THE MEI MALARIA ELIMINATION TOOLKIT

# A Malaria Elimination Guide to Targeted Surveillance and Response in High-Risk Populations

## Module 3: Monitoring Malaria Transmission and Intervention Coverage


The Malaria Elimination Initiative

UCSF Institute for Global Health Sciences



The Malaria Elimination Initiative is an initiative of the UCSF Institute for Global Health Sciences.

shrinkingthemalariamap.org

# Contents

# Key Terms

| | |
|---|---|
| Probability proportional to size (PPS) | In PPS, the probability of selection is not equal. Instead, larger items have a greater chance of getting selected. |
| Simple random sampling (SRS) | A type of sampling whereby each item has the same probability of getting chosen. Use SRS when the units you are sampling (venues or VDTs, depending on the scenario), are similar in size. |
| Time-location sampling (TLS) | A sampling method used to access and survey people at specific venues and times where HRPs are more likely to be present (e.g., forest worksites or border crossing points). TLS seeks to produce a representative sample of high-risk individuals who frequent the kind of venues included in the survey. |
| Venue-day-time period (VDT) | Specific high-attendance time slots at specific venues that are eligible to be included in a survey. |

# Overview of Module 3

Module 3 provides guidance on implementing time-location sampling (TLS) to access and survey people at specific venues and times where HRPs are more likely to be present (e.g., forest worksites or border crossing points). Module 3 supports programs to quantitatively assess the prevalence of malaria infection among HRPs in these sites and track other key indicators such as intervention use and associated risk behaviors. Through repeat surveys using this approach, programs can monitor these indicators over time in specific HRPs.

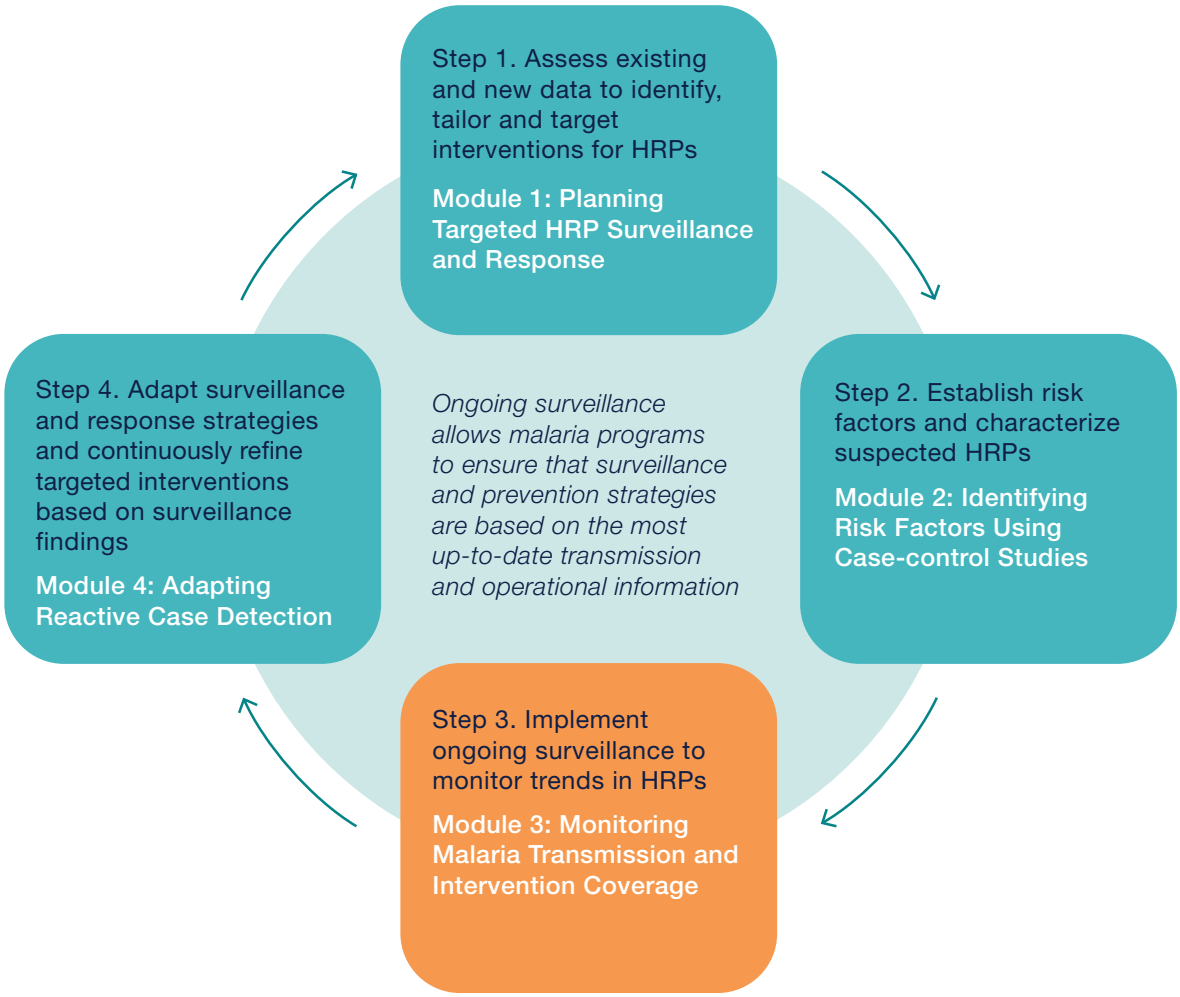
Module 3 is designed to guide project staff during the implementation of surveys using TLS. This module should be adapted to the specific goals and context of the survey and findings from the formative assessment. **The module is written for a target population of forest workers. It can be adapted for use with other target populations.**

Module 3 links with the other modules in the HRP Guide (Figure 1).

This module contains:

- Procedures for recruitment and enrollment
- Procedures for survey participation
- Roles and responsibilities of staff and survey communication
- Documentation and data management
- Forms for field work

**Figure 1: Generating and using evidence: steps in the surveillance cycle for targeting HRPs**



# Introduction to Monitoring Malaria Transmission and Intervention Coverage

## What is Monitoring?

The goal of this module is to estimate the prevalence of malaria infection, related risk behaviors, and access to interventions and health care among forest workers or other HRPs. The project is a component of regular monitoring and evaluation for malaria outcomes and intervention coverage, similar to a malaria indicator survey. survey. However, it is designed to target a specific HRP (e.g., forest workers, who tend to be in the forest during mosquito-biting hours), includes a linked risk factor survey, and employs a specialized sampling method to improve representativeness of the sample. A formative assessment phase including mapping of locations is included in the survey protocol. In accordance with ethical standards, informed consent will be required. Stringent safeguards must be implemented to restrict access to all survey forms and documentation to ensure confidentiality of all data collected by the project.

Proposed procedures include:

- Mapping locations
- Determining high-attendance times at these locations through interviews and direct observation ("enumeration")
- Selecting a representative sample of locations and times for conducting a questionnaire and testing
- Administration of a risk factor questionnaire
- Conducting specimen collection, dried blood spot (DBS) preparation, and malaria rapid diagnostic testing (RDTs) at the survey location

Completion of the risk factor questionnaire and malaria testing are required to participate in the survey. Persons testing positive by RDT should be referred to nearby health facilities for care and treatment.

## Formative Assessment and Rationale for TLS

Prior to finalizing the survey methods, a formative assessment (described in detail in Module 1) must be carried out to gain a better understanding of the operational definition of the target HRP in the local context, and to identify the most suitable sampling and recruitment strategies. In the illustrative example of forest workers for this module, a formative assessment would include direct observation.

### Box 1. A note on the formative assessment

The Formative Assessment should be carried out before finalizing the TLS protocol and this TLS operations module. You can find a separate protocol and operations module for conducting formative assessment in this toolkit. The formative assessment is an important step for planning TLS survey in HRPs that will help determine key information, including:

1. Whether there are accessible locations where identified HRPs are likely to be found
2. Whether members of the population may be missed by surveillance due to asymptomatic infections or limited access to testing
3. Willingness of individuals to participate in the survey, obstacles to participation and ways to overcome them
4. Information about patterns of exposure needed to develop an operational definition of the HRP for surveillance (e.g., seasonal workers who travel from one region to work in another region)
5. Whether TLS and other potential sampling methods are likely to be feasible and effective
6. An initial mapping of venues and estimates of attendance levels, which are necessary to develop the initial sampling frame
7. Additional operational information:
   - » Travel patterns that may influence the timing of the survey, particularly for mobile populations
   - » Gatekeepers who may facilitate or impede access to the population
   - » Measures needed to provide adequate

confidentiality, privacy or legal protections due to any illegal or stigmatized behaviors or mistrust
- » Minimum incentives required for participation
- » Local languages and terminology for the questionnaire
- » Preferences for survey office locations, hours and profile of survey staff

TLS should be used to generate representative estimates of HRP characteristics when all or most members of the population tend to congregate at locations that are identifiable and where it is safe and feasible to approach and enroll individuals in a malaria survey. Depending on details of the local setting, some examples might include:

- Forest workers - at forest work sites, sleeping camps, processing plants, permit offices, supply stores
- Truck drivers – at common rest stops, weighing stations and border crossings
- Agricultural workers – at work sites and roads leading to works sites
- Construction workers – at work sites
- Security guards – at work sites

In general terms, TLS is carried out in four steps:

1. Conduct a formative assessment to plan the survey, including determining objectives and key outcomes, defining the eligible population, determining sample size, and determining the feasibility and appropriateness of TLS in the HRP of interest.
2. Map all venues, days and times that the HRP can be found in numbers large enough to warrant recruitment.
3. Define a complete list of venue-day-time intervals (VDTs)—typically from 2 to 4 hours in duration—when recruitment can be conducted safely and a minimum recruitment quota is likely to be met (the "sampling frame").
4. Randomly select VDTs from the sampling frame and place them on the "sampling calendar" for the upcoming month.
5. Conduct the survey at the scheduled VDTs; at each "sampling event", systematically select among eligible individuals who are present at any time during the entire pre-defined time interval.

A more detailed list of steps—from formative assessment, to pre-implementation fieldwork, to survey implementation—appears in Figure 1 in the Overview section on Project Timeline.

Sometimes, the formative assessment may reveal that there are very few accessible locations for accessing likely HRPs. If this is the case, TLS may not be appropriate and other methods to monitor these populations may be needed, such as peer referral approaches described in Module 4.

## Why Conduct Monitoring?

The purpose of the TLS survey is to estimate levels of infection, risk behaviors, personal protective measures, access and utilization of personal protective measures, and patterns of testing and treatment-seeking among the target HRP using a representative sampling method. TLS can support malaria elimination efforts by generating representative estimates of malaria burden, transmission patterns, and prevention gaps in HRPs that are not easily accessed at their households but can be accessed at other locations, such as work locations or along travel routes. TLS surveys contribute to surveillance efforts by shedding light on patterns of malaria burden and transmission in HRPs; they support program monitoring by producing high-quality estimates of coverage of services and programs. Consecutive TLS surveys can also be used to track trends over time because estimates are representative. How often TLS surveys should be conducted depends on the local context and how quickly key indicators are expected to change. Repeating surveys every 2 to 3 years is likely to be adequate for tracking trends in most malaria elimination contexts. Specific objectives include:

- Identify specific venues and times where high-risk individuals congregate.
- Develop a representative estimate of the prevalence of malaria and associated risk factors among high-risk individuals.
- Identify determinants of access and utilization of interventions and fever case management services among high-risk individuals.
- Enhance the national capacity to conduct targeted surveillance among HRPs in order to identify and eliminate remaining reservoirs of malaria.

## TLS Overview

The following describes TLS methods for obtaining estimates of malaria prevalence and associated risk factors from venues. Mapping and enumeration of venues were conducted first during the formative assessment phase. The mapping exercise identified all potential venues and times where forest workers can be recruited. Venues were categorized as work sites and off-site locations. Work sites were classified as logging sites, mines, agricultural (plantations or farms), cattle ranch, and other.

Staff should conduct additional fieldwork prior to beginning the survey, in order to update and validate the information obtained during the formative assessment, since in many contexts venues and patterns of venue attendance can change rapidly. Therefore, staff should conduct a second round of mapping and enumeration (the first having been conducted during the formative assessment). Specifically, staff should visit the venues identified during the formative assessment at the expected time intervals of high attendance to carry out standardized counts of patrons who appear to fit the eligibility criteria (enumeration), conduct brief interviews with venue owners and/or key informants on site, and obtain approval of venue owners or managers to conduct recruitment inside or outside these venues during the implementation phase.

Based on the updated mapping and enumeration counts, staff should update the list of venues and associated VDTs (typically 2 to 4 hours in duration). They should then construct a sampling frame, which is a list of all VDTs expected to result in at least eight eligible forest workers in order to ensure that valuable staff time and resources are not wasted by conducting recruitment at low-attendance VDTs.[1]

Once the sampling frame is finalized, VDTs should be randomly selected and placed on a "sampling calendar" as "sampling events" for the upcoming month. Toward the end of each month, the sampling frame for the next month will be updated to reflect any recently closed or new venues, new VDTs should be randomly selected, and a sampling calendar for the upcoming month should be developed. See the Appendices for step-by-step examples on how to select VDTs and develop the sampling calendar, as well as guidance on how to carry out random selection.

Staff should designate an interview location at each venue, in coordination with venue owners, and based on visits to the venue during the formative assessment phase and the "fieldwork prior to survey" phase. Interview locations should be selected to ensure confidentiality of the participant. Typically, TLS interviews are conducted in a private room at the venue or in a tented area or mobile vehicle nearby the venue.

Staff must obtain permission from venue officials (e.g., owner or manager) to recruit forest workers at or nearby the venue in order to include the venue in the sampling frame. This may not be necessary if the venue is a public space, such as a bus stop, where there are no such venue officials.

The field coordinator should notify venue officials that the team will conduct the survey one or two weeks prior to recruitment and upon arriving to the venue on the scheduled day and time. The coordinator will also be responsible for ensuring the appropriate information is collected prior, during and after each recruitment event.

Unique ID codes will be assigned to each venue and survey participant.

## Survey Population

### Participant eligibility criteria

Participation in the survey is subject to eligibility criteria based on risk, determined through Module 1 and 2 or other methods. For the forest worker example presented in this module, participants must meet all of the following inclusion criteria:

- Age ≥ 15 years (if age is 15 to 17, a legal guardian must provide consent)
- Able to speak one of the survey languages
- Worked in the forest in the past 60 days
- Was at a forest work site sometime between sundown and sunrise in the past 60 days, whether working or sleeping
- Approached by survey staff at one of the randomly selected venues, days and times
- Provides informed consent to participate

### Exclusion criteria

However, individuals may not participate if they meet any of the following:

- Not capable of providing informed consent (e.g., due to sleep deprivation or under the influence of alcohol or drugs)
- Previous participation in the survey in the past 30 days

1 This minimum should be appropriate for the local context. See Box 2 (Choosing a minimum number of expected participants for VDTs).

Repeat participation is allowed after 30 days given the possibility of malaria re-infection. Nationality and citizenship will not be inclusion or exclusion criteria because foreigners may be affected by malaria in the area.

## Venue and VDT eligibility criteria

Study participants will be recruited from venues where forest workers tend to gather at specific times. Recall that recruitment will be carried out only at selected venue-day-time intervals, each of which will last about from 2 to 4 hours. To be included in the sampling frame, venues and VDTs must meet these eligibility criteria:

- The venue is geographically accessible
- It is safe for project staff to conduct the survey at the VDT
- Permission is provided by the venue owner/manager (if applicable)
- The number of survey participants expected during the entire duration of the VDT is at least 8 (See Box 2 below)

### Box 2. Choosing a minimum expected number of participants per VDT

TLS surveys often set a minimum expected number of participants for VDTs to be considered eligible for inclusion in the sampling frame. This is for logistical reasons, to avoid wasting valuable staff time and resources on sampling events that are likely to result in few new study participants. This minimum is often set to 6 or 8 participants in TLS surveys. However, there is no fixed rule and in some settings a lower or higher figure may be appropriate. Choose a minimum number that makes sense for your context by reviewing the enumeration counts and other information you have about expected attendance levels. Be careful not to set a threshold that is too high:

- A high threshold might jeopardize the survey's ability to meet the overall required sample size.
- A high threshold might exclude unique subgroups.

