision. In Honduras, treatment supervision forms often were not found with confirmed malaria case records stored at the regional headquarters where record review was carried out. Table 7.22 shows the indicator results. Only 31.4% of cases reviewed had evidence of complete and adequate treatment, and only 20.1% had evidence of any supervision. This evidence could be a note on the case investigation form that one or more doses was supervised, or a separate form included in the patient's record at the health region. Overall, 11.7% of cases reviewed had evidence that treatment was adequate, complete, and supervised. Table 7.23 shows the indicator 4.01 result by department for comparison.

Table 7.22: Indicator 4.03: Complete treatment with supervision

	N	n	%	95% CI
Denominator: Total malaria cases (omitting 1 death on day of diagnosis)	539	538	99.8	(99 - 100)
Adequate treatment and number of doses administered	538	169	31.4	(28 - 35)
Evidence of at least one supervised dose	538	108	20.1	(17 - 24)
Indicator Result: Complete treatment with supervision	538	63	11.7	(9 - 15)

Table 7.23: Comparison: result by department

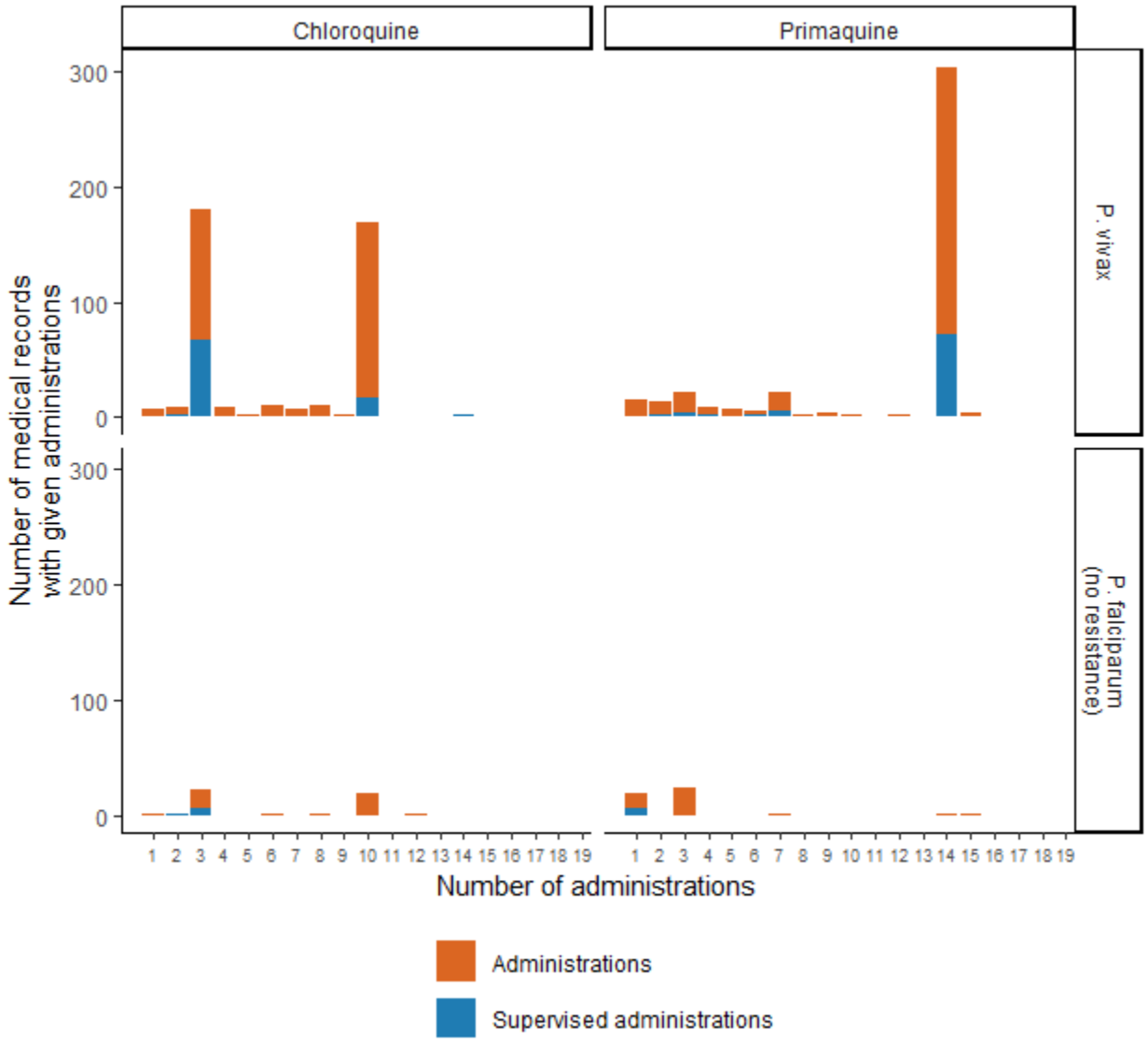
	N	n	%	95% CI
Complete treatment with supervision				
Colón	102	28	27.5	(20 - 37)
Gracias a Dios	34	10	29.4	(17 - 47)
El Paraíso	216	24	11.1	(8 - 16)
Islas de la Bahía	112	0	0	(-)
Yoro	74	1	1.4	(0 - 9)
Total	538	63	11.7	(9 - 15)

7.4.2 Supervision of malaria treatment

Figure 7.4 shows the number of doses with evidence of administration and supervision by species. The number of malaria cases with evidence of all doses supervised was generally much lower than the total number of doses registered. For *P. vivax*, a 14-day treatment scheme is most frequent in Honduras. The results suggest that the vector control technicians filling out case investigation forms may sometimes record the number of pills taken, rather than the number of complete daily doses administered, as 10 is a frequent number of chloroquine doses recorded on the forms. However, only the exact number of

administrations specified in each treatment scheme is considered adequate and complete treatment, so there may be potential to improve results for adequate treatment simply by standardizing registration by case investigators to reflect the number of daily doses of treatment given.

Figure 7.4: Confirmed cases: number of doses administered and supervised



Chapter 8: Management and follow-up of confirmed malaria cases

As a country malaria program enters the elimination phase, it becomes important that every confirmed case be investigated by qualified personnel in order to identify the origin of the case and to plan a local-level response. The aggregate information from case investigations also informs surveillance planning at the regional and national levels. This chapter summarizes information captured during the review of confirmed malaria cases from 2018, which included review of the case investigation form whenever it was available at the regional headquarters, as well as responses to the health facility interview relating to malaria case management.

8.1 Case investigation

8.1.1 Case investigation practices

In Honduras, the malaria case investigation is usually carried out by a vector control technician and must be completed within 72 hours of diagnosis. It includes an interview with the patient and an analysis of the information provided in order to classify the malaria case. The M-7 form is filled with the responses of the interview, as well as health care information such as the date, place, and results of malaria tests (obtained from the provider or laboratory), and tracking of treatment administration and follow-up tests. A copy of the case investigation is filed at the municipal and regional levels. The information is entered to the “SIS” information system (*Sistema Integral de Salud*, a DHIS-2 database) at the municipal headquarters and transmitted to an electronic database accessible by local, regional, and central-level malaria personnel.

8.1.2 Case detection source and classification

During the confirmed case medical record review, field personnel reviewed 539 cases, of which 353 were detected passively, 113 were detected during active or reactive search in the community, and 70 did not have the source of the case registered (Table 8.1).

According to the case investigation forms, 79.4% of malaria cases were autochthonous to Honduras (Table 8.2).

Table 8.1: Source of confirmed case detection

	N	n	%	95% CI
Case detection source:				
Passive search	539	353	65.5	(61 - 69)
Active search	539	113	21	(18 - 25)
Not registered	539	70	13	(10 - 16)
Other	539	3	0.6	(0 - 2)

Table 8.2: Classification of confirmed malaria cases

Classification	#	%
Autochthonous/indigenous/local	428	79.4%
Imported	44	8.2%
Introduced	4	0.7%
Relapse	3	0.6%
Autochthonous and relapse	2	0.4%
Introduced and imported	1	0.2%
Not registered	57	10.6%
Total cases	539	

8.2 Case management

8.2.1 Patient follow-up testing: health facility interview

According to the health facility interview and as shown in Table 8.3, 91.1% of respondents said that malaria patients receive at least one follow-up test in order to ensure the malaria infection has gone away. Table 8.4 shows that the thick blood film sample is most frequent for follow-up testing.

Table 8.3: Follow-up testing after malaria treatment: facility interview

	N	n	%	95% CI
After a patient begins treatment for malaria, do they ever receive a follow-up test for malaria?	56	51	91.1	(80 - 96)

Table 8.4: Follow-up testing methods

	N	n	%	95% CI
Is an RDT or thick blood film more commonly used for follow-up tests?				
Only thick blood film used more commonly	51	44	86.3	(73 - 93)
Both RDT and thick blood film: Samples are routinely taken for both tests at the same time	51	4	7.8	(3 - 20)
Only RDT used more commonly	51	2	3.9	(1 - 15)
Don't know	51	1	2	(0 - 13)

The interview also asked how many follow-up tests are routinely administered according to facility practices (Figure 8.1), and when the first and last samples are taken from the patient for follow-up testing (Figure 8.2). Administrative units, where the vector control personnel responsible for malaria case management are typically based, report conducting follow-up testing from one or two weeks after diagnosis through six months after diagnosis. Some primary and secondary care facilities only conduct, or are only aware of, the first follow-up test within two weeks of diagnosis.