For example, consider the effect of setting a minimum of 8 forest workers per VDT in a survey in which attendance is expected to be less than 8 participants at logging VDTs, and greater than 8 participants at mining VDTs. This would clearly lead to under-representation of loggers in the survey.

As another example, if families tend to work at some work sites, while other sites are run by large companies, then a high minimum number could end up excluding the entire family worker "sector" from the survey. In general, consider the effect your choice of threshold may have on specific sub-groups relevant to the survey.

## Survey sites

The example survey will take place in [INSERT location]. Survey sites should be chosen based on the following factors or information:

- Passive surveillance or case investigation suggests risk factors related to forest work.
- Formative assessment suggests there are many forest workers present in the forest during mosquito biting hours.
- Formative assessment suggests TLS is a viable method for representative sampling, given that there are several venues where forest workers congregate, most of these venues would be safe and accessible to conduct a survey, and venue owners/managers and population members interviewed suggest they are willing to support and participate in a malaria survey.

*[Example language regarding survey sites and sample size, to be adapted to suit your project.]*

The survey will aim to recruit 710 participants per survey site. This is the minimum needed in order to:

- Estimate malaria parasite prevalence among forest workers with a maximum error of +/- 2%
- Detect a change in parasite prevalence between the present survey and a future survey, assuming that prevalence among forest workers will be reduced from 4% to 0.5% or less.
- Detect a statistically significant difference in parasite prevalence between forest workers and the general population (e.g., from a household survey), assuming forest worker prevalence is 4% or greater and household prevalence is 0.5% or lower.

Table 1 summarizes the required sample sizes to produce these estimates and comparisons.

**Table 1. Sample sizes for desired estimates and comparisons**

| Desired estimate or comparison | Assumed parasite prevalence | Required sample size (no. survey participants) |
|---|---|---|
| Estimate current prevalence among forest workers with ≤ 2% error | 4% | 711 |
| Detect a decline in parasite prevalence among forest workers over time | Current survey: ≥ 4% Future survey: ≤ 0.5% | 617 in both surveys |
| Detect elevated risk among forest workers compared to general population in same area | Current survey: ≥ 4% General population: ≤ 0.5% | 617 in both surveys |

The key inputs to the first sample size calculation (prevalence estimate) are:

- A finite population correction, assuming a total of 10,000 forest workers in the project area (a rough estimate based on findings from the formative assessment)
- A design effect (DEFF) of 2.0 in the current survey (due to clustering among venues/VDTs)

For the second and third calculations (comparisons), the key assumptions are:

- A DEFF of 2.0 in a future forest worker survey
- A DEFF of 2.0 in the survey used to generate the estimate for the general population (e.g., a household survey)
- A continuity correction

All of the sample size calculations assume 80% power and a 95% confidence level. See Appendix 17 for sample size formulas. This Module also includes sample size spreadsheets that you can use to calculate sample size for the survey and explore how the required sample size would change under different assumptions.

In this example, staff will aim to recruit 711 forest workers. This is the minimum sample size required to provide the statistical precision necessary to produce useful estimates (see protocol for sample size calculation). Key factors that determine the survey's ability to attain this sample size are shown in Table 2. Much of this information should be drawn from information gathered during the formative assessment and fieldwork prior to survey (e.g., number of forest workers expected per event, rate of willingness to participate, overlap) while others are up to the survey team and can be adjusted (e.g., months of data collection, number of Interviewers).

**Table 2. Example inputs to determine the survey's ability to attain sample size**

| Planning input | Value |
|---|---|
| Months of data collection | 5 |
| Number of sampling events per month | 15 |
| Expected forest workers per sampling event (i.e., VDT) | 12 |
| Expected percent of forest workers willing to participate | 90% |
| Expected percent of forest workers encountered at an event who were already enrolled during previous events (i.e., % overlap) | 10% |
| Number of Interviewers assigned to each event | 4 |
| Time required to enroll a participant | 60 minutes |
| Average duration of a sampling event (i.e., the duration of an average VDT) | 3 hours |

Based on the above inputs, we first determine **the number of venue-goers available to recruit per month** (regardless of whether we have enough Interviewers to recruit them):

(# events per month) x (forest workers per event) x ( % willing to participate) / (1 + overlap) = 15 x 12 x (0.9) / (1 + 0.1)

This yields 147 venue-goers that would be available to recruit each month. Because the survey aims for a total sample size of 711 participants, and the survey will last 5 months, each month the survey needs to recruit a minimum of 143 (=711 / 5) participants. The minimum needed per month (143) is less than the number expected to be available per month (147); thus there are enough potential participants to meet sample size goals.

We now determine the survey team's capacity to enroll enough participants. The number of participants staff would be able to enroll each month (regardless of the actual number of forest workers present) is:

(# Interviewers) x (duration of a sampling event) x (# events per month) / (time required to enroll a participant) = 4 x (3 hours x 60 minutes/hr) x 15 / (60 minutes)

This gives a capacity to recruit a maximum of 180 participants a month, which is more than the 147 required; thus the team size is large enough.

These calculations can be made using the Recruitment Planning Tool in Excel, available for download. Calculations should explore how key planning inputs would affect recruitment goals (e.g., months of data collection, number of Interviewers per event, sampling events per month, time to enroll a participant) and to decide what parameters may need to be changed. For example, the team's capacity to recruit participants can be increased by increasing the number of Interviewers or reducing the time to enroll each participant (i.e., by shortening the questionnaire).

The parameter most difficult to estimate will be the percent overlap. This is likely to be a best guess. Consider factors such as turnover in the overall worker population and how often each venue will be visited.

## Project Timeline

Data collection will begin during Q1 of Year 1 and will continue for approximately 5 months. The project report will be disseminated after 12 months after the start of data collection. See timeline below (Figure 2).

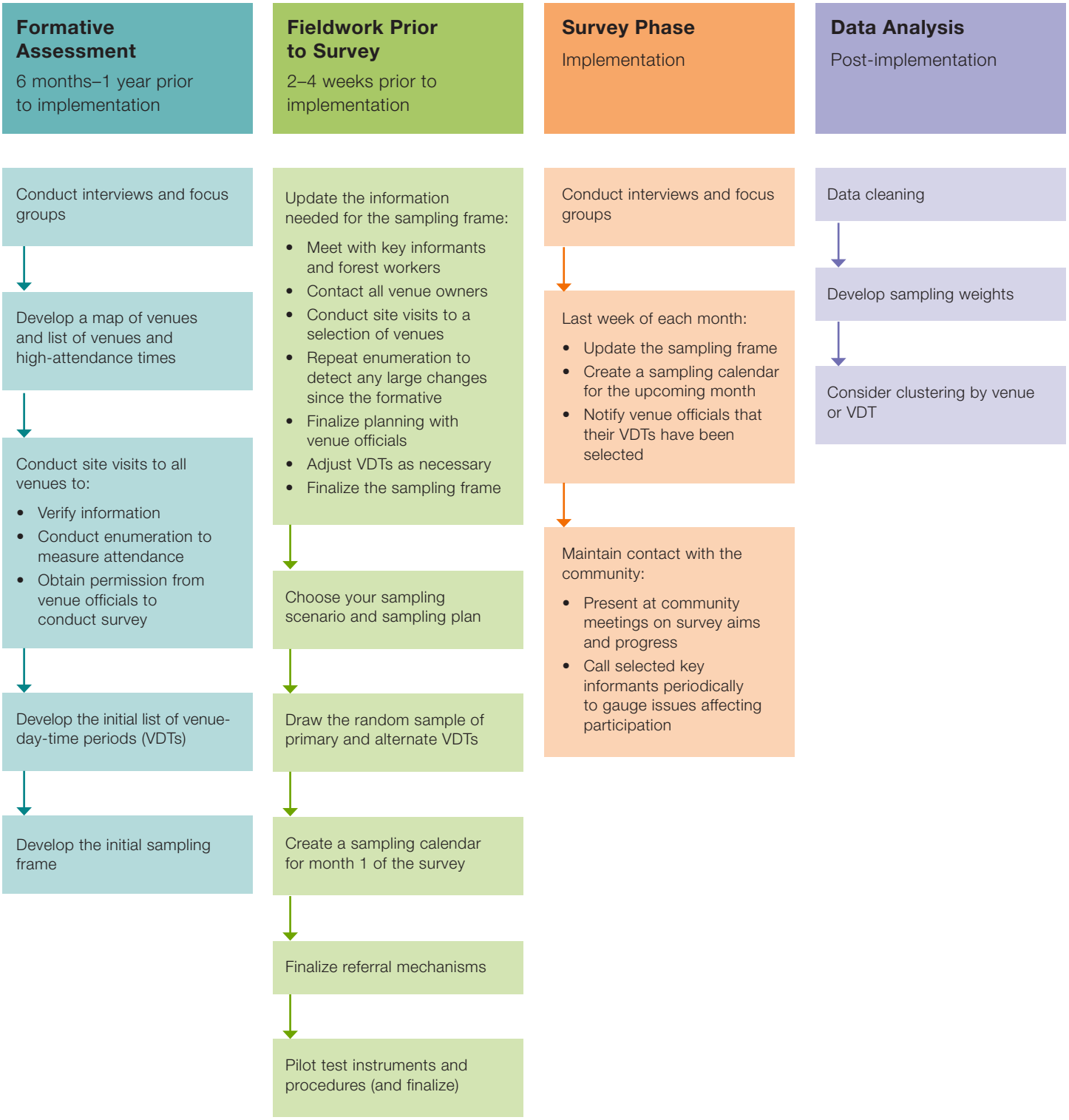
To determine approximately how many months will be needed to meet the required sample size, use the Recruitment Planning Tool in Excel, available for download with this module.

Figure 3 shows the key steps that should be conducted across the different phases of the TLS survey, during the formative assessment, fieldwork prior to survey, and the survey itself. The formative assessment is described in a separate protocol and operations guide, Module 1. The remaining two phases—fieldwork prior to survey and survey phase—are described in the next sections of this document.

**Figure 2. Timeline**

| | Year 1 | | | | Year 2 | | | |
|---|---|---|---|---|---|---|---|---|
| | Q1 | Q2 | Q3 | Q4 | Q1 | Q2 | Q3 | Q4 |
| **Preparation** | | | | | | | | |
| Formative assessment (Module 1) and protocol development | ■ | | | | | | | |
| Ethics submission and approval | | ■ | ■ | | | | | |
| Hiring staff | | | ■ | ■ | | | | |
| Trainings and pilot testing | | | | ■ | | | | |
| **Study commencement** | | | | | | | | |
| Mapping, development of sampling frame and sampling calendar | | | | ■ | | | | |
| Field data collection | | | | ■ | ■ | | | |
| Laboratory assays | | | | ■ | ■ | ■ | | |
| Data analysis, preparation of project report and manuscripts | | | | | | ■ | ■ | ■ |
| Local dissemination of findings | | | | | | | | ■ |

## Figure 3. Major steps of the TLS survey



# Fieldwork Prior to Survey

Following the formative assessment and 2 to 4 weeks before implementation begins, additional fieldwork should be conducted to finalize planning and logistics, update the sampling frame, and develop a sampling calendar. Although much of this information should already have been gathered during the formative assessment, it is important to update it as venues and attendance patterns can change rapidly.

## Update the Sampling Frame

A sampling frame is a list of VDTs. Examples are included in Appendices 4–5. VDTs are specific high-attendance time slots at specific venues that are eligible to be included in the survey (e.g., Secret Gold Mine, Tuesdays from 17:00 to 21:00). Each month during the survey, VDTs will be randomly selected from this list and field teams will recruit venue-goers during the specific time slots specified by the VDT. The sampling frame should also contain the information below for each VDT:

- Name of the venue
- Day, start time, and end time
- Location details or address of the venue
- Contact information of the venue owner/manager
- Number of forest workers expected during the VDT
- A unique venue ID
- A unique VDT ID

Sampling frames are typically stored as tables or spreadsheets. Table 3 shows an example.

Note the "day" can be:

- A recurring day of the week, like "Thursdays"
- A recurring date, such as "3rd Thursday of the month"
- A specific date, such as "14 March, 2017"

**Table 3. Example format of a sampling frame**

| Venue ID | Venue name | VDT ID | Day | Time | # Forest workers expected at this time |
|---|---|---|---|---|---|
| B001 | Rigos Mine | B001-1 | Wednesdays | 20:00-22:00 | 10–15 |
| B001 | Rigos Mine | B001-2 | Thursdays | 20:00-22:00 | 8–10 |
| B001 | Rigos Mine | B001-3 | Fridays | 19:00-23:00 | 15–20 |
| E001 | Smith Processing Plant | E001-1 | Mondays | 05:00-08:00 | 40–60 |
| E001 | Smith Processing Plant | E001-2 | Mondays | 12:00-16:00 | 30–40 |
| C001 | Ishowe Palm Plantation | C001-1 | Mondays | 20:00-23:00 | 5–10 |
| C001 | Ishowe Palm Plantation | C001-2 | Tuesdays | 20:00-23:00 | 5–10 |
| C001 | Ishowe Palm Plantation | C002-3 | Thursdays | 08:30-10:30 | 20–25 |
| C001 | Ishowe Palm Plantation | C002-4 | 3rd Thursday of the month | 20:00-23:00 | 5–10 |

*Note: other information such as venue location and contact information not shown*

## Step 1. Assemble the preliminary sampling frame

Begin with the preliminary sampling frame developed during the formative assessment. The formative assessment findings include information obtained from interviews, focus groups, and visits to the venues identified at that time. Be sure the sampling frame has all of the information described above.

## Step 2. Gather information to update the sampling frame

Carry out the following steps 2 to 4 weeks prior to implementation to update the sampling frame and finalize details of coordination with venues. These activities are typically led by the Local Survey Coordinator, together with any Interviewers available prior to implementation:

1. Meet with selected key informants from the formative phase and at least 3–5 forest workers in the area to review the map and complete list of venues. Identify any new venues and any that are no longer active.
2. Contact venue owners/contacts of all venues to confirm:
    a. details about location and accessing the site
    b. that the venue is still active and will be active during the first month of the survey
    c. permission to conduct the survey
    d. safety of conducting the interviews and testing at the venue
    e. days and times when the number of forest workers at the venue typically meets the VDT eligibility criteria (i.e., ≥ 8)
    f. any patterns in the types of individuals that tend to be present at the different days and times (e.g., due to work shifts, travel patterns)
3. Visit venues to take a new enumeration (a first count should have been conducted during the formative assessment) and finalize planning:
    a. Conduct a site visit to a small number of the venues contacted (i.e., 5–10) and all venues that could not be contacted, during days and times when high attendance levels are expected.
    b. During site visits:
        i. Conduct enumeration to update the expected count of forest workers at the VDT. Stay for the entire VDT to obtain an accurate count.
        ii. Check whether the count taken this time around differs dramatically from the count taken previously (during the formative assessment). If so, try to determine the cause of the difference and whether new enumeration counts may be needed at some other VDTs. Speak with the owner, manager or staff present to determine what may have changed. You may begin by asking whether attendance was similar, higher, or lower than usual for that day and time.
        iii. Meet with the venue/owner to remind them of the survey, review survey procedures, confirm the days and times included in the sampling frame, and confirm permission to conduct the survey.
        iv. Make a rough map of the venue and surroundings. Designate specific areas where venue-goers will be intercepted. Identify discrete places at or nearby the venue where participants will be interviewed and tested. Review these plans with the owner/manager. (See sample venue map in Appendix 8.)

## Step 3. Refine the list of VDTs included in the sampling frame

With the information gathered in Step 1 and during the formative assessment, you are now ready to make any adjustments to finalize the VDTs in the sampling frame.

First, finalize the list of venues:

1. Add any new venues identified.
2. Remove any closed or inactive venues.
3. Remove any venues that do not have permission from venue officials.

Then, adjust the VDTs:

4. Make sure VDTs are listed for all venues. As a starting point, list all days and times with highest attendance (peak times), in 2- or 4-hour blocks.
5. Remove any VDTs that are not safe and accessible
6. Adjust the timing and duration of the VDTs. VDTs do not all have to be the same length: some can be 2 hours, some can be 4 hours, or even longer. However, make sure VDTs meet the following conditions:
    a. VDTs should be short enough that survey staff are able to be present the entire time.

b. VDTs should meet the minimum number of expected participants defined for the survey (See Box 2). To approximate the expected number of participants at different days and times, use the information from enumerations and discussions with venue officials. You may need to adjust the start and end time to ensure enough expected participants. Venues where there are not likely to be enough participants during any reasonable time slot should be excluded from the sampling frame.

c. To the extent possible, VDTs should have approximately the same number of expected participants.[2] This may not be possible in all cases, especially when venues have very large differences in attendance. You can increase the expected number of participants by lengthening a VDT and decrease the number expected by shortening a VDT.

d. Consider shifting times to when venue-goers are more likely to participate. For example, to recruit workers, consider defining VDTs that are during breaks or just after working hours; if workers sleep on site, consider VDTs that are after hours or on a day off. However, be careful not to exclude a unique subgroup.

7. Finally, determine if there are large differences in the number of VDTs per venue (for example, if some venues have 4 VDTs and other venues 1 VDT). Large differences can lead to bias in some of the sampling approaches described in the next section. To reduce potential bias, consider keeping at most three or four VDTs per subgroup per venue. See Box 3 for more details.

2 This will improve the precision of the estimates from the study by reducing the error that comes from clustering of participants within VDTs.

## Box 3. Defining VDTs that reflect population subgroups

If some venues have many VDTs and others few VDTs, bias may result. To avoid bias, think about the VDTs in terms of the different population subgroups they tend to represent.

Specific venues and times are likely to represent different types of individuals – they may vary in terms of demographic characteristics, type of work, migrant status, travel route, expected level of risk or other key outcomes.

For example, some VDTs may tend to reflect younger loggers while other VDTs reflect older loggers. Some VDTs may be likely to represent agricultural workers at large company farms while other VDTs represent family farmers. More generally, you may anticipate that different VDTs may reflect:

- Different ways of working
- Day workers vs. evening workers
- Different demographic profiles (age, sex, place of origin)
- Migrants vs. non-migrants, or people who travel along different routes
- Other key differences that may be related to risk or other key outcomes

Beginning with your preliminary sampling frame, write down next to each VDT the subgroup you feel is most represented. Then review the list and delete VDTs until there are no more than 3 or 4 VDTs for each subgroup you expect to be at the venue over the course of a month.

## Examples of defining VDTs

Here we illustrate how to think through the process of defining VDTs to include in the sampling frame in different situations.

### Example 1: Different work places with minor day-to-day changes in workforce

In this example, we envision 15 mines at different locations in the forest. Each mine is run by a different company with different policies that may affect malaria protection and risk. Working hours are Monday to Thursday from 6am to 6pm. Companies house workers in sleeping quarters located near the mines and workers generally stay for weeks at a time. After visiting each mine, we find that all locations are within a short 2-hour drive of the nearest health facility (where survey staff will be based), conditions appear safe to conduct the survey on site, and managers and owners are open to the study. Owners tell us that there are few changes in staff from one day to the next, although some workers may return home one or two days per week for personal reasons; turnover due to hiring and firing of workers per month is about 20%. All 15 mines have similar numbers of staff, at about 30–40 workers per mine. Formative assessment interviews and focus groups with workers and community members confirms this and identifies specific risk factors related to working and sleeping conditions, entomology, and limited use of prevention.

### Defining the VDTs in Example 1

In this example the 15 mines are the venues. Because all venues are safe, accessible, and permission is granted, all will be included in the sampling frame. In adjusting the VDTs, we consider the points listed at the beginning of this section:

- Since staffing levels are similar each day, there are no peak times.
- Supposing our minimum number of expected participants is 25 per VDT, on any given day the number of workers at each mine would exceed this minimum.
- There are some changes in the workers present each day because of workers returning home, so we define one VDT per day per venue.
- We expect workers will be more able to participate after work hours, so we set the VDTs from 6pm to 10pm at the sleeping quarters.

Table 4 shows preliminary VDTs for two out of the 15 total companies (additional details such as venue locations, contacts, and number of expected workers, are not shown).

**Table 4. VDTs at two mines for Example 1**

| Venue | Day | Time |
|---|---|---|
| Company 1 mine | Mon | 18:00–22:00 |
| Company 1 mine | Tue | 18:00–22:00 |
| Company 1 mine | Wed | 18:00–22:00 |
| Company 1 mine | Thu | 18:00–22:00 |
| Company 2 mine | Mon | 18:00–22:00 |
| Company 2 mine | Tue | 18:00–22:00 |
| Company 2 mine | Wed | 18:00–22:00 |
| Company 2 mine | Thu | 18:00–22:00 |

We could make our survey logistics easier by limiting data collection to particular days (e.g., Mondays and Wednesdays), since the number and type of workers present are similar from one day to another. However, we retain all the VDTs above in order to allow for recruitment on all four days during the week, in order to speed up the survey.

Finally, the number of VDTs is the same at each venue, so does not create any potential problem for bias.

### Example 2. Venues in similar settings and key differences in workforce across days and times

In this example, independent workers frequent a loosely connected series of mining sites spread out over a 20km stretch of two rivers and nearby tributaries; sites are relatively close (2 to 5km) to one another. Most workers go to the mines Monday to Wednesday due to greater availability of transportation, returning home each day. The formative assessment reveals mosquitoes are observed at all sites and that most workers either work during the day or evening but not both, leading to two clear subgroups: day workers and night workers. Day workers may be at risk due to night-time travel, and night workers due to working at night. Individuals tend to stay several hours at the mine and tend to work at the mine only 3 to 6 days per month. At all sites, there are about 30 workers present during any given 4-hour period between 7am and 2pm and from 6pm to 11pm from Monday to Wednesday. Many workers sift raw material from the mine at a processing plant in town, most often from 8am to 12pm Tuesdays and Thursdays, although many others do not use the plant, processing the materials instead at the mines or at home. Most mining sites are within a day's drive of our survey office, however one site is claimed by a local rebel group; when approached, rebel leaders were not open to participating in the survey.

### Defining the VDTs in Example 2

As before, we are guided by the points listed at the beginning of this section. In defining the venues, we are tempted to limit the survey to the processing plant, which, although it poses no risk itself, is a convenient location to recruit at-risk workers from many sites. However, because many workers do not use the plant, we include the mining sites as venues as well. We exclude the site associated with the rebel group since it is potentially dangerous to survey staff. We are careful to record this decision in our notes as a potential limitation of findings. In defining the VDTs, we consider the following:

This is a fluid venue-going population with different venue-goers likely to be present from one day to the next. We define VDTs to reflect daytime and evening workers at times when workers tend to take breaks (11am to 2pm and 5pm to 8pm), when they will be more likely to participate in the survey.

Our minimum number of expected workers per VDT is 10. Since 30 workers are present in a 4-hour period, we estimate that 22 would be present in a 3-hour period (22 = 3 x (30/4)). Of these, we estimate that about half, or 11, will be new to the survey and willing to participate, based on formative assessment findings. A 3-hour VDT also leaves enough time for staff to travel to and from the mine in a single day.

At the processing plant, we include two VDTs, one each day on Tuesdays and Thursdays; we estimate we can recruit 10 new participants in two hours time from 10am to 12pm when workers are often just finishing their shift.

Finally, we need to note that the number of VDTs per venue is quite different (6 VDTs at each mine and 2 VDTs at the plant); therefore, we must note the main subgroup that is represented by each VDT and ensure that we have no more than 3 or 4 VDTs per venue per subgroup. Here, we do not have a problem because we have 3 VDTs per venue per subgroup.

Table 5 shows VDTs for the processing plant venue and two (of the many) mining site venues included in our sampling frame.

**Table 5. VDTs at two mines and a processing plant for Example 2**

| Venue | Day | Time | Subgroup |
|---|---|---|---|
| Mining site 1 | Mon | 11:00–14:00 | day workers |
| Mining site 1 | Tue | 11:00–14:00 | day workers |
| Mining site 1 | Wed | 11:00–14:00 | day workers |
| Mining site 1 | Mon | 17:00–20:00 | night workers |
| Mining site 1 | Tue | 17:00–20:00 | night workers |
| Mining site 1 | Wed | 17:00–20:00 | night workers |
| Mining site 2 | Mon | 11:00–14:00 | day workers |
| Mining site 2 | Tue | 11:00–14:00 | day workers |
| Mining site 2 | Wed | 11:00–14:00 | day workers |
| Mining site 2 | Mon | 17:00–20:00 | night workers |
| Mining site 2 | Tue | 17:00–20:00 | night workers |
| Mining site 2 | Wed | 17:00–20:00 | night workers |
| Processing Plant | Tue | 10:00–12:00 | day and night workers who use the plant |
| Processing Plant | Thu | 10:00–12:00 | day and night workers who use the plant |

## Develop the Sampling Calendar

### Step 1: Determine the Sampling Scenario and Sampling Plan

With the VDTs defined, the next step is to define how you will randomly select VDTs to recruit from each month, and how you will schedule the selected VDTs onto a "sampling calendar." See Appendix 3–4 for an example of a sampling calendar. It is important to note that there is no one TLS sampling method. In TLS, the sampling approach needs to be appropriate to the context of venues and attendance patterns in the project area. Your sampling plan will depend on key features of your project site: the total number of venues; how frequently workers change over time; and whether you expect greater differences in your key survey outcomes (e.g., malaria prevalence, use of prevention) between venues rather than over time at the same venue. The first step to define your sampling approach is to determine your "sampling scenario". Below we describe different sampling scenarios and the general approach that is appropriate in each case.

Choose the Sampling Scenario below that best describes your setting. Then follow the guidance for your scenario for how to select and schedule VDTs

each month. Table 6 at the end of this step provides a summary of the scenarios.

### Sampling Scenario 1 – Important differences between venues, minor differences over time

This scenario is similar to Example 1 in the previous section. In this kind of scenario, you expect that the workers you find at different venues will differ greatly in terms of key outcomes of interest. Thus, you wish to include as many different venues as possible in the survey, in order to capture all of the possible variation across venues in your project area. On the other hand, you suspect that it will not be useful to recruit over and over again from the same venue in a given month because you will end up recruiting more or less the same people; this will not give you much new information. Therefore, the sampling plan for this scenario does not allow recruitment more than once at the same venue in a given month. See below:

*Sampling plan for Sampling Scenario 1: Each venue is visited at most once per month*

**Select venues:**

1. Each month, randomly select n venues (i.e., the number of desired sampling events for the month) from the sampling frame. Select from the complete list of venues each month, including those that were selected previously. Random selection can be done automatically using a computer program such as Excel.

**Select and schedule VDTs:**

2. Arrange the selected venues in order from the venue with the fewest VDTs to the venue with the most VDTs.
3. Beginning with the venue with the fewest VDTs, randomly select a VDT.
4. Place the selected VDT on the first available day of the sampling calendar for the upcoming month.
5. It may happen that the calendar is fairly full already and you can not find any dates open to schedule the selected VDT. In this case, follow the guidance under 'Sampling Event Conflicts' under the section 'Practical considerations for the sampling calendar' on page 18. In brief, you can postpone the VDT until next month; and if there is also no open slot available next month, you can randomly select and schedule another VDT at the same venue for this month (i.e., the upcoming month).
6. Repeat steps 3 and 4 for the next venue in the list. Continue until one VDT has been scheduled at each of the selected venues.

*Sampling plan for Sampling Scenario 1 using sampling with probability proportional to size (PPS)*

In Scenario 1, we may want to take a slightly different approach if there are large differences in the number of expected participants between venues. For example, imagine a situation where some venues have 100 workers and others have just 20 workers. With such large differences, we could conduct recruitment more rapidly by selecting larger venues more often. That is, when we randomly select venues, we allow larger venues to have a better chance of being selected. This is done by probability proportional to size (PPS) sampling (See Step 2 later in this section for details). PPS can also be used in Sampling Scenarios 2 and 3 below.

### Sampling Scenario 2 – Important differences over time, minor differences between venues

This scenario is similar to Example 2 in the previous section. In contrast to Scenario 1, here we expect more differences in attendance patterns over the course of a typical month. Workers might turn over more frequently, there might be different groups working different hours or shifts, which divide workers in ways that might be related to survey outcomes, or other dynamics that lead to different attendance patterns over time. Because we expect considerable changes in the workers present over the course of the month, in this scenario, the sampling plan allows us to select multiple VDTs for each venue in a given month. However, a given VDT can only be selected once per month, at most.

*Sampling plan for Sampling Scenario 2: Venues can be visited repeatedly each month, at different times*

Beginning with the complete list of VDTs in the sampling frame (excluding any "exceptional" or non-random events), assign a random number to each VDT. This can be done automatically using a computer program such as Excel.

Arrange the VDTs in order from the lowest to the highest of the randomly assigned numbers. Now the list of VDTs is in a random order.

Schedule the first VDT on the list (the one with the lowest random number), by placing it on the first day and time slot available on the sampling calendar. If no days are available for that VDT during the month, schedule it on the first day available of the following month.

Next schedule the second VDT on the list (the one with the next lowest random number) and again place it on the first day and slot available on the sampling calendar.

Continue down the list of VDTs until the calendar for the upcoming month is filled. Note that in a given month, some VDTs will be scheduled and some will not be scheduled.

### Sampling Scenario 3 – Few venues, some variation over time

In this scenario your limiting factor is that you have a small number of venues in your project area. You also suspect there may be at least some differences in the workers present at the venue at different days and times over the course of a month (i.e., the worker population is not fixed). To meet your sample size target for the survey, you believe it is critical to be able to conduct multiple sampling events at the same venues during a given month.

*Sampling plan for Sampling Scenario 3*

Follow the sampling plan under Scenario 2.

### Sampling Scenario 4 – Few venues and fixed worker population

Here you have few venues and the workers present tend to be fixed over time (as in Scenario 1). In this case, there is little justification for sampling by location and time. Instead, it may be more appropriate to periodically take a complete census of workers at all venues, rather than randomly selecting VDTs. In this case, the survey is more similar to a series of censuses over time than TLS. How often should you conduct the censuses? Consider how rapidly conditions change that would affect survey outcomes: infection rates, use of prevention, treatment-seeking and/or intervention coverage. Note that even though the workers themselves may not change over the survey period, rates of infection may change.

*Sampling plan for Sampling Scenario 4: Conduct a census of workers at each venue once, or periodically*

Plan to carry out recruitment at the peak attendance time at each venue once during the survey, or periodically.

**Table 6. Sampling scenarios and recommended sampling plans**

| Sampling Scenario | Description | Example | Sampling plan |
|---|---|---|---|
| Scenario 1 | Important differences between venues, minor differences over time<br>• Venues are very different from one another<br>• Days and times at the same venue are not so different | Many forest mines organized under different employers. Staff are similar over time, and turnover is generally less than once per month. | Sample in two stages:<br>1. Randomly select venues<br>2. From each selected venue, randomly select 1 VDT<br>• This will result in conducting at most 1 sampling event at a given venue each month |
| Scenario 2 | Important differences over time, minor differences between venues (e.g., high turnover, work shifts) | Many mining locations relatively close to one another. Independent workers come and go fluidly over days and weeks | • Randomly sample VDTs<br>• This will allow for multiple sampling events at a given venue each month |
| Scenario 3 | Few venues, some variation over time | 4 mines with fluid worker populations or day/night shifts | • Follow sampling plan for Scenario 2 |
| Scenario 4 | Few venues and fixed worker population | 4 mines organized under different employers with minimal monthly turnover | • Conduct a worker census at all venues, once or periodically, depending on how frequently key outcomes are expected to change<br>• No sampling of venues or VDTs |
| In Scenarios 1–3, if there is large variation in number of workers across venues, follow the sampling plans above, but use PPS when selecting venues and/or VDTs. | | | |

### Complex Scenarios – None of the above accurately describes your situation

If you find that none of the scenarios above fits your context well, consider going with the closest scenario and adjust the sampling plan accordingly. Note that the spirit of TLS is random selection of locations and times in a way that produces representative estimates of the target population. There is no fixed rule for how to select the sample that can fit all contexts perfectly; there is room for flexibility. Consider seeking statistical support to ensure adherence to basic statistical principles for cluster sampling.

## Step 2: Decide on the approach for random selection

If your sampling plan includes selecting venues and/or VDTs randomly (as in Sampling Scenarios 1–3), a key decision is how to carry out the random selection. This decision should be based on the relative size of venues and VDTs in the project area.

First, determine the size of each venue and VDT:

- VDTs: Measure the size of the VDT as the number of workers expected from start to finish of the VDT. This information should already be in the sampling frame.
- Venues: Measure the size of the venue as the sum of total expected workers across all VDTs at the venue. This can be calculated in Excel using a PivotTable.