Figure 8.1: Follow-up tests administered according to facility practices

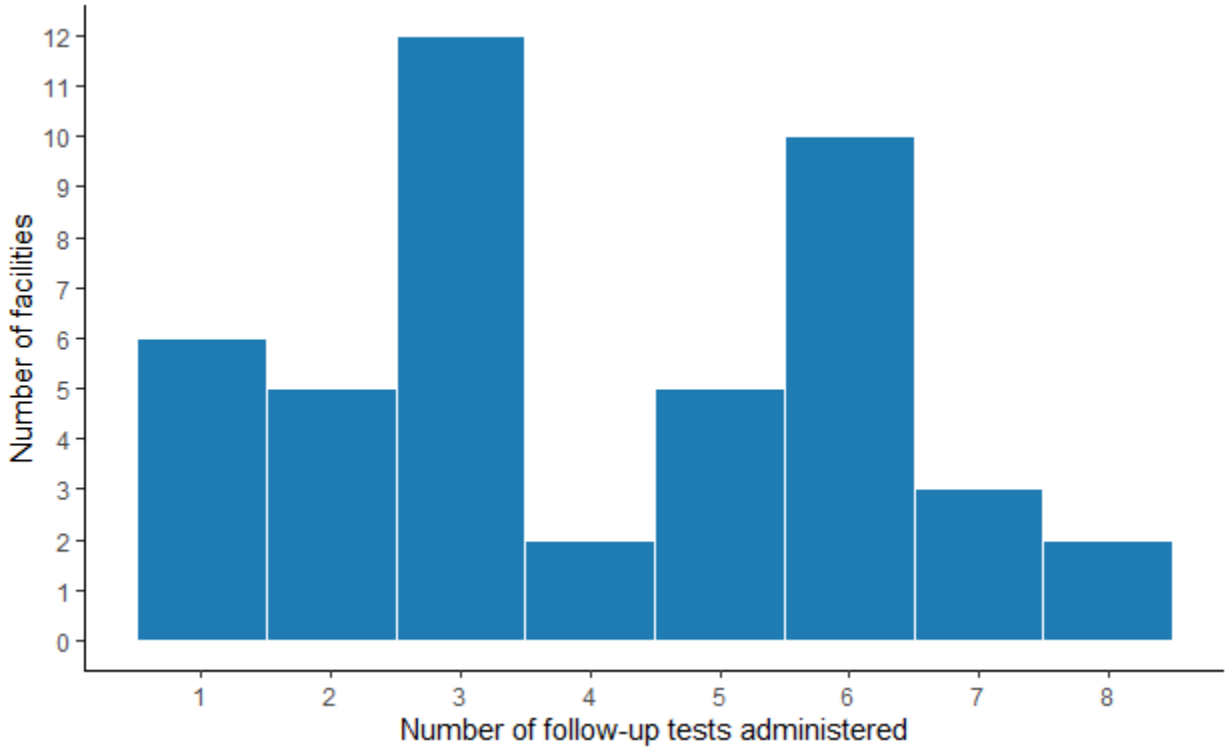
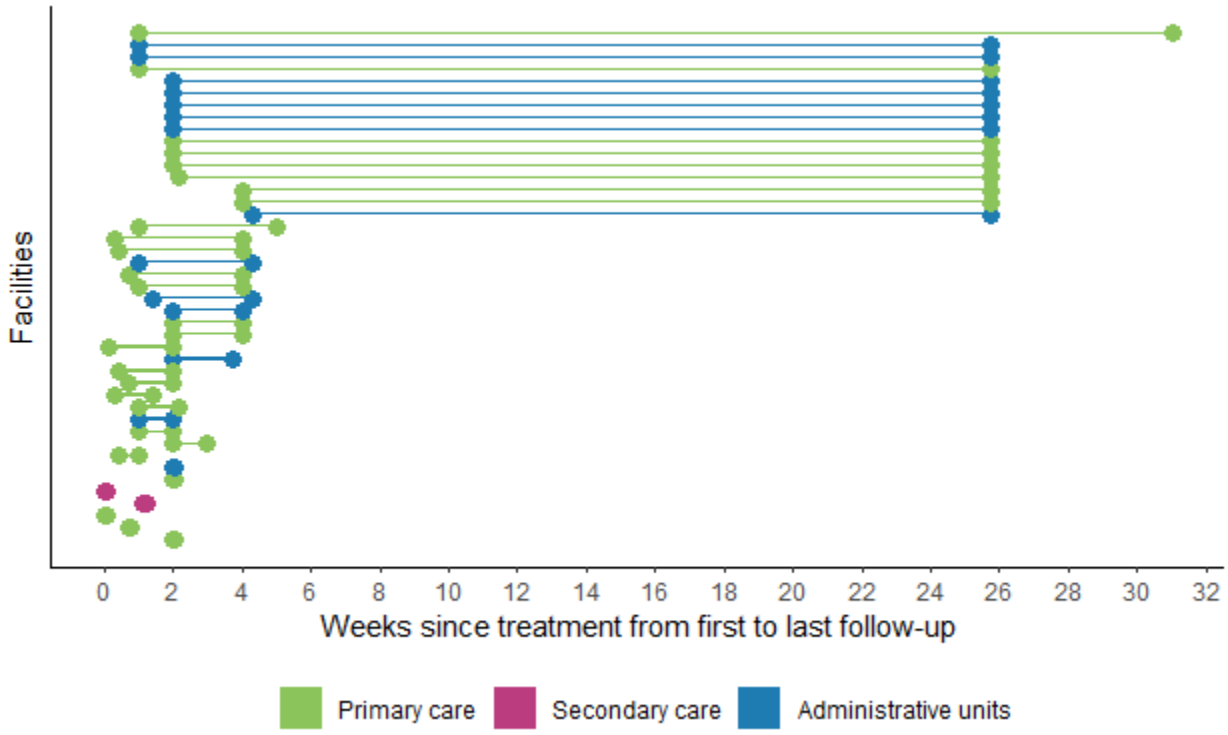


Figure 8.2: Timing from first to last follow-up test



8.2.2 Patient follow-up testing: medical record review

The case investigation form (M-7) has space to track treatment administration and follow-up malaria testing, though in practice these activities may be tracked on separate, locally-developed forms and never updated on the case investigation form after it is entered to the SIS database and a copy sent to the regional headquarters. Chapter 7 covers treatment administration practices in detail.

There was evidence of at least one follow-up test for 85.2% of confirmed cases reviewed (Table 8.5). The number of follow-up tests recorded on the forms used for case review is shown in Figure 8.3 - most frequently there is only evidence of one follow-up test. Considering the discrepancy with the information reported in the health facility interview, it is possible that patients receive more than one test, but the dates and results for subsequent tests are not recorded on the case investigation form filed at the regional headquarters.

Table 8.5: Follow-up testing after malaria treatment: medical record review

	N	n	%	95% CI
Received at least one follow-up test for malaria?	244	208	85.2	(80 - 89)

Figure 8.3: Follow-up tests administered: medical record review

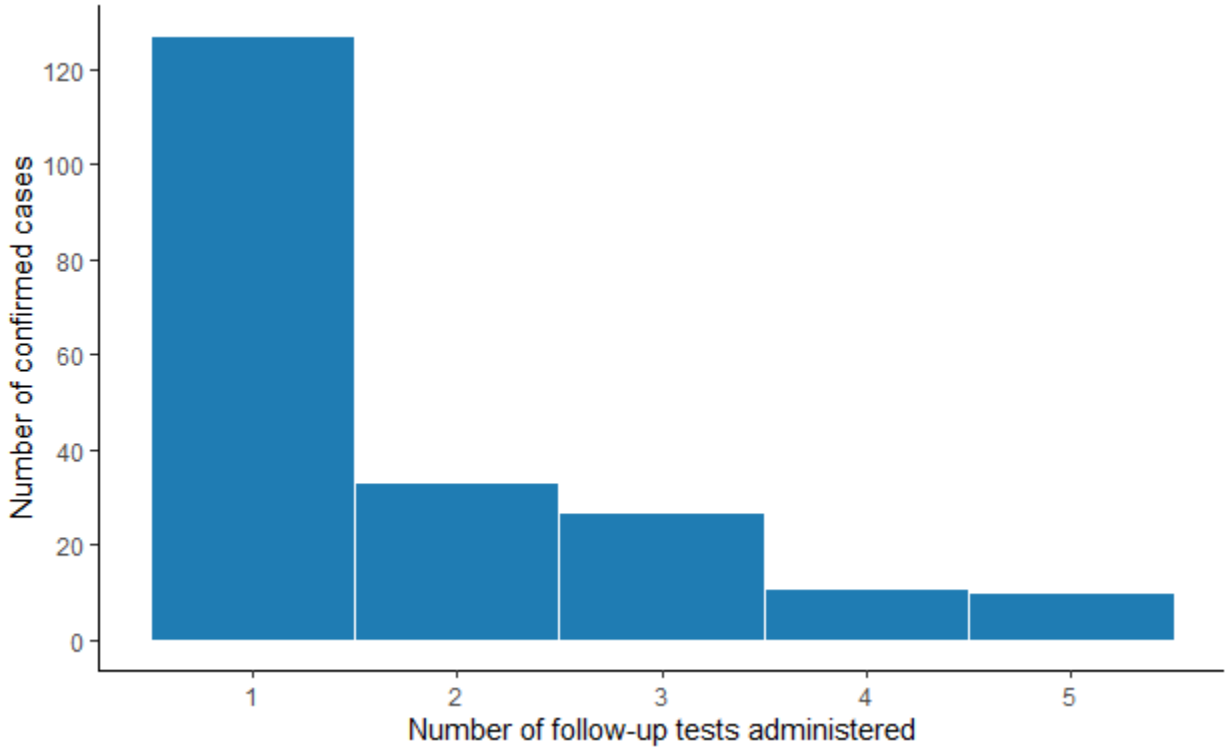
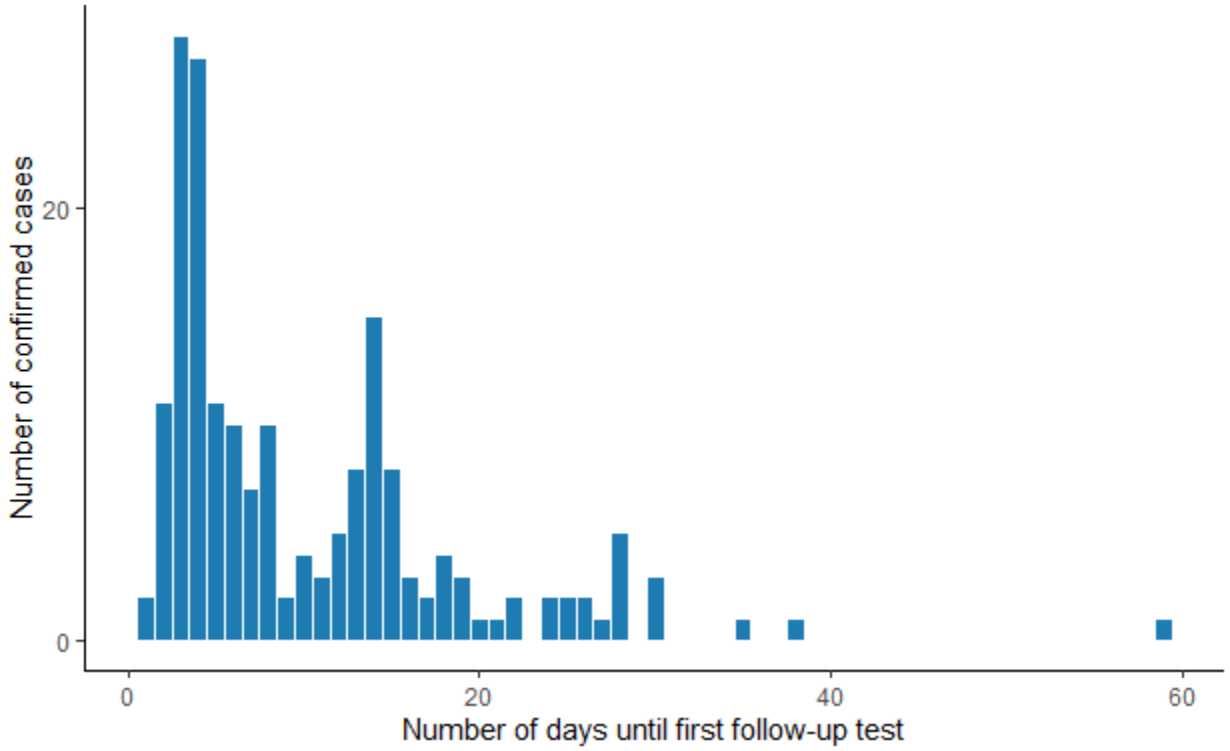


Figure 8.4: Days to first follow-up test: medical record review



8.3 Case response

Information extracted from the case investigation also allows vector control programs to plan community activities in response to a confirmed malaria case. Some of these activities are registered on the case investigation forms reviewed during the confirmed case review. Among the 539 cases reviewed, 452 had information about the environmental investigation and case response recorded. Table 8.6 shows the results of the environmental investigation, among the 452 cases with information.

Table 8.6: Medical record review case response

	N	n	%	95% CI
Is there information about dwelling/environmental investigation and case response in the file?	539	452	83.9	(80 - 87)
House located	452	415	91.8	(89 - 94)
Mosquito nets in house	452	235	52	(47 - 57)
Patient used/slept under net	452	183	40.5	(36 - 45)
House had been sprayed with insecticide	452	165	36.5	(32 - 41)
Anopheles vector present	452	30	6.6	(5 - 9)
Breeding areas observed around the home	452	32	7.1	(5 - 10)
Household members tested for malaria	452	265	58.6	(54 - 63)
Other contacts tested for malaria	452	21	4.6	(3 - 7)

The case investigation form also specifies details about active case detection in a radius of the case, as well as insecticide application in the neighborhood. The results observed during the medical record review are shown in Table 8.8. Figure 8.5 shows the distribution of number of households visited for active case detection as recorded in the confirmed case investigations reviewed and Figure 8.6 shows the number of households where indoor residual spraying was applied.

Table 8.8: Evidence of active case detection in medical records

	N	n	%	95% CI
Was active case detection done?	452	408	90.3	(87 - 93)
Were houses sprayed?	452	383	84.7	(81 - 88)
Were houses fogged?	452	422	93.4	(91 - 95)

Figure 8.5: Households covered during active case detection

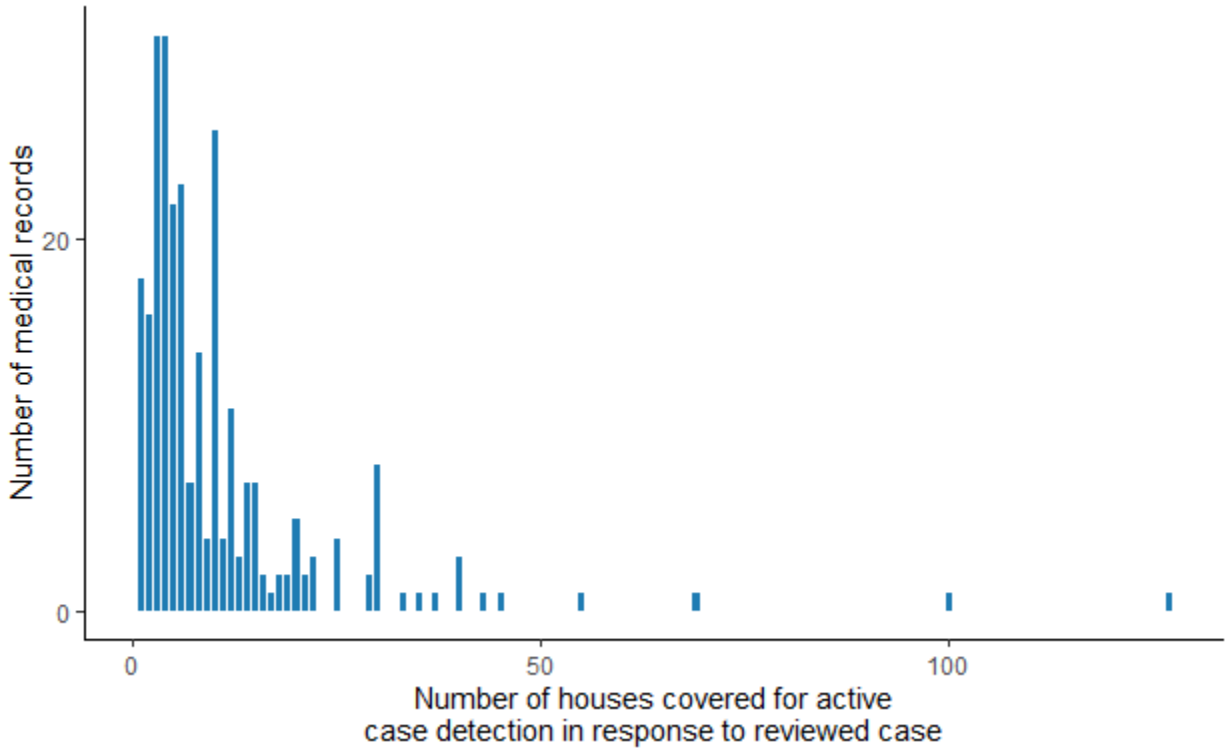
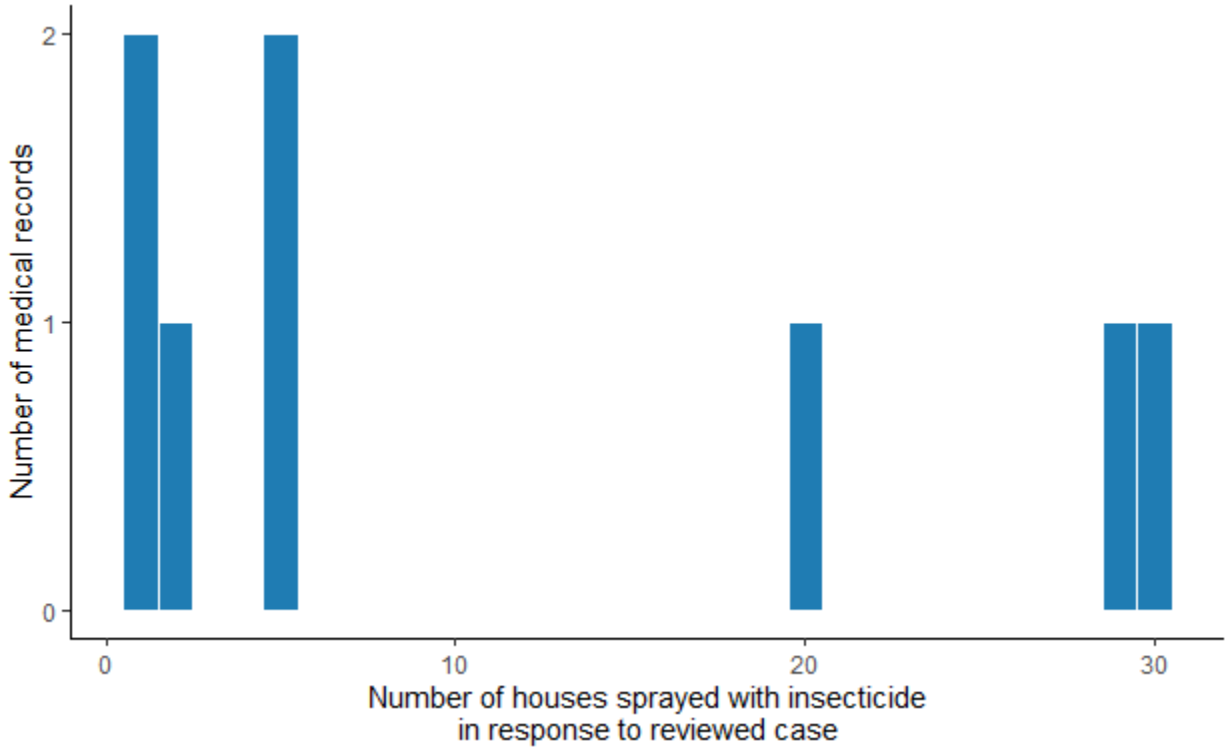


Figure 8.6: Houses sprayed (IRS) during case response



Chapter 9: Surveillance, Notification, and Reporting

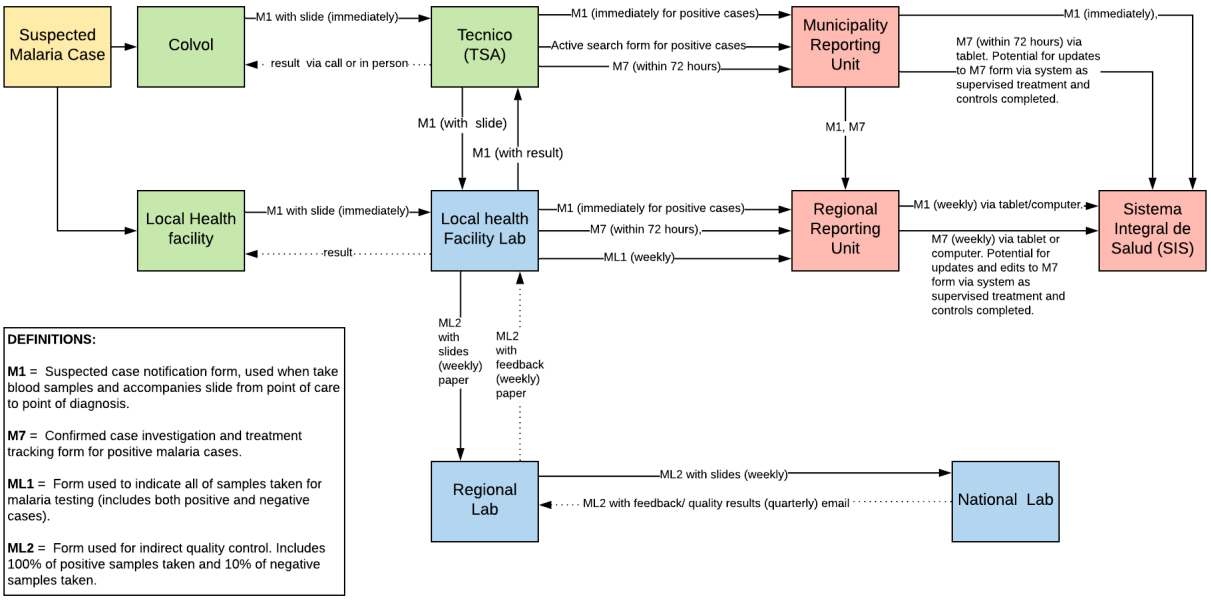
This chapter provides an overview of the malaria surveillance system in Honduras based on the fact-finding visit and health facility surveys, and summarizes results related to case reporting and laboratory reporting and quality control indicators.

9.1 Background

The fact-finding trip in May 2019 allowed for an understanding of notification and reporting flows at the local, regional, and central levels. The trip focused on identifying how individual cases are notified (including positive and negative test results for suspected cases) and understanding the weekly and monthly reporting requirements to which facilities are subject. This regular, aggregate reporting allows the regional and central levels to stay aware of malaria transmission activity, and the data can be used as an input for planning and directing resources where they are most needed.

Figure 9.1 shows the information flows beginning with a patient with malaria symptoms. The left side of the diagram shows sample-taking and examination practices, already discussed in Chapters 5 and 6. Once a slide has been examined, the patient must be informed of the test result. Additionally, the laboratory is obligated to inform the regional health authorities of malaria test results. Negative results are informed in aggregate, once weekly or once monthly. Positive results are often notified immediately to relevant personnel in the vector control program (*técnicos de salud ambiental*, or TSA), at the regional headquarters and laboratory, and at the point where the sample was taken. Any positive results will also be included in aggregate monthly or weekly laboratory reporting. Facilities with capacity to diagnose malaria are obligated to prepare monthly or weekly reports of any cases of notifiable diseases (malaria alongside other illnesses with obligatory notification), and to send these reports to the regional headquarters. In practice, the format and frequency of these case reports varies by health region in Honduras.

Figure 9.1: Honduras surveillance system flow diagram



9.2 Notification of malaria test results

9.2.1 Notification to patient among facilities that send slides elsewhere for diagnosis

The health facility interview included questions about notification of malaria test results. As described in Chapter 5, health facilities that do not have microscopic diagnostic capacity in-facility (or have it in-facility only at certain days or hours) send thick blood film slides to a microscopy post or laboratory for initial diagnosis. Table 9.1 and Table 9.2 show the method by which a patient is notified of a negative test result among the 14 facilities that send slides elsewhere for examination and reported they receive negative test results for the slides they send. Respondents could indicate more than one answer to these questions. It is frequently health personnel from the facility where the sample was taken who are responsible for notifying the patient of the negative test result (in 64.3% of facilities). Among the 9 facilities where facility personnel are responsible to notify at least some patients of the test result, the notification is often in person (in 77.8% of facilities).

Table 9.1: Notification to patient of negative test results (among facilities that send slides elsewhere for examination): personnel

	N	n	%	95% CI
Who notifies the patient of a negative test result?				
Health personnel from this facility	14	9	64.3	(37 - 85)
Vector control personnel	14	3	21.4	(7 - 50)
The laboratory that tested the sample	14	1	7.1	(1 - 38)
Community health worker	14	1	7.1	(1 - 38)
Volunteer collaborator	14	1	7.1	(1 - 38)

Table 9.2: Notification to patient of negative test results (among facilities that send slides elsewhere for examination): method

	N	n	%	95% CI
How is the patient notified of a negative test result? (among those notified by facility personnel)				
In person	9	7	77.8	(41 - 95)
Phone call	9	4	44.4	(17 - 76)
Other	9	1	11.1	(1 - 52)

In the case of a positive test result, 19 facilities that send slides elsewhere for examination reported they receive positive test results for the slides they send. Among these facilities, 57.9% are sometimes or always responsible to notify the patient of the positive test result by their own personnel (Table 9.3). Among these 11 facilities, the most common modality for notification of a positive test result is in person (Table 9.4).