Next, choose a random sampling approach:

- Simple random sampling (SRS)

  In SRS, each item has the same probability of getting chosen. Use SRS when the units you are sampling (venues or VDTs, depending on the scenario), are similar in size.

- Probability proportional to size (PPS)

  In PPS, the probability of selection is not equal. Instead, larger items have a greater chance of getting selected. This means that venues and/or VDTs with more workers will be more likely to be included in the survey.

  Use PPS if there are large differences in the numbers of workers across venues (e.g., 100 workers at some venues vs. 10 workers at others). Why use PPS? PPS results in more rapid recruitment and more of the sample will be drawn from larger work sites. However, smaller work sites will still have some chance of getting into the survey and findings from the survey will still be representative of all venues. This is achieved through statistical weighting during analysis; data from larger sites should be down-weighted and data from smaller sites should be given more weight, to compensate for the difference in probability of selection imposed by PPS. SRS and PPS are not applicable in Scenario 4, where there is no random selection.

## Step 3: Schedule primary VDTs

Once the sampling frame and sampling plan are finalized, you are ready to begin selecting primary VDTs and placing them on the "sampling calendar" for the first month of data collection. Two kinds of events should be scheduled: primary sampling events and alternate sampling events, described below.

Preliminaries to developing the sampling calendar:

1. First, create an empty calendar showing all of the days during the month that will be available to conduct sampling events. Block out any days when staff will be unable to conduct events (e.g., holidays, days off, days reserved for training)
2. Next, determine how many sampling events you will be able to conduct during the month, based on staffing and other resource available.
3. Then, place on the calendar any "exceptional" events that you wish to include purposively (i.e., non-randomly. See the section on "Non-random events").

Then select the primary VDTs from the sampling frame in accordance with your sampling plan. Follow the detailed examples in Appendix 3: Developing the Sampling Calendar.

## Step 4: Schedule alternate VDTs

Once the primary VDTs have been placed on the sampling calendar, one alternate sampling event should be scheduled for each of the scheduled primary events, in case there are problems recruiting at the primary event. For example, field teams may find that the primary venue is closed or that i nclement weather impedes access.

To select the alternates, use the same approach that was used to schedule the primary VDTs (e.g., random selection; SRS or PPS). However, only consider VDTs:

1. at venues that have not already been selected for primary events during the month
2. that overlap with the time period of the primary event (e.g., if the primary VDT is Tuesdays 08:00–12:00 then VDTs on Tuesdays 10:00–13:00 would overlap, while VDTs on Wednesdays 08:00–12:00 would not)

### Practical considerations for the sampling calendar

#### Sampling event conflicts

As the calendar gets filled, scheduling conflicts will arise. If there is no space on the calendar for the upcoming month for a VDT that is selected, it can be placed on the first available time slot of next month's calendar. If, during next month, conflicts emerge due to unexpected circumstances, then attempt to schedule the VDT on a different day that month. If it cannot be placed next month, randomly select a different VDT from the same venue. If no VDTs from that venue can be scheduled, select a different venue and VDT.

#### Canceling events

If a sampling event must be canceled due to lack of staff, sickness, or other reason, the same VDT should be rescheduled on the first available day of the sampling calendar, without displacing other scheduled events.

#### Alternates

If the primary venue is poorly attended or closed, staff should conduct sampling at the scheduled alternate VDT. However, if the primary venue is open and accessible, staff should attempt to conduct recruitment for at least 30 minutes before making the decision to move to the alternate VDT.

On occasion, neither the primary nor the alternate event may yield any interviews. In that case, the sampling event should be cancelled for the day. This is unlikely to happen so long as formative assessment and enumeration counts are done accurately and VDTs are defined so that they meet the minimum expected number of participants.

#### Non-random events

There may be one-time gatherings or meetings where it would be convenient to recruit forest workers. If staff are aware of these events when developing the calendar, they can be added to the sampling frame and treated as any other VDT. If there is little advance notice of these events, they can be placed on the calendar purposively (non-randomly). However, limit the number of non-random events since they make interpretation of findings difficult and data from such events will be down-weighted because of the non-random selection. At the discretion of the principal investigator, a very important event may replace a scheduled VDT. In this case the scheduled VDT should be rescheduled for the next available slot on the calendar.

## Finalize Referral Mechanisms

Meet with key staff from health facilities where participants who test positive will be referred. Ensure they are aware of the survey and timeline. Review the process for referring participants and the services they will receive.

## Pilot Test

Pilot test survey procedures on 6–10 individuals who are members of the target population but who are very unlikely to be encountered during the actual survey, for example forest workers from outside the area. Make the pilot testing as realistic as possible by completing as much of the procedures as possible. Administer consent, administer the complete eligibility screening and survey interview, collect specimens if possible and practice dialogue for returning results, handing out incentives (if applicable), and any informational materials that will be given to participants. Fill out all forms. At each step, note any problems. Correct procedures and instruments as needed.

It is not advisable to pilot test at an actual venue since pilot participants might later ended up being recruited into the survey, leading to bias due to their previous exposure to the interview and testing.

## Working with the Community

Ensuring a good relationship with the target population and the larger community in the project area can improve participation, reduce rates of refusal and ensure that the survey findings are seen as credible and put to use. Here are some steps that can prove useful:

**During the formative assessment:**

- Inform community leaders of plans for the survey and seek their advice.

- Include key informants both from the target population and the larger community.

**During the survey phase:**

- Each month, contact 2–3 of the key informants who were interviewed during the formative assessment to get their sense of how the survey is being perceived by the community and whether there are any problems that may need to be addressed.
- Before and after each sampling event, contact the venue owner/manager to discuss the event. Close coordination will ensure any problems are identified and addressed promptly.
- If there are regular meetings of community leaders, community members, or members of the target population (e.g., a forest workers' group) in the project area, consider making a presentation at the meeting every 1–2 months, describing the aims, expected outcomes, progress and challenges of the survey, and seeking input.

After the survey:

- Share findings from the survey with the community, discuss implications, share lessons learned, and seek input on how to improve future survey.

# Survey Phase

The survey phase marks the period when data collection is ongoing. It begins with the first sampling event and ends when the last sampling event is completed. The survey is planned for a period of 3 to 5 months. If the target number of survey participants is achieved early, the principle investigators should determine whether to continue recruitment until the end of the time available.

Each month, field teams will carry out the sampling events as scheduled on the sampling calendar.

The last week of the month, the local coordinator will update the sampling frame based on any new information available (e.g., new venues that have opened, venues that have closed, or low attendance at previous events).

The survey will be successful only if each team member understands and follows correct data collection procedures. The steps in Table 7 describe the staffing and procedures for the survey phase.

**Table 7. Key steps during the Survey Phase**

| | |
|---|---|
| **Before each sampling event** | • Contact venue owner/manager<br>• Prepare materials |
| **At each sampling event** | • Greet venue owner/manager<br>• Ensure conditions at venue are safe to conduct the survey<br>• Set up interview area<br>• Decide on the enumeration method (fixed line, moving line, or area)<br>• Designate enumeration and intercept areas/lines<br>• Count/click all potential participants during the entire VDT<br>• Direct the Interviewers to approach potential participants |
| **Each participant** | • Intercept potential participant<br>• Check eligibility status<br>• Forward participant to interview area<br>• Create participant UPC<br>• Administer informed consent<br>• Administer the questionnaire<br>• Take blood samples<br>• Create slides and DBS<br>• Perform rapid test<br>• If malaria positive, administer treatment and provide referrals if applicable<br>• Provide prevention materials and incentives (if applicable) and thank participant |
| **After each sampling event** | • Make a backup copy of the questionnaires of each netbook/tablet<br>• Send data files to data manager (24 hours after event) |
| **Daily** | • Planning and debriefing meeting with all field staff<br>• Review all records of each participant, separate information sheets and rapid test result and store in a safe location<br>• Store all survey equipment and documents/forms in a secure, restricted-access location |
| **Weekly** | • Meeting on overall survey progress and planning with survey team |
| **Last week of the month** | • Update sampling frame<br>• Create sampling calendar for upcoming month<br>• Inform venue owner/managers of scheduled sampling events |

## Staff Roles and Responsibilities

Project staff must adhere to ethical principles and standards when conducting the survey. Most importantly, they must respect and protect the privacy, confidentiality, and autonomy of participants. In addition, project staff should conduct themselves in a professional manner when interacting with participants, fellow staff members, and the general public. Staff working with participants will be required to sign an employee confidentiality agreement (Appendix 15).

The survey field staff include the following positions:

- Local Survey Coordinator
- Interviewers
- Enumerators
- Nurses/Laboratory Technicians

Size of field teams:

- **Typical team.** To conduct a single sampling event, 3 staff members are needed: Local Survey Coordinator, 1 Interviewer, and 1 Enumerator.
- **Enhanced team.** To meet recruitment targets, larger teams may be assembled by increasing the number of Interviewers and/or including a dedicated Nurse/Laboratory Technician.
- **Reduced team.** When recruitment targets are minimal, a reduced team of 2 staff (1 Interviewer, 1 Enumerator) can be formed by having the Interviewer or Enumerator carry out the responsibilities of the Local Survey Coordinator.

Consider including an entomological surveillance officer on field teams to collect entomological data at or around venues.

The time needed for one Interviewer to enroll one survey participant is likely to be about 60 minutes, including eligibility screening, informed consent, survey interview, malaria testing, return of results and treatment (if applicable). During a 4-hour event approximately 4 surveys can be completed. This can be doubled to 8 surveys by including two Interviewers. Adding a dedicated Nurse/Lab Technician can further increase recruitment by about 33%, assuming lab procedures take 15 minutes. The Local Survey Coordinator should plan the size of field teams for each sampling event accordingly.

The roles and responsibilities of these positions are described below and listed in Figure 4 (next page).

### Local Survey Coordinator

The Local Survey Coordinator will be responsible for the day-to-day management of all survey activities, including selecting and scheduling sampling events, data collection (interviews and biological specimens), quality assurance blood draw, administering malaria treatment, and management of data and records. The Local Survey Coordinator will also be responsible for key decisions at sampling events (e.g., which enumeration method to use), direct supervision of field staff, leading daily debriefs and weekly meetings, and developing progress reports.

### Interviewer

Interviewers support the Local Survey Coordinator in updating the sampling frame and sampling calendar. At sampling events, they approach (intercept) potential participants as directed by the Enumerator, assess eligibility, administer informed consent and conduct the interview using the netbook/tablet. They must ensure the quality of the data and report any adverse events to the Local Survey Coordinator.

### Nurse/Lab Technician

Nurses/Lab Technicians are responsible for taking blood samples, creating slides and DBS, conducting malaria tests, returning and explaining results to participants, providing treatment for positive participants and providing referrals to health providers if needed. They are also responsible for storing and transporting samples and completing all related laboratory forms.

### Enumerator

Generally, only one Enumerator is present at a sampling event. The Enumerator communicates and coordinates with the venue owner/manager before and during the event. The Enumerator counts (enumerates) all individuals present at the event using the enumeration method selected by the Local Survey Coordinator (fixed line, moving line, or area-based), completes all enumeration forms, and directs Interviewers to intercept potential participants as they are enumerated.

**Figure 4. Field staff responsibilities**

**All Team Members**

- Prepare for the sampling event

**Local Survey Coordinator**

- Update the sampling frame
- Create the monthly sampling calendar
- Maintain the Universe of Venues Form up to date
- Ensure that field personnel are punctual and have a professional demeanor
- Support the field teams in the identification of suitable sites at venues for the completion of the survey, and to ensure that there is a secure place to store materials and equipment
- Manage expenses
- Ensure the availability of all survey materials
- Based on supervision of sampling events, provide feedback to the field team to improve procedures for data collection and fix problems found by the team
- Prepare and send the interview data files and reports to the data manager within 24 hours after the completion of each sampling event
- Store survey equipment and documents (consent forms, field notes, enumeration and other forms) in a safe, secure place at the end of each day
- Save the file and send daily to the team in the central office
- Ensure proper documentation of all survey activities, using the tablets, spreadsheets and forms
- Review, tabulate, and reconcile questionnaires, forms and logs used in the field. Review errors with field staff
- Report any adverse events to the investigators within 48 hours of the occurrence who will report to the bioethics committee
- Write a daily report of fieldwork and weekly progress reports used by the field team and principal investigator to monitor recruitment and sampling characteristics
- Conduct daily debriefings with the team to assess the procedures for data collection, challenges, and how to improve data quality
- Conduct weekly meetings with the larger survey team (including investigators) to communicate and discuss progress and adjust the planning of the survey, as necessary

*During the sampling event:*

- Decide the type of enumeration at each site (fixed line, moving line, area)
- Organize team
- Ensure security of team
- Enter information about each individual approached on the Intercepts and Enrollments form, including basic demographics, eligibility, enrollment, and other information
- Decide whether to terminate the primary event and move to an alternate event
- Supervise and monitor the work of the field teams (Interviewers, Enumerators, Nurses/Lab Technicians)

*If more than one sampling event is carried out at the same time, the Local Survey Coordinator will designate an Interviewer or Enumerator to complete these responsibilities at events where the Local Survey Coordinator is not present.*

**Interviewers**

- Support the creation of the monthly sampling calendar
- Ensure that the material is prepared for each sampling event
- Intercept and recruit participants for interviews
- Complete recruitment files
- Assess eligibility and complete the eligibility screening form
- Create individual codes for participants
- Conduct informed consent
- Conduct interviews
- Maintain data integrity (i.e., all data collected accurately represents the information provided by participants)
- Comply with guidelines for maintaining safety, data security, and participant confidentiality
- Implement local safety procedures and report field incidents and adverse events to the Local Survey Coordinator immediately

**Nurse/Lab Technicians**

- Take blood samples from participants using venipuncture and finger-sticks
- Create slides and DBS for analysis
- Perform rapid tests
- Fill out the laboratory forms
- Properly store and transport the samples
- Conduct daily inventory of all lab supplies, and communicate with the Local Study Coordinator when any supplies are low or need to be replenished
- In cases of positive malaria results, administer the appropriate treatment and record in treatment tracking form
- Provide referrals for participants to health providers partnering with the project
- Provide prevention materials and incentives to participants

*One staff member may assume the role of both the Interviewer and Nurse/Lab Technician if staff are limited, or at events with low attendance or a low sampling quota.*

**Enumerator**

- Contact venue owner/manager prior to the event
- Greet venue owner/manager upon arrival to the venue
- Enumerate all potential participants from start to finish of the sampling event using a clicker/counter
- Complete the enumeration forms
- Direct Interviewers to approach potential participants, as Interviewers are available

## Conduct Survey at Selected VDTs

### Step 1. Prepare the necessary materials

Prior to travelling to the venue, each staff member should gather and prepare the materials they will need during the sampling event. These are listed in Figure 5.

The field team should arrive at the venue at least 30 minutes prior to the start time of the VDT of the sampling event in order to coordinate with the venue owner/manager, set up the interview area, determine the enumeration method and define the enumeration line or area.

### Step 2. Confirm permission from venue officials (if applicable)

*Staff member: Enumerator*

#### Material required

- Study information sheets

#### Procedures

1. Greet the owner/manager of the venue and inform them of the survey and the date they were informed that their site has been selected to be included in the survey.
2. Ensure that the enumeration and recruitment processes will not interfere with the normal activities of the venue.
3. Remind the owner/manager that the survey has the support of local government.
4. Provide a brief study information sheet and address questions, if any.