Table 9.3: Notification to patient of positive test results (among facilities that send slides elsewhere for examination): personnel

	N	n	%	95% CI
Who notifies the patient of a positive test result?				
Health personnel from this facility	19	11	57.9	(35 - 78)
Vector control personnel	19	8	42.1	(22 - 65)
The laboratory that tested the sample	19	2	10.5	(3 - 35)
Volunteer collaborator / promoter	19	2	10.5	(3 - 35)
Other	19	1	5.3	(1 - 31)

Table 9.4: Notification to patient of positive test results (among facilities that send slides elsewhere for examination): method

	N	n	%	95% CI
How is the patient notified of a positive test result? (among those notified by facility personnel)				
In person	11	10	90.9	(55 - 99)
Phone call	11	4	36.4	(14 - 67)

9.2.2 Notification to patient among facilities that examine slides for malaria

Other health facilities reported their own microscopic diagnosis capacity in-house. In these 31 facilities, health personnel from the facility where the sample was taken are responsible for notifying at least some patients of a negative test result in 58.1% of facilities (Table 9.5). In the case that a positive test result is detected in the facility, 58.1% are sometimes or always responsible to notify the patient of the positive test result by their own personnel.

Table 9.5: Notification to patient of negative test results (among facilities that examine slides): personnel

	N	n	%	95% CI
Who notifies the patient of a negative test result?				
Health personnel from this facility	31	18	58.1	(40 - 74)
Vector control personnel	31	10	32.3	(18 - 51)
Volunteer collaborator	31	3	9.7	(3 - 27)
The patient is not notified	31	2	6.5	(2 - 23)
Other	31	2	6.5	(2 - 23)

Table 9.6: Notification to patient of positive test results (among facilities that examine slides): personnel

	N	n	%	95% CI
Who notifies the patient of a positive test result?				
Health personnel from this facility	31	18	58.1	(40 - 74)
Vector control personnel	31	13	41.9	(26 - 60)
Community health worker/health promoter	31	2	6.5	(2 - 23)
Volunteer collaborator	31	1	3.2	(0 - 21)
Other	31	1	3.2	(0 - 21)

9.2.3 Notification to health authorities among facilities that examine slides for malaria or perform rapid diagnostic tests

When a case of malaria is confirmed in Honduras, notification must be sent to health authorities. Among all facilities that either examine TBF slides or perform RDTs, 55.6% notify the regional health authority and 40% notify the municipal health authority (Table 9.7).

Table 9.7: Notification to health authorities of positive test results

	N	n	%	95% CI
Who is notified when a confirmed case of malaria is detected?				
Regional health authority	45	25	55.6	(41 - 70)
Municipal health authority	45	18	40	(27 - 55)
Epidemiological surveillance unit	45	11	24.4	(14 - 39)
Regional laboratory	45	9	20	(11 - 35)
Local vector control unit	45	8	17.8	(9 - 32)
National malaria program	45	3	6.7	(2 - 19)
National laboratory	45	2	4.4	(1 - 17)
Other	45	2	4.4	(1 - 17)

9.3 Malaria surveillance data and reporting

All health facilities in the sample were asked if they have access to an electronic health information system as shown in Table 9.8. Three percent of primary care facilities, 66.7% of secondary care facilities, and 66.7% of administrative units reported access. Facilities with access to any electronic information system were asked if they have access to a system for entering information about malaria, and 75% of secondary care facilities and 100% of administrative units reported access to a system used for malaria information.

Table 9.8: Access to electronic information systems

	N	n	%	95% CI
Primary care units				
Access to an electronic health information system for capturing and/or consulting health statistics	36	1	2.8	(0 - 18)
Access to an electronic health information system for entering malaria-specific information	1	0	0	(-)
Secondary care units				
Access to an electronic health information system for capturing and/or consulting health statistics	6	4	66.7	(26 - 92)
Access to an electronic health information system for entering malaria-specific information	4	3	75	(23 - 97)
Administrative units & National Lab				
Access to an electronic health information system for capturing and/or consulting health statistics	18	12	66.7	(42 - 85)
Access to an electronic health information system for entering malaria-specific information	11	11	100	(-)

9.3.1 Indicator 2.03: Malaria case reporting

RMEI indicator 2.03 has two parts: case reporting and laboratory reporting. According to the negotiated definition for case reporting, health units in Honduras that conduct malaria diagnosis (by RDT or microscopy) must send weekly reports to the regional headquarters that include the aggregate number of malaria cases detected during the week, or a notification that zero malaria cases were detected. The report is to be sent within the first six business days of the close of each week and have the date sent from the facility recorded on the report. The report can be specific to malaria or combined with other notifiable diseases, so long as the exact number of malaria cases can be determined from the report.

The fact-finding visit revealed substantial variation from one health region to the next in terms of the format and frequency of malaria case reporting, and this finding was confirmed during health facility surveys. Some health regions did not routinely require weekly reports during the year 2018 at all (but rather relied on the monthly TRANS report prepared by the *Unidad de Gestión de Información* at the central level). The format of the reports observed during the survey at the facilities responsible to send case reports to health authorities (primary and secondary facilities with diagnostic capacity) where at least one report was observed is shown in Table 9.9. The destination of the reports is shown in Table 9.10, and respondents could indicate more than one destination.

Table 9.9: Format of case notification reports observed

	N	n	%	95% CI
Format of case reports observed				
Alerta Semanal	21	10	47.6	(27 - 69)
Telegrama	21	3	14.3	(5 - 37)
TRANS	21	3	14.3	(5 - 37)
Boletín epidemiológico semanal	21	2	9.5	(2 - 32)
Other	21	4	19	(7 - 42)

Table 9.10: Destination of case notification reports observed

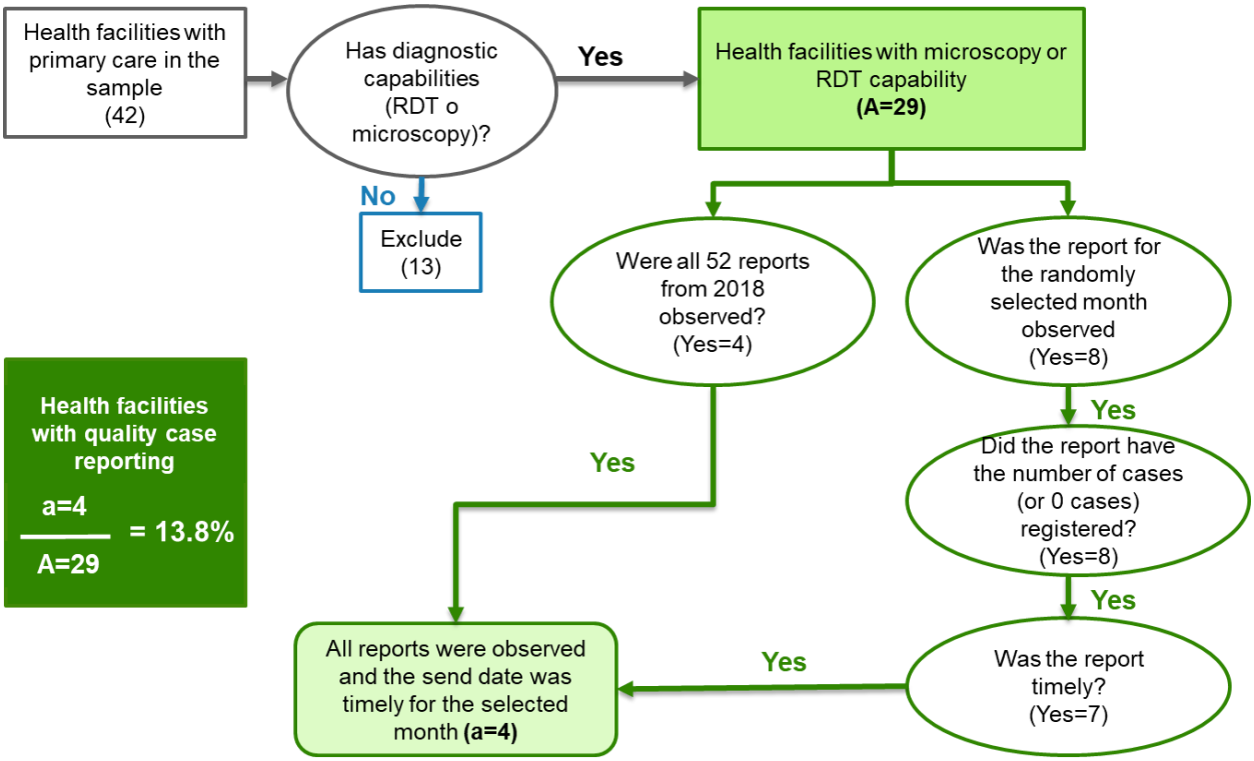
	N	n	%	95% CI
Where are case reports sent?				
Regional health authority	21	17	81	(58 - 93)
Municipal health authority	21	3	14.3	(5 - 37)
Other	21	1	4.8	(1 - 28)

Field personnel conducted an audit of all malaria case reports from 2018 stored at primary and secondary level facilities in the sample. They began by discerning whether the facility prepared monthly or weekly reports during 2018. They then sought to observe all 12 monthly reports or all 52 weekly reports for the year 2018. If a week was missing, they looked for written evidence of why the report was not submitted (for example, if the only microscopist was on holiday). Next, the electronic survey module presented a randomly selected month (or set of four epidemiological weeks). Surveyors sought to find the reports corresponding to this month, and then proceeded to enter detailed information from the report to the survey module, such as the number of malaria cases reported (or whether zero cases were reported) and the date sent or received as listed on the report (or as listed in a logbook of official correspondence sent and received, in facilities that use such a book). Health facility eligibility and completion of indicator according to a decision algorithm is shown in Figure 9.2.

Table 9.11 shows the results of the case reporting component of the indicator, which requires the following:

- that the reports be in a weekly format
- that all 52 reports be observed for the year 2018
- that all four weekly reports be observed for the selected month with send date
- that all four send dates are verified to be within the first six business days of the close of the selected week

Figure 9.2: Eligibility of health facilities for Indicator 2.03 (case reporting)



Twenty-nine facilities that provide attention to patients are eligible for consideration in the indicator. The results are shown in Table 9.11 and four units met all the requirements of the indicator. The breakdown of the case reporting component of the indicator is shown in Table 9.10.

Table 9.11: Indicator 2.03: Case reporting

	N	n	%	95% CI
Indicator: Attention units				
Relevant units	42	42	100	(-)
Excluded due to survey error[1]	42	1	2.4	(0 - 16)
Units with diagnostic capacity	41	29	70.7	(55 - 83)
Units indicating reporting of malaria cases	29	29	100	(-)
At least one weekly report from 2018 observed	29	10	34.5	(19 - 54)
All 52 weekly reports from 2018 observed	29	4	13.8	(5 - 32)
Four weekly reports for randomly selected month observed[2]	29	8	27.6	(14 - 47)
Number of cases (or zero) recorded for all reports of randomly selected month	29	8	27.6	(14 - 47)
Dates for reports of randomly selected month observed	29	7	24.1	(12 - 43)
Dates for reports of randomly selected month are valid	29	7	24.1	(12 - 43)
Result: Malaria case reporting to standard	29	4	13.8	(5 - 32)

[1]Missing data for one unit
[2]Three attention units had monthly reports available, for one of which all 12 were observed, with no dates

Table 9.10: Destination of case notification reports observed

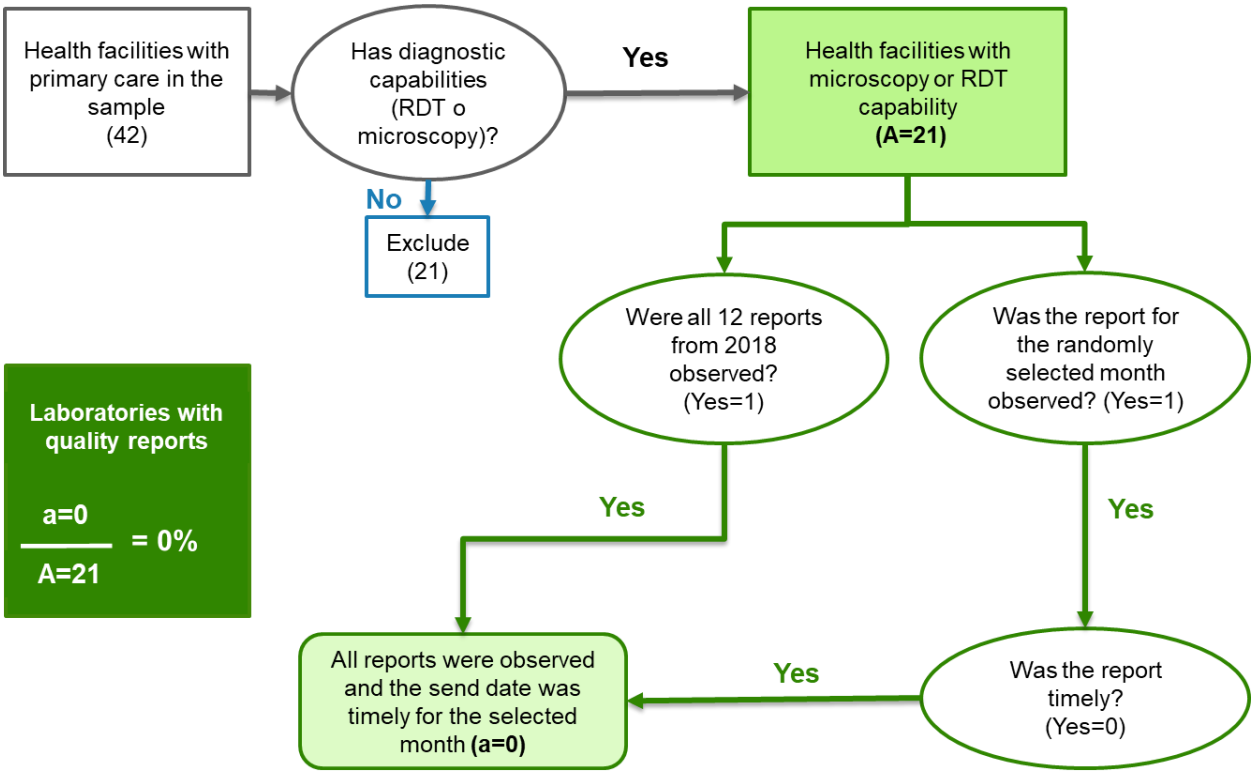
	N	n	%	95% CI
Malaria case reporting to standard				
Stratum 3	2	0	0	(-)
Stratum 4	27	4	14.8	(6 - 34)
Total	29	4	13.8	(5 - 32)

9.3.2 Indicator 2.03: Laboratory production reporting

The other component of Indicator 2.03 is the observation of monthly laboratory production reports that show the number of TBF slides examined and the number of RDTs performed. All facilities that conduct malaria diagnosis (by RDT or microscopy) must send these reports to the regional headquarters or regional laboratory within the first 15 days of the following month. The observation of the laboratory reports during the survey was conducted in the same way as the case reports. Health facility eligibility and completion of indicator according to a decision algorithm is shown in Figure 9.3. The indicator required:

- that the reports be in a monthly format
- that all 12 reports be observed for the year 2018
- that the report be observed for the randomly selected month with send date
- that the send date is verified to be within the first 15 days of the following month

Figure 9.3: Eligibility of health facilities for Indicator 2.03 (laboratory reporting)



Twenty-one facilities that provide attention to patients are eligible for consideration in the indicator. The results are shown in Table 9.12 and no unit met all the requirements of the indicator.

Table 9.12: Indicator 2.03: Lab reporting

	N	n	%	95% CI
Indicator: Attention units				
Relevant units	42	42	100	(-)
Excluded due to survey error[1]	42	9	21.4	(11 - 37)
Units with diagnostic capacity	33	21	63.6	(46 - 78)
At least one monthly report from 2018 observed	21	1	4.8	(1 - 28)
All 12 monthly reports from 2018 observed[2]	21	1	4.8	(1 - 28)
Report for randomly selected month observed	21	1	4.8	(1 - 28)
Date for report of randomly selected month observed	21	1	4.8	(1 - 28)
Date for report of randomly selected month is valid	21	0	0	(-)
Result: Laboratory production reporting to standard	21	0	0	(-)

[1]Missing data for 9 units
[2]14 attention units had weekly reports available, for 4 of which all 52 were observed.

The destination where laboratory production reports are sent is shown in Table 9.13.

Table 9.13: Destination of lab production reports observed

	N	n	%	95% CI
Where are laboratory production reports sent?				
Regional health authority	51	30	58.8	(45 - 72)
Regional lab	51	10	19.6	(11 - 33)
Municipal health authority	51	8	15.7	(8 - 29)
National lab	51	5	9.8	(4 - 22)
Other	51	5	9.8	(4 - 22)

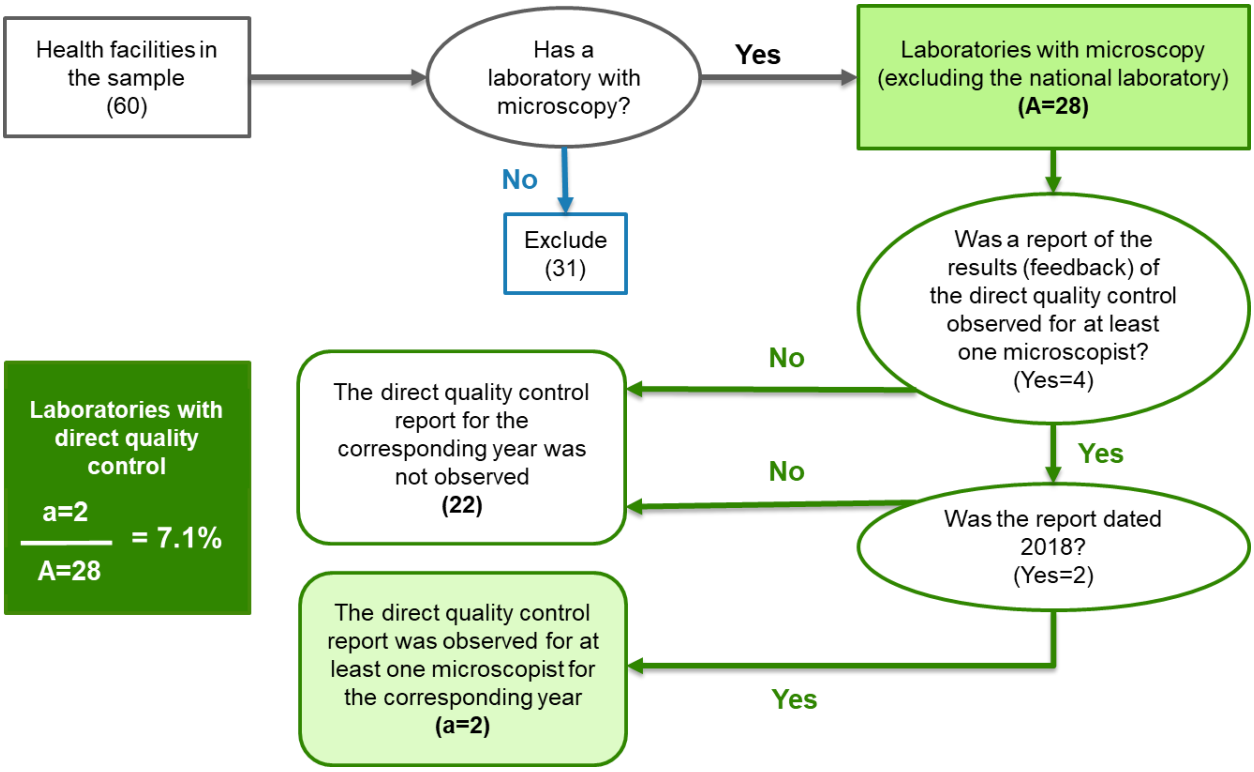
9.4 Indicator 3.02: Laboratory quality control

The RMEI indicators also require participation of the national reference laboratory for malaria in an external quality control certification with the Pan American Health Organization, which was observed at the Honduras national reference laboratory for the year 2018.

Additionally, all laboratories and microscopy posts that diagnose malaria through microscopy must participate in direct and indirect quality control exercises with their corresponding regional reference laboratory, and personnel of the regional laboratory must participate in the same exercises with the national reference laboratory. Thus, 28 laboratories at the primary, secondary, and regional levels are eligible for the indicator.

The first exercise, direct quality control, is a yearly slide panel exam administered by the reference laboratory in which the evaluated microscopist must examine several slides (for which the results are known by the reference laboratory) and submit the test result of each with parasite density and species. The reference laboratory then checks the results submitted and provides feedback to the evaluated microscopist. Health facility eligibility was determined according to a decision algorithm shown in Figure 9.4. According to Table 9.14, complete evidence of participation in direct quality control was observed at 7.1% of local and regional laboratories. The evidence required was a report of the results of the 2018 exam received back from the reference laboratory with feedback.

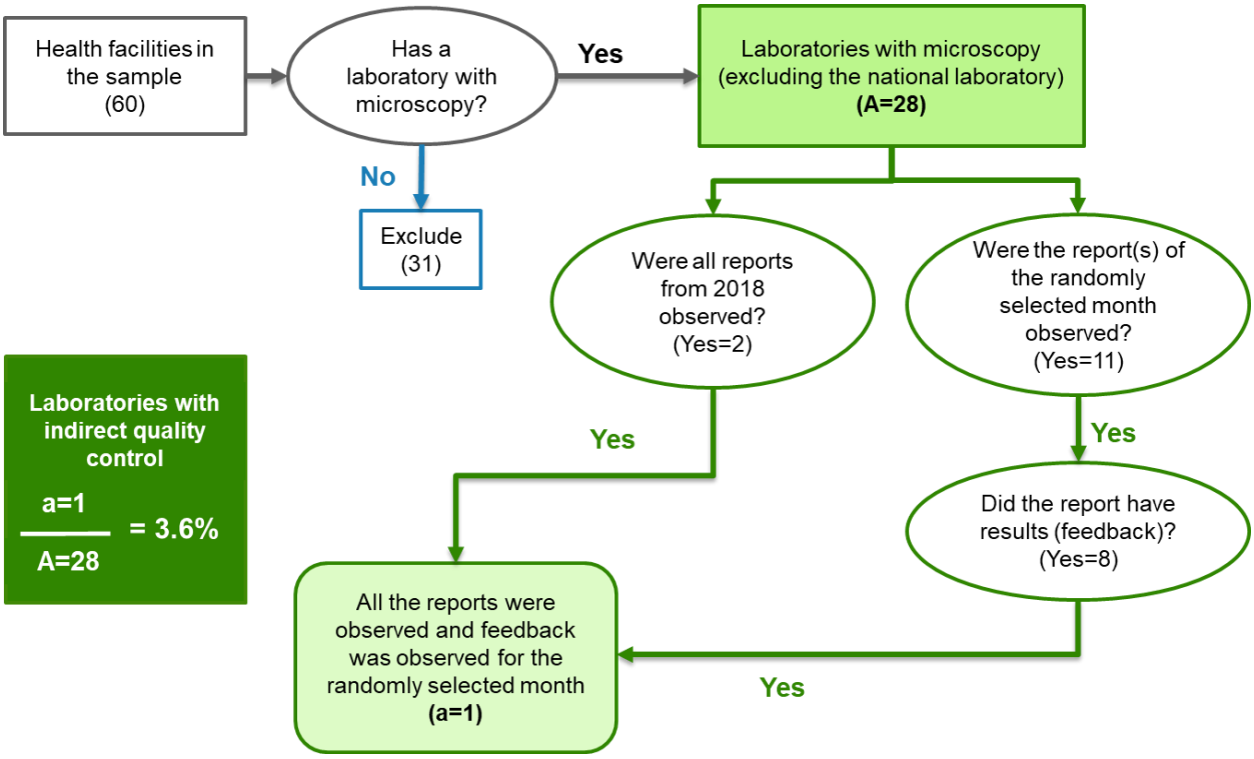
Figure 9.4: Eligibility of health facilities for Indicator 3.02 (direct)



The second exercise, indirect quality control, is a cross-check of a set proportion of the slides initially diagnosed by each local laboratory (or in the case of the regional laboratory, of the slides first cross-checked) by a senior microscopist. In Honduras, local laboratories must send 10% of the slides with a negative test result for malaria and 100% of the slides with a positive test result to the regional lab for cross-checking each month. The selection method for the 10% of negative slides may vary regionally or locally. Regional laboratories must send 100% of the positive slides cross-checked and 10% of the negative slides received there for cross-checking (thus, 1% of the total negative slides initially diagnosed at the local level) to the national laboratory. Health facility eligibility was determined according to a decision algorithm shown in Figure 9.5. While 14.3% of local and regional laboratories reported participating in quality control, only 3.6% met the standards of the indicator based on the reporting observation. The evidence required was:

- that all 52 reports (or written evidence that no slides were examined in a given week without a report) be observed for the year 2018 for reports in a weekly format OR
- that all 12 reports be observed for the year 2018 for reports in a monthly format AND
- that the report be observed for a randomly selected month in 2018 (or the corresponding four epidemiological weeks), with results or feedback from the reference laboratory.