**Figure 5. Checklist of materials to prepare for a sampling event**

### Local Survey Coordinator

- ☐ Sampling event card
- ☐ Sample universe of venues form (in case new information is obtained about venues in the project area)
- ☐ Recruitment monitoring forms
- ☐ Incident forms
- ☐ Ineligible participant log book and stickers for ineligible participants
- ☐ Extra pens
- ☐ Extra forms
- ☐ Extra laptop/tablet (charged) and charger

### Interviewer

- ☐ Laptop/tablet (charged) and charger
- ☐ Paper copy of questionnaire
- ☐ Eligibility screening forms
- ☐ Survey leaflet
- ☐ Participant ID forms/barcodes
- ☐ Informed consent forms
- ☐ Refusal forms
- ☐ Stickers (cards) for eligible and ineligible participants
- ☐ Intercepts and Enrollments forms
- ☐ Database of previous survey participants (to detect repeat participation)
- ☐ Copies of approval letters from the bioethics committee and administrative approval

### Nurse/Lab Technician

- ☐ Slides and slide-box
- ☐ Dried Blood Spot (DBS) cards
- ☐ Microtainers and vacutainers
- ☐ Gloves
- ☐ Alcohol swabs
- ☐ Lancets, syringes, needles
- ☐ Cotton or gauze
- ☐ Biohazard plastic bag (red)
- ☐ Plastic bag for other trash (black)
- ☐ Sharps container
- ☐ Coolbox with frozen gelpacks
- ☐ Study barcodes
- ☐ Pencils, pens, and permanent markers (sharpies)
- ☐ Clear plastic zip bags for samples
- ☐ Drying racks for slides and DBS
- ☐ Prevention informational materials (i.e., brochure/pamphlet)
- ☐ Incentives (if applicable)

### Enumerator

- ☐ Watch
- ☐ Clicker/counter
- ☐ Enumeration Summary form
- ☐ Study information sheet
- ☐ Copies of approval letters from the bioethics committee and administrative approval

**Figure 6. Summary of how individuals at the venue are selected into the survey**

Enumerate and intercept each potential participant who crosses the enumeration area/line during the entire sampling event period (e.g., 4 hours):

1. The Enumerator counts (enumerates) all potentially eligible individuals who pass through the enumeration area / line. See Appendix 1. Enumeration Methods.
2. The Enumerator directs each Interviewer to approach, in a systematic way, potential participants who have been enumerated. Potential participants are approached as the Interviewers are free and ready to receive participants.
3. The Interviewer introduces the survey, assesses the eligibility of the potential participant, and completes the line listing for the individual in the Intercepts and Enrollments form.
4. The Enumerator continues to enumerate the potential participants even when the Interviewers are occupied.
5. When an Interviewer becomes free, the next potential participant is intercepted.
6. If there are problems, the Local Survey Coordinator can guide the Enumerator to stop enumerating.
7. The Enumerator stops enumerating only at the scheduled end of the sampling event (i.e., after 4 hours of a 4-hour event) and records details on the Enumeration Summary form.

## Step 3. Designate enumeration and interview areas

*Staff members: Local Study Coordinator and Enumerator*

The unique characteristics of each venue must be taken into account when deciding on the placement and type of enumeration area.

### Procedures:

1. Local Study Coordinator examines the venue and movement of people in the venue and decides which enumeration method will be used for the sampling event (See Appendix 1: Enumeration Methods).
2. The Local Study Coordinator and Interviewer set up a designated interviewing area, which should ensure privacy and be out of earshot of anyone not involved in the survey.
3. The Local Study Coordinator and Enumerator define the enumeration area. Think about the enumeration area used previously at the same venue and reassess as needed for the current sampling event.

## Step 4. Enumerate potential participants from start to finish of the sampling event

*Staff member: Enumerator*

### Material required

- Enumeration Summary form
- Counter/clicker
- Watch

### Procedures

1. Fill out the Enumeration Summary form prior to the start time of the sampling event with all information except the observed number of potential participants and staff sign-offs.
2. Begin enumerating (counting/clicking) all "potential participants" right when the VDT begins and stop enumerating right when the VDT ends. For example, if the VDT goes from 17:00 to 20:00 you should begin enumerating people right at 17:00 and stop enumerating people right at 20:00). A potential participant is any person who:
    a. Appears to be part of the target population (e.g., a forest worker) – AND –
    b. Is included by the enumeration method chosen by the Local Survey Coordinator. Depending on the selected method, you will enumerate people as they:
        i. Cross a designated line (real or imaginary),
        ii. Enter a designated area, - OR -
        iii. You cross them with a moving interception line as they are sitting/standing in a designated area.
3. Make sure you use only one enumeration method at each sampling event.
4. Ask any Interviewer who is free to intercept a potential participant.

5. Direct any available Interviewer to intercept each new potential participant as you enumerate them.
6. Even if all Interviewers are busy with participants, continue enumerating (counting or clicking) potential participants for the entire duration of the sampling event.
7. When you enumerate a new potential participant at a time when all Interviewers are busy, you have two options:
    a. If there are few people at the venue and you think it will be difficult for your team to meet its recruitment target, then make a list of the potential participants so that you can direct the next available Interviewer to intercept each one. To avoid making mistakes, make a list by recording one or two stand-out features of each person so you can remember them more easily (e.g., "white vest, red boots" or "blue hat").
    b. On the other hand, if there are plenty of people at the venue and you feel it will be easy to meet your recruitment target, do not make a list. Enumerate all potential participants, but only direct available Interviewers to new potential participants, not people who were enumerated earlier while they were busy.

*Completion or interruption of enumeration*

1. Stop enumerating when the end time of the sampling event is reached or if/when Local Study Coordinator announces that the event has been terminated early (due to a problem or moving to an alternate VDT).
2. If there are problems, the Local Survey Coordinator can direct you to terminate the enumeration. Inform other field staff at the venue about closure of the enumeration process.
3. When enumeration is terminated, tell Interviewers that no more interceptions are needed.
4. Write down the number of people enumerated during the event on the Enumeration Summary form.

## Step 5. Approach potential participants

*Staff member: Interviewer*

### Material required

- Survey leaflet (provides a brief description of survey objectives and procedures)
- Intercepts and Enrollments form

### Procedures

1. Approach and greet the potential participant and greet them as directed by the Enumerator.
2. Present survey briefly, highlighting the following information contained in the survey leaflet:
    a. Survey objectives
    b. Survey procedures: interview, blood sample, testing in the central laboratory
    c. Confidentiality and data protection
3. Create a rapport with the recruit, using a strategic approach and prepare to circumvent any reasons given for not participating.
4. Complete the Intercepts and Enrollments form for all persons approached.

## Step 6. Check survey eligibility status

*Responsible: Interviewer*

### Material required

- Eligibility screening form

### Procedures

1. Ask all eligibility verification questions on the eligibility screening form. Each question must be asked exactly as it is written.
2. If the person meets the survey eligibility criteria, take them to the designated interview area.
3. If the person is not eligible, tell them that unfortunately they cannot participate in the survey. Do not tell the person the specific reason they are not eligible survey. You can say it was the computer that determined it. There will be no interview or sample collection for this person and no incentive will be given to them. Provide them with the prevention information materials. The survey ends here for this potential participant.
4. Complete the eligibility screening form.

## Step 7. Create the unique participant code (UPC)

[The participant ID procedures described below are designed for anonymous surveys in which staff do not ask for the participant's name or other identifying information. This is appropriate if the target population is highly stigmatized or engaged in illegal behaviors. If there is no need for anonymity, then repeat participation can be avoided by recording names and dates of birth and a barcode can be used as the unique participant ID.]

*Responsible: Interviewer*

### Material required

- Participant ID Form
- Eligibility screening form

### Procedures

1. For eligible participants, complete UPC. The UPC serves to check if the participant participated in any previous survey or not.
2. Check the "identity" of the participant.
3. The UPC is created from a series of questions:
   a. Province of birth of the participant
   b. Mother's first name of the participant
   c. Day of birth of the participant
   d. Participant shoe size
   e. Month of birth of the participant
4. Describe some physical characteristics of the participant in the UPC form. If the participant does not want or show difficulties or is reluctant to answer these questions, explain that this is the only way to check if they have participated before.
5. Check the UPC in the database of previous survey participants (in Excel or EpiData).
6. Complete space 2 in the eligibility screening form, UPC created.
7. Save all UPC records for the day in a safe location, and send them to the site supervisor at the end of each day.

## Step 8. Administer informed consent

No interviews, blood collection, or malaria testing will be done without first obtaining the informed consent of the participant. Informed consent is important because it is an opportunity for the participant to know the objectives of the investigation, the procedures through which they will pass, the risks and benefits of participation. All this information will allow them to make a voluntary decision to participate or not in the survey.

*Staff Member: Interviewer*

### Material required

- Informed consent form (2 copies)
- Eligibility screening form
- Laptop/tablet

### Procedures

1. Using the informed consent form, provide the participant information on the survey.
2. Probe to check whether the participant understood the information.
3. The Interviewer signs the two copies of the information sheet. Keep a copy in the participant's folder and give the other one to the participant.
4. Record the consent in the laptop/tablet and eligibility screening form.
5. If the participant has not given their consent, complete the eligibility screening form and insert not consented in the participant's folder. Provide the individual with prevention information materials and continue recruiting other forest workers.
6. If the participant has consented to the interview, note the change in the eligibility screening form and go to the next step: administering the survey questionnaire.

## Step 9. Administer the survey questionnaire

*Staff member: Interviewer*

### Material required

- Laptop/tablet (make sure the battery is charged)
- Paper copy of questionnaire and pen as back-up
- Participant folder (containing two copies of the Informed Consent form and eligibility screening form)

### Procedures

1. Complete the interview in laptop/tablet or on paper-based questionnaire.
2. At the end of the interview, thank the participant and escort him/her to the Nurse/Lab Technician.

## Step 10. Collect blood sample, conduct malaria testing and laboratory procedures

*Staff Member: Nurse/Lab Technician*

## Step 11. Make a backup copy of the completed questionnaires and conduct a data quality check

*Staff member: Local Survey Coordinator*

### Material required

- Field supervisor's netbook/tablet
- Interviewers' netbooks/tablets
- USB flash drives

### Procedures

Surveys on paper

1. Interviewers should give any completed paper questionnaires to the Local Survey Coordinator immediately after the interview.
2. Check all questionnaires for accuracy and completeness, and consult the Interviewer and/or participant for any corrections before the participant leaves the survey site.
3. Enter all the data of the interviews on paper into the netbook/tablet before close of business each day (i.e., convert them into computerized interviews).
4. Store the paper questionnaires data in a safe location.

### Electronic surveys

1. Ensure all completed questionnaires are saved to a central server or to a flash drive. Rename and copy each questionnaire file to reflect the survey site, the number of the laptop/tablet, the date of the interview and the name of the survey. For example: MFW010301012017.
2. MFW = Survey of malaria among forest workers 01 = survey site 01; 03 = Computer 03; Interview date = 01012017 [DayMonthYear]
3. Do not delete the document in the netbook/tablet until the copies are transferred to the data manager.
4. Follow every step above in all netbooks/tablets used each day.

## Step 12. Review survey forms

*Staff member: Local Survey Coordinator*

### Material required

- Local Survey Coordinator's laptop
- Enumeration Summary form (from Enumerator)
- Intercepts and Enrollments form (from Interviewers)

### Procedures

1. Collect enumeration forms used in the sampling event from the Enumerator and Interviewers.
2. Open the Monitoring Registry Excel spreadsheet.
3. Complete the monitoring logbook using the information in the Enumeration Summary form and Intercepts and Enrollment form from the sampling event.

### Example of performance criteria programmed into the Monitoring Registry:

- Collect data for at least two months and a maximum of four months.
- Complete 15 sampling events per month.
- Enroll a minimum of eight participants per sampling event.
- Complete 100% of scheduled sampling events.
- At least 90% of individuals assessed as eligible consent to participate in the survey.
- Prepare DBS samples for 100% of participants.

**Other things to remember**

- If possible, keep the netbook/tablet connected to AC power during the interview to ensure that the battery is not exhausted.
- If a participant is disturbed for any reason, stay calm, apologize for any inconvenience caused and inform the Local Survey Coordinator.
- If the participant does not want to use the netbook/tablet in the interview, explain that the method is secure and confidential, and that it facilitates the interview process. If he/she refuses to use the netbook/tablet, use the paper-based questionnaire as a last resort.
- Record all problems that arise in the course of the interview (e.g., skip errors, lack of responses in categories, etc.), and discuss with the Local Study Coordinator and colleagues during team meetings.

*REMEMBER: The participants' responses to the questionnaire are confidential. Do not share personal information provided by the participant with others, including survey team members.*

# Update the Sampling Frame and Calendar Monthly

## Sampling frame

The last week of each month, the Local Survey Coordinator will update the sampling frame:

- Meet with Interviewers to review the venues and VDTs in the sampling frame.
- Visit new venues that have opened to assess eligibility and define VDTs.
- Delete venues that have closed, become unsafe or no longer provide permission.
- Review enumeration counts; adjust VDTs timings to ensure they meet minimum expected attendance levels.

- Save any changes to the frame in a new file named with the month (e.g., frame_2017-01 for January).
- Retain previous versions for each previous month as a historical record in case they are needed during data analysis.

### Sampling Calendar

A new sampling calendar should be created each month. Once the sampling frame has been updated, create a new sampling calendar by following the same procedure described in the 'Fieldwork Prior to Survey' section.

## Monitoring and Supervision of Recruitment

The Local Survey Coordinator will provide supervision by:

- Observing 10% of all interviews at sampling events, with the consent of the participant, including data entry of responses into the netbook/tablet (or onto a paper questionnaire)
- Reviewing all Enumeration Summary forms, Intercepts and Enrollments forms, and eligibility Screening forms for consistency and completeness immediately following each sampling event

To monitor the study, the Local Survey Coordinator will:

- Compare the enumeration count obtained at each sampling event to counts obtained earlier (during formative assessment, fieldwork prior to survey, and earlier events at the same VDT) and discuss any differences of 20% or more with the field team to ensure standard procedures are being followed.
- Prepare a weekly monitoring report, to track the following figures weekly and monthly:
  - » % of planned sample achieved to date
  - » Number (and %) of events that met their target sample size
  - » Average (and range) of number of individuals recruited per event
  - » Number (and %) of eligible potential participants who refused to participate
  - » Number (and %) of individuals who tested positive for malaria that received treatment
  - » Break down the above figures by type of venue (e.g., agricultural venues vs. logging venues) to be able to detect recruitment problems affecting specific types of venues

Monitoring reports will be shared with investigators and field team staff each week and discussed during weekly project meetings.

## Venue and VDT Identification Codes

A venue identification (ID) code is a unique four-digit code that identifies specific venues. Venue ID codes are fixed; that is, new venues may not be given identification codes of venues that have been deleted from sampling frames.

### Venue category

The first character of the venue ID identifies the venue category. The venue category represents the primary activity of the venue:

A = Logging site

B = Mine

C = Agricultural (plantation or farm)

D = Cattle ranch

E = Processing plant

F = Permit office

G = Other type

#### Specific venue

The remaining three numeric digits of the code identify the specific venue.

Examples:

- E001 represents the 1st processing plant in the venue universe
- C003 represents the 3rd agricultural site in the venue universe
- B010 represents the 10th mining site in the venue universe

VDTs should also be assigned a unique code by adding a consecutive number after the venue ID.

Examples:

- C003-1 represents the 1st VDT for venue C003 (e.g., Mondays from 20:00 to 22:00)
- C003-2 represents the 2nd VDT for venue C003 (e.g., Tuesdays from 20:00 to 22:00)

# Safety

## General Principles

- Always carry the survey badge, credential or identity card.
- Plan ahead.
- Always be alert.
- Use common sense.
- Whenever possible, three members of the survey team should be together in the office during business hours.

### Plan ahead

- Have an emergency contingency plan.
- Know what to do well ahead of time.
- Know who to contact in an emergency.
- Familiarize yourself with all the exits in the survey office.
- Adopt a code word to use in case you need the help of a work colleague.
- Be aware of what is going on around you.
- Position yourself closer to the exit than participants.
- Be friendly to the survey's participants, but also careful if you suspect anything.
- Pay attention to your sixth sense.

### Common sense

- Limit the quantity of valuable items on site.
- Do not carry guns.
- Do not work under the influence of alcohol or drugs.
- Do not offer or accept gifts from participants or any people visiting the office.
- Interrupt the interview at any moment in case of threat.

### Aggressive participants

- Use calming techniques.
- Let participants express themselves.
- Look for opportunities of interaction.
- Listen and acknowledge the participants concerns.
- Avoid being defensive.
- Reply to legitimate complaints.
- Lower your voice tone and volume.

### Sexual harassment

- Remind participants the purpose of the interview.
- If the participant persists in harassing then terminate the interview.
- Avoid shaming the participants.

### Drunk or intoxicated participants

- They are not eligible if they are incoherent during eligibility screening.
- If they become incoherent after this time, then thank them for their time and terminate the interview.

### Protection of electronic equipment

- When not in use, electronic equipment should be stored in a safe location.
- Do not leave electronic equipment unattended.
- Do not leave participants alone in any room with notebooks and cell phones.
- Send encrypted data electronically at the end of each business day.