Figure 9.5: Eligibility of health facilities for Indicator 3.02 (indirect)



The detailed results of the indicator are shown in Table 9.15 and Table 9.16. A breakdown of the direct and indirect components of the indicator by stratum are shown in Table 9.17.

Table 9.14: Indicator 3.02: Quality control

	N	n	%	95% CI
External quality control: 2018 National Lab Evaluation form observed	1	1	100	(-)
Direct	28	2	7.1	(2 - 25)
Indirect	28	1	3.6	(0 - 22)

Table 9.15: Indicator 3.02: Indirect and direct quality control

	N	n	%	95% CI
Facilities with microscopy (excluding national lab)	60	28	46.7	(34 - 60)
Facilities passing direct quality control (DQC) component	28	2	7.1	(2 - 25)
Facilities that report participating in DQC	28	18	64.3	(45 - 80)
Feedback for at least one assessment in 2018 was observed	28	4	14.3	(5 - 33)
Feedback report with results was dated 2018	28	2	7.1	(2 - 25)
Facilities passing indirect quality control (IDQC) component	28	1	3.6	(0 - 22)
Facilities that report participating in IDQC	28	25	89.3	(71 - 97)
Randomly selected month report was observed	28	11	39.3	(23 - 59)
Cross-checked results and feedback were observed on randomly selected report	28	8	28.6	(15 - 48)
All reports observed for 2018	28	2	7.1	(2 - 25)

	N	n	%	95% CI
Facilities passing both direct and indirect quality control	28	1	3.6	(0 - 22)

Table 9.16: Indicator 3.02: Indirect quality control in detail

	N	n	%	95% CI
Facilities who have microscopy (excluding national lab)	60	28	46.7	(34 - 60)
At least one report was observed for 2018	28	16	57.1	(38 - 74)
Reports are monthly	28	4	14.3	(5 - 33)
1-3 reports observed	28	1	3.6	(0 - 22)
4-7 reports observed	28	2	7.1	(2 - 25)
8-11 reports observed	28	0	0	(-)
12 reports observed	28	1	3.6	(0 - 22)
Reports are weekly	28	12	42.9	(26 - 62)
1-17 reports observed	28	1	3.6	(0 - 22)
18-34 reports observed	28	3	10.7	(3 - 29)
35-51 reports observed	28	7	25	(12 - 45)
52 reports observed	28	1	3.6	(0 - 22)
All reports observed for 2018	28	2	7.1	(2 - 25)

Table 9.17: Comparison: result by stratum

	N	n	%	95% CI
Stratum 3				
Facilities passing direct quality control (DQC) component	1	0	0	(-)
Facilities passing indirect quality control (IDQC) component	1	0	0	(-)
Facilities passing both direct and indirect quality control	1	0	0	(-)
Stratum 4				
Facilities passing direct quality control (DQC) component	27	2	7.4	(2 - 26)
Facilities passing indirect quality control (IDQC) component	27	1	3.7	(0 - 23)
Facilities passing both direct and indirect quality control	27	1	3.7	(0 - 23)

Chapter 10: Challenges, Conclusions, and Recommendations

10.1 Challenges and limitations

10.1.1 Challenges for health facility data collection

In Honduras, field personnel were generally able to gain authorization to interview in selected health facilities and to observe relevant service areas. However, it was challenging to access laboratories and to observe laboratory forms in the few cases where the laboratorist was on leave or otherwise not available during the week of the visit. Interviewers were able to conduct revisits within the span of a few days if key personnel were not available at the initial visit, but did encounter some extended laboratory closures. Even if the facility director was able to unlock the laboratory and allow interviewers to observe equipment, other facility personnel were often not equipped to find laboratory supplies, records of stock, and reporting files.

First-line malaria medications and RDTs were observed at relatively few facilities, and records of stock were sometimes not available or insufficiently detailed to determine stock-out over a three-month period. Often, laboratory supplies for malaria diagnosis and malaria treatments are tracked under a separate system from other pharmacy and lab inputs. Sometimes stock records are not maintained at the local facility, but rather at the municipal or regional headquarters of the malaria program.

A key challenge for the review of suspected malaria cases was identification of a sufficient number of eligible cases, particularly in smaller health facilities. Because most facilities in the sample did not keep lists of fever cases nor International Classification of Diseases (ICD) code databases for electronic extraction that could be used as a sampling frame, the field team usually had to select the sample of suspected cases based on daily attention registries (*"Atenciones Ambulatorias"*). Often, the total number of eligible attentions in the year 2018 barely exceeded the quota for record revision. Occasionally, health facility personnel had difficulty locating selected records for review (for example, when medical record number was left blank on the attention registry). Interviewers observed that children were overrepresented in attentions with eligible diagnoses, because unspecified fever is usually not recorded as the principal diagnosis for adult attentions.

10.1.2 Challenges for confirmed case review

In Honduras, malaria case notification (M-1) and investigation (M-7) forms were generally found for most confirmed cases of malaria and could be reviewed at the health region. The information found on these forms was sufficient to measure most indicators, with two exceptions. Sometimes the species of the parasite was not registered on the forms, making it impossible to determine what treatment scheme should have been followed. Additionally, treatment records were often not sufficiently complete to measure complete and continuous treatment, and evidence of treatment supervision was not often found. From the fact-finding visit, we anticipated these obstacles to measurement. Some regions have treatment follow-up formats in use in the field, but these forms are not often sent to the health region archive nor is the information updated in the digital surveillance database after the case is initially entered within 72 hours of diagnosis.

10.1.3 Challenges for case and lab reporting review

In Honduras, the only nationally standard form for aggregate reporting of malaria cases (or notification of zero cases) from the health facility to the regional or central level is a monthly form called the TRANS. Some health regions use regionally-standard formats for weekly case reporting such as an epidemiological bulletin (*"boletín epidemiológico", "telegrama"*). The malaria lab reporting form (ML-1), in contrast, is nationally standard.

Copies of the forms are filed at the sending health facility and the receiving health region. Case and lab reporting formats do not typically include the date sent or received, complicating the attempt to evaluate timeliness of submission. Additionally, field personnel were sometimes unable to observe the forms from

the year 2018 when facility personnel were unable to find the files. This was a particular problem where there had been changes in lab or statistics personnel since 2018.

10.1.4 Challenges for household data collection

Household data collection in Honduras encountered few logistical challenges. In terms of the measurement of vector control intervention coverage, interviewers found that mosquito nets they observed were generally not labeled with a brand name (unless they were still in their original packaging and unused). Evidence of the completion and date of indoor residual spraying (such as a “house card” signed by vector control personnel) was rarely observed. Recall bias has the potential to affect results for both vector control and case detection indicators, as respondents may have trouble remembering the details of a recent fever, or the time frame when IRS was applied to their home. For most of the fevers reported during the last two weeks, the respondent also reported exclusion symptoms, therefore the sub-sample size for the case detection indicator is quite small.

10.2 Key findings and recommendations

Migration to electronic information systems must take into account the effectiveness of current paper-based practices, and must consider timelines that ensure updated information in the electronic system. Forms should be reviewed in order to ensure essential information is captured, but more importantly, the pipeline from recording on paper in the field to the final electronic database should be reviewed and improved to ensure the highest data quality, in particular as regards the information captured after malaria diagnosis that requires updates after initial notification (treatment administration and supervision and follow-up parasitological tests). The emphasis must be on ensuring complete and precise data at the lowest levels of information, and in enabling effective data storage, processing, quality control, and analysis for decision-making at the regional and central levels.

Because malaria and other infectious disease programs have been managed for decades as parallel, vertically integrated systems, some disconnects between service provision in health facilities and through the vector control program persist. Different groups manage different activities for case detection, case management, and vector control, and there is not always a clear coordination plan. Vector control teams in the field must inform to the malaria program, while patients visit health facilities that are part of a separate reporting chain to the health region. To reach malaria elimination, stakeholders will have to work to bridge gaps and reduce fragmentation in service provision.

Some practices and procedures are not standardized from region to region, in particular notification flows and detection and record-keeping protocols for patients with fever presenting at a health facility (suspected malaria cases). At the local level, there is a notable variation in practices among health facilities, and sometimes a lack of understanding of central-level operations and goals. It is crucial to reach a shared understanding of how each part of the system connects with the others in order to reach success in malaria elimination and other projects in the Mesoamerican region.

Appendix A: Indicator Matrices

A.1 Performance indicator matrix

#	Indicator	N	%	CI
P2.02	Fever cases with blood sample	67	43.3	(32 - 55)
P2.03	Case reporting with quality	29	13.8	(5 - 32)
	Lab production reporting	21	0	(-)
P3.02	Quality control (external)	1	100	(-)
	Quality control (direct)	28	7.1	(2 - 25)
	Quality control (indirect)	28	3.6	(0 - 22)
P4.02	Diagnosis within 48 hours	521	26.9	(23 - 31)
P4.01	Treatment within 24 hours	521	62.4	(58 - 66)
P4.03	Treatment complete and supervised	538	11.7	(9 - 15)
P6.01	Vector control coverage	2798	53.1	(40 - 66)
P7.01	Equipment and instruments for diagnosis and treatment	53	18.9	(10 - 32)

A.2 Monitoring indicator matrix

#	Indicator	N	%	CI
M2.01	Suspected cases with malaria test (MRR)	801	8.4	(7 - 10)
E2.04	Notified within 24 hours of detection	533	15.6	(13 - 19)
E3.03	Equipment and instruments for sampling, diagnosis and RDTs	48	35.4	(23 - 50)
E4.05	Health facilities without stockouts of first-line treatments	36	27.8	(15 - 45)
E6.03	Population protected by IRS	3595	33.7	(32 - 35)
E6.05	Population protected by ITNs	3649	30.8	(29 - 32)

#	Indicator	N	Median	CI
E4.03	Median time between onset of symptoms and start of treatment (days): passive surveillance	341	5	(-)
	Median time between onset of symptoms and start of treatment (days): active surveillance	112	5	(-)
	Median time between onset of symptoms and start of treatment (days): surveillance type not registered	68	5	(-)

Appendix B: Indicator Definitions

This section defines the indicators verified in IHME surveys, and excludes others that are measured by expert review.

M2.01: Suspected malaria cases with parasitological test

Source: Medical record review of suspected cases of malaria

Denominator: Cases with suspicion of malaria (registered fever or eligible diagnoses)

Sampling by ICD code - diagnoses eligible for review

- A41.9 Sepsis, unspecified organism
- A68 Relapsing fevers
- A68.9 Relapsing fever, unspecified
- A98.5 Hemorrhagic fever with renal syndrome
- B34.9 Viral infection, unspecified
- B50 *Plasmodium falciparum* malaria
- B50.0 *Plasmodium falciparum* malaria with cerebral complications
- B50.8 Other severe and complicated *Plasmodium falciparum* malaria
- B50.9 *Plasmodium falciparum* malaria, unspecified
- B51 *Plasmodium vivax* malaria
- B51.0 *Plasmodium vivax* malaria with rupture of spleen
- B51.8 *Plasmodium vivax* malaria with other complications
- B51.9 *Plasmodium vivax* malaria without complication
- B52 *Plasmodium malariae* malaria
- B52.0 *Plasmodium malariae* malaria with nephropathy
- B52.8 *Plasmodium malariae* malaria with other complications
- B52.9 *Plasmodium malariae* malaria without complication
- B53 Other specified malaria
- B53.0 *Plasmodium ovale* malaria
- B53.1 Malaria due to simian plasmodia
- B53.8 Other malaria, not elsewhere classified
- B54.X Unspecified malaria
- G03.9 Meningitis, unspecified
- R16 Hepatomegaly and splenomegaly, not elsewhere classified
- R16.1 Splenomegaly, not elsewhere classified
- R16.2 Hepatomegaly with splenomegaly, not elsewhere classified
- R17.X Unspecified jaundice
- R50 Fever of other and unknown origin
- R50.0 Fever with chills
- R50.1 Persistent fever
- R50.8 Other specified fever
- R50.9 Fever, unspecified
- R51.X Headache
- R68 Other general symptoms and signs
- R68.8 Other general symptoms and signs
- A27 Leptospirosis

- A27.0 Leptospirosis icterohemorrhagica
- A278 Other forms of leptospirosis
- A279 Leptospirosis, unspecified
- A90.X Dengue fever [classical dengue]
- A91.X Dengue hemorrhagic fever
- A92 Other mosquito-borne viral fevers
- A92.0 Chikungunya virus disease
- A92.8 Other specified mosquito-borne viral fevers
- A92.9 Mosquito-borne viral fever, unspecified

Sampling by presumptive or final diagnosis - diagnoses eligible for review

- Fever (acute, relapsing, persistent, unspecified, etc.)
- Malaria (*P. falciparum*, *P. vivax* or unspecified)
- Leptospirosis
- Dengue (classical, hemorrhagic or unspecified)
- Chikungunya
- Mosquito-borne fever
- Viral infection, unspecified
- Meningitis
- Hepatomegaly
- Splenomegaly

Sampling by principal complaint - motives eligible for review

- Fever
- Malaria
- Dengue
- Chikungunya

Numerator: Cases with evidence a malaria test was ordered

Exclusions:

1. Health facility in stratum 3 + documented patient residence in strata 1, 2, or 3 + documented lack of travel history to stratum 4 nor endemic country + no evidence of intermittent symptoms (fever+chills+sweating)

2. Diagnoses ineligible without a documented fever:

All health facilities:

Sampling by ICD code

- A41.9 Sepsis, unspecified organism
- B34.9 Viral infection, unspecified
- G03.9 Meningitis, unspecified
- R68 Other general symptoms and signs
- R68.8 Other general symptoms and signs
- A27 Leptospirosis
- A27.0 Leptospirosis icterohemorrhagica
- A27.8 Other forms of leptospirosis

- A27.9 Leptospirosis, unspecified

Sampling by presumptive or final diagnosis

- Leptospirosis
- Viral infection, unspecified
- Meningitis

Only health facilities in stratum 3:

Sampling by ICD code

- R16 Hepatomegaly and splenomegaly, not elsewhere classified
- R16.1 Splenomegaly, not elsewhere classified
- R16.2 Hepatomegaly with splenomegaly, not elsewhere classified
- R17.X Unspecified jaundice
- R51X Headache

Sampling by presumptive or final diagnosis

- Hepatomegaly
- Splenomegaly

3. Diagnoses ineligible for record review (febrile illnesses with defined etiology):

- Arbovirus with positive viral test
  - Dengue
  - Chikungunya
  - Zika
  - Acute respiratory infection
- Gastrointestinal infection
- Fever of neurological origin
- Skin lesion
- Urinary infection
- Findings in soft tissues
- Focal infection
- Other parasitological infection

P2.02: Fever cases with blood sample

Source: Household survey

Denominator: People in stratum 4 communities who reported fever during the two weeks prior to the survey

Numerator: People who reported a blood sample was taken from their finger, heel, earlobe, or vein during their febrile illness

Exclusions: People who reported the presence of respiratory, urinary, or skin symptoms during their febrile illness (Sore throat, difficulty swallowing, ear pain and secretions, cough with discharge or phlegm, Mucus or nasal secretions, intercostal retractions or retractions of the thorax muscles, pain or discomfort urinating, strong smelling urine, dark colored urine, genital itch, frequent urination and in small quantities, vaginal or penile secretions, pimples or rash, redness or inflammation of the skin or presence of pus in the skin, open wounds with presence of pus or black borders)

P2.03a: Malaria case reports with quality standards

Source: Health facility observation

Denominator: Health facilities with self-reported diagnostic capacity (microscopy or RDTs)

Numerator: Health facilities with weekly epidemiological surveillance reports observed

- Reports list the aggregate number of malaria cases or report of zero cases
- Reports observed for all 52 weeks of the year 2018
- Reports in randomly selected month list sending date
- All observed dates within first 6 business days of the following week

Exclusions: Municipal and regional health units, national reference laboratory

P2.03b: Malaria laboratory production reports with quality standards

Source: Health facility observation

Denominator: Health facilities with self-reported diagnostic capacity (microscopy or RDTs)

Numerator: Health facilities with monthly (or weekly) laboratory production reports observed

- Reports list the malaria samples taken (thick blood film or RDT)
- Reports observed for all 12 months or 52 weeks of the year 2018
- Reports in randomly selected month list sending date
- All observed dates within first 15 business days of the following month

Exclusions: Municipal and regional health units, national reference laboratory

P3.02a: National laboratory participates in external quality control

Source: Health facility observation

Denominator: National malaria reference laboratory

Numerator: Laboratory with observation of Diagnostic Performance Results Report from the Pan-American Health Organization dated 2018 or 2019**

Exclusions: N/A

P3.02b: Laboratories that participate in direct quality control

Source: Health facility observation

Denominator: Health facilities with self-reported microscopic diagnostic capacity

Numerator: Health facilities with observation of Evaluation Results Report (for slide panel exam) from the reference laboratory for at least one microscopist responsible for malaria diagnosis, dated 2018

Exclusions: National reference laboratory

P3.02c: Laboratories that participate in indirect quality control

Source: Health facility observation

Denominator: Health facilities with self-reported microscopic diagnostic capacity

Numerator: Health facilities with monthly (or weekly) slide cross-check reports observed

- Reports observed for all 12 months or 52 weeks of the year 2018
- Reports in randomly selected month have results and feedback from the reference laboratory

Exclusions: National reference laboratory

P4.01: Malaria cases with treatment within 24 hours of diagnosis

Source: Medical record review of confirmed cases of malaria

Denominator: Number of confirmed malaria cases reviewed

Numerator: Number of confirmed malaria cases that received first-line antimalarial treatment according to national policy the day of diagnosis or the day after diagnosis, as recorded on case notification or investigation forms

- *P. vivax* or *P. falciparum* from areas without chloroquine resistance: chloroquine + primaquine
- Imported *P. falciparum* cases from areas with documented resistance to chloroquine: artemisinin-based treatment (artemether + lumefantrine)
- Severe malaria cases: artesunate or quinine or artemether (or others according to the norm)

Exclusions: Cases with an extreme time interval (suspected of registration errors): treatment begun more than 7 days before or more than 30 days after diagnosis date

P4.02: Malaria cases with diagnosis within 48 hours of start of symptoms

Source: Medical record review of confirmed cases of malaria

Denominator: Number of confirmed malaria cases reviewed

Numerator: Number of confirmed malaria cases that were diagnosed within two days or less after fever or other symptoms began, as recorded on case notification or investigation forms

Exclusions: Cases with an extreme time interval (suspected of registration errors): diagnosis more than 7 days before or more than 30 days after symptoms began

P4.03: Malaria cases with complete and supervised treatment

Source: Medical record review of confirmed cases of malaria

Denominator: Number of confirmed malaria cases reviewed

Numerator: Number of confirmed malaria cases that received complete antimalarial treatment according to national policy with at least one dose supervised, as recorded on case notification or investigation forms

- For *P. vivax* cases and *P. ovale* cases: 3 days of chloroquine and 7 or 14 days of primaquine
- For *P. falciparum* cases without documented resistance to chloroquine: 3 days of chloroquine and one day of primaquine
- For mixed infections cases without documented resistance to chloroquine: 3 days of chloroquine and 7 or 14 days of primaquine
- For imported *P. falciparum* cases from areas with documented resistance to chloroquine: 3 days of artemisinin-based treatment (artemether + lumefantrine) and one day of primaquine

- For severe malaria cases: If IV treatment with artesunate started, when completed: 3 days of artemisinin-based treatment (artemether + lumefantrine)

Exclusions: If the patient died, treatment will be required until the day prior to death. Cases with death on the day of diagnosis or the following day excluded.

P6.01: Risk group protected with vector control interventions

Source: Household survey

Denominator: People who slept at home the night before the survey in target communities (as informed at surveyed health facility)

Numerator: People protected by either of two vector control interventions (IRS or LLIN)

- Respondent informed that interior walls of dwelling were sprayed in the 12 months prior to the survey
- Respondent informed that the individual slept under an insecticide-treated net the night prior to the survey

Exclusions: People in households with “don’t know” response to indoor residual spraying, who did not sleep under a net the night prior

P7.01: Equipment and supplies for malaria diagnosis and treatment

Source: Health facility observation

Denominator: Points of care and laboratories

Numerator: Points of care and laboratories with supplies for the diagnosis and treatment of malaria observed the day of the survey and without stockout in the three months prior to the survey

First-line antimalarial medications: Chloroquine tablets + Primaquine tablets (15 mg or 5 mg) without stockout in the three months prior to the survey

- All UAPS/CESAR, CIS/CESAMO, Policlínico, and Servicio Materno-Infantil

Antimalarial medications for severe malaria: Quinine or Artesunate [tablets, IV, or rectal]

- All area and regional hospitals

Antimalarial medications for cases of P. falciparum from areas of known chloroquine resistant malaria:* Derivatives or artemisinin (artemether + lumefantrine)

- All area and regional hospitals

Supplies for taking samples and elements for basic biosafety: Disposable gloves + lancets + microscope slides

- All UAPS/CESAR, CIS/CESAMO, Policlínico, and Servicio Materno-Infantil

Forms for sending slide samples

- All UAPS/CESAR, CIS/CESAMO, Policlínico, and Servicio Materno-Infantil

Supplies for on-site diagnosis: Rapid diagnostic tests (RDTs)

- Stratum 4 UAPS/CESAR, CIS/CESAMO, Policlínico, and Servicio Materno-Infantil

Equipment for microscopy: Microscope (with 100x retractable lens) + cell counter (manual or automatic)

- All health facilities that reported microscopic diagnostic capacity, including regional and national labs

Supplies for staining and testing: Immersion oil + concave slide or coloring tray/container + laboratory stopwatch (or other method of keeping time) + plastic or glass tubes (or alternative according to country) + syringe/pipette/dropper

- All health facilities that reported microscopic diagnostic capacity, including regional and national labs

Reagents for staining: Giemsa or [Methylene blue + Solution A + Solution B + Methanol] + Buffer solution or [buffer tablets + distilled water]

- All health facilities that reported microscopic diagnostic capacity, including regional and national labs

Exclusions: *Supplies for taking samples and elements for basic biosafety:* Disposable gloves + lancets + microscope slides

- Six eligible establishments where this information was not captured due to an error in the survey logic are excluded from this component of the indicator.

Forms for sending slide samples

- Six eligible establishments where this information was not captured due to an error in the survey logic are excluded from this component of the indicator.

Appendix C: Sample design and methods

C.1 Sample size

The size of the sample of health facilities for Honduras was defined as a part of the funding proposal to cover 60 points of measurement. In the case of the RMEI indicators, the “effective sample size”, or number of observations with data available for a specific indicator, varies from a fraction of the facility sample (e.g., participation in microscopy quality control assessment can only be measured in facilities with microscopy capabilities) to a much larger number (e.g., several hundred records of fever cases reviewed to verify if a malaria test was taken). The sample of 60 points was allocated purposively among different types of facilities based on the findings of the joint IDB-IHME fact-finding visit in order to satisfy minimum anticipated effective sample sizes. The LQAS measurement was defined as a part of the funding proposal to cover 32 communities with 25 households surveyed in each, or a total of 800 households surveyed.

In terms of the ability to calculate indicator estimates precisely, as the size of the sample increases, the marginal return (in terms of estimation power) of each additional observation diminishes. The probability of failing to detect a true impact decreases as sample size increases, but the chance of a “false positive” finding rises. Thus, the statistics of sample size calculations focuses on balancing the risk of these two types of error by identifying the minimum sample size necessary to detect a difference considered to be meaningful, or to calculate an estimate with believable precision. Another important consideration in fixing the sample size for a public health intervention is financial, in order to maximize the resources available to benefit the target population by keeping measurement costs modest. The per-facility cost of data collection is also subject to an economy of scale, but the decrease in cost for the marginal facility is modest after 30 facilities, based on IHME’s data collection experience in the region.

The precision of the indicator estimate is driven by two factors: the size of the sample, and the population variance of the indicator. For a binary indicator, an estimate near 0 or near 1 will have low population variance. An estimate between .25 and .75 will have higher population variance. Because the sample was selected before RMEI indicators had been tracked or reported in Honduras, the population variance was difficult to estimate a priori, necessitating review of a range of scenarios where population variance and sample size are allowed to vary, as shown in Figure C.1.

Figure C.1: Sample size and corresponding margin of error by population variance

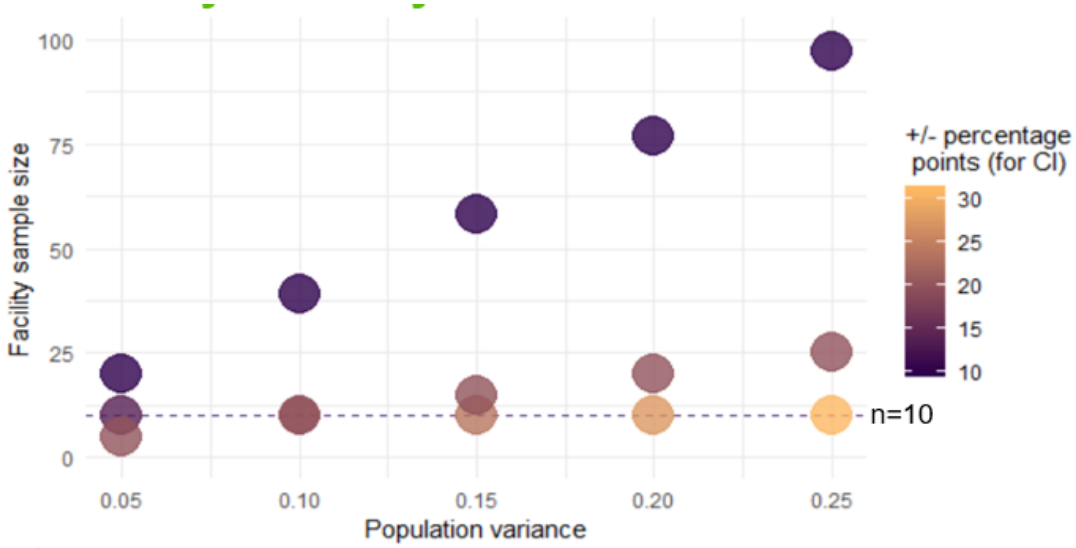


Figure 1. Facility sample sizes and corresponding margins of error across different levels of population variance. Potentially acceptable margins of error range from +/-10 ppts (ideal) to +/-30 ppts (considered high) on either side of the point estimate.

C.2 Sample selection procedures

C.2.1 Selecting health facilities

We prepared the sampling frame of facilities eligible for random selection by identifying all primary care facilities (*Unidad de Atención Primaria de Salud, Centro Integral de Salud, Policlínico,* and *Servicio Materno-Infantil*) in municipalities in malaria strata 3 and 4 based on referral networks and facility lists provided by the Honduras Secretary of Health. Eligible facilities were listed according to whether or not they provide malaria diagnosis by microscopy. Additionally, they were listed according to whether vector control activities (IRS or ITN distribution) were carried out within the catchment area, as noted in intervention activity lists that the Secretary of Health provided to IHME. Primary care facilities were sorted by a random variable and a sample was drawn in four strata: with and without microscopy capacity in malaria stratum 4, and with and without microscopy capacity in malaria stratum 3.

Facilities with vector control activities carried out in the catchment area during 2019 had first priority for selection in each sampling stratum. If all facilities with vector control activity had been selected in a given stratum and spaces still remained in the sample, facilities were selected at random among all eligible facilities in the stratum until the full sample size was reached. Two additional facilities per municipality were selected and added, in random order, to an alternate sample to be used in the case a selected facility could not be surveyed and required substitution.

Next, we built a list of the eligible municipal offices, regional offices, and referral hospitals according to the referral network, including each municipality with primary care units already selected to the sample. This sampling frame consisting of, respectively, municipal offices, regional offices, and hospitals, was sorted by a random variable and the first facilities in the list selected up to a fixed sample size by facility type. The remaining facilities not selected from the sampling frame were ordered and listed to use as an alternate sample in case a facility could not be surveyed and required substitution. We assigned each administrative unit (*"sede municipal", "región sanitaria"*) to the maximum stratum found in its service area (regions with any municipalities in stratum 4 are therefore assigned to stratum 4). The national reference laboratory for malaria was selected with certainty.

C.2.2 Selecting suspected cases of malaria

The data collection team was responsible for compiling and reviewing the full random sample of medical records at each facility. The sample may be selected in one of three ways, depending on the resources of the facility and the type of registries maintained. First, where the facility keeps a list or registry of all fever attentions, this list can serve as the sampling frame. Second, where there is access to a coded digital database of attentions or diagnoses, the sampling frame is extracted based on a list of eligible codes as seen in Appendix B, Indicator 2.01. If there is no fever list nor electronic database, the sample is selected from daily registries or logbooks of all types of attentions, identifying the eligible complaints or diagnoses in the process. In Honduras, the attention registry used for sampling at most primary care facilities is called "ATA" or *"atenciones ambulatorias"*. Some hospitals have electronic registries that could be used instead. The time window for the baseline measurement was the calendar year 2018.

Based on the list of eligible attentions extracted from the digital system or the attention records, interviewers selected the sample manually by first counting the total number of attentions and total eligible attentions during a one-month period during 2018. Next, they entered the totals to the Quotas Module to receive a randomly generated start date during 2018 and a calculated skip interval to use to select records. Using the registry or extracted list, they began at the provided start date, and then skipped through the list searching for eligible cases from 2018 according to the provided skip interval. They made a list of selected records to search out and review, but identifiable patient information was never entered to the survey modules.

C.2.3 Selecting communities

At each selected primary care facility in malaria stratum 4, the field supervisor asked for information about the facility's catchment area, including the number of communities served, name and population of each community, and recent vector control activity in each community (IRS or distribution of ITN). The information was typically obtained from a vector control technician based at the facility. The supervisor input the information to a Sample Selection Module which automated the process of selecting at random among eligible communities served by the facility. If any facilities in the catchment area had received vector control interventions, a community was selected at random among those with interventions. If no communities received interventions or the intervention status of all communities was unknown, a community in the catchment area was selected at random. A second community from the catchment area was selected as a backup in the event that the first community could not be surveyed due to security concerns, logistical challenges, or community refusal of the study.

C.2.4 Selecting households

In order to achieve the desired sample size of 800 households, we sought to complete interviews with residents of 25 randomly selected households in each of the 32 communities selected from the catchment areas of the ambulatory facilities in the health facility sample.

Field staff selected the sample of households using systematic manual sampling techniques with the dwelling as the unit of random selection. For each community, the Sample Selection Module discussed in the previous section output a random integer between 1 and 9 and a randomly selected cardinal direction to use as a starting point, and calculated a skip interval by dividing the total number of households in the community in order to achieve a sample of 25 households completed. If the calculated interval was greater than 9, an interval of 9 was output such that only a single sector of larger communities was surveyed to facilitate field operations. The field team started at the recognized center of the community (such as a plaza, church, or market) and began sample selection in the random direction provided by the sampling module, counting dwellings first to the random start point and subsequently according to the skip interval, along the right hand side of the street. Each selected household was approached to explain the study and request participation. Upon reaching a dead end or reaching the border of the community, field workers made a turn to the right (or turned around) and continued the systematic selection along the right hand side. If a selected dwelling contained more than one household, each of those households was eligible for the survey and counted toward the quota of 25 households per community. If a selected household could not be interviewed due to absence or refusal, it was replaced with the household in the dwelling next door on the right side.

Informed consent was sought from each respondent to the household questionnaire. Occasionally, a survey was refused in course, resulting in a partially complete household result. Because multiple interviewers worked the sample simultaneously, in a handful of instances more than 25 surveys were completed. In the baseline, counts of complete households by community range from 24 to 34 households. Counts of absent households range from 0 to 25 households. Counts of refused households range from 0 to 8 households.

C.3 Sampling weights for the household survey

Household data are weighted by the inverse of the probability of selection according to the Large Country - Lot Quality Assurance Sampling method of Hedt, Olives, Pagano & Valadez (2008) with modifications to adjust to the facility-matched sample design. Estimates in this report take into account sampling weight, clustering, stratification, and the finite population correction.

Where

m = The number of households sampled in community i in the catchment area of facility h

M = The total number of households in the catchment area of facility h

n = The number of communities (each matched to a primary care facility *h*) sampled in the study region

N = The total number of primary care facilities in the study region

$$Weight = \frac{1}{P(ith\ community\ selected) * P(jth\ household\ selected \mid ith\ community\ selected)}$$

$$= \frac{1}{\frac{n}{N}\left(\frac{m}{M}\right)} = \frac{NM}{nm}$$

This report of the Regional Malaria Elimination Initiative (RMEI) Honduras baseline survey was produced in agreement with the Inter-American Development Bank (IDB). All analyses and writing were conducted by the Institute for Health Metrics and Evaluation (IHME) at the University of Washington.

About IHME

The Institute for Health Metrics and Evaluation (IHME) is an independent population health research center at UW Medicine, part of the University of Washington, that provides rigorous and comparable measurement of the world's most important health problems and evaluates the strategies used to address them. IHME makes this information freely available so that policymakers have the evidence they need to make informed decisions about how to allocate resources to best improve population health.

IHME aspires to make available to the world high-quality information on population health, its determinants, and the performance of health systems. We seek to achieve this directly, by catalyzing the work of others, and by training researchers as well as policymakers.

Our mission is to improve the health of the world's populations by providing the best information on population health.

IHME Team

Rebecca Cogen, BA
Data Analyst, IHME

Charbel El Bcheraoui, PhD, MSc
Assistant Professor, IHME

Katie Panhorst Harris, MPA
Evaluation Scientist, IHME

Bernardo Hernandez, MS, DSc
Associate Professor, IHME

Casey Johanns, MPH
Research Manager, IHME

Ali H. Mokdad, PhD, *Principal Investigator*
Professor, IHME

Paulami Naik, MPH
Data Analyst, IHME

Erin Palmisano, MPH
Senior Research Manager, IHME

Max Thom, BS
Data Specialist, IHME

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