### Adverse events

An adverse event is any event that causes serious physical or psychological damage to a participant in the survey or a staff member, as a result of their participation in the survey. Examples are:

- Violation of confidentiality
- Harassment or violence
- Negative reaction from the community (loss of home or job as a result of the participation in the survey)
- Notification of adverse events
- In case of an adverse event, notify the relevant people/institutions
- Fill out a report of adverse event form (see Appendix 16 for an example).

## Biosafety

Measures to be followed during handling of any potentially infectious material.

- Always be aware of what you are doing.
- Always wash your hands before and after handling any infectious materials.
- Always use individual protection equipment like nurse's gowns and gloves to prevent contamination when conducting any activities.
- Do not eat, drink or smoke during blood collection.
- Use basic protective measures.
- Prevent pricks, cuts and scratches.
- Protect wounds and lesions.
- Control contamination of work surfaces by following disinfection procedures.
- Properly dispose biohazard waste.

### Precautions

- Always wear gloves and glasses when handling infected or potentially infected materials or when there is a possibility of exposure and/or contact with this type of material.
- Dispose used gloves in appropriate containers, whether they are knowingly contaminated or not.
- Do not touch the eyes, nose, mouth, other mucous membranes and the skin with the gloves.
- Do not leave the work area wearing gloves.
- Immediately wash your hands with plenty of soap after any contact with infected or potentially infected material, and after finishing work. If this contact takes place when wearing gloves, immediately remove the gloves and wash your hands with plenty of soap.
- Do not open or close doors or handle personal objects while wearing gloves.
- Always use your gown protecting your clothes and wear closed shoes. Do not leave the work area wearing your gown. Try to disinfect your gown with a disinfectant solution before washing.
- Leave the gown overnight in a receptacle completely covered with a disinfectant solution. Wash it the following morning.
- Always keep the work room clean, dry, with good ventilation and free from unnecessary materials and furniture.
- Disinfect (with a disinfectant solution based on sodium hypochlorite, see at the end of this section) the work surface (bench or table) whenever you finish a procedure and at the end of the work day.
- Avoid using cutting objects (blades, knifes or scissors) to open packages or for other purposes. In order to collect samples securely, follow the instructions included in this module to the letter.
- Always use appropriate accessories (for example, pipette bulbs).
- Follow all the technical procedures in order to minimize the chance of creating aerosols, droplets and spills.

### Droplets/spills and accidents

- In case of droplets and spills of potentially infected materials, initially cover with absorbent materials (gauze, cotton or toilet paper).
- Pour a disinfectant solution around the area and then over the absorbent material (gauze, cotton or toilet paper) and wait 10 minutes.
- After that time has elapsed, remove the mix of droplet or spill and the absorbent material and place it in a recipient for contaminated materials.
- Clean the surface again with a disinfectant solution.
- Always wear gloves when following these procedures.
- Immediately wash wounds from needle pricks or other puncture objects, cuts, and skin that has been contaminated by droplets or spills from samples, with plenty of soap and water.
- Immediately communicate all accidents (pricks, cuts), droplets/spills involving direct contact of the skin with potentially infected materials to the health unit director.
- Whenever possible, provide counseling to the injured person and provide a medical evaluation (including HIV testing on the spot and after four weeks).

### Handling and disposal of contaminated materials and waste

- Needles from blood collection systems must be placed in the receptacle for puncture materials (provided specifically for the duration of the survey). When full, the receptacles should be incinerated.
- Gloves and other materials used for blood collection must be placed in the plastic bag for biological waste.

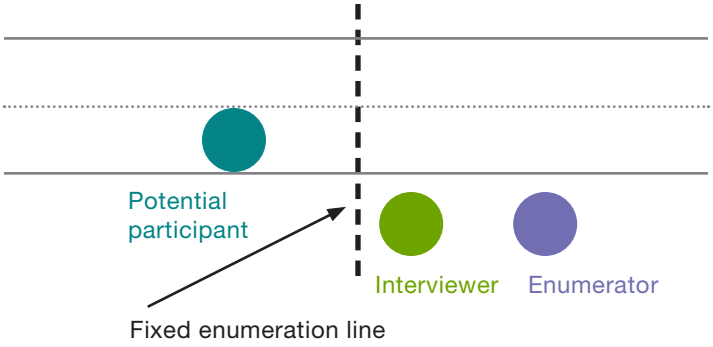
# Appendix 1: Enumeration Methods

There are three types of enumerations: fixed line, moving line, and area-based.

## Fixed Line Enumeration

During line-based enumeration, people are counted as they cross an imaginary line for the first time during a sampling event. Line-based enumeration is conducted in locations with high traffic flow. In Figure 7 individuals are enumerated and intercepted as they cross a fixed imaginary line at a point in a road that leads to a work site.

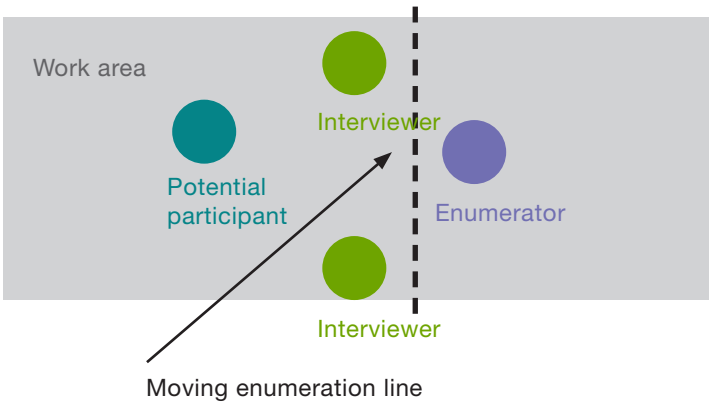
**Figure 7. Example of fixed line enumeration**




## Moving Line Enumeration

A moving line can be used for enumeration and recruitment. Staff will start at one end of the area and slowly walk side by side through the area. All persons are counted as an imaginary line crosses the people. Figure 8 below shows a moving line enumeration. As the Interviewers move through the crowd making intercept approaches, the Enumerator systematically counts all potentially eligible individuals in the area.

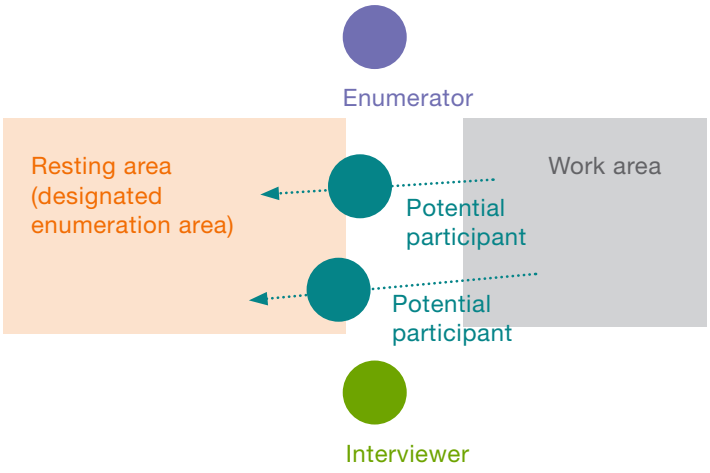
**Figure 8. Example of moving line enumeration**




## Area-based Enumeration

In area-based enumeration, individuals are counted the first time they enter a designated enumeration area during a sampling event. Area-based enumerations work best when individuals do not come or go frequently and there is a low flow of movement within the venue. The area can be small or large depending on the venue. In Figure 9, all individuals who appear to be workers who exit the work area (e.g., a mine or agricultural plot) are enumerated as they enter the workers' resting area.

**Figure 9. Example of area-based enumeration**



# Appendix 2: Enumeration Summary Form

**Forest Workers' Malaria Survey** **Page _____ of _____**

*To be completed by the Enumerator*

Area name: _____ Venue Name: _____ Venue #: _____ Event #: _____

Team lead: _____ Enumerator:_____ Date of visit: _____ / _____ / 20__ __

**Type of venue:** ☐ Logging ☐ Mining ☐ Agriculture ☐ Processing plant ☐ Permit office
☐ Other-specify:_____

**VDT period:** Day: M Tu W Th F Sa Su Start: ___:___ am pm End: ___:___ am pm

**Actual enumeration period:** Day: M Tu W Th F Sa Su Start: ___:___ am pm End: ___:___ am pm

*(should be same as VDT period unless the sampling event was terminated early)*

Observed # potential participants enumerated during enumeration period (number clicked): _____

| Draw area of intercept area or line in this space | Comments (weather, safety, etc) |
|---|---|

Supervisor sign off: _____ Team sign off: _____

# Appendix 3: Developing the Sampling Calendar

## Examples of Developing the Sampling Calendar

### Example for Scenario 1: Very different mines with moderate variation in workers over time

Continuing with Example 1 presented in the section, 'Develop the Sampling Calendar,' (p 14) recall that the venues (company mines) are quite different from one another. To ensure good coverage of venues, our approach is to first randomly sample the venues, then sample one VDT from each venue. The first step is to make an empty calendar with days blocked off when events cannot be conducted (e.g., due to holidays, days off or training) (see below).

Next, we determine that we have staff and resources to conduct 10 sampling events this month. Below are a few lines from the sampling frame. Because we are in a situation like Scenario 1, we need to make a list of venues and a list of VDTs at each venue. Here we will refer to the venues by the names of their employers. Some larger mines are separated into different work areas that are far apart and essentially distinct operations. (For Scenario 2 we would just need the list of VDTs).

**Venues 1 to 6:**

1. Felipe Mine 1
2. Felipe Mine 2
3. Rigos Mine
4. Ishowe Mine
5. Vasquez Mine, North
6. Vasquez Mine, South

**Scenario 1 sample monthly sampling calendar with a few days blocked off**

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

We illustrate selecting 2 of the 10 venues needed for the month. First we use Excel's rand() function to assign a random number to each mine. Note that Excel will recalculate the numbers each time you make a change to the spreadsheet, so you need to copy and "paste values" in a new column to retain the original random numbers generated.

### Scenario 1 venues 1 to 6 with random numbers

| Venue | Randomly assigned number |
|---|---|
| 1. Felipe Mine 1 | 0.519927139 |
| 2. Felipe Mine 2 | 0.430996628 |
| 3. Rigos Mine | 0.070172456 |
| 4. Ishowe Mine | 0.620274873 |
| 5. Vasquez Mine, North | 0.278627057 |
| 6. Vasquez Mine, South | 0.049381547 |

Then we sort the random numbers so that the list is in random order.

### Scenario 1 venues 1 to 6, sorted according to the random numbers

| Venue | Randomly assigned number |
|---|---|
| 1. Vasquez Mine, South | 0.049381547 |
| 2. Rigos Mine | 0.070172456 |
| 3. Vasquez Mine, north | 0.278627057 |
| 4. Felipe Mine 2 | 0.430996628 |
| 5. Felipe Mine 1 | 0.519927139 |
| 6. Ishowe Mine | 0.620274873 |

Thus, the first two venues selected are Vasquez Mine, South and Rigos Mine. Now we bring up the list of VDTs to randomly select and schedule a VDT from Vasquez Mine, South. As above, we first assign random numbers to each VDT.

| VDTs at Vasquez Mine, South | Randomly assigned number |
|---|---|
| 1. Mondays 6pm–10pm | 0.966944685 |
| 2. Tuesdays 6pm–10pm | 0.478027952 |
| 3. Wednesdays 6pm–10pm | 0.896001344 |
| 4. Thursdays 6pm–10pm | 0.460044935 |

The lowest number corresponds to Thursdays at 6pm–10pm, so we select this as the VDT. To schedule the event, we place it on the first available slot on the sampling calendar, in this case the 3rd of the month. Next, we follow the same steps to choose a VDT for Rigos Mine, generating a new set of random numbers.

| VDTs at Rigos Mine | Randomly assigned number |
|---|---|
| 1. Mondays 6pm–10pm | 0.12001826 |
| 2. Tuesdays 6pm–10pm | 0.411637514 |
| 3. Wednesdays 6pm–10pm | 0.454484508 |
| 4. Thursdays 6pm–10pm | 0.880430492 |

This time, Mondays 6pm–10pm is selected. We schedule it for the first available slot, the 7th of the month (see next page).

### Scenario 1 sample monthly sampling calendar with two primary events scheduled

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| | | 1 | 2 | **3** Vasquez Mine, South 6pm–10pm | 4 | 5 |
| 6 | 7 Rigos Mine 6pm–10pm | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

Next we need to schedule alternate VDTs in case recruitment cannot be conducted at the primary VDTs for any reason, to avoid wasting valuable staff time. The pool of potential alternates for the Vasquez Mine, South event are the Thursday VDTs at the venues that have not been placed on the calendar yet. Below we show just the remaining venues from the 6 we are using for illustration, but in reality there would be many more (all those that appear from the full sampling frame).

### Scenario 1 pool of potential alternates for Vasquez Mine, South, Tuesday, 6pm–10pm

| Venue | Potential VDTs | Randomly assigned number |
|---|---|---|
| 1. Vasquez Mine, North | Thursdays 6pm–10pm | 0.987308411 |
| 2. Felipe Mine 2 | Thursdays 6pm–10pm | 0.931090955 |
| 3. Felipe Mine 1 | Thursdays 6pm–10pm | 0.3363291 |
| 4. Ishowe Mine | Thursdays 6pm–10pm | 0.506129748 |

Normally, we would first select the venue and then select the alternate VDT, but in this case there is only one possible VDT per venue, so we can select from the above directly. Here, Felipe Mine 1 has the lowest random number so will serve as the alternate.

We repeat this process to select an alternate VDT for Rigos Mine 6pm–10pm.

### Scenario 1 pool of potential alternates for Rigos Mine, Thursday, 6pm–10pm

| Venue | Potential VDTs | Randomly assigned number |
|---|---|---|
| 1. Vasquez Mine, North | Tuesdays 6pm–10pm | 0.56299633 |
| 2. Felipe Mine 2 | Tuesdays 6pm–10pm | 0.296254376 |
| 3. Ishowe Mine | Tuesdays 6pm–10pm | 0.444922243 |

As shown above, Felipe Mine 2 has the lowest number and so is chosen as the alternate for Rigos. We now place the alternates on the calendar. Note it may not always be possible to find an alternate for every primary event.

We would continue scheduling until all 10 VDTs have been placed on the sampling calendar. Instead of generating random numbers in Excel, a computer program could be used to do the scheduling automatically, drawing on the sampling frame and outputting a new calendar each month.

**Scenario 1 sample monthly sampling calendar with two primary and alternate events scheduled**

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| | | 1 | 2 | **3**<br>Vasquez Mine, South<br>6pm–10pm<br>Alternate:<br>Felipe Mine 1<br>6pm–10pm | 4 | 5 |
| 6 | 7<br>Rigos Mine<br>6pm–10pm<br>Alternate:<br>Felipe Mine 2<br>6pm–10pm | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

**Example for Scenario 2: Similar mines with fluid attendance by day and evening workers**

Here we continue with Example 2 from the section Develop the sampling calendar. Recall that the venues are segments of an extensive, loosely connected series of mines. Because workers attend the mines fluidly over days and times, with potential day/night differences in worker profile, we will sample from the complete list of VDTs directly (without first selecting venues). As in example 1, first we make an empty calendar with days blocked off that are not available for sampling events.

**Scenario 2 sample monthly sampling calendar with a few days blocked off**

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

As in Example 1, we will assume we can conduct 10 sampling events monthly. Below is a small excerpt of the sampling frame of VDTs. Here we show just 3 of the venues (2 segments of the mining area plus the processing plant). In practice there would be many more venues included in the frame.

**Scenario 2 excerpt from the sampling frame of VDTs**

| Venue | VDT |
|---|---|
| Segment 1 | Mon 11am–2pm |
| Segment 1 | Tue 11am–2pm |
| Segment 1 | Wed 11am–2pm |
| Segment 2 | Mon 11am–2pm |
| Segment 2 | Tue 11am–2pm |
| Segment 2 | Wed 11am–2pm |
| Processing plant | Tue 10am–12pm |
| Processing plant | Thu 10am–12pm |

We will illustrate selecting and scheduling the first three primary VDTs and alternates. Again, we use Excel's rand() function to assign random numbers to the VDTs.

**Scenario 2 sampling frame of VDTs with random numbers**

| Venue | VDT | Random number |
|---|---|---|
| Segment 1 | Mon 11am–2pm | 0.67784712 |
| Segment 1 | Tue 11am–2pm | 0.104291045 |
| Segment 1 | Wed 11am–2pm | 0.521965798 |
| Segment 2 | Mon 11am–2pm | 0.132004637 |
| Segment 2 | Tue 11am–2pm | 0.157166249 |
| Segment 2 | Wed 11am–2pm | 0.998556794 |
| Processing plant | Tue 10am–12pm | 0.132477127 |
| Processing plant | Thu 10am–12pm | 0.357655996 |

Now we will sort the list of VDTs by this random number and schedule the VDTs with the lowest random numbers first.

### Scenario 2 sampling frame of VDTs, sorted by random number

| Venue | VDT | Random number |
|---|---|---|
| Segment 1 | Tue 11am–2pm | 0.104291045 |
| Segment 2 | Mon 11am–2pm | 0.132004637 |
| Processing plant | Tue 10am–12pm | 0.132477127 |
| Segment 2 | Tue 11am–2pm | 0.157166249 |
| Processing plant | Thu 10am–12pm | 0.357655996 |
| Segment 1 | Wed 11am–2pm | 0.521965798 |
| Segment 1 | Mon 11am–2pm | 0.67784712 |
| Segment 2 | Wed 11am–2pm | 0.998556794 |

Thus, we first schedule Segment 1 Tue 11am–2pm on the first calendar slot available, then Segment 2 Mon 11am–2pm and finally Processing plant Tue 10am–12pm. The calendar is shown below. We would then continue down the list and schedule each in turn until all 10 primary VDTs have been scheduled.

### Scenario 2 sample monthly sampling calendar with two primary events scheduled

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| | | 1<br>Segment 1<br>11am–2pm | 2 | **3** | 4 | 5 |
| 6 | 7<br>Segment 2<br>11am–2pm | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15<br>Process. plant<br>10am–12pm | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

Next we schedule the alternate VDTs, selecting from those that have not been placed on the calendar yet. (Normally we would first finish scheduling the rest of the primary VDTs before moving on to the alternates). The only available alternate for the first primary, Segment 1 Tue 11am–2pm, is Segment 2 Tue 11am–2pm. For the second primary VDT, the only potential alternate is Segment 1 Mon 11am–2pm. There are no remaining alternates available for the third primary VDT, among the limited set we are working with in this example. The updated calendar is shown below.

### Scenario 2 sample monthly sampling calendar with two primary events scheduled

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| | | 1<br>Segment 1<br>11am–2pm<br>Alternate:<br>Segment 2<br>11am–2pm | 2 | **3** | 4 | 5 |
| 6 | 7<br>Segment 2<br>11am–2pm<br>Alternate:<br>Segment 1<br>11am–2pm | 8 | 9 | 10 | 11 | 12 |
| 13 | 14 | 15<br>Process.<br>plant<br>10am–12pm | 16 | 17 | 18 | 19 |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| 27 | 28 | 29 | 30 | 31 | | |

# Appendix 4: Model Sampling Frame (Calendar Format)

## Forest Workers' Malaria Survey

| Venues | Day-time periods | | | | | | |
|---|---|---|---|---|---|---|---|
| **Venue ID** | **Monday** | **Tuesday** | **Wednesday** | **Thursday** | **Friday** | **Saturday** | **Sunday** |
| A001 | 6p–10p | | 6p–10p | | | | |
| A002 | | | 8p–12a | 8p–12a | 8p–12a | 8p–12a | |
| A003 | | 6p–10p | | | 6p–10p<br>10p–12a | 6p–10p<br>10p–12a | 4p–8p |
| B001 | | | | | | 2p–6p | 4p–8p |
| B002 | | | | | | 6p–10p | |
| C001 | 6p–10p | 6p–10p | 6p–10p | | | | |
| C002 | 4p–8 p<br>8p–12a | 12a–2a | 12a–2a<br>4p–8 p<br>8p–12a | 12a–2a<br>4p–8 p<br>8p–12a | 12a–2a<br>4p–8 p | | |
| C003 | | | | | 8p–12a | 8p–12a | |
| C004 | | | 8p–9p | | | | |
| D001 | | 1st and 3rd<br>7p –10p | | | | | |
| D002 | 8p–12a | | | | | | |
| E001 | 6p–10p | | | | 6p–10p<br>10p–12a | 6p–10p<br>10p–12a | 4p–8p<br>6p–10p |
| G001 | 6p–10p | 6p–10p | 6p–10p | 6p–10p | 8p–12a | 8p–12a | |

# Appendix 5: Model Sampling Frame (Line Listing Format)

### Forest Workers' Malaria Survey

| Ven-ue ID | VDT ID | Day | Time | Venue name | Venue location | Venue contact (names, phone #s, emails) | Notes |
|---|---|---|---|---|---|---|---|
| A001 | A001-01 | Mondays | 6p–10p | Sabe Mountain East | | | |
| A001 | A001-02 | Tuesdays | 6p–10p | Sabe Mountain East | | | |
| A002 | A002-01 | Wednesdays | 8p–12a | Gile Forest Sector 4 | | | |
| A002 | A002-02 | Thursdays | 8p–12a | Gile Forest Sector 4 | | | |
| A002 | A002-03 | Fridays | 8p–12a | Gile Forest Sector 4 | | | |
| A002 | A002-04 | Saturdays | 8p–12a | Gile Forest Sector 4 | | | |
| A003 | A003-1 | Tuesdays | 6p–10p | Lampang ridge NE | | | |
| A003 | A003-2 | Fridays | 6p–10p | Lampang ridge NE | | | |
| A003 | A003-3 | Fridays | 10p–12a | Lampang ridge NE | | | |
| A003 | A003-4 | Saturdays | 6p–10p | Lampang ridge NE | | | |
| A003 | A003-5 | Saturdays | 10p–12a | Lampang ridge NE | | | |
| A003 | A003-6 | Sundays | 4p–8p | Lampang ridge NE | | | |
| B001 | B001-1 | Saturdays | 2p–6p | Rigos Mine | | | |
| B002 | B001-2 | Sundays | 4p–6p | Felipe Mine | | | |
| C001 | C001-1 | Mondays | 6p–10p | Ishowe Palm Plantation | | | |
| C001 | C001-2 | Tuesdays | 6p–10p | Ishowe Palm Plantation | | | |
| C001 | C001-3 | Wednesdays | 6p–10p | Ishowe Palm Plantation | | | |
| C001 | C001-4 | Saturdays | 6p–10p | Ishowe Palm Plantation | | | |

(continues) Venue type codes: A=Logging, B=Mine, C =Agricultural, D=Cattle ranch, E=Processing plant, F=Permit office, G=Other

# Appendix 6: Model Sampling Event Calendar

## Forest Workers' Malaria Survey

| Sunday | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|---|---|---|---|---|---|---|
| | | 1<br>PR: B008, 7p-10p<br>ALT: E013, 7p-10p | 2<br>PR: A004, 8p-10p<br>ALT: A052, 8:30p-11p | **3** | 4<br>PR: D101, 11:30a-3:30p<br>ALT: B033, 12:30p-3p | 5 |
| 6 | 7<br>R: C001, 8p-12a<br>ALT: C033, 9p-11p | 8 | 9<br>PR: E001, 6p-10p<br>ALT: C019, 6p-10p | 10 | 11<br>PR: B002, 8p-12a<br>ALT: A052, 9p-11:30p | 12 |
| 13 | 14<br>PR: E005, 6p-10p<br>ALT: G001, 6:30p-9:30p | 15<br>Process. plant 10am–12pm | 16 | 17<br>PR: A052, 8p-12a<br>ALT: G021, 8p-11p | 18<br>PR: G019, 10p-12a<br>ALT: F001, 10p-12a | 19<br>PR: D001, 8p-12a<br>ALT: D021, 9p-12a |
| 20 | 21 | 22<br>PR: A013, 12a-2a | 23 | 24<br>PR: F001, 6p-10p<br>ALT: C015, 7p-10:30p | 25 | 26 |

PR = Primary sampling event; Alt = Alternate sampling event; Shaded areas are days when staff are not available.

Venue type codes: A=Logging, B=Mine, C =Agricultural, D=Cattle ranch, E=Processing plant, F=Permit office, G=Other

# Appendix 7: Sample Universe of Venues Form

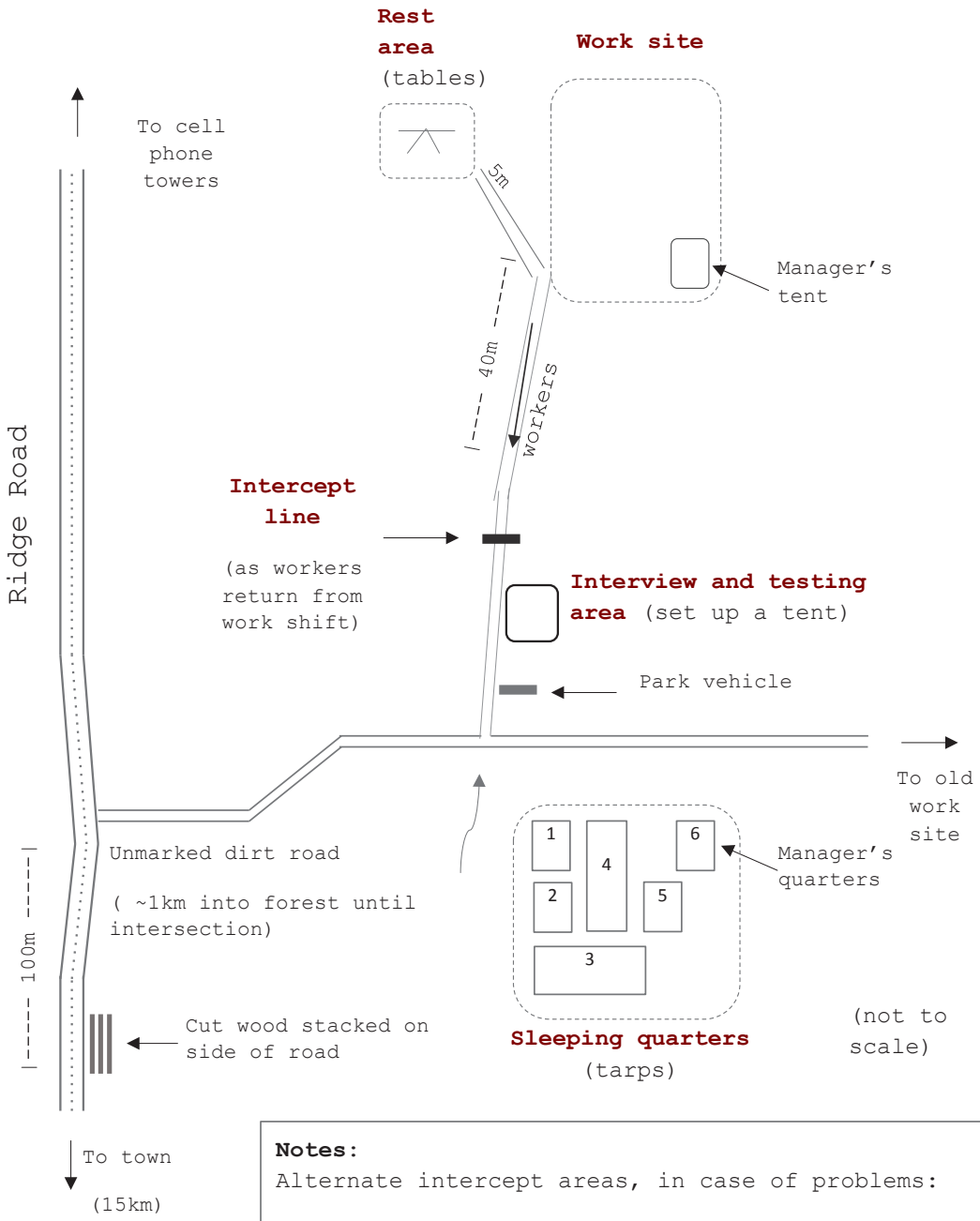
**Forest Workers' Malaria Survey**

Page _____ of _____

| Venue info | | | | VDT info | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Venue ID | Name | Address | Phone | M | T | W | Th | F | Sa | Su |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |

# Appendix 8: Sample Venue Map

**Name of venue:** Rigos logging site
**Venue ID:** A010
**Site verification visit:** 03/04/2017
**Map last updated:** 05/04/2017




**Notes:**
Alternate intercept areas, in case of problems:

- Path to rest area (use fixed line enumeration)
- Sleeping quarters (after 6pm, proceed from #1 to #6)

# Appendix 9: Intercepts and Enrollments Form

Area name: _____ Venue Name: _____ Venue #: _____Event #: _____

Team lead: _____ Interviewer: _____ Date of visit: _____ / _____ / 2016

**Peak time interval.** Day: M Tu W Th F Sa Su Start: ___:___ am pm End: ___:___ am pm

**Visit period.** Day: M Tu W Th F Sa Su Start: ___:___ am pm End: ___:___ am pm

**Enumeration period.** Day: M Tu W Th F Sa Su Start: ___:___ am pm End: ___:___ am pm

| Approached for intercept # | Refused intercept | Age (years) | Lives or works in Bezi | Previous encounter | Eligible | Enrolled | Reason for intercept or enrollment refusal |
|---|---|---|---|---|---|---|---|
| 1 | Y N | | Y N U | Y N U | Y N | Y N | |
| 2 | Y N | | Y N U | Y N U | Y N | Y N | |
| 3 | Y N | | Y N U | Y N U | Y N | Y N | |
| 4 | Y N | | Y N U | Y N U | Y N | Y N | |
| 5 | Y N | | Y N U | Y N U | Y N | Y N | |
| 6 | Y N | | Y N U | Y N U | Y N | Y N | |
| 7 | Y N | | Y N U | Y N U | Y N | Y N | |
| **Subtotals** | | | | | | | |

Add more entries as needed

**Supervisor sign off:** _____ **Team sign off:** _____ **Date of sign off:** _____

# Appendix 10: Sampling Event Card

## Forest Workers' Malaria Survey

Sampling event information

| |
|---|
| **Scheduled date:** ___ / ___ / ____ |
| **PRIMARY VDT**<br>Venue name: Venue ID:<br>Venue owner/contact:<br>Event number:<br>Time period: ___ : ___ AM PM to ___ : ___ AM PM<br>Expected number of venue-goers: _____ |
| **ALTERNATE VDT**<br>Venue name: Venue ID:<br>Venue owner/contact:<br>Event number: |
| Time period: ___ : ___ AM PM to ___ : ___ AM PM<br>Expected number of venue-goers: _____ |

# Appendix 11: Recruitment Monitoring Form

**Forest Workers' Malaria Survey**

Page _____ of _____

| Date | Event # | VDT # | Start Time | End Time | Enumerated No. | Intercepted No. | Refused intercept No. | Previous encounter No. | Eligible | | Enrolled | | Comments |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | No. | % | No. | % | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

# Appendix 12: Eligibility Screening Form

## Forest Workers' Malaria Survey example

| No. | Questions | Coding of answers |
|---|---|---|
| **FOR PARTICIPANT: Please answer the following questions.** | | |
| 1 | How old are you? (If participant responds <18 years, inform them that they are ineligible) | _____ years |
| 2 | Have you participated in this survey in the past 30 days at any place in Bezi? | 1. Yes → Ineligible<br>2. No |
| 3 | Do you currently live or work in Bezi? | Zone ____ |
| 4 | Have you worked in the forest in the past 60 days? | 1. Yes<br>2. No → Ineligible |
| 5 | Have you been at a forest work site anytime between sundown and sunup in the past 60 days, whether working or sleeping? | 1. Yes<br>2. No →Ineligible |
| 6 | Do you agree to participate in a face-to-face structured survey? | 1. Yes<br>2. No |
| 7 | What are the reasons for NOT agreeing to participate in a face-to-face structured survey? | 1. Too busy<br>2. Fear of being stigmatized for participation<br>3. Not interested<br>4. Incentive is not worth the time<br>5. Already answered survey<br>6. Other: _____ |
| **FOR INTERVIEWER: Please answer "Yes" or "No" to the following statements.** | | |
| 8 | Participant appears unable to provide informed consent due to the influence of alcohol or drugs or sleep-deprivation. | 1. Yes<br>2. No |
| 9 | Participant has provided verbal informed consent. | 1. Yes<br>2. No |
| 10 | Participant was recruited from a selected site. | 1. Yes<br>2. No |
| 11 | Eligible to participate in the survey.* | 1. Yes<br>2. No |

* Eligible = answers to questions 8-10 must match answers in bold.

## Additional screening questions

***[Adapt based on formative assessment in the local area]***

*[Check with supervisor which questions to use today]*

How do you prepare for entering a mine ?

What times do people work and sleep at mining/logging/agricultural sites?

What tools are required for mining/logging/agricultural in the forest?

What permits are required to work in the forest in mining / logging / agriculture?

**Confidence in forest worker status**
How confident are you that the participant is truly a forest worker?

☐ Highly confident
☐ Somewhat confident [state reason why]: _____
☐ Not confident [please see supervisor for further instructions]

# Appendix 13: Consent Form for Survey

## Consent to Participate in Resarch

### Forest Workers' Malaria Survey

VDT ID: _____

Participant survey code: _____

My name is _____ and I work with [Institution leading the survey]; the Ministry of Health and [Other partner institutions] are members of this partnership. You/your child are/is being asked to take part in this survey because working in the forest in this area may put you at risk of becoming infected with malaria. If the patient is a child, we need to ask a parent or guardian for permission, as well as asking the child if he/she is over 18 years old.

In this survey, the researchers are collecting blood samples to test for malaria and asking community members questions to learn more about the causes of malaria in this area. The goal of this survey is to gather information that will help _____ eliminate malaria. Your participation is very important but your participation is completely voluntary.

#### What will happen if I take part in this survey?

If you agree to be in this survey, we will perform a finger prick to collect blood for rapid malaria testing. We will also save a small amount of blood on filter paper for other laboratory tests related to malaria only. We will also conduct a questionnaire to assess your time spent at this venue along with assess potential risk factors for malaria including occupation and daily activities. If you decide to participate in this survey, we will provide you with malaria prevention information. In total, participation in the survey will take about 60 minutes.

#### What will happen if my malaria result is positive?

You will be tested for malaria as part of this survey by a rapid diagnostic test that will yield a negative or positive result. The result appears within 20 minutes and the nurse will disclose the result of your test. If the result is positive, you will be referred to the nearest health facility for administration of proper treatment.

#### Are there risks?

There are minimal risks for participating in the interview. The questionnaire does not ask sensitive questions and measures are in place to keep the information you provide confidential. One may feel a brief moment of pain when the blood is being collected, but the risk is minimal because the process will be done by a well-trained officer. Participation or refusal to participate in this survey will not affect you or your child's medical care or access to public health services in any way.

#### *Are there benefits?*

The results of this survey may help the Ministry of Health develop better strategies to prevent malaria in this area. The team will also provide education on malaria prevention. You will also be able to know if you or your child is infected with malaria by rapid testing and will be treated if infected.

#### Will my information be kept confidential?

We will not inform anyone of your or your child's participation in the survey and your or your child's name will be kept confidential by replacing it with a number/identifier that will be used throughout the survey.

#### Who can answer my questions about the survey?

You can talk to the Survey Coordinator about questions, concerns, or complaints you have about this survey. If you wish to ask about the survey or your or your child's rights as a participant or if you wish to tell someone about problems or concerns you may have, please call the [Ethics review board] at [phone number] or [Local survey contact person and telephone]. You have been given a copy of this consent form to keep.

### Consent

Do you agree to participate in the questionnaire AND provide a blood sample to be used for current and future malaria testing?

☐ Yes ☐ No

Date:

_____

Participant's Signature/Thumb Print for Consent

Date:

_____

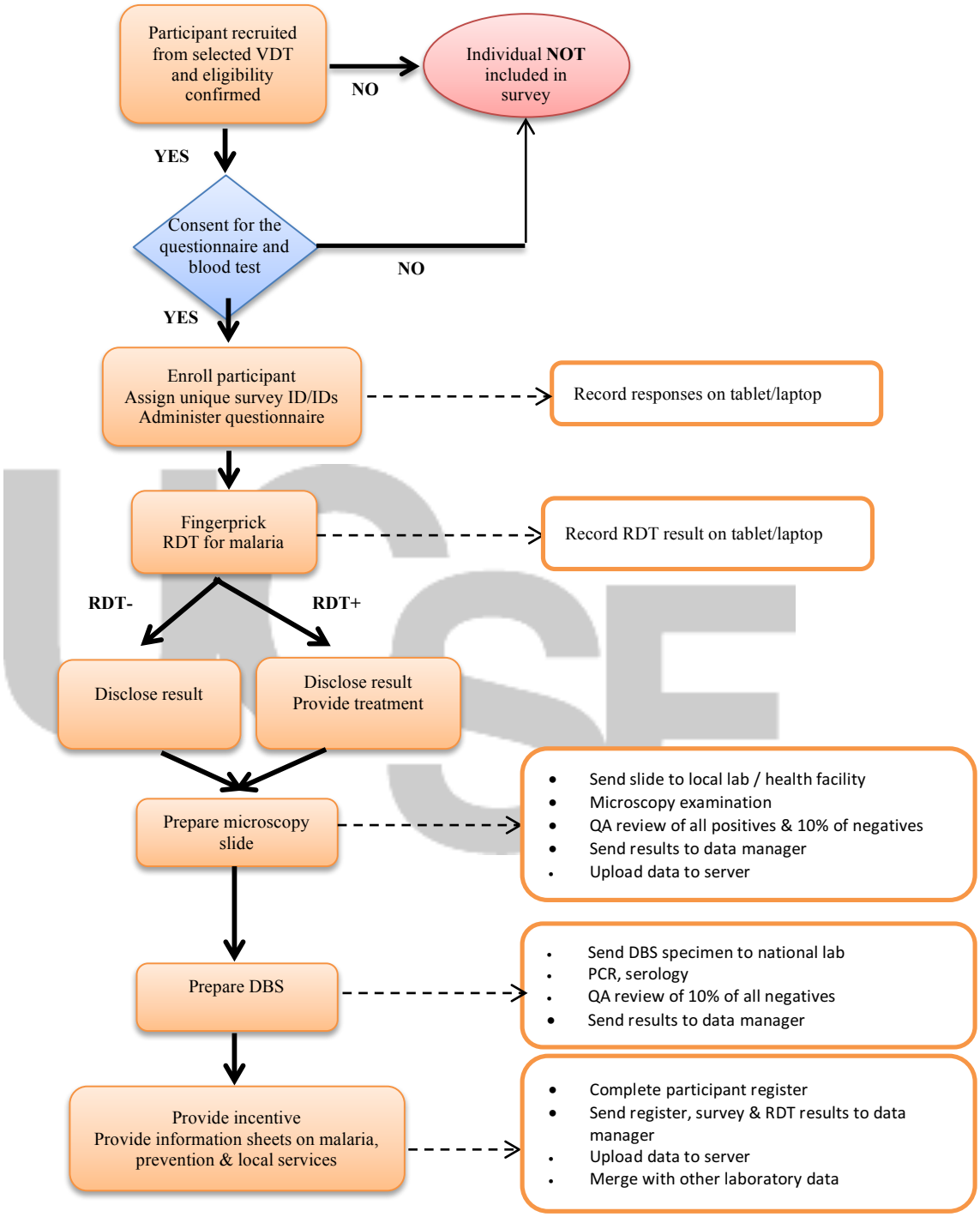
Witness signature (if participant does not speak/read English) or Parent or Guardian signature if participant is under 18 years; if participant is over 10 the child's signature must also be obtained above.

Date:

_____

Person Obtaining Consent – Printed Name

# Appendix 14: Sample Data and Specimen Flow Chart



# Appendix 15: Employee Confidentiality Agreement

**Forest Workers' Malaria Survey**

## Employee Confidentiality Agreement

I recognize that in carrying out my assigned duties as a staff member on the Forest Workers' Malaria Survey I may obtain access to private information about persons in this survey that was provided under an assurance of confidentiality.

I understand that I am prohibited from disclosing or otherwise releasing any personally identifying information, either directly or indirectly, about any individual in the survey. Should I be responsible for any breach of confidentiality, I understand that civil and/or criminal penalties may be brought against me.

I acknowledge that my responsibility to ensure the privacy of protected health information contained in any electronic records, paper documents, or verbal communications to which I may gain access shall not expire, even after my employment or affiliation with this survey has terminated.

By my signature, I acknowledge that I have read, understand, and agree to comply with the terms and conditions of this confidentiality agreement.

Employee name (printed) _____

Employee signature _____

Date _____

Supervisor name (printed) _____

Supervisor signature _____

Date _____

# Appendix 16: Incident Reporting Form

## Forest Workers' Malaria Survey

| **Name of person writing report:** | |
|---|---|
| Date of writing report: | |
| Date of incident: | |
| Staff involved: | |
| Location: | |
| **Adverse/unusual event category (Check all that apply to incident)** | |
| ☐ Venue-goer harmed or threatened | ☐ Venipuncture/fingerprick incident |
| ☐ Staff harmed or threatened | ☐ Venipuncture/fingerprick difficulty |
| ☐ Stipend issue | ☐ Specimen transport or storage issue |
| ☐ Theft or loss of equipment | ☐ Confidentiality issue |
| ☐ Other safety issue | ☐ Other |

| **Narrative description of incident:** |
|---|
| |

| Recommendations: |
|---|
| |

| Resolution: |
|---|
| |

# Appendix 17: Sample Size Formulas

See an Excel spreadsheet included in the Module to carry out the formulas described in this appendix.

## 1. Sample size to estimate parasite prevalence among forest workers

To calculate the sample size required to estimate parasite prevalence with a maximum level of acceptable error, we begin with the formula:

$$n = \frac{(P(1-P)Z^2_{(1-a)}}{\Delta^2}$$

Then apply the design effect and the finite population correction. The finite population accounts for the fact that the sample size may represent a non-trivial fraction of the total forest worker population. The DEFF is needed to compensate for the loss of statistical information that results because people recruited from the same venues may be similar to one another (i.e., effect of clustering).

$n'=DEFF \times n(1+n/N)$

Where:

n'=required sample size per survey site

P=anticipated level of parasite prevalence in the target population

Δ=maximum acceptable error (the half-width of the confidence interval of the estimate)

N=total size of the target population in the project area

DEFF=design effect

$Z_{(1-a)}$=the Z-score corresponding to a confidence level of 1-a (e.g., 1.96 for a 95% confidence level)

**Example**

Say we want to calculate the minimum number of survey participants we would need to estimate the parasite prevalence among forest workers in the project area. First, we need a "best guess" of what the estimate will be; based on data available prior to the survey, we anticipate that prevalence will be 4%. Next, we decide we need the estimate to have at most 2% error, i.e., the confidence interval will be 4% +/- 2% or (2-6%). We willl use a 95% confidence level, which corresponds to a Z-score of 1.96. The first part of the formula is:

$n=(0.04(1-0.04)\ 1.96^2)/(0.02)^2$

This results in n = 369. The second step is to apply the finite population correction, assuming 10,000 total forest workers in the Bezi area, and a design effect of 2.0.

n'=2(369/(1+369/10000))

The sample size required for this estimate is n' = 711 survey participants.

## 2. Sample size to detect a decline in parasite prevalence among forest workers over time

Apart from estimating the prevalence of parasite infection, another objective of the survey is to be able to track trends in prevalence over time, by conducting a similar survey among forest workers sometime in the future. The following formula gives the minimum sample size required to be able to detect changes in the prevalence estimated by this survey and another one:

$n=1/ |P-P_2 | [Z_{(1-a)} \sqrt{(2P(1-P))}+Z_{(1-ß)} \sqrt{(P(1-P)+P\_2 (1-P\_2 ) )}]^2$

As before, we then apply the finite population correction and design effect:

$n'=DEFF \times n/(1+n/N)$

Finally we apply the continuity correction (from Fleiss, 1980):

$n''=n'+1/0.5|P-P_2 |$

Where:

n"=required sample size per survey site

P=anticipated level of parasite prevalence in the target population in this survey

P2=anticipated level of parasite prevalence in the target population in a future survey

N=total size of the target population in the project area

DEFF=design effect

$Z_{(1-a)}$=the Z-score corresponding to a confidence level of 1-a (e.g., 1.96 for a 95% confidence level)

$Z_{(1-ß)}$=the Z-score corresponding to a power level of 1-ß (e.g., 0.84 for 80% power)

**Example**

Continuing with the example above, say we expect that 2 years after the present survey is conducted, malaria control and elimination efforts will have led to a decline in parasite prevalence among forest workers. For this calculation, we will assume that parasite prevalence is currently 4% and that by the time of the next survey it will have declined to 0.5% or lower. We also assume the total number of forest workers in the project area will remain at 10,000 and that both surveys will use the same methodology, so they will have the same DEFF. To calculate the sample size needed in each survey to be able to track trends (i.e., to produce statistical evidence of a decline), we apply the formulas as follows:

$$n=1/|0.04-0.005|\ [1.96\sqrt{(2(0.04)(0.96))}+0.84\sqrt{(2(0.04)(0.96)+0.005(0.995))}]^2$$

This results in a minimum sample size of n = 280.3. We then apply the finite population correction and DEFF:

$$n'=2 \times 280.3/(1+280.3/10000)$$

This gives n' = 545.4. Finally we apply the continuity correction:

$$n''=545.4+1/0.5|0.04-0.005|$$

The final required sample size for this comparison is n" = 603 participants in each survey round.

### 3. Detect elevated risk among forest workers compared to general population in same area

Similar to the above, we may wish to compare parasite prevalence in forest workers with the household population, to produce evidence that forest workers do actually have elevated malaria risk. Just as above, we would like to be sure that the survey has enough statistical power to be able to make this kind of comparison. The sample size calculation is the same as the one in example #2 above, however this time we set P2 as the expected prevalence in the household population. For example if we expect that parasite prevalence is likely to be 0.5% in the household population, then the required sample size would be 603 survey participants.

Finally, after calculating the sample size required for these three different survey objectives, we would set our final sample size to be 711 participants, the largest of the three sample sizes required.

**References**

Hulley SB, Cummings SR, Browner WS, Grady D, Newman TB. Designing clinical research : an epidemiologic approach. 4th ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2013. Appendix 6B, page 75.

Fleiss JL, Tytun A, Ury HK. A simple approximation for calculating sample sizes for comparing independent proportions. Biometrics 1980;36:343-46.

# Appendix 18: Sampling Event Preparation Checklist

## To complete 1–2 weeks prior to sampling event

- ☐ Contact the venue manager or their designated contact person by phone to notify them that the team will be in or near the venue conducting an event on the specific day and time.
- ☐ If an interview area will be set up outside the venue (e.g., tent or van), obtain permits from the appropriate local office, if necessary.

## Sampling event information to gather right before sampling event

| |
|---|
| Event number: |
| Survey code of 1st participant at VDT: |

## Tasks to complete right before sampling event

- ☐ Batteries for the tablets/laptops are fully charged
- ☐ Data from the previous sampling event are downloaded from the tablet/laptop to the main database(s)

## Materials to bring to the sampling event checklist

*Equipment*

- ☐ Tablets/laptops (1 for each Interviewer and a backup)
- ☐ Tally counter (clickers)
- ☐ Communication equipment (e.g., 2-way radios or cell phones)

*Malaria testing supplies*

(add here based on testing procedures)

*Blank forms/logs*

- ☐ Enumeration Summary forms
- ☐ Intercepts and Enrollments forms
- ☐ Sampling event card
- ☐ Recruitment monitoring form
- ☐ Eligibility screening form
- ☐ Consent forms
- ☐ Data corrections log
- ☐ Paper copies of the questionnaire (for emergency use only)
- ☐ Incentive tracking form (if applicable)

*Reference material*

- ☐ Protocol
- ☐ Operations module
- ☐ Sampling frame for month (in case venue officials recommend changes)
- ☐ Sampling calendar for month (in case venue officials wish to confirm dates)

*Other materials*

- ☐ Enough incentives to cover expected number of participants
- ☐ Enough educational materials to cover expected number of participants
- ☐ Other item: _____
- ☐ Other item: _____

# Appendix 19: Event Notes and Post-Event Checklist

## Event Notes

1. Describe recruitment type and the area within the venue where the recruitment took place:

2. Describe any barriers to project activity at the venue:

3. Was there any significant change in the population at the venue? If yes, explain:

4. What new VDTs were suggested by venue attendees?

5. Should the venue be removed from the frame? If yes, explain:

6. If the event was moved to an alternate venue, explain why: