



# MALARIA ELIMINATION: EXPANDING TEST, TRACK AND TREAT IN MINING AREAS

Baseline Report submitted to the  
Ministry of Health, Malaria Programme

Impact study  
on the MSD  
strategy

# Malaria Elimination: Expanding test, track and treat in mining areas

## Baseline report on the MSD strategy

July 2015

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### **Produced for:**

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## Abbreviations

|                   |   |
|-------------------|---|
| ACD               | Active Case Detection   |
| ACT               | Artemisinin-bases Combination Therapy   |
| BCC               | Behaviour Change Communication  |
| BOG               | Bureau of Public Health (Bureau Openbare Gezondheidszorg)   |
| CDC               | Center for Disease Control  |
| <i>currutela</i>  | Gold miners' village (Por)  |
| FG                | French Guiana   |
| <i>garimpeiro</i> | Gold miner (Por)  |
| IDB               | Inter-American Development Bank   |
| KAP               | Knowledge, Attitudes and Practices  |
| LLIN              | Long-Lasting Insecticidal Nets  |
| MoH               | Ministry of Health  |
| MP                | Malaria Programme   |
| MP I              | First malaria programme, executed by the Medical Mission  |
| MP II             | Second malaria programme "Looking for gold, finding malaria", executed by the BOG Malaria Programme |
| MP III            | Third malaria programme "Malaria Elimination programme", executed by the BOG Malaria Programme      |
| MSD               | Malaria Service Deliverer   |
| MSH               | Management Sciences for Health  |
| MZ                | Medical Mission Primary Health Care Suriname ( <i>Medische Zending</i> )                            |
| NMB               | National Malaria Board  |
| $N_{total}$       | Total valid sample for the indicated question   |
| OTC               | Over-The-Counter (medicine)   |
| PAHO              | Pan American Health Organization  |
| RBM               | Roll Back Malaria Partnership   |
| RDT               | Rapid Diagnostic Test   |
| SSGM              | Small-scale gold mining   |
| SIAPS             | Systems for Improved Access to Pharmaceuticals and Services   |
| SPSS              | Statistical Package for the Social Sciences   |
| SRD               | Suriname dollar   |
| TB                | Tuberculosis  |
| TWG               | Technical Working Group   |
| US                | United States   |
| USAID             | US Agency for International Development   |
| USD               | United States dollar  |
| WHO               | World Health Organization   |

# Summary

**Introduction and background:** The data presented in this report establish the baseline for a research programme to monitor and evaluate the activities of the Suriname Ministry of Health (MoH) programme aimed at complete elimination of malaria in Suriname (hereafter: Malaria Elimination programme). This IDB funded programme will be executed by the Bureau of Public Health (BOG) Malaria Programme (MP). The Malaria Elimination programme focusses on small-scale gold mining areas in the Suriname-French Guiana border region, which are the main remaining point sources of malaria transmission in Suriname.

Analysis of existing data and reports suggests that the largest share of malaria cases detected in Suriname today are probably the result of transmission in French Guiana. Several interrelated factors explain this trend, including the proximity of French gold deposit to the Suriname border, French repression of clandestine mining, high mobility of mining populations, and limited access to health services in French *garimpos* (mining areas). Intervention strategies of the Malaria Elimination program include an extension of MSD services, distribution of LLINs, and Behaviour Change Communication (BCC).

**Methodology:** the researchers conducted a quantitative surveys with inhabitants of small-scale gold mining regions in the Lawa and Marowijne areas who had experienced (suspected) malaria in the 1 ½ years preceding the interview. A purposive sampling strategy was used. Because of the low malaria prevalence, it was not possible to reach the target of 200 respondents. A total of 141 valid surveys were conducted, with 62 women (44%) and 79 men (56%). Respondents were on average 36.3 years of age, and all but three respondents were born in Brazil (97.9). Most men worked as gold miners and transport providers, and most women worked as traveling vendors or cooks. Qualitative interviews were conducted with MSDs and the Malaria Programme management.

**Results and conclusions:** Quantitative study results are presented and compared with results from earlier malaria KAP studies in Table 1. It is concluded that malaria is not a principle health concern to the target population. Nevertheless, because of the continuous influx of people from French Guiana gold mining areas, new cases appear regularly and malaria monitoring and control remains necessary. Comparison with data from earlier KAP studies suggests that since 2009, malaria knowledge has increased. Malaria conscious behaviour, on the other hand, has worsened. Today, fewer people use bed nets, test for malaria when experiencing symptoms, and adhere to the malaria treatment regime than in 2009. One challenge for the MP is that, regardless of how many MSDs are trained, the main at risk population -people working in French Guiana mining areas- continuous to have poor access to health facilities and therefore use OTC medication. Furthermore, due to the low malaria prevalence, people do not perceive malaria as a threat, do not go for malaria testing, and do not feel the need to sleep with a bed net. Programme sustainability is questionable, unless additional funding is secured, possible (also) for services other than malaria.

Several listed recommendations are already part of the MSD strategy, suggested that the strategy is in line with the current field situation. The researchers recommend improved access to LLINs and enhanced visibility of the MP as quick wins that can be immediately implemented. In the area of BCC it is recommended to focus on person-to-person communication, provide simple and clear messages that are consistent across organizations and use popular visual media. Recommended services include enhancement of access to malaria testing and treatment, and increase of the range of health services offered to mobile populations. Collaboration could be useful with sellers of OTC medication and with health professionals, politicians and other stakeholders in neighbouring countries.

Table 1. Indicators used in the 2009 MoH malaria KAP study, the 2012 MoH malaria KAP study, the 2013 PAHO/MSH study on malaria treatment behaviour and the present (2015) baseline study.

| % of at risk population who:   | 2009               | 2012               | 2013  | 2015  |
|--|--------------------|--------------------|-------|-------|
| Name mosquitoes as the cause for malaria <sup>a</sup>  | 60.6%              | 62.3%              | 83.3% | 87.2% |
| Name <i>only</i> mosquitoes as the cause for malaria   | -                  | -                  | -     | 81.6% |
| Know the main symptoms of malaria <sup>a</sup>   | 85.6%              | 88.1%              | 99.1% | 99.3% |
| Can name at least one effective method to prevent malaria <sup>a</sup>   | 64%                | 81.9%              | 72.2% | 73.6% |
| Name the bed net as an effective way to protect oneself against malaria  | 59.2%              | 76.2%              | 66.7% | 69.5% |
| Can name a malaria testing and treatment facility <i>in Suriname</i>   | 89.2% <sup>d</sup> | 82.6% <sup>d</sup> | 62.5% | 64.5% |
| Can name a malaria testing and treatment facility <i>in their present vicinity</i>                               | -                  | -                  | -     | 99.3% |
| Have correct knowledge of the causes, symptoms, prevention and treatment of malaria                              | 33.1%              | 47.3%              | 46.8% | 59%   |
| Possess an Insecticide Treated Net (ITN) <sup>b</sup>  | 62.6%              | 38.4%              | -     | 10.6% |
| Slept under a bed net in the night prior to the interview <sup>a</sup>   | 59.4%              | 49.4%              | 18.5% | 12.8% |
| Slept under an ITN in the night prior to the interview <sup>a,b</sup>  | -                  | -                  | 11.1% | 6.4%  |
| Did a malaria test the last time they suspected to be ill with malaria   | -                  | 83.9%              | 54.2% | 65.2% |
| Got tested for malaria with an MSD, among those who got tested for malaria the last time they suspected malaria  | -                  | 19.8%              | 22.8% | 33.7% |
| Self-medicated for (suspected) malaria at least once in the past 1 ½ years                                       | 53.8% <sup>c</sup> | 44.7% <sup>c</sup> | 58.8% | 54.6% |
| Completed malaria treatment last time the person had (suspected) malaria   | 80.6%              | 86.4%              | 61.1% | 65%   |
| Completed malaria treatment, among those who had self-medicated  | -                  | -                  | 40.2% | 37.5% |
| Completed malaria treatment, among those who had been tested by a health worker                                  | -                  | -                  | 78.9% | 79.3% |
| Were in French Guiana, the last time they had (suspected) malaria  | 12.5%              | 19.5%              | 59.3% | 64.5% |
| Recall hearing or seeing any malaria message within the past 6 months <sup>a</sup>                               | Not measured       |                    |       | 64.5% |
| Recognize the MP logo and know what it stands for  | Not measured       |                    |       | 12.1% |
| Mobility indicator: Share of respondents who spent more than three months in Suriname during the past six months | Not measured       |                    |       | 36.4% |

a Indicator from the Roll Back Malaria Partnership (RBM)

b Global Fund Core Indicator for malaria prevention programs

c Overall; not limited to the past 1 ½ years

d Anywhere, not only in Suriname

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# 1. Introduction

This baseline report presents baseline data on knowledge, attitudes and practices related to malaria and malaria treatment among small-scale gold miners and others working in the small-scale gold mining sector in the Suriname-French Guiana border region. The baseline study is part of a research programme to monitor and evaluate the activities of the Suriname Ministry of Health (MoH) Malaria Programme (MP) aimed at complete elimination of malaria in Suriname, fully named: “Malaria elimination: expanding test, track and treat in mining areas” (hereafter: Malaria Elimination) programme. The Malaria Elimination programme is supported by the IDB, as Technical Cooperation project “Support for Active Malaria Case Detection Program” (SU-T1072). It is a logical follow-up of earlier programs to fight malaria in Suriname’s interior (Figure 1).

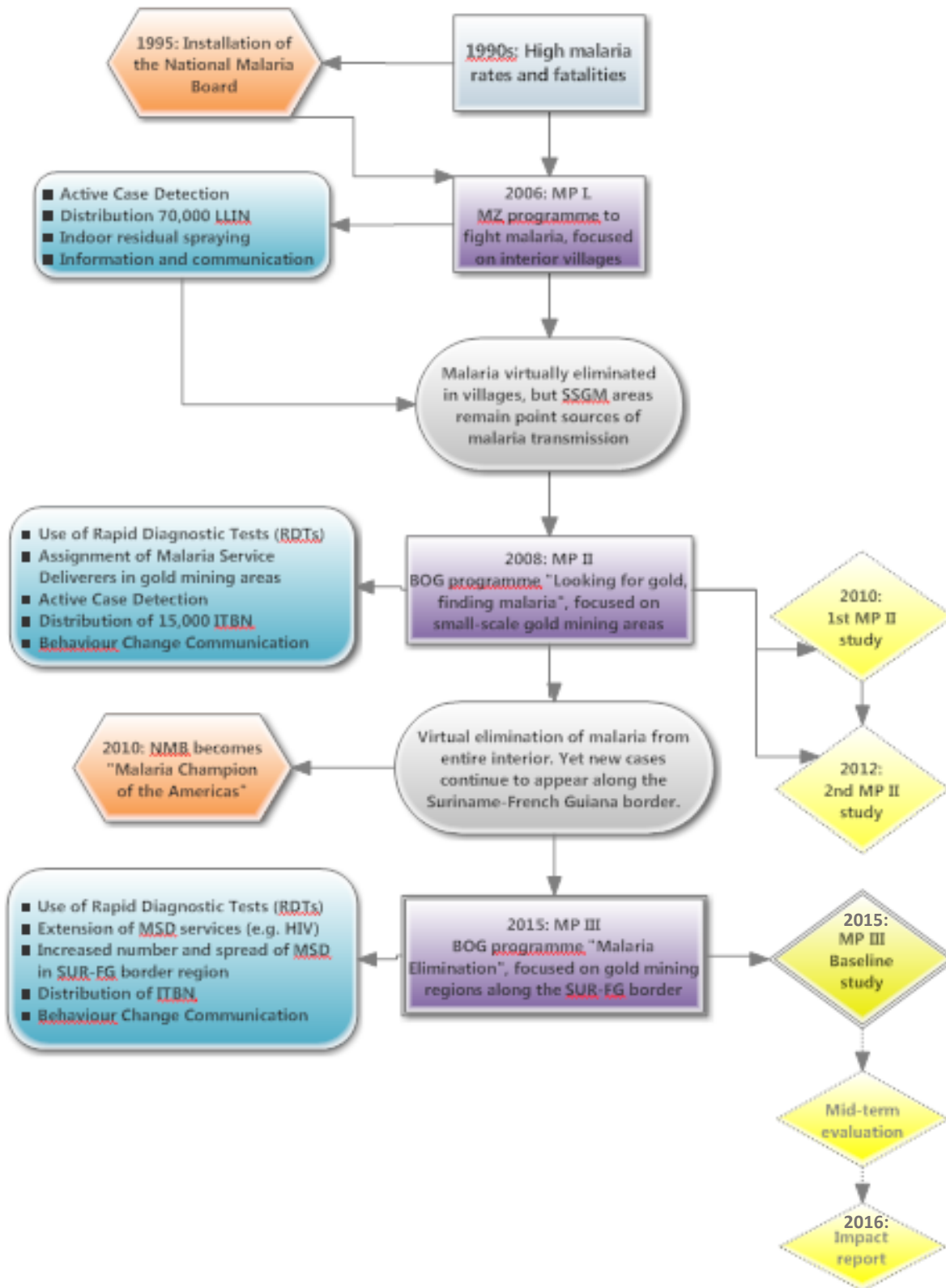
The Malaria Elimination programme (MP III) focusses on small-scale gold mining areas in the Suriname-French Guiana border region. Suriname’s small-scale gold mining sector is concentrated in South-East Suriname and employs an estimated 13,000 small-scale miners and a similar number of mining service providers (e.g. cooks, transport providers, sex workers). Small-scale gold mining areas are the primary remaining point sources of malaria transmission in Suriname. Lack of adequate health infrastructure; “open” living and sleeping arrangements (often just a roof); large pits of standing water; long workdays; limited protection against mosquitoes; and a highly mobile population are associated with high prevalence of malaria in mining areas (Figure 2). In addition, we found in earlier studies that self-diagnosis, self-medication, and incomplete medication intake are common in mining populations, thus compromising effective treatment (Heemskerk and Duijves, 2013).

It is a challenge to communicate public health messages to, and execute health intervention with, gold miners because travel to the mining areas is difficult and expensive and gold miners are mobile populations. In the case of migrant miners (mostly Brazilians), who constitute a significant share of the mining population, providing health messages and care is even more difficult because they typically do not speak the local languages, may not have medical insurance, and are unlikely to visit the MZ health centres when they fall ill (Heemskerk and Duijves, 2012b). As a result of the mentioned factors, small-scale gold miners –particularly migrants- are most at risk populations for malaria transmission.

Presently, almost all observed cases of malaria in Suriname originate from gold mining areas. More specifically, data from the BOG Malaria Programme and recent studies suggest that most new malaria cases come from mining areas situated near the border with French Guiana, and that the largest share of transmission takes place in this neighbouring country (Heemskerk and Duijves, 2013; Malaria Programme, 2013 - see Table 1). For this reason, the present Malaria Elimination programme focusses on Suriname locations along border with French Guiana where gold miners working in French Guiana assemble when they leave the mines to buy supplies, rest, seek medical assistance, see their families and so forth.



Figure 1. History of the malaria programme in Suriname



The aim of the Malaria Elimination programme is to completely eliminate<sup>1</sup> malaria in Suriname. This will be done by expanding on strategies that have been successful in the key affected areas and populations during previous campaigns. These strategies include the provision of free malaria testing and treatment in mining areas by Portuguese speaking Malaria Service Deliverers, and the distribution of free Long Lasting Impregnated Nets (LLINs).

An impact study has been planned to document the impact of the Malaria Elimination programme. The present study was performed at the onset of this programme. Its primary goal is to:

*Document baseline conditions at the onset of the Suriname Ministry of Health Malaria Elimination programme (July 2015) on small-scale gold mining populations in the Suriname-French Guiana border regions, in order to be able to establish programme impact one year later (July 2016).*

Baseline conditions documented in this study include:

- Malaria knowledge in the target population.
- Malaria prevention behaviour of the target population, particularly with regard to the (consistent) use of bed nets.
- Malaria treatment behaviour among the target population, particularly in terms of self-medication and incomplete treatments.
- Exposure to Behaviour Change Communication (BCC) about malaria in general, and information by the Suriname MP in particular.
- Knowledge of, access to, and use of Malaria Service Deliverer (MSD) services in the mining areas.
- Familiarity with, and recognition of, Malaria Programme posts and their services.

In addition, this baseline study provides insight in the mobility of small-scale gold mining populations in the Suriname-French Guiana border region.

The baseline study will be followed by an intermediate evaluation and an impact report (Figure 1). The acquired knowledge will serve to establish targets, assign priorities and refine the approach to treating malaria in the target communities.

This report proceeds as follows. The introduction is followed by a literature review (Section 2), which synthesizes information from earlier studies on malaria and malaria programmes in Suriname. It also looks at lessons learned from malaria programmes in neighbouring countries. Section 3 presents the methods that have been used for data collection and analysis, and describes the study sample. The results are delivered in Section 4. Next, in section 5, we look at trends that may be established from this and earlier studies on malaria knowledge, attitudes and practices (KAP) in Suriname mining populations. The conclusions and recommendations are presented in section 6.

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<sup>1</sup> We use the term “elimination” rather than eradication for the following reason. According to the CDC definition (Dowdle, 1999), elimination of disease is “Reduction to zero of the incidence of a specified disease in a defined geographical area as a result of deliberate efforts; continued intervention measures are required.” Eradication is “Permanent reduction to zero of the worldwide incidence of infection caused by a specific agent as a result of deliberate efforts; intervention measures are no longer needed.” In this case, continued intervention and control measures will be necessary as long as malaria has not been eliminated in the region.

Figure 2. Living and working conditions in mining areas facilitate malaria transmission

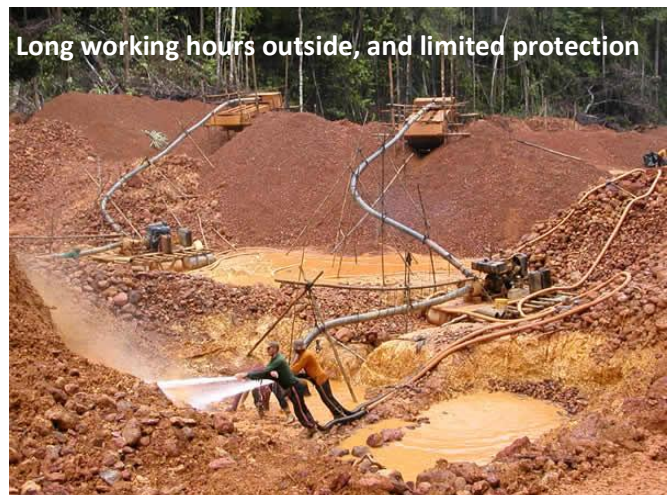
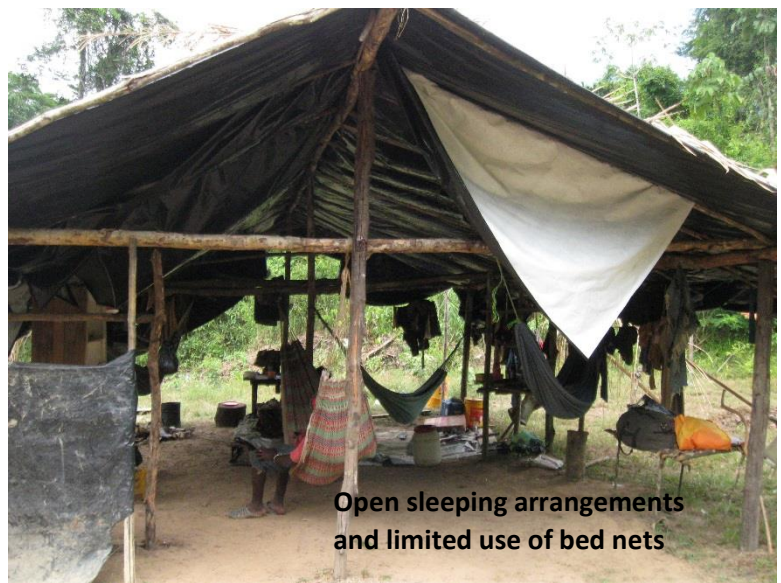


Figure 1. Distribution of Malaria Service Deliverers across mining areas in the Suriname interior (situation by mid-2015)

The expanded “Test and Treat” service provision in the mining areas will including the following:

- A Medische Zending run Medical Clinic at the Airport in Lawatabiki (funded and overseen by the Ministry of Health)
- 3 Mobile Medical “Professional” Malaria Service Deliverers who use both a boat and all-terrain vehicles to proactively provide Test and Treat services to gold miners in more remote locations.
- 6 “Fixed Post” Malaria Service Deliverers, situated at key locations where many miners stay and/or pass through. These locations include Papatam/Albina, where an MSD kiosk is about to be opened.
- 30 (or 40?) volunteer Community Health Worker MSDs that provide more informal Testing and Treatment in remote mining communities with poor access to the fixed points, the mobile MSDs, or the established medical clinic.

Furthermore, the Test and Treat strategy has a second layer outside of the mining areas, along supply and transportation routes frequently used by miners. This second layer includes the following:

- The Tourtonne Migrant Medical Clinic / Lab in Paramaribo, now with an expanded range of services including HIV counseling and testing, Leishmaniasis referral and treatment, and TB referral, counselling and diagnosis.
- The “Zorg en Hoop” Airport Cabin / Kiosk in Paramaribo, managed and staffed by the Suriname Malaria Program during peak hours for flights to the Lawa River area. The malaria kiosk at Zorg en Hoop national airport was opened in August 2015.

Other planned interventions include:

- Distribution of at least 37,000 LLINs in malaria risk areas, notably the mining areas, with the Benzdorp region as specific area of attention. Ten thousand LLIN will be distributed before the end of 2015, and another 17,000 in 2016. (en die andere 10,000?) An additional number of LLINs from Brazil will also be distributed, but the exact numbers are as of yet unknown.
- Design and implementation of a Malaria communication campaign to promote the Malaria Program Primary health messages, reaching a minimum of 20.000 people of the target population by;
  - Dispersion of multilingual IEC messages on billboards, posters (3000), radio-spots, SMS, and polo shirts (200), caps (1000) and lanyards (1000).
  - Adaptation and broadcasting of existing video messages, and the production of at least two short new ones; one on the primary health messages, and one on TropClinic (which is new name of the malaria clinic at Anamoestraat).

## 2.3 Findings from earlier studies

In 2009-10, the Ministry of Health commissioned the first malaria KAP study in small-scale gold mining areas. This study concluded that malaria knowledge was inadequate, with especially among local people a persistent belief that malaria is caused by drinking or being near 'bad' water. Awareness of the correct ways of malaria treatment also was classified as too low, with too many individuals buying over the counter medicine (18%) and significant levels of non-completion of the prescribed doses of medicine (19.4%). The study also found that half of the respondents did not consistently use a bed net; the main reason being "not having one".

The follow-up evaluation in 2012 found that as compared to 2009, overall malaria knowledge among gold mining area inhabitants had increased (Table 3). Nevertheless, treatment behaviour remained sub-standard. Only 38.6 percent of interviewees reported that they had used the services of a formal or government health clinic the last time they had malaria; a mere 37 percent of respondents in gold mining areas named the Malaria Program's Malaria Service Deliverers (MSD) as a location where one can test for malaria; and only 20.1 percent of respondents had used the services of an MSD the last time they had malaria. A surprising finding in this study was that despite the 15,000 Long Lasting Insecticidal Net (LLIN) that had been distributed among small-scale gold miners in the interior, an increased share of gold miners reported that they did not possess an LLIN. Meanwhile a decreased number of respondents appeared to be sleeping with a bed net.

Table 2. Indicators used in the 2009 MoH malaria KAP study, the 2012 MoH malaria KAP study and the 2013 PAHO/MSH study on malaria treatment behaviour.

| <b>% of interviewees who:</b>   | <b>2009</b>        | <b>2012</b>        | <b>2013</b> |
|---|--------------------|--------------------|-------------|
| Name mosquitoes as the cause for malaria <sup>a</sup>   | 60.6%              | 62.3%              | 83.3%       |
| Know the main symptoms of malaria <sup>a</sup>  | 85.6%              | 88.1%              | 99.1%       |
| Can name at least one effective method to prevent malaria <sup>a</sup>  | 64%                | 81.9%              | 72.2%       |
| Name the bed net as an effective way to protect oneself against malaria   | 59.2%              | 76.2%              | 66.7%       |
| Know where to go for malaria testing and treatment in Suriname  | 89.2% <sup>d</sup> | 82.6% <sup>d</sup> | 62.5%       |
| Have correct knowledge of the causes, symptoms, prevention and treatment of malaria                             | 33.1%              | 47.3%              | 46.8%       |
| Have an Long Lasting Insecticidal Net <sup>b</sup>  | 62.6%              | 38.4%              | -           |
| Slept under a bed net in the night prior to the interview <sup>a</sup>  | 59.4%              | 49.4%              | 18.5%       |
| Slept under an LLIN in the night prior to the interview <sup>a,b</sup>  | -                  | -                  | 11.1%       |
| Did a malaria test the last time they suspected to be ill with malaria  | -                  | 83.9%              | 54.2%       |
| Got tested for malaria with an MSD, among those who got tested for malaria the last time they suspected malaria | -                  | 19.8%              | 22.8%       |
| Self-medicated for (suspected) malaria at least once in the past 1 ½ years                                      | 53.8% <sup>c</sup> | 44.7% <sup>c</sup> | 58.8%       |
| Completed malaria treatment   | 80.6%              | 86.4%              | -           |
| Completed malaria treatment, among those who had self-medicated   | -                  | -                  | 40.2%       |
| Completed malaria treatment, among those who had been tested by a health worker                                 | -                  | -                  | 78.9%       |
| Were in French Guiana, the last time they had (suspected) malaria   | 12.5%              | 19.5%              | 59.3%       |
| Recall hearing or seeing any malaria message within the past 6 months <sup>a</sup>                              | Not measured       |                    |             |

<sup>a</sup> Indicator from the Roll Back Malaria Partnership (RBM)

- b Global Fund Core Indicator for malaria prevention programs
- c Overall; not limited to the past 1 ½ years
- d Anywhere, not only in Suriname

In 2013, the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program in collaboration with the Pan American Health Organization (PAHO) commissioned a study on malaria treatment behaviour. This study emphasized the ever increasing importance of cross-border movements of mining populations in malaria prevention measures. It also recognized that an increasing share of people who tested positive for malaria in Suriname had most likely been infected in French Guiana (Table 1, Nacher et al. 2013). At the time (2013), French Guiana was the first choice in malaria treatment locations among respondents from the Suriname-French Guiana border region. The Malaria Programme facilities (MSD and Paramaribo malaria clinic) came second among the best known places to be tested and treated for malaria.

The 2013 study also found that among persons who had malaria in the past 1 ½ years, a worrisome 60 percent had used Over-The-Counter (OTC) malaria medicines. With regard to the completion of the treatment, persons who had been tested and received medication from a health worker/MSD were more likely to complete their treatment regime than persons relying on self-medication (about four fifths versus two fifths). The researchers concluded that good access to health service providers is crucial in improving medicine intake behaviour. The use of bed nets had decreased even further in this year, to just over 10 percent of the interviewed population.

Table 2 summarizes quantitative research findings from the three above mentioned studies that are most related to the present research objectives.

## 2. Methods

### 2.1 Approach

This baseline study was conducted prior to the MSD intervention, in order to measure baseline knowledge, attitudes and practices with regard to malaria, and to also inform the general scope and format for the training of new MSDs. It will be followed by an intermediate evaluation, three months after the onset of the MSD intervention to evaluate rapid impact of the MSD intervention; and an overall impact assessment at the end of 12 months (Figure 1)

This baseline study and the final impact study consist of a survey to assess changes in general malaria (treatment) knowledge and behaviour, mobility, health care seeking behaviour and familiarity with the Malaria Programme, among the target population. The baseline survey and impact survey will be largely the same, but the impact survey will have additional questions about the specific interventions that have been executed in the context of the Malaria Elimination programme. Comparison of the answers before and after execution of the Malaria Elimination programme will provide a quantitative measure of programme impact. In addition, qualitative interviews with MSD and malaria programme staff have been conducted in this stage, and will be conducted during the second and third evaluation moments, to provide a better understanding of programme relevance, effectiveness, efficiency and sustainability.

Prior to the first baseline field visit, the consultant presented the work plan and survey to the MoH “Impact Study” technical working group (TWG), comprising key representatives of relevant MoH programs in Suriname. Input from the TWG has been integrated in the final work plan and research tool.

### 3.2 Survey Interviews with mining populations

**Familiarity with the Malaria Programme:** Knowledge of location of nearest MSDs, recognition of MSD post/logo, opinion of/satisfaction with current MSD services, knowledge of malaria clinic at Anamoestraat and its functions, reasons to select or avoid the MSD/malaria clinic in case of (suspected) malaria.

The survey form is attached as Annex I.

An MSD was part of the survey team in all locations to provide individuals in the target area with an opportunity to be tested for malaria.

In the study locations, the surveys will be conducted by experienced and trained surveyors who are fluent in Portuguese and/or Sranantongo. The lead researcher will review every completed survey form to ensure high data quality. Completed survey forms will be entered in an SPSS data base, which will be submitted to the Malaria Programme upon completion of analysis.

### 3.3 Indicators

Based on earlier KAP studies in the target populations and on international malaria indicators, the consultant selected indicators that will be compared before and after programme implementation. The indicators are linked to the objectives and specific research questions, as depicted in Table 4.



### 3.4 Survey sample size and sampling strategy

The reason to interview only persons who had (suspected) malaria in the past 1 ½ years was that answers about past malaria incidences, knowledge of treatment facilities, and treatment behaviour are more meaningful if the surveyed person actually had a recent experience with malaria. Individuals who, for example, had malaria ten years ago in Brazil may not give much thought to where to find a cure. Because we only targeted individuals who had (suspected) malaria in the past 1 ½ year, we do not know the true size and distribution of our sample population.

It proved difficult to find sufficient interviewees who had experienced malaria in the past 1 ½ years. The population concentrations in and around the *currutelas* of Benzdorp and Kabanavo have been virtually malaria free in the past couple of years. When the interviewers went door to door (>200 houses and sheds), and camp to camp, they only encountered respectively 4 and 2 persons who had experienced (suspected) malaria in the past 1 ½ years. In total, 125 persons were interviewed in the Benzdorp general area (incl. Antonio do Brinco, Peruano). The only location where many individuals met the inclusion criteria was Peruano, where three-quarters of persons in this general area were interviewed (N=93, 74.4% of total number of interviews in this region).

To increase the sample size, the research team travelled for one day to Papatam, a satellite community of Albina (Figure 6). Papatam is, like Peruano, a place where Brazilians working in the gold sector in French Guiana converge for a couple of days before returning to their working location across the river. A total of 18 individuals were interviewed at Papatam, all of whom worked in mining area named Sophía (FG).

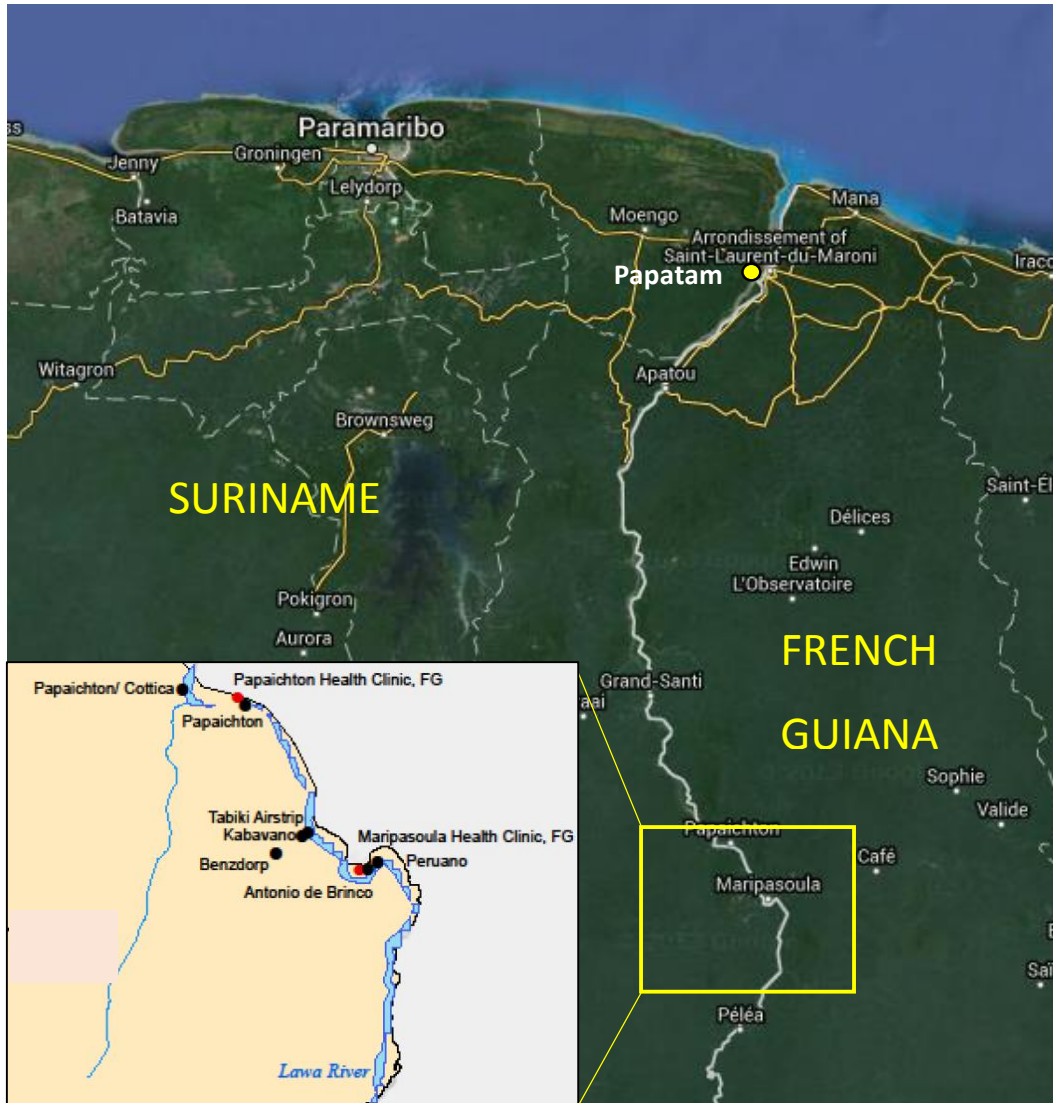
Because two survey forms were classified as invalid based on doubts of the reliability of the interviewee, the total sample size is 141 (Table 5).

*Table 3. Total population and target sample size in different sites within the target area*

| Name of site/camp                | Est. pop. Size | Sample size |
|----------------------------------|----------------|-------------|
| Ronaldo/Peruano                  | 520            | 92          |
| Benzdorp                         | 682            | 4           |
| Buese                            | 297            | 0           |
| Kabanavo                         | 293            | 2           |
| Papaiston                        | 203            | 0           |
| Yawpasi                          | 102            | 0           |
| Antonio do Brinco                | 475            | 25          |
| Njankreek                        | 82             | 0           |
| Lawatabiki                       | 262            | 0           |
| <b>Total Lawa River region</b>   | <b>2916</b>    | <b>123</b>  |
| Papatam                          | ??             | 18          |
| <b>Total SU-FG border region</b> | <b>2916</b>    | <b>141</b>  |

For the follow-up study the sample size will be increased to 200 by also interviewing persons who did not experience malaria in the past 1 ½ years. These persons will only be interviewed, after an effort has been made to interview the maximum number of individuals with a recent malaria history. Persons who have not experienced malaria very long ago or never will be able to answer the malaria knowledge questions, but may not provide meaningful answers on questions about their most recent malaria episode and treatment choices.

Figure 3. Map of the border region between Suriname and French Guiana, with the main research locations



### 3.4.2 Sampling strategy

Because we did not know the size and distribution of our sample population, and because the population in some of the areas (e.g. Peruano) is very mobile, random sampling was impossible. Instead, the survey team made use of a purposive sampling<sup>2</sup>; every person encountered in the target area was asked whether he or she had experienced (suspected) malaria in the past 1 ½ years. If the person answered affirmatively, he or she was asked to participate in the survey. Each person who completed the survey received an SRD 20- (USD 6-) mobile phone recharge card to express gratitude for their time and information.

Even though the team made an effort to spread the survey efforts across the most populated sites, a disproportionate number of respondents were interviewed in Peruano, simply because this location hosted most individuals who met the inclusion criteria. Because the sample is non-random, we cannot extrapolate the results to the Suriname small-scale gold mining population at large.

### 3.4.3 Sample characteristics

One hundred and forty-one valid surveys were conducted, with 62 women (44%) and 79 men (56%). Three survey forms had been removed from the sample because they were inconsistent and/or the researchers had reasons to believe that the answers were unreliable. Respondents were between 17 and 62 years of age, with a Mean age of 36.3 years ( $N_{\text{total}}=141$ ). There was hardly any difference between women and men in terms of their Mean age (resp. 35.3 and 37.0) and age range (resp. 18-59 and 17-62). All but three persons were born in Brazil (97.9%,  $N_{\text{total}}=141$ ). Of these three, two were Peruvian (one man and one woman) and one woman originated from Portugal.

Most surveyed women were traveling vendors ( $N=31$ ) and cooks ( $N=21$ ). Other women were gold miners (equipment owners) or housewives, or earned a living with a variety of other jobs. Men were most often gold miners (workers), transport providers and traveling vendors, in addition to some other professions (Figure 8). Two persons had double jobs, combining the provision of transportation with respectively resale (traveling vendor) and work in the mines.

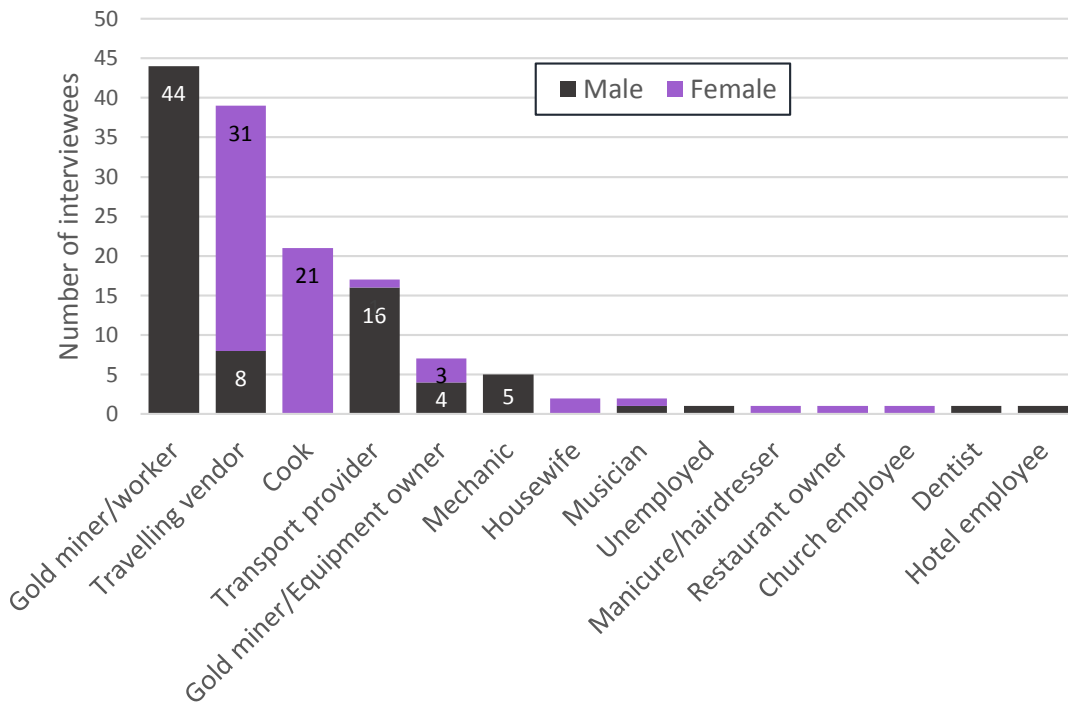
## 3.5 Qualitative interviews

Qualitative interviews were conducted with MSDs and the Malaria Programme management. Questions focussed on the relevance and content of the Malaria Elimination programme, particular challenges, sustainability and the longer-term vision, and the policy context. In addition, qualitative interviews served to clarify and verify quantitative findings.

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<sup>2</sup> Purposive sampling is a type of nonprobability sampling in which the researcher consciously selects specific elements or subjects for inclusion in a study in order to ensure that the elements will have certain characteristics relevant to the study.

Figure 4. Income generating activities performed by interviewees.



### 3.6 Protection of Human Subjects and Ethical Considerations

Research procedures adhered to professional ethical standards for anthropological and health research. Prior to conducting a survey interview, the potential interviewee was approached in an unobtrusive manner. The surveyor introduced him or herself, explained the purpose of the research, and determined whether or not the person fulfilled the inclusion criteria. If the person was eligible, he or she was explained that participation in the research is voluntary and anonymous, and that he or she had the opportunity to get tested for malaria as well. Names of study participants have not been recorded to guarantee respondent anonymity. Information provided to the survey team by the interviewees has been treated confidentially and has not been revealed in a way that can be linked to their person. All survey data has been presented in an aggravated manner.

Malaria testing was performed by Malaria Service Deliverers of the Suriname Ministry of Health Malaria Programme according to national standards for such procedures. The MSD also extended medication to positive patients. All MSD involved were fluent in Portuguese and able to explain the testing and treatment procedures in the patients’ own language.

### 3.7 Limitations and Assumptions

Because the size of the target population was unknown, and given the specific conditions in the target population, random sampling was impossible. Because we used a purposive sampling design (interviewing any person who fit the criteria), the survey results cannot be extrapolated to Suriname’s small-scale gold

mining population at large. Based on our research experience in the region and conversations with local MSD, we do believe that the persons we interviewed were 'typical' for the population living and/or working in the mining areas of the Suriname-French Guiana border region, with a relatively recent (past 1 ½ years) experience of (suspected) malaria.

Survey responses are subject to self-report. Responses may be influenced by response bias if respondents are familiar with desired behaviour and respond in the 'correct' way as opposed to according to their true actions. We expect that we have minimized this bias by using experienced interviewers who are familiar with the situation in gold mining areas, and by including control questions in the survey.

Some questions may be subject to bias/confounding due to probing by interviewers. Probing/prompting styles are not uniform across interviewers. Discussion of all the questions with the team of interviewers prior to field work, and discussion of the completed forms in the field, helped reduce probing bias. This bias was further minimized by field supervision throughout the field work period, revision of all interview forms immediately upon completion, and discussion of these forms with the individual interviewers.

### 3. Results

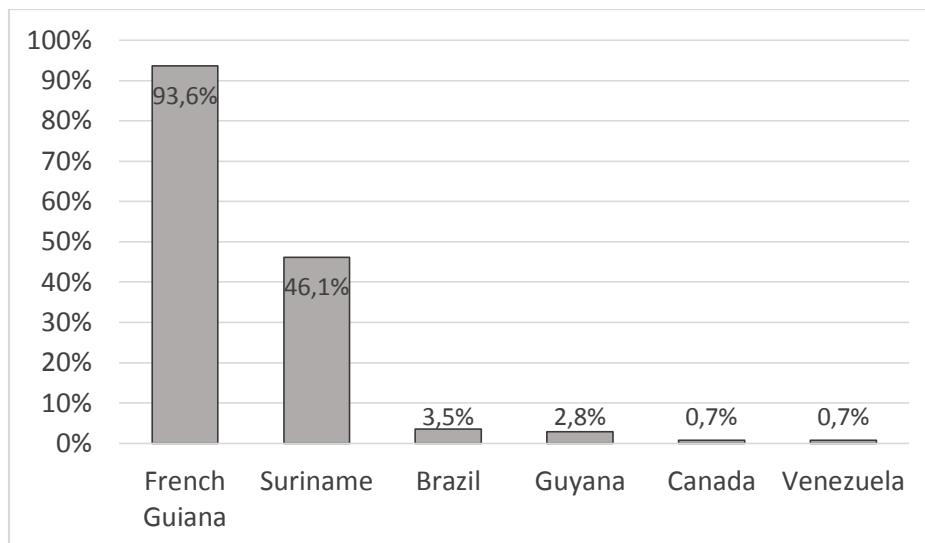
#### 4.1 Mobility

It was earlier mentioned that the research population is extremely mobile, and that a large share of the persons with a recent (suspected) malaria incident are only temporarily in Suriname. The survey results confirm this observation.

While the interviews were conducted on the Suriname site of the border, when asked about their principal work location, 59.6 percent of respondents named French Guiana ( $N_{total}=141$ ). Thirty-seven percent of interviewees worked primarily in Suriname at the time of the interview, three persons (2.1%) reported working equally in both Suriname and French Guiana, one person considered Brazil as his main working location, and one woman reported that she was not working.

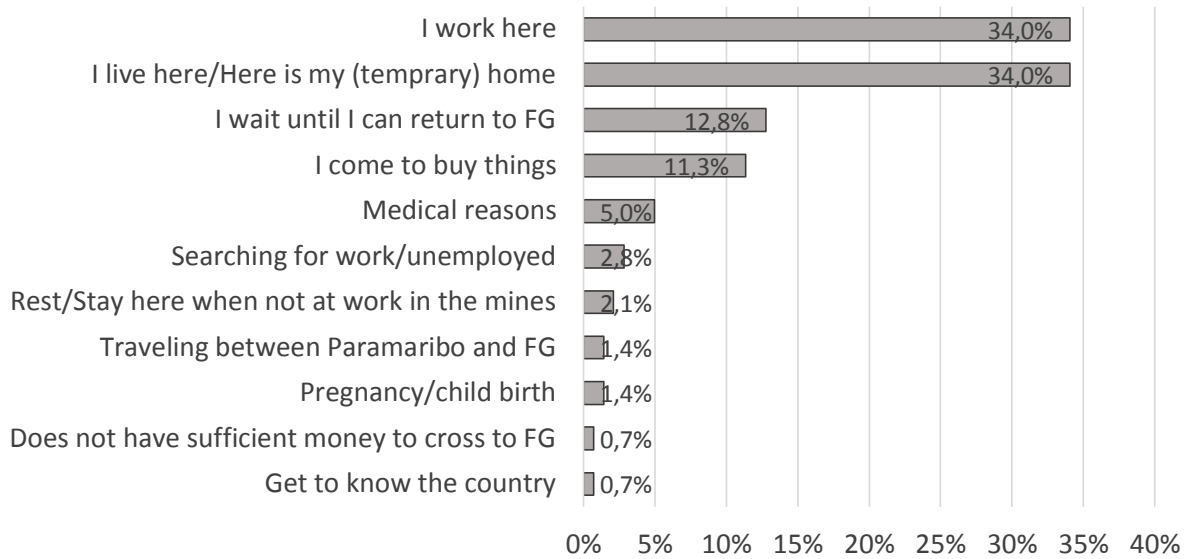
Looking at what countries respondents had worked in the past 1 ½ years (January 2014-july 2015), virtually everyone referred to French Guiana as one of the countries where they had been working. Just under half of respondents had (also) worked in Suriname during this time period, and small numbers of individuals had worked in Brazil, Guyana, Canada and Venezuela (Figure 9).

Figure 5. Countries where respondents had worked in the past 1 ½ years



While French Guiana obviously plays an important role as a working location, all respondents were interviewed in Suriname. We asked them about their main reason(s) to be in Suriname at the moment of the interview. About one third of respondents was in Suriname to work, and another third share reported that they lived in Suriname (Figure 10). Others were waiting until they could return to French Guiana, for example to avoid *gendarmes* on the travel route, while yet others had come to buy supplies, usually for use in French Guiana gold mines.

Figure 6. Primary reason to be in Suriname at the moment of the interview (N=141)

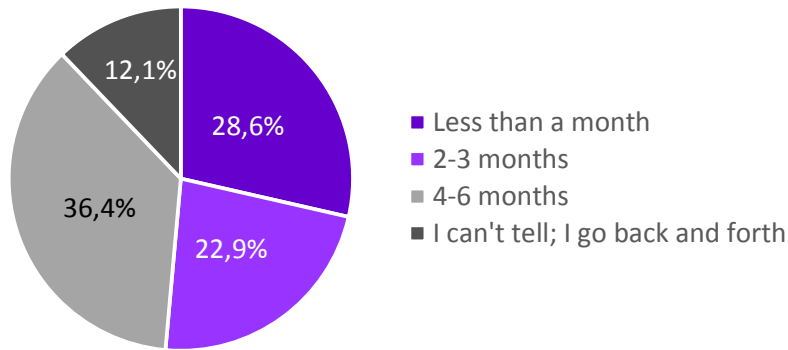


Persons who had come to Suriname for medical reasons not necessarily sought treatment in Suriname. Instead, they had usually left the mining areas in French Guiana and were seeking medical help in this country. However, because of the stringent control on illegal migrants in French Guiana, they stayed in Suriname prior and after their doctor’s visit. Individuals who reported that they had come for medical reasons specified that they had come to obtain treatment for leishmania or malaria, buy medication, go to the doctor, or recover from illness. Two women were staying temporarily in Suriname for reasons related to pregnancy and child birth. One was pregnant, and was waiting for her due date, upon which point she was planning to cross the border to have her baby in a French hospital. The second woman just delivered her baby boy in St. Laurent, and was now caring for her new-born across the river in Papatam, until he would be strong enough to take to the forest.

In the six months preceding the interview, just under a third of respondents had spent less than one month in Suriname (Figure 11). Others had spent two to three months (22.9%) or more (36.4%) time in Suriname in this past half year. Twelve percent of respondents reported that they could not tell how much time they had spent on this side of the border because they were continuously traveling back and forth. This was the case, for example, for canoe-drivers who transport persons and supplies between Suriname and the French gold fields.



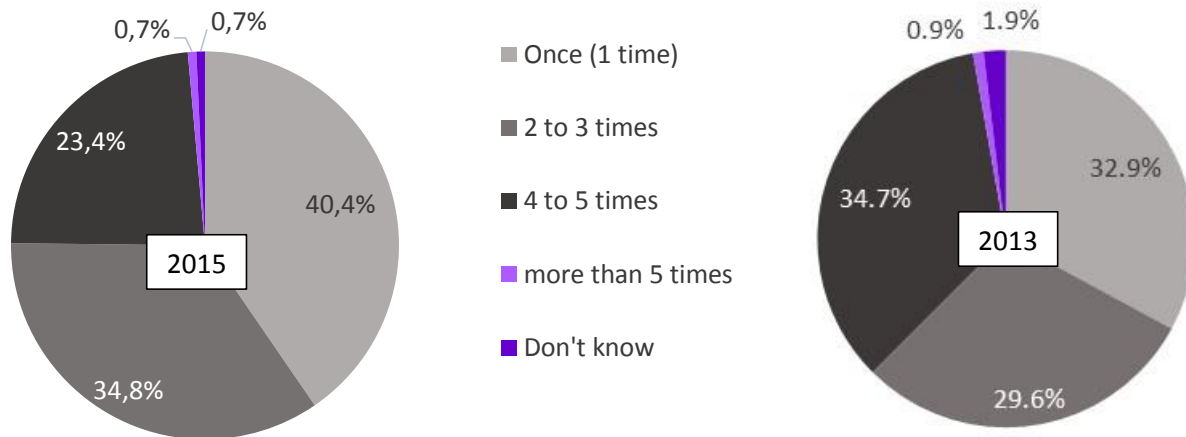
Figure 7. How much time have you spent in Suriname in the past six months? (N=140, one missing)



## 4.2 Malaria History

Figure 10 shows the number of self-reported (suspected) cases of malaria experienced by the respondents in the year and a half preceding the interview. The largest group of respondents had been ill with malaria only once in the indicated period (40.4%). Others had experienced (suspected) malaria two to three times (34.8%, four to five times (23.4%), or more than five times (0.7%) in the past 1 ½ years (N<sub>total</sub>=141; Figure 12 –left circle). These figures roughly compare to those we found two years ago, with the difference that in 2013, relatively fewer persons had experienced only one case of (suspected) malaria and more respondents reported that they had been ill with malaria four to five times in the 1 ½ years preceding the interview (Heemskerck and Duijves 2013; Figure 12- right circle). Remember that in both cases, only persons who had been ill with (suspected) malaria in the 1 ½ years preceding the interview were interviewed. Hence the data do not apply to the small-scale gold mining population at large.

Figure 8. Number of malaria incidents in the past 1 ½ years



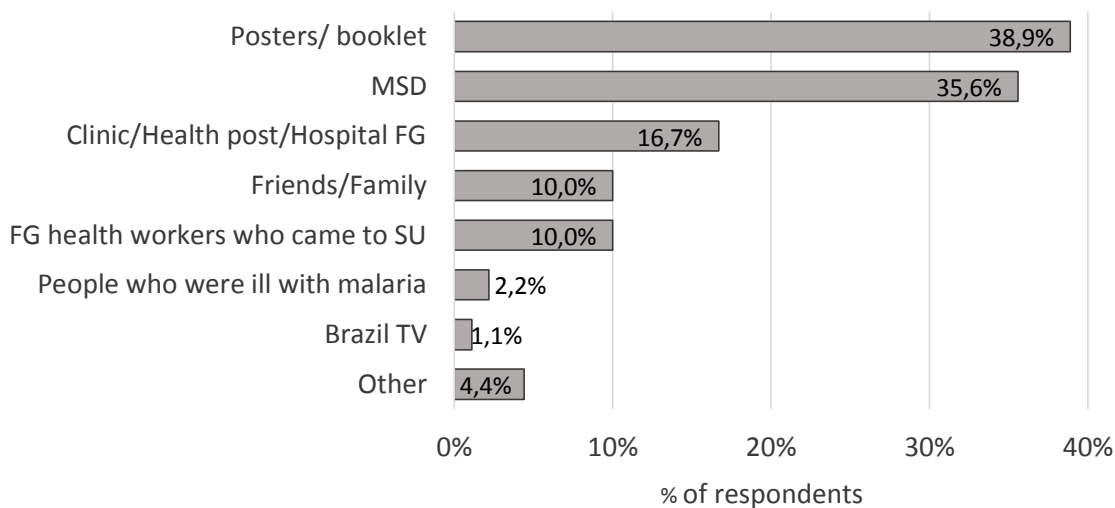
Almost two-thirds of respondents had been in French Guiana the last time they suspected being ill with malaria (64.5%; N<sub>total</sub>=141). Just under one third of respondents had been in Suriname when they experienced their most recent (suspected) malaria (31.2%), and only a few individuals had experienced their most recent (suspected) malaria in Brazil (2.8%) or Guyana (1.4%; N<sub>total</sub>=141).

For 12.1 percent of respondents, their most recent (suspected) malaria episode had been experienced in the month preceding the interview ( $N_{total}=141$ ). Thirty-seven percent of interviewees had been ill with (suspected) malaria in the past one to six months (36.9%), and another 40.4 percent between seven and twelve months ago. A smaller group, 9.9% of total, reported that their most recent malaria had been more than a year ago and one person could not remember when it had been ( $N_{total}=141$ ).

### 4.3 Exposure to outreach activities

When asked about their exposure to malaria awareness messages, almost two-thirds of respondents reported that they had seen or heard a malaria message in the six months preceding the interview (64.5%;  $N_{total}=141$ ). Thirty-one percent of respondents indicated that they had not seen or heard any malaria message in the past half year (31.2%), and seven persons (5%) did not remember whether or not they had been exposed to information about malaria.

Figure 9. Share of respondents who received malaria information from a specific source in the six months preceding the interview ( $N=90$ , excl. one missing)

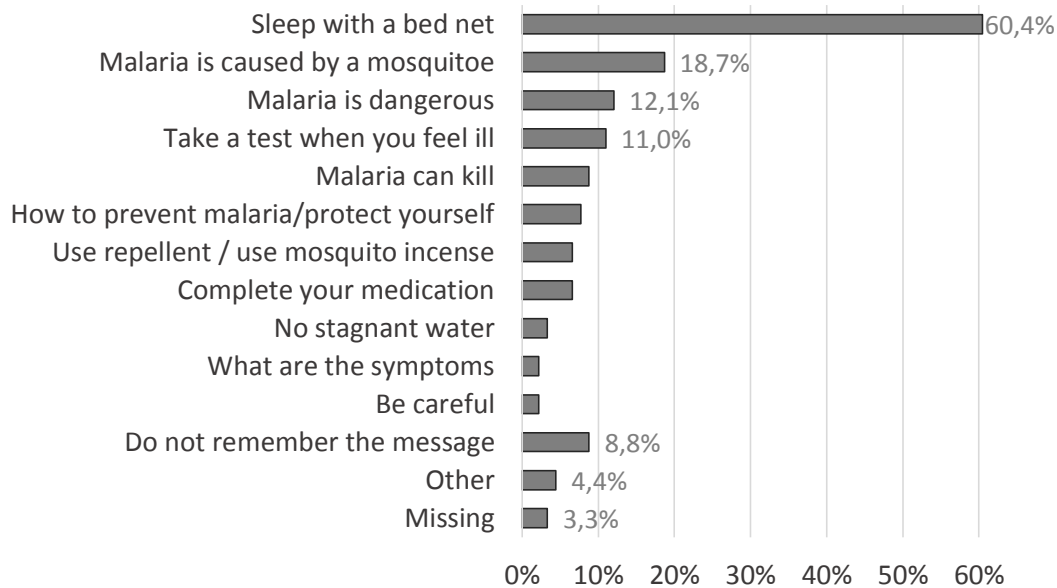


The primary sources of malaria information in the target region were malaria posters (38.9%), notably those printed by the Malaria Programme, and the Malaria Service Deliverers (MSD) (35.6%;  $N_{total}=90$ ). The category “other” included “People in French Guiana but does not know who they were”, “People who sell medication in the gold mines in French Guiana”, “Health workers in Suriname” and “People in the street”. No-one reported that they had received information from the malaria clinic at Anamoestraat in Paramaribo. Just over a quarter of respondents had received information from French Health workers, either in a French Guiana clinic or hospital (16.7%) or during malaria research of French health workers in Suriname (10%) ( $N_{total}=90$ ). It must be noted that French health workers had conducted an extensive malaria survey (incl. testing) in the research area some months prior to our study. This may explain the significant number of respondents who named French health workers in Suriname as a source of malaria information.

By far the most heard and viewed malaria message was “sleep with a bed net” (60.4%;  $N_{total}=91$ ). Respondents also had been informed about the cause of malaria (18.7%), about the fact that malaria is dangerous (12.1%) and about the necessity to take a test when suspecting malaria (11%), among many other issues (Figure 14). Eight persons could not remember the message and one woman commented

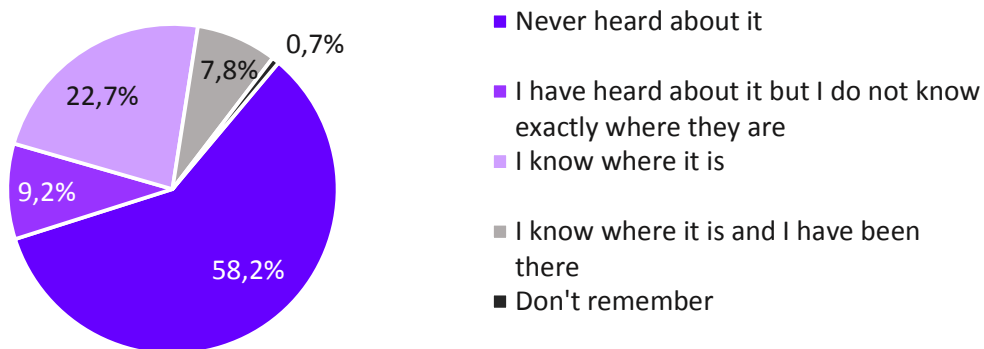
that she had not understood the message because the health workers spoke French. “Other” messages were all reported by one person and included that malaria can cause anaemia, that one should take Artecom, that one should not drink river water, and that it is important to close any holes in the bed net.

Figure 10. Malaria messages received in the past six months (N=91)



The results suggest that the Malaria Programme is not widely known among the inhabitants of small-scale gold mining areas in the Suriname-French Guiana border region. When asked whether they were familiar with the Malaria Clinic at Anamoestraat, more than half of respondents indicated that they had never heard of it (58.2%; N<sub>total</sub>=139). Thirteen others responded that they had heard about it but could not tell where it was (9.2%). When asked about their familiarity with the Malaria Clinic, 22.7 percent of respondents were able to explain where it was, and 7.8 percent of interviewed inhabitants of mining areas had actually visited the MP clinic in Paramaribo (Figure 15).

Figure 11. Answers to the question: “Are you familiar with the Suriname Malaria Clinic at Anamoestraat, in Paramaribo?” (N=139, excl. 2 missing)



At the time of the survey, the Malaria Clinic at Anamoestraat was still only providing malaria testing and treatment. It has been planned to extend the MP clinic services to other areas, including HIV/AIDS and leishmaniosis.

To further test gold miners' familiarity with the Malaria Programme, we wanted to know whether they recognized the logo. Respondents were presented with four different logos: the Suriname Malaria Programme logo, two logos from malaria programs in Africa, and the coat of arms of Suriname. Respondents were asked whether they recognized one or more of these logos and if so, what the logo signified.

Almost one third of respondents reported that they had never seen any of these logos (32.6%;  $N_{total}=140$ ). Another 9.9 percent of surveyed inhabitants of mining areas said that they might have seen one or more of the logos but could not indicate which one or what they stood for.

Forty-five percent of respondents pointed at the logo of the Malaria Programme, among the four logos they were presented with, as a logo they recognized (44.7%;  $N=140$ ). Persons who had their (temporary) home and/or family in Suriname were not significantly more likely than those who used Suriname as a temporary transit haven to recognize the Malaria Programme logo. Of those who recognized the Malaria Programme logo, 27 percent correctly named its meaning: 14.3 percent indicated that this was the logo for the Malaria campaign/Malaria programme and 12.7 percent said that this was the symbol for a place where one can test for malaria. This means that 12.1 percent of the total sample identified that MP logo and could tell what it stands for.

Other people who did recognize the Malaria Programme logo could not clearly describe what it meant. When asked about the meaning of the logo, they named, among others, "malaria" (14.4%), "stop malaria" (12.7%), "malaria mosquito" (9.5%), and "dengue" (3.2%) ( $N_{total}=63$ ). Fourteen respondents indicated that they had seen the logo before but did not know what it stood for.

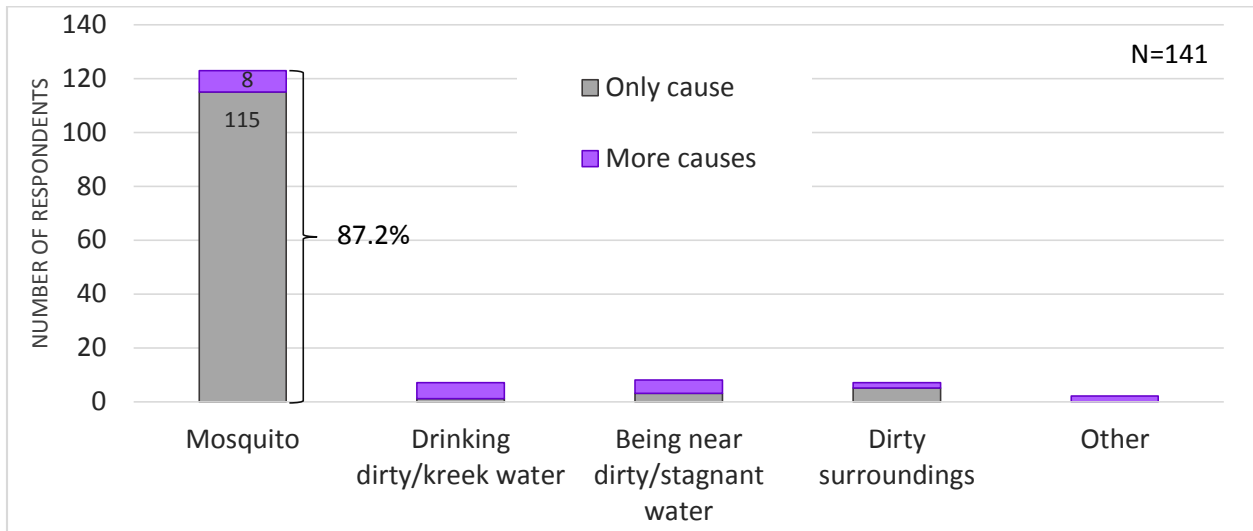
Quite some respondents recognized one or more of the other logos. Eleven percent of respondents recognized and could tell the meaning of the Suriname coat of arms (11.3%;  $N_{total}=140$ ). Furthermore, 5.2 percent of respondents believed that they recognized one of the logos from foreign Malaria Programme's, though this is in fact unlikely ( $N_{total}=140$ ).

#### 4.4 Malaria knowledge

Malaria knowledge was tested by asking inhabitants of gold mining areas about the cause and symptoms of malaria, about measures to protect oneself against this disease, and about their knowledge of malaria testing and treatment locations –either in in Suriname or anywhere in the area.

The grand share of respondents correctly cited the mosquito as the cause of malaria (87.2%;  $N_{total}=141$ ) (Figure 16). Eight of these persons also named additional causes, such as drinking dirty water or being near (stagnant, dirty, creek) water. In total, seven persons named drinking dirty or creek water as a cause of malaria and eight respondents believed that proximity to (stagnant) water caused the infection. One of them specified that particularly stagnant water with larvae was a source of malaria. In total seven persons referred to a dirty environment as the cause of malaria, among whom one person added that malaria was particularly prevalent in forested environments, and one individual blamed the lack of ventilation in the *garimpo* (mining area). Eight persons reported that they did not know what caused malaria (5.7%;  $N_{total}=141$ ).

Figure 12. Causes of malaria named by the respondents (N=141)



We also asked inhabitants of mining areas if they could name the symptoms of malaria. All but one persons were able to name one or more malaria symptoms. The most named malaria symptom was a headache (85.6%), followed by fever (72.7%), body pains (60.4%), feeling cold/shivering (38.8%) and throwing up/nausea (27.3%;  $N_{total}=139$ ) (Table 6). More than half of the respondents were able to name three or four symptoms of malaria (Figure 17). In total, 99.3 percent of respondents named at least one valid malaria symptom ( $N_{total}=139$ ).

Figure 13. Number of symptoms named by respondents ( $N_{total}=139$ , excl. 2 missing)

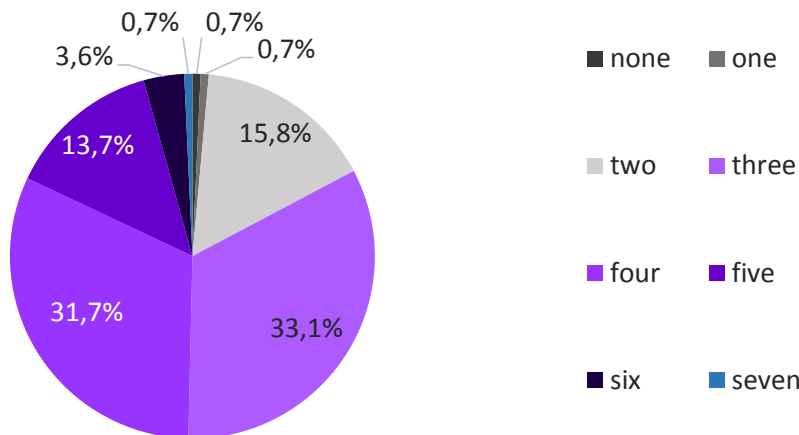


Table 4. Symptoms of malaria named by the respondents

| Symptom   | N          | %             |
|---|------------|---------------|
| Headache  | 119        | 85.6%         |
| Fever   | 101        | 72.7%         |
| Body pains  | 84         | 60.4%         |
| Feeling cold/shivering  | 54         | 38.8%         |
| Throwing up/nausea  | 38         | 27.3%         |
| Diarrhea  | 25         | 18.0%         |
| Joint pains   | 20         | 14.4%         |
| Feeling weak/tired  | 14         | 10.1%         |
| No appetite   | 12         | 8.6%          |
| Pain in the liver/Infected liver  | 5          | 3.6%          |
| Bitter taste in the mouth   | 4          | 2.9%          |
| Pain in the eyes  | 4          | 2.9%          |
| Pain in the legs  | 2          | 1.4%          |
| Chikungunya/ dengue-like symptoms   | 2          | 1.4%          |
| Missing   | 2          | 1.4%          |
| Pain in the knuckles  | 1          | 0.7%          |
| Dizziness   | 1          | 0.7%          |
| Back pain   | 1          | 0.7%          |
| Muscle pain   | 1          | 0.7%          |
| Green vomit   | 1          | 0.7%          |
| Body feels damp   | 1          | 0.7%          |
| inflated stomach  | 1          | 0.7%          |
| Get symptoms (fever, cold shivers) always at the same time in the afternoon | 1          | 0.7%          |
| Don't know  | 1          | 0.7%          |
| <b>Total</b>  | <b>139</b> | <b>100.0%</b> |

Knowledge of possibilities to protect oneself against malaria was tested by asking interview participants to name all measures they knew to protect themselves from malaria. Their answers are listed in Table 7. The answers we considered to be a correct answer are listed in the shaded areas.

The best known protective measure is to sleep with a bed net (69.5%), followed by the use of repellent (22.7%;  $N_{total}=141$ ). Other valid protective measures included not being near stagnant water, destruction of breeding sites, prevent being bitten by a mosquito, use a mosquito candle or insect spray, and wear protective clothing. About one out of every eight respondents, however, was of the opinion that it is not possible to protect oneself against malaria. One person added that particularly in the forest it was not possible to protect oneself against malaria because you are at work all day and the malaria mosquito does not only bite at night. Other answers were either incorrect or impractical given the living and working conditions of the target population. In total, 73.6 percent of respondents were able to name at least one effective method to protect themselves against malaria.

Table 5. Known means to protect oneself against malaria (N=141)

| Protective measure   | %           | N          |
|--|-------------|------------|
| Sleep with a bed net   | 69.5%       | 98         |
| Use repellent  | 22.7%       | 32         |
| It is not possible to protect oneself against malaria                            | 12.1%       | 17         |
| Not get near dirty/stagnant water  | 4.3%        | 6          |
| Destroy breeding sites/keep surroundings clean/remove places with stagnant water | 4.3%        | 6          |
| Not drink dirty water  | 2.8%        | 4          |
| Prevent being bitten by a mosquito   | 1.4%        | 2          |
| Use mosquito candle/insect spray   | 1.4%        | 2          |
| Take medication to strengthen the liver, such as Legalon                         | 1.4%        | 2          |
| Wear long sleeves/protective clothing  | 1.4%        | 2          |
| Use Artecom  | 0.7%        | 1          |
| Window screens (but difficult in the forest)                                     | 0.7%        | 1          |
| Not bath daily   | 0.7%        | 1          |
| Stay out of reach of mosquitoes between 5 and 6 pm                               | 0.7%        | 1          |
| Sleep with air-conditioning in the city  | 0.7%        | 1          |
| Not travel to the interior   | 0.7%        | 1          |
| Stay away from creeks in the early morning and evening                           | 0.7%        | 1          |
| Don't know   | 10.6%       | 15         |
| <b>Total</b>   | <b>100%</b> | <b>141</b> |

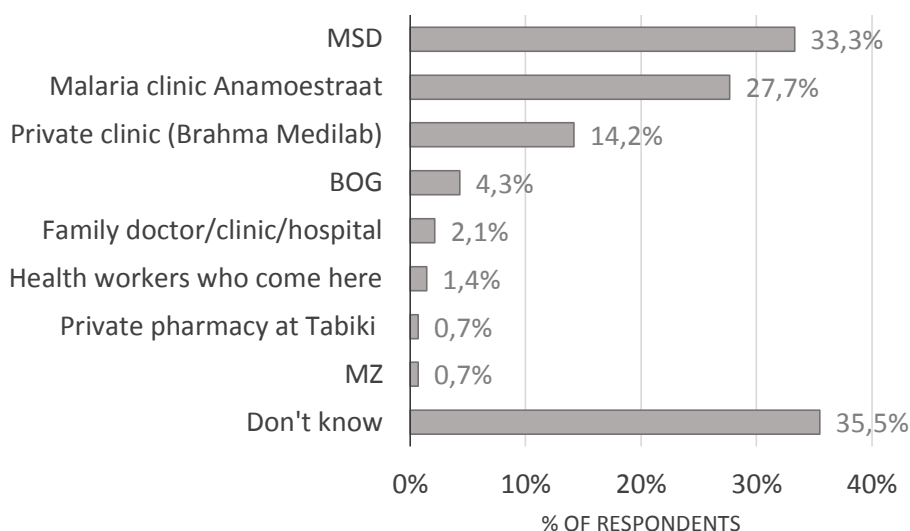
To test malaria knowledge respondents also were asked about their knowledge of the location of malaria testing and treatment facilities. We first asked respondents whether they could tell us where one could be tested and treated for malaria in the general vicinity of the interview location, either in Suriname or in French Guiana. For people who were interviewed in the Benzdorp region, the closest malaria testing and treatment facilities were the hospital/health center in Maripasoula (FG) or the MP Malaria Service Deliverers (MSD) in the mining area. For people interviewed in Papatam (Albina) the nearest malaria testing and treatment facilities were the hospital in St. Laurent (FG), the Regional Health Service (RGD) health clinic in Albina, or the mobile MSD who occasionally visit Papatam.

When asked about a malaria testing and treatment facility nearby, 73 percent of respondents named a health post in French Guiana (either Maripasoula or St. Laurent). In addition, 48.2 percent of respondents (also) named the MSD – though typically not by that name. Instead, they would refer to “Carla” (name of the MSD stationed in Antonio do Brinco), “Benzdorp” (location of a stable MSD), “Tabiki” (former location of a stable MSD) and “Antonio do Brinco” (MSD location). Four respondents referred to persons from French Guiana who once in a while come to the Suriname border towns for malaria research and services, all in combination with fixed locations. Only one person could not think of any nearby testing location and named Paramaribo as the closest place to go for malaria services, resulting in 99.3 percent of respondents who could name a nearby malaria testing and treatment location.

When asked about places in Suriname to get tested for malaria, however, 35.5 percent of respondents said they did not know. Some of them explained that they had never been to Paramaribo, and did not

know much about Suriname other than their temporary hang-out along the river. The best-known malaria services facilities in Suriname were the MSD (named by 33.3%) and the malaria clinic at Anamoestraat (27.7%). The survey results are strikingly similar to those found earlier when asked the same question to –mostly migrant- inhabitants of mining areas (Heemskerk and Duijves 2013). Also in line with earlier studies, we found that MZ clinics are hardly known by migrant gold miners (only mentioned by one person).

Figure 14. Malaria testing and treatment facilities in Suriname named by respondents (N=141)



An internationally used malaria knowledge indicator is the percentage of persons who have adequate knowledge of malaria causes, prevention, symptoms and treatment. In order to measure this variable we used a composite measure “optimal malaria knowledge”, which represents the proportion of respondents who:

1. Correctly identified the mosquito as the cause of malaria<sup>3</sup>, AND
2. Listed at least one symptom of malaria, AND
3. Named at least one effective method to protect oneself against malaria, AND
4. Knows where to go for malaria testing and treatment.

With regard to the latter point (4), we included anyone who could name a testing and treatment facility in the vicinity, regardless of the country.

In total, 59 percent of respondents displayed optimal malaria knowledge. That is, they named the mosquito as *the only* cause of malaria AND they named at least one malaria symptom AND they knew at least one valid measure to protect oneself against malaria AND they knew where to find malaria testing and treatment services near their location at the time of the interview (Table 8).

<sup>3</sup> exclusively persons who named only the mosquito and no other supposed cause(s) for malaria were counted

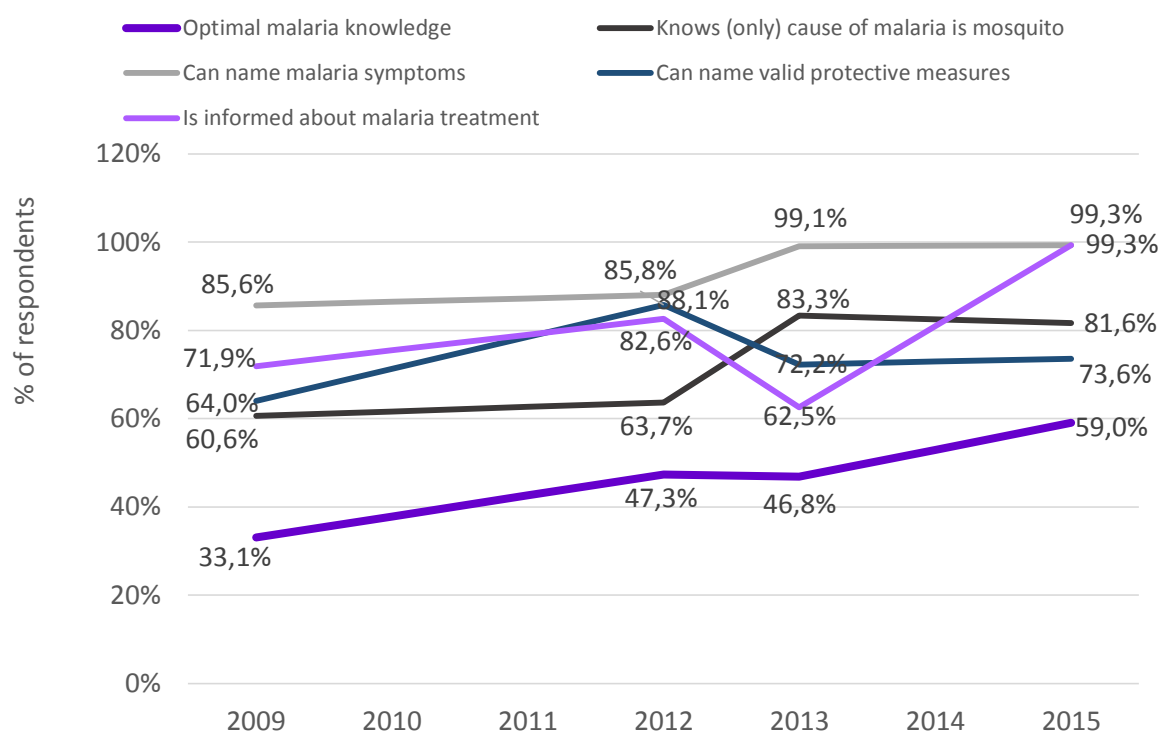


Table 6. Proportion of the target population with optimal malaria knowledge (Global Fund Indicator)

| Proportion of respondents who  | %          |
|--|------------|
| Know that malaria is caused by a mosquito                                | 81.6%      |
| Can name at least one symptom of malaria                                 | 99.3%      |
| Know at least one way to protect oneself against malaria                 | 73.6%      |
| Are informed about where to get malaria treatment <i>in the vicinity</i> | 99.3%      |
| N  | 139        |
| <b>Has optimal malaria knowledge:</b>                                    | <b>59%</b> |

In time, malaria knowledge has increased. Both the separate indicators and the composite measure “optimal malaria knowledge” show an upward trend when we look at figures for 2009, 2012, 2013 and 2015 (present) (Figure 19).

Figure 15. Malaria knowledge indicators in 2009, 2012, 2013 and 2015



It must be noted the concept “optimal malaria knowledge” was not measured in the same way in the different research years. In 2010, by lack of better questions in the questionnaire, knowledge of malaria treatment was considered good if the respondent reported that he or she had always taken a malaria test when suspecting malaria. In fact, this is a behavioural indicator and may not provide a good sense of what the respondent knows about malaria testing and treatment. In 2012, this indicator was measured as being able to name at least one malaria testing and treatment facility (anywhere), while in 2013 respondents were asked about a testing and treatment facility *in Suriname*. In 2015, having knowledge of a testing and treatment facility in the vicinity of where the person was interviewed (regardless of country) was believed to be a more meaningful measure.

Another difference between the different years is the sample and sampling method. In 2009, surveyors visited three mining regions in Suriname: (1) Sella Creek/Upper Tapanahoni, (2) Stuwmeer (Hydraulic Lake) /Sarakreek area, and (3) Benzdorp/Lawa River. Due to budgetary constraints the same areas could not be revisited for the 2012 evaluation study. Instead, the 2012 survey was performed in the (1) Benzdorp/Lawa River area, (2) the Sarakreek area and (3) the Maripaston area. In both 2009 and 2012, a random sample of gold mining equips, households, or other economic units (e.g. cantinas, bars, hotels, transportation stations, brothels, and stores) was taken. In the population centers or *curatelas*, every third economic unit was approached by a member of the research team. If there was no-one present at the third unit or if the inhabitants refused to participate, the surveyors would approach the nearest economic unit. In 2009, every third mining camp in the forest was approached but in 2012, the researchers visited every mining camp along the travel routes to reduce travel expenses. In both 2013 and 2015, the researchers approached every observed inhabitant of mining areas but the survey sample only included persons who had experienced (suspected) malaria in the year and a half preceding the interview.

Due to the 2013 and 2015 inclusion criteria (must have had suspected malaria in the past 1 ½ years), Suriname miners and mining service providers constitute an ever decreasing proportion of the sample. In 2010, for example, Sella creek with its predominantly local mining population was one out of three research sites. In 2015, no single Suriname national was part of the sample because we did not meet any who fit the inclusion criteria.

#### 4.4 Malaria prevention

An important malaria research indicator used by Global Fund and other international organizations that combat malaria, is the proportion of population that slept under an ITN the previous night. Table 9 list the value of this indicator, as well as values for related indicators. Global Fund indicators with regard to households did not apply to our study, because the target population typically does not live in a traditional household setting.

When asked whether they possessed a bed net, any type, only 28.4 percent of respondents answered affirmatively. Despite the many bed nets that have been distributed by the Suriname Malaria Programme and, more recently, by French health workers, only 10.6 percent of respondents indicated that they owned an Insecticide treated net (ITN) ( $N_{total}=141$ ; Table 9). Approximately one out of every eight inhabitants of mining areas had slept with a bed net in the night prior to the interview (12.8%), and only nine individuals (6.4%) indicated that they had slept with an ITN the previous night. Three respondents were not sure whether their bed net was insecticide treated.

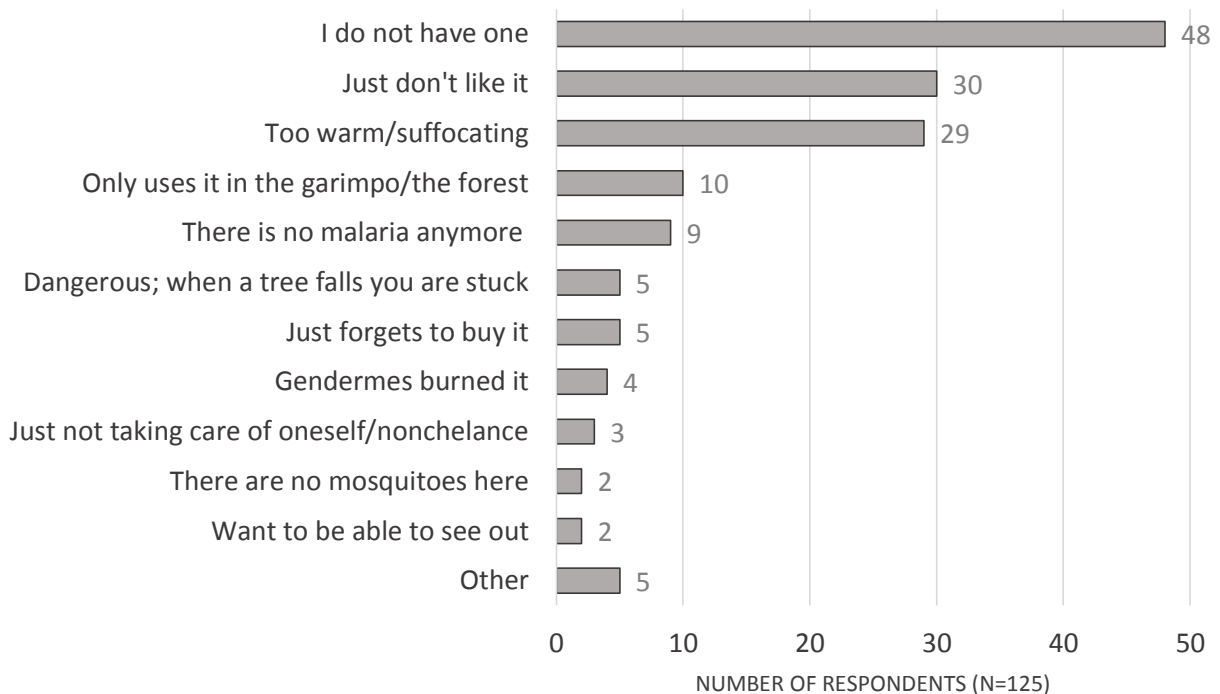
Table 7. Malaria prevention indicators

| Indicator  | 2009  | 2012  | 2013  | 2015  |
|--|-------|-------|-------|-------|
| % of interviewees who have an ITN  | 62.6% | 38.4% | -     | 10.6% |
| % of interviewees who had slept under a bed net in the night prior to the interview                            | 59.4% | 49.4% | 18.5% | 12.8% |
| % of interviewees who had slept under an insecticide-treated bed net (ITN) in the night prior to the interview | -     | -     | 11.1% | 6.4%  |
| % of interviewees who had slept with a bed net consistently in the week prior to the interview                 | -     | -     | -     |       |

When asked about the consistency of their bed net use, 11.3 percent of respondents reported that they had slept with a bed net every night in the week preceding the interview. Respondents cited many reasons for not sleeping with a bed net (Figure 19). The most cited reason for not sleeping with a bed net was that the person did not possess one (38.4%;  $N_{total}=125$ , only counting people who did not sleep with a bed net in the week preceding the interview). This appears to be somewhat of an easy answer, as bed nets are widely available and rather cheap. Perhaps a better question would have been: “why do you not have a bed net?” Some persons who reported that they did not have a bed net provided additional explanations: it had ripped and they had not bought a new one; the French gendarmes had burned it; the person had left it behind when running from the French gendarmes; or the person had forgotten to buy it.

The second and third most mentioned reasons for not sleeping with a bed net were, respectively, that the person did not like it (24%) and that it was too warm or suffocating (23.2%;  $N_{total}=125$ ). Several persons indicated that it was important to sleep with a bed net in the *garimpo* (mining area) or in the forest, but in the population centres such as Antonio do Brinco, Peruano and Papatam they did not feel the need. Some did not have the impression that there was malaria in these border villages, and others explained that there were more mosquitos, insects and/or bats in the forest – against which the bed net protected them. These and other reasons for not (consistently) using a bed net are listed in Figure 20.

Figure 16. Reasons for not sleeping with a bed net

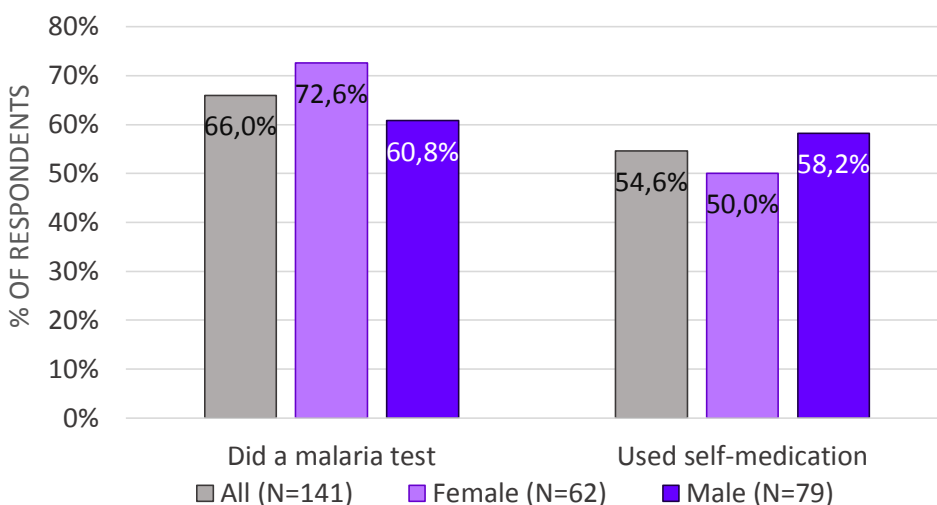


## 4.5 Malaria treatment behaviour

Data presented in section 4.2 showed that the largest group of respondents had been ill with (suspected) malaria only once in the year and a half preceding the interview (40.4%). Others had experienced (suspected) malaria two to three times (34.8%, four to five times (23.4%), or more than five times (0.7%) in the past 1 ½ years ( $N_{\text{total}}=141$ ). In this section we zoom in on the treatment regimes used by recent malaria patients and people who believed they had malaria in the past 1 ½ years.

When asked what type of treatment strategies people had used during this past 1 ½ years when they had malaria, or believed they had malaria, 66 percent of respondents said they had taken the malaria test at least once during this period. Meanwhile just over half of respondents had (also) used self-medication (54.6%;  $N=141$ ) (Figure 21). One out of every five persons had both tested and used self-medication against malaria in the year and a half preceding the interview. This finding suggests that not all inhabitants of mining areas are not consistent in their treatment choices. Instead, these choices are defined by opportunities, challenges and risks.

Figure 17. Treatment regimes used by women and men when having or suspecting malaria in the 1 ½ years preceding the interview



In line with our earlier findings (Heemskerk and Duijves 2013), women were more likely than men to take the malaria test, and men were relatively more likely to self-medicate.

Among persons who self-medicated the drug of choice was Artecom, which had been used by 84.7 percent of respondents in this group ( $N_{\text{total}}=77$ ). Other drugs that had been used to treat suspected malaria (without testing) included Paracetamol (5 persons), Coartem<sup>4</sup> (5 persons), Nivaquine<sup>5</sup> (3 persons),

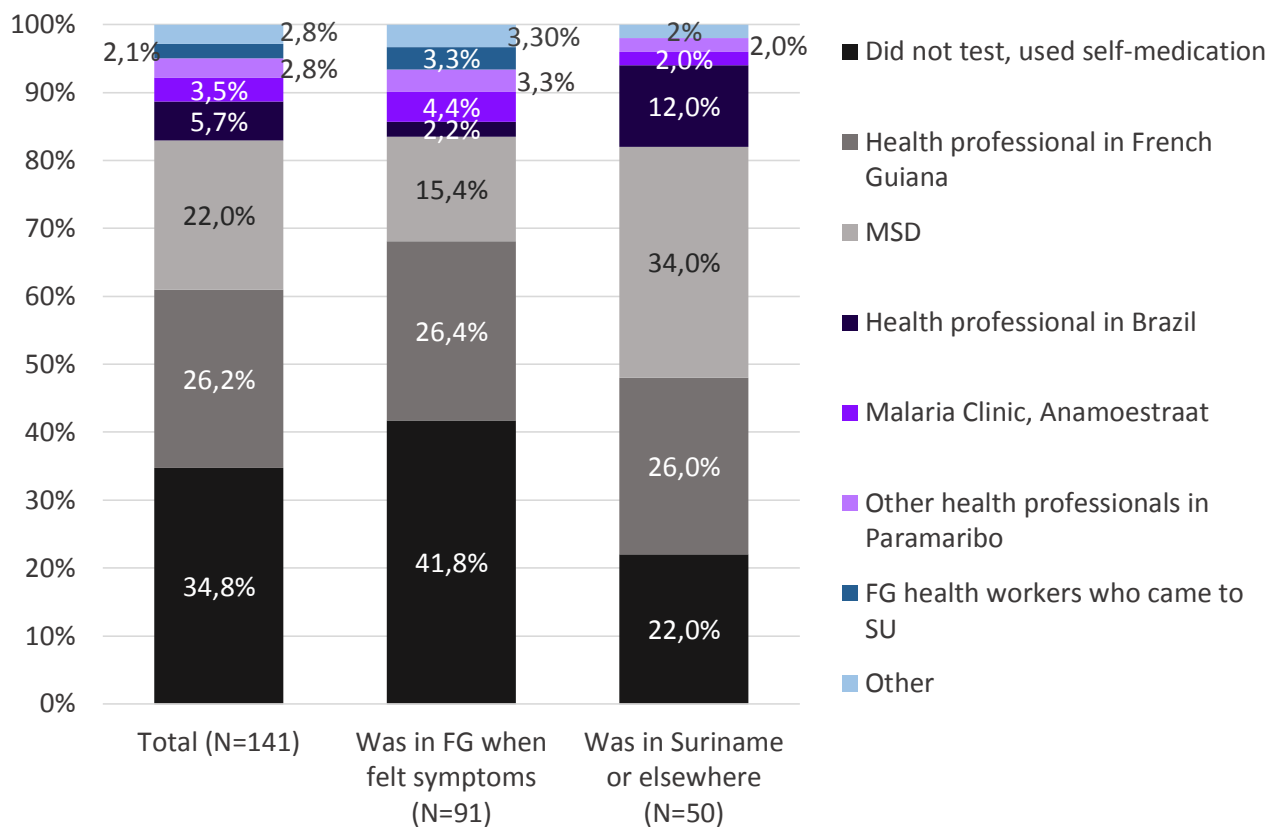
<sup>4</sup> Drug prescribed by the Suriname Malaria Programme to treat acute uncomplicated malaria infections due to *Plasmodium falciparum*

<sup>5</sup> Drug prescribed by French health workers to treat malaria infections due to *Plasmodium vivax*

Primaquine (3 persons), Chloriquine<sup>6</sup>, Nulex (anticonvulsant, 1 person), Artefan (1 person), Arinate (1 person) and creolin<sup>7</sup> with water.

Respondents also were asked about their treatment choice the last time they believed they had malaria. Just over one third of respondents reported that they had used self-medication the last time when they suspected to have malaria (34.8%; N<sub>total</sub>=141). Respondents who primarily worked in French Guiana were more likely to have relied on self-medication than people with another main work location, such as Suriname (resp. 40.5%; N<sub>total</sub>=84 and 26.3%; N<sub>total</sub>=57). Furthermore, respondents who had experienced their most recent (suspected) malaria in French Guiana were twice as likely as those who had fallen ill in Suriname (or elsewhere) to self-medicate (Figure 22).

Figure 18. Treatment strategies used in response to the most recent (suspected) malaria episode, comparing respondents whose main working location is French Guiana (N=84) and others (N=57).



Those who had tested for malaria the last time they fell ill, most often did so in a French Guiana health center or hospital (26.2% of total; N<sub>total</sub>=141). There was no difference in the propensity to test for malaria in French Guiana between individuals who had been in French Guiana the last time they were plagued by malaria symptoms, and others (Figure 22). This finding may be explained by the fact that for people working in French Guiana gold fields is expensive, difficult and risky to travel to the larger population

<sup>6</sup> Chloroquine has long been used in the treatment or prevention of malaria, however, the malaria parasite *Plasmodium falciparum* started to develop widespread resistance to it.

<sup>7</sup> Creolin is both antiseptic, germicide and hemostatic, used –among others, in obstetrician and dentistry

centers (e.g. Maripasoula, St. Laurent) to visit a health facility. On the other hand, for people in Suriname border locations the French health facilities are just a short (and often free) boat ride away.

The second most used malaria testing and treatment facility was an MSD (22%;  $N_{total}=141$ ). Others had been tested by a health professional in Brazil (5.7%), the Malaria Clinic at Anamoestraat (3.5%) or other health professionals in Paramaribo (e.g. BOG). In addition, three persons had been tested by French Guiana health professionals who had come to Suriname for a specific malaria study, which has been terminated by now. The category “other” include a woman who initially had been tested for malaria by an MSD in Suriname but next, when that test was negative, went to Brazil for another malaria test – which turned out positive. This category also included a young man who first used Artecom and next went for a test, and an elderly man who conveyed that someone had come to the mining areas in French Guiana to test, but he did not know who it was.

The most mentioned reason for selecting a specific test location was proximity; people with suspected malaria who wanted to take a test mostly went to the place that was nearest (81.5%;  $N_{total}=92$ , only counting persons who did go test). Other reasons were mentioned by just a couple of persons and included: good medical care (6 persons), service is free (5 persons), it is/was the only place to test (3 persons), good medication (3 persons), convenience- they came by (2 persons), recommendations of others (2 persons), and you can do different tests there (1 person).

An MSD in the Benzdorp greater area conveyed that there may be several reasons for persons to prefer French Guiana health facilities over the Suriname MSD as a test location. One of these reasons is that the MSD are rather mobile and not 24/7 at their post. They may be at another site for monitoring and/or malaria testing, they may be in the capital city, or they may simply be having lunch somewhere nearby. People who feel ill want to be certain that they will encounter the service they need if they take the effort to travel there. A second issue is that the staff at the French health centre can perform multiple tests. Hence if the malaria test is negative it is possible to test for other diseases such as dengue or chikungunya.

Also for those who had not tested the last time they had fallen ill with (suspected) malaria, distance was their single most important motivator. In this group, 81.6 percent reported that they had omitted to test because they had been too far from a health post when they had fallen ill ( $N_{total}=49$ ). Others had not tested because there were no health workers/MSD in the area at the time (4 persons), or they had no time/were in a hurry (3 persons). One man said that he knew his status (1 person), and another man had taken Artecom and the symptoms went, so the test was no longer necessary.

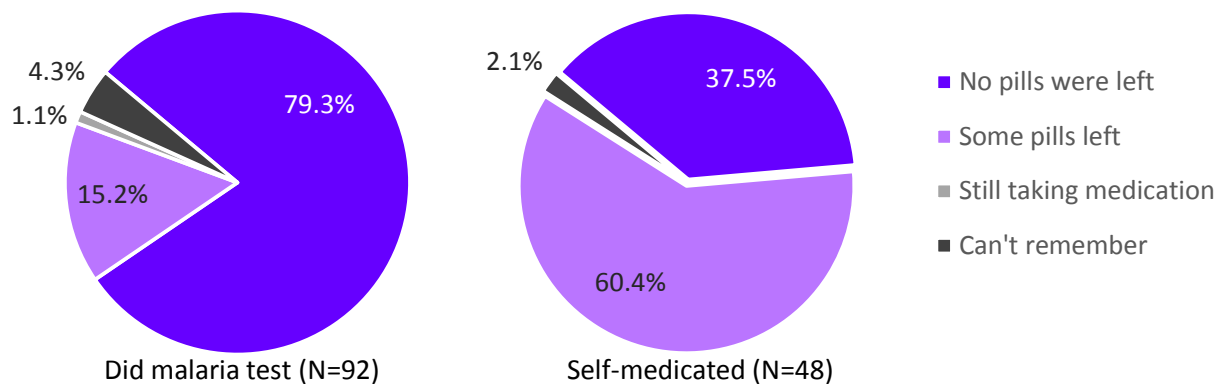
An important concern in the research region is emergence of drug resistant malaria parasites. Apart from the haphazard use of non-prescribed medication without testing, the fact that people do not complete their treatment also plays a role in this development. Almost one third of respondents reported that they had some pills left when they had stopped taking their malaria medication (30.7%;  $N_{total}=140$ ). Sixty-five percent of respondents reported that they had taken the complete dose, five persons could not remember and one person was still taking malaria medicine at the time of the interview.

In line with findings from earlier studies, we find that people who rely on self-medication are much less likely than those who went for a test to complete their malaria cure (Figure 23). Of the 42 persons who had pills left when they quit their malaria treatment, 81 percent had stopped taking medication because they already felt better. Three persons reported that they had not taken the complete dose because they experienced side effects, two persons indicated that out of habit they always only took only a certain

number of pills, and five others had other reasons. One of them had lost the medication, someone else had forgotten to take the pills, yet another respondent had bought only four pills (half a pack of Artecom) from someone else, a fourth person mentioned that the medication was really strong, the fifth person said he just didn't like to take all.

At the moment, the Pan American Health Organisation is designing an awareness campaign for inhabitants of small-scale gold mining areas, aimed at motivating them to complete their treatment – regardless of whether they use OTC-medication or prescription drugs. A main motivation behind this effort is concern about the development of drug resistance as a result of incomplete medication intake by malaria patients.

Figure 19. Share of respondents who completed their malaria treatment, by use of self-medication



## 5. Conclusions and Recommendations

### 5.1 Conclusions

This baseline study investigates knowledge, attitudes and behaviour with regard to malaria and malaria treatment among the inhabitants of mining areas in the Suriname-French Guiana border region. The study is part of the Malaria Elimination programme of the Suriname Ministry of Health (MoH) Malaria Programme (MP). An important pillar of this program is to minimize the distance between the patient and the diagnosis, by training and improving access to fixed, mobile and volunteer Malaria Service Deliverers.

In the past decade, Suriname's malaria figures have dropped dramatically and more recently malaria has become virtually eliminated from large parts of Suriname. Study activities focussed on the Suriname-French Guiana border region<sup>8</sup>, which is a remaining point source of malaria transmission. Yet even here it proved difficult to find individuals who had been ill with (suspected) malaria in the 1 ½ years prior to the interview, which was a survey inclusion criterion. Many persons conveyed that they had not experienced malaria for many years, and some had never contracted this disease.

That malaria prevalence (both reported and unreported) is very low was confirmed by people we encountered in the mining region and by the MSDs. Various respondents indicated that malaria may not be the principle health problem of the target population. People were much more preoccupied by, for example, leishmania, lepra and other skin infections. In addition, the researchers observed piles of garbage, stray dogs, poor sanitary conditions and open sewers in –primarily- Antonio do Brico and Peruano. The lack of hygiene surrounding people's living arrangements may pose a larger public health threat than malaria.

This does not mean that malaria can be ignored. Living and working conditions in the target areas, and the extremely mobile lifestyle of the target population, create conditions wherein a new outbreak of malaria can be rapid and far spread. Malaria Programme management also emphasized that it is important to stay alert. New people, some of them knowingly or unknowingly ill with malaria, arrive from French Guiana mining areas daily. The team encountered positive malaria cases in different location during the survey work; all among persons working the French *garimpos*. Also the MSD at Benzdorp, which appears almost malaria free, recently encountered a positive case, suggesting that malaria continues to be present. Without close monitoring and control, malaria numbers may be back on the rise rapidly.

The present baseline study was preceded by three earlier malaria KAP studies (2009, 2012, 2013). One observed trends is that over the years, malaria knowledge has steadily increased. Presently virtually everyone can name the symptoms of malaria and knows where to go for malaria testing and treatment. Also the proportion of respondents who know that malaria is caused by a mosquito has increased from 60.6 percent in 2009 to 81.6 percent today. Figures on knowledge of protective measures have fluctuated across years, a pattern that may in part be explained by the different forms of measurement in different years. With regard to this variable we observe that an increasing number of individuals argues that, given their lifestyle and working hours, one cannot protect oneself against malaria. These men and women often know what protective measures are available but since they often work long hours and have to bath at dawn or dusk, they feel they cannot avoid having exposed skin during malaria mosquito biting hours.

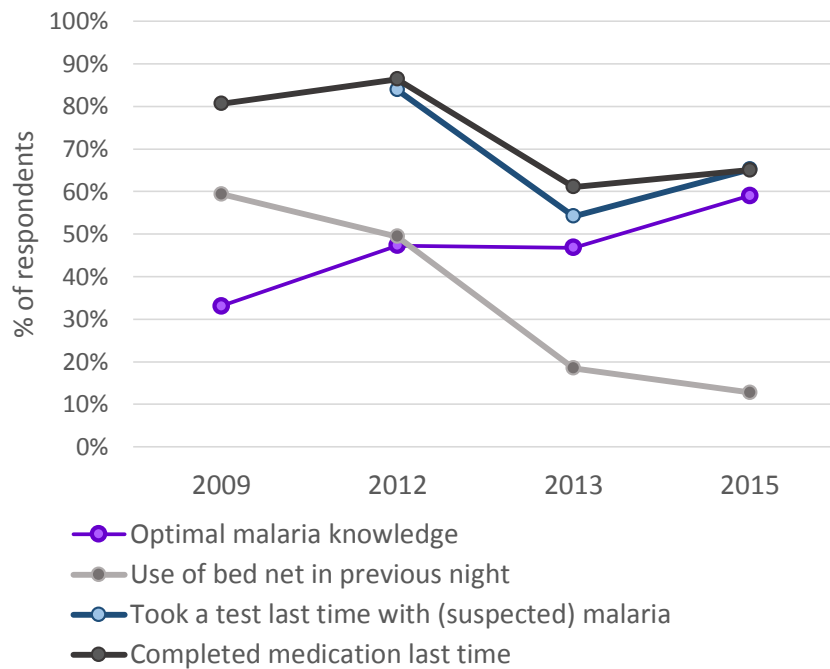
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<sup>8</sup> Survey locations included Peruano, Antonio do Brinco, Kabanavo, Benzdorp and surroundings, and Papatam



Curiously, while malaria knowledge improves, malaria avoiding behaviour deteriorates (Figure 24). This trend is most clearly visible when considering the use of bed nets, which decreased from 59.4 percent of respondents in 2009 to 12.8 percent of respondents presently. Also the share of respondents who completed their treatment shows a downward trend, though not very clearly (Figure 24). The proportion of people who took a malaria test the last time they (suspected) being ill with malaria actually increased a little as compared to 2013, but is smaller today than in 2012. A primary challenge for the Malaria Elimination programme will to enhance malaria conscious behaviour, including motivating the target population to sleep with a bed net.

Figure 20. Trends in malaria knowledge and behaviour between 2009 and present



Over a third of respondents in the present study had used OTC medication the last time they had experienced (suspected) malaria. The main and virtually only reason to do so was that the person was in the deep forest when he or she experienced symptoms, without any nearby health services. An extension of MSD services could resolve this problem and improve malaria testing. Indeed, a main intervention of the Malaria Elimination programme is to train additional Malaria Service deliverers (MSD) of three types: (1) fixed MSD who are situated at one post, (2) mobile MSD who travel by boat and/or ATV, and (3) community members who are trained in malaria testing and treatment and provide their services voluntarily. Increased malaria testing, in turn, is likely to elevate the chances that people will complete treatment. This logic only applies, however, if the MSD are located in or near the locations where people fall ill. An individual who works in a French Guiana *garimpo* when he or she experiences malaria symptoms will most likely turn to OTC medication – regardless of the number of MSDs in Suriname.

Another MP intervention is the distribution of LLINs in small-scale gold mining areas. We have seen that, throughout the years, bed net use has steadily decreased. The success of earlier malaria programs is debit to this trend. People do not see the need for sleeping with a bed net because they believe that there is (hardly) any malaria anymore and they don't like it. Some experience it as too warm or stuffy, and others

find sleeping with a bed net in the forest dangerous because it reduces their mobility when they need to jump from their hammock to avoid a falling tree or the French gendarmes. The most often cited reason to not use a bed net, however, was not having one. This observation suggests that bed net distribution may in fact increase the use of LLIN. The distribution phase could have an added benefit of meeting inhabitants of mining areas face to face to explain about multiple benefits of bed net use (it protects against mosquitoes, sand flies, bats, etc.) and the reason for insecticide treatment of the net.

MSD were the second most used test location, after health professional in French Guiana. The fact that the MSD are not always on their post and that in French Guiana additional health checks can be performed may partly explain the preference for French Guiana malaria services. An extension of MSD service or, for example, the establishment of a small pharmacy could make a visit to the MSD more worthwhile. Furthermore, the use of rotating MSDs could reduce absence at the MSD posts.

The Suriname Malaria Programme and the location of its MSD are not widely known among the inhabitants of small-scale gold mining areas in the Suriname-French Guiana border region. When asked whether they were familiar with the Malaria Clinic at Anamoestraat, more than half of respondents reported that they had never heard of it, and several others had heard of it but could not indicate its location. Only one out of every eight respondents recognized the Malaria Programme logo and could explain what it stood for.

The MP is presently working on its visibility in the field. A media firm has been hired to develop promotional materials and more specific media messages. Furthermore, a motorized dugout canoe has been bought to visit landings leading to mining areas. The boat will be painted in the colours and with the logo of the MP. The MSDs will be requested to more proactively visit the various gold miners' communities to convince inhabitants of mining areas to take a test when they experience malaria symptoms. Discussions about markers for the fixed MSD posts are ongoing. More prominent visibility of the logo on, for example, flags at the test locations, the MP vehicles and boat, and promotional materials (e.g. small backpacks, caps) could make the inhabitants of mining areas more familiar with the programme.

The findings suggest that regional collaboration is indispensable if malaria is to be eliminated from Suriname. Increasing efforts to exchange knowledge, experiences and data between Suriname, French Guiana and Brazil are in line with this vision.

Finally, the MP faces several challenges. One main challenge is that malaria rates are very low. As a result, people do not go for a test and do not sleep with a bed net, and contracting MSDs has been difficult. A second challenge is programme sustainability. The Ministry of Health and the Medical Mission do not have the staff, infrastructure and resources to provide malaria service to mobile populations. Hence once donor funding dries up, it will become difficult to maintain the network of MSDs and offer malaria services in Suriname's remote, distant mining regions.

## 5.2 Recommendations

Considering:

- I. Present efforts of the Ministry of Health, supported by the IDB, to eliminate malaria in Suriname
- II. That the broad objective of the present study is to provide baseline data against which to measure potential impacts of the MP Malaria Elimination programme one year from now.
- III. The data collected in the framework of this consultancy and our key findings reported here above

The researchers assert that despite the low malaria prevalence, targeted malaria monitoring and control is necessary to prevent new malaria outbreaks in Suriname. Recommendations are organized in four sections: Quick wins, Behaviour Change Communication, Services and Collaboration. “Quick wins” are a list of specific activities that are viewed as something that can be done with relatively little effort and normally in a short time. Recommendations in the area of “Behaviour Change Communication” provide input in the main knowledge and information gaps that require attention. “Services” refers to recommendations aimed at improved access of mobile populations to malaria prevention and treatment. Recommendations related to “Collaboration” suggest ways in which joining forces with third parties, including national and international organizations and foreign governments, can help malaria elimination efforts. Several of the recommended interventions are already planned by the MP for 2015-16.

Quick Wins:

- 1) Improve access to and use of LLINs among most at risk populations
  - a. Ensure that the ordered LLINs are appropriate and functional for small-scale gold miners. That is, they should be strong, easy to put up, and fit both hammocks and twin-size beds. If the first batch of hammocks (to be delivered 2015) does not fit the criteria, make sure to adjust the design of the second batch (planned for 2016).
  - b. Distribute the LLINs to most-at risk populations, that is, people working in mining areas in the Suriname-French Guiana border region (already planned).
  - c. Use aggressive bed net installation methods in gold miners’ communities and camps. Instead of just handing out the bed nets, malaria program staff should go from person to person, or to groups of persons hanging out together, to show people how the bed net is properly installed and how it should be treated. The relevance of insecticide in the bed net should also be explained
  - d. Propagate use of the bed net as an effective way to protect oneself against multiple pests and diseases, including mosquitoes (malaria, dengue, chikungunya), bats (rabies), sand flies (leishmaniasis), triatomine bugs (Chagas’ disease) and so forth.
- 2) Enhance visibility of the Malaria Programme and its logo
  - a. Place a MP flag at the fixed MSD posts, on the MSD boat and ATV, and at the MP clinic at Anamoestraat. The clinic at Anamoestraat also could be made more visible with an eye-catching billboard outside pointing to the clinic.
  - b. Make sure MSD staff is recognizable, wearing a t-shirt, badge or button of the Malaria Programme when at work.
  - c. If cubicles, kiosks, or houses are used as a fixed MSD post, paint them in the MP colours and add the logo (e.g. at Papatam, Zorg en Hoop, Atonio do Brinco)

### Behaviour Change Communication:

- 3) Focus on person-to-person information transmission, as inhabitants of gold mining areas may not easily absorb information provided on posters or in documents.
  - a. Use moments such as the distribution of bed nets as moments for person-to-person information transmission.
  - b. Pro-actively approach individuals who are waiting to return to the French Guiana mines. They typically put up their hammocks beneath a Chinese store in, for example, Peruano or Papatam, and may have substantial leisure time.
  - c. Make sure MSD provide clear and correct information when distributing medication, and use the waiting time for the results to provide additional information.
  - d. For prescription drugs, adherence to treatment should come close to 100 percent. When handing out drugs to a positively tested person, make sure the person understands the details of medication intake and can repeat it in his or her own words.
- 4) Promote correct and responsible malaria testing behaviour and adherence to treatment regimes through simple and clear messages that are consistent across organizations.
  - a. With regard to malaria testing, provide a simple but clear message: “When you feel malaria symptoms, take a malaria test”.
  - b. With regard to treatment regimes, provide a simple but clear message: “Whatever malaria medication you take, make sure you take the complete dose.”
  - c. Attune BCC efforts with those of PAHO and other health organizations (also in French Guiana) to ensure that they all give the same message, as not to confuse the target population. For example, if PAHO promulgates that taking Artecom is fine as long as one takes the complete dose, MP representatives should not tell people that they should not take Artecom.
  - d. PAHO develops informational pamphlets that can be stuck to a package of a certain treatment. Ensure that the MSD are aware of the message and can explain it to possible patients.
- 5) Reach populations by speaking their language (already implemented)
  - a. Public health outreach activities (written or spoken word) should make use of Portuguese and Sranantongo.
  - b. Given the growing population of Chinese, and the central role of Chinese merchants in the distribution of OTC medication, the MP should consider contracting someone with Mandarin language skills to reach this group.
- 6) Use visual media that are familiar to, popular with, and accessible for small-scale gold miners, particularly Brazilians.
  - a. Make short video messages to be broadcasted in the Zorg en Hoop waiting room at peak hours for travel to the Lawa River region.
  - b. Use a Brazilian telenovela star, soccer player (Brazilian or Suriname/Dutch), singer/songwriter or other famous person to broadcast a short and clear malaria message.
  - c. Learn from the use of visual media by other organizations. For example, if PAHO plans to work with photo comic booklets, observe how that is received and possibly adopt the idea.

## Services:

- 7) Enhance access to malaria testing and treatment
  - a. Implement the already designed and planned extension of MSD services, using fixed MSD, mobile MSD and volunteer MSD
  - b. Devise the MSD system in such a way that there is always (24/7) an MSD available at the fixed MSD posts. A person who is feeling ill will not travel to a testing post if there is a considerable chance that the MSD is not there. If the fixed MSD has to leave the post, for example to travel to town or another test location, he or she must be replaced by another MSD (volunteer, mobile or fixed) for the time being.
  - c. Ensure that inhabitants of mining areas know where and when to find the MSD at a certain location. Bed net distribution can be an opportune moment to provide that message, but the MSD can also pro-actively provide this information in the mining community.
- 8) Provide a wider range of health services
  - a. As planned, provide a wider range of health services that are direly needed among the target population. Testing (and treatment) for HIV, leishmaniasis, Tuberculosis, Chagas' disease, and other medical conditions will elevate the usefulness of the Malaria Clinic at Anamoestraat to the target population.
  - b. Change the name "Malaria Clinic" once it offers an extended range of services.
  - c. Promote the clinic with the new name with a festive opening, inviting both neighbourhood inhabitants and representatives of other health institutes such as the dermatological service and Medical Mission.
  - d. Once established as a specialized health clinic for tropical diseases, with multilingual staff, the clinic can become a central location for outreach to (mobile) populations in the Suriname interior.

## Collaboration:

- a. Seek collaboration with Chinese shops and Brazilian pharmacies that sell OTC malaria medication, in Paramaribo and the mining areas, asking them to instruct clients about completion of the cure. The pamphlets currently being developed by PAHO could be used for this purpose.
- b. Create a list of Suriname health institutes that offer services related to the (extended) activities of the MP, and develop clear guidelines for collaboration (e.g. cross-referrals, recommended treatment, health promotion etc.).
- c. Continue efforts for regional collaboration, primarily with French Guiana and Brazil. It would be useful to have regional meetings for specific professional groups, for example health practitioners (Malaria Programme staff, medical staff), as well as meetings that include practitioners, politicians, anthropologists, representatives of international organizations and other stakeholders.
- d. Work with French health practitioners –particularly those working in the French Guiana interior communities- and policy makers to find a way in which the MSD strategy, possibly in altered form, can be introduced to French Guiana mining areas.

## References

Breeveld, Florence J.V., Stephen G.S. Vreden and Martin P. Grobusch. 2012. History of malaria research and its contribution to the malaria control success in Suriname: a review. *Malaria Journal* 11(95). URL: <http://www.malariajournal.com/content/11/1/95>

Dowdle, Walter R. 1999. The Principles of Disease Elimination and Eradication. CDC Morbidity and Mortality Weekly Report. December 31, 1999 / 48(SU01);23-7.  
URL: <http://www.cdc.gov/mmwr/preview/mmwrhtml/su48a7.htm>

Global Fund. 2015. Core List of Indicators - Malaria. Monitoring and Evaluation. Web site. Last updated: 2015. Accessed 02/08/15. URL: <http://www.theglobalfund.org/en/me/requirements/>

Global Fund. 2014. Suriname Malaria. Powerpoint presentation.  
URL: [www.theglobalfund.org/.../SUR/.../2014/SUR-M\\_ConceptNote\\_0\\_en/](http://www.theglobalfund.org/.../SUR/.../2014/SUR-M_ConceptNote_0_en/)

Heemskerk, M., and C. Duijves. 2013. *Study on knowledge, attitudes and practices of malaria and malaria treatment in the small scale gold mining sector in Suriname*. Submitted to the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.

Heemskerk, M. and C. Duijves (2012a). *Looking for gold, finding malaria. Assessment of changes in malaria-related knowledge, attitudes, and practices resulting from the Ministry of Health malaria program in small-scale gold mining areas in Suriname*. Report submitted to malaria program, Ministry of Health, Bureau of Public Health.

Heemskerk, M. and C. Duijves (2012b). *Migrant & mobile populations and access to HIV services in gold mining areas in Suriname. In-Country Mixed-Methods Research and Data Collection*. Report submitted to EPOS Health Management GmbH

Heemskerk, M. (2010). *Searching for gold, finding malaria. Baseline study in three small scale mining areas in the Suriname interior*. Report submitted to malaria program, Ministry of Health, Bureau of Public Health.

Hiwat, H. et al (2012) *Novel strategies lead to pre-elimination of malaria in previously high-risk areas in Suriname*, *Malaria Journal* 2012, 11:10

Nacher, M., P. Guérin, M. Demar-Pierre, F. Djossou, F. Nosten and B. Carme (2013). *Made in Europe: will artemisinin resistance emerge in French Guiana?* *Malaria Journal* 2013, 12:152

Panchoe, and H. Cairo. 2013. *Malaria Control in Suriname. Situational Analysis*. Presentation at the Bi-National Health Meeting, Georgetown, Guyana 11 – 13 July 2013.

Suriname Malaria Program. 2015. Implementation plan for “Test and Treat” and the Malaria Service Deliverers. Policy document. Suriname Ministry of Health

WHO. 2014. *World Malaria Report*. WHO Global Malaria Programme.

URL: [http://www.who.int/malaria/publications/world\\_malaria\\_report\\_2014/report/en/](http://www.who.int/malaria/publications/world_malaria_report_2014/report/en/)

# Annex 1. Draft survey form



Interviewer Initials:

## Malaria Questionnaire

**Inclusion of interviewee:** Ask the below question to determine whether the person should be included/ continue to be interviewed, or not

Did you have, or suspect you had, malaria in the past 1 ½ year (2014-June 2015)?

1. Yes            2. No (Participant is not part of the target group. Discontinue the interview)

Are you 16 years of age or older?

1. Yes            2. No (Participant is not part of the target group. Discontinue the interview)

Have you worked or lived in small-scale gold mining areas along the Lawa River (either Suriname or French Guiana) for at least the past 6 months (Since January 2015)

1. Yes            2. No (Participant is not part of the target group. Discontinue the interview)

Date: \_\_\_\_\_ Location: \_\_\_\_\_

1. Gender (circle) :    0 = Female    1 = Male

2. What is your date of birth (insert: day/month/year) :    . . / . . / . . . .

3. Where were you born?

1. Suriname            4. Dominican Republic            88. Other, specify: \_\_\_\_\_  
2. Brazil                5. French Guiana  
3. Guyana               6. China

4. What do you do in the mining area (any country) at this moment (Circle all that apply)

1. Gold miner (worker)            5. Brothel owner            9. Unemployed  
2. Gold miner (machine owner)    6. Shop employee            10. Travelling vendor  
3. Sex worker                        7. Shop owner                88. Other, specify: \_\_\_\_\_  
4. Transport provider                8. Housewife

5. What is/are the main reason(s) of your presence in Suriname at this moment? (Circle all that apply)

1. I live here/my (temporary) home/family is here  
2. I work here  
3. I come to buy things  
4. I wait until I can return to French Guiana  
88. Other, specify: \_\_\_\_\_

6. What country do you consider as your primary working location at this moment?

1. Suriname    2. Fr. Guiana    3. Brazil            88. Other: \_\_\_\_\_            5. I don't work

7. What country do you consider as your primary living location/home at this moment?

1. Suriname    2. Fr. Guiana    3. Brazil            4. Other: \_\_\_\_\_

8. In what countries have you been working in the gold mining sector in the past 1 ½ years (2014- June 2015)? (more than one answer possible; circle all applicable answers)

1. Suriname                            3. Brazil                            5. Other; \_\_\_\_\_  
2. French Guiana                    4. Guyana

9. In the past 6 months (January 2015-now), how much time did you spend in Suriname?
1. Less than a month total
  2. 2-3 months
  3. 4-6 months
  4. Cannot say, I go back and forth
  5. Other: \_\_\_\_\_
10. In the past six months, have you heard or seen any messages about malaria?
0. No, **GO TO 13**
  1. Yes
  99. Don't know
11. If you did hear or see a message, by whom was it provided? (circle all that apply – do NOT read out the answers)
1. MSD in the mining area
  2. Tourtonnen lab.
  3. Poster in the mining area
  4. Brazilian TV
  5. Suriname TV
  6. Suriname radio
  7. MZ
  8. Friends/family
  9. French Guiana clinic
  10. French Guiana health workers
  88. Other, specify: \_\_\_\_\_
12. If you did hear or see a message, what did it say? (circle all that apply – do NOT read out the answers)
1. Malaria is dangerous
  2. Malaria can kill
  3. Mosquitoes spread malaria
  4. Sleep with a bed net
  5. When you feel ill, take the test
  6. Complete your medication
  7. Clean your surroundings
  88. Other, specify: \_\_\_\_\_
13. Do you recognize any of these Logos (show malaria programme logo and 2 'made-up' logos). If so, can you tell me what it stands for?
0. No, never seen any of them
  1. I may have seen them but I don't know what they mean
  2. Yes, I have seen this one (MP logo), It is the logo for: \_\_\_\_\_
  3. Yes, I have seen this one (made up logo), It is the logo for: \_\_\_\_\_
  99. Don't know
14. What do you think is the cause of malaria? (circle all that apply – do NOT read out the answers)
1. Bite of a (malaria) mosquito
  2. Drinking dirty water (river/creek)
  3. Being near to dirty water
  4. Dirty surroundings (trash)
  99. Don't know
  88. Other, specify: \_\_\_\_\_
15. Can you name symptoms of malaria? (circle all that apply – do NOT read the answers)
1. Headache
  2. Fever
  3. Feeling cold/shivering
  4. Feeling weak/tired
  5. Vomiting/Nausea
  6. Bitter taste
  7. No appetite
  8. Diarrhea
  9. Joint pains
  10. Body pain
  99. Don't know
  88. Other, specify: \_\_\_\_\_
16. How often have you been ill with malaria in the past 1 ½ year (2012-2013)?
1. Once (1 time)
  2. 2 to 3 times
  3. 4 to 5 times
  4. more than 5 times
  99. Don't know
  88. Other, specify: \_\_\_\_\_
17. The last time you were ill with malaria, in what country were you?
1. Suriname
  2. Brazil
  3. Guyana
  4. French Guiana
  88. Other country, specify: \_\_\_\_\_
18. When is the last time you were ill with malaria?
1. In this past month
  2. In the last 1-6 months
  3. 7-12 months ago
  4. More than a year ago
  99. Don't know

19. How can someone protect themselves against malaria?

- |  |   |                |
|--|---|----------------|
| 1. Sleep under bed net                   | 6. Use mosquito repellent                 | 99. Don't know |
| 2. Avoid mosquito bites                  | 7. Stay away from dirty water             |                |
| 3. Use mosquito candle                   | 8. Keep your area clean                   |                |
| 4. Use Baygon etc. (insect spray)        | 9. It is not possible to protect yourself |                |
| 5. Don't drink dirty water (creek/river) | 88. Other, specify: _____                 |                |

20. Do you have (possess) a bed net, and if so, is it a Malaria Programme net?

- |  |                                   |
|--|-----------------------------------|
| 0. No, I do not have a bed net                     | 2. I have another type of bed net |
| 1. Yes, I have a Malaria Programme (green) bed net | 88. Other: _____                  |

21. Did you sleep under a bed net last night?

- |        |       |                  |
|--------|-------|------------------|
| 1. Yes | 0. No | 99. I don't know |
|--------|-------|------------------|

22. If you slept under a bed net last night, was that bed net insecticide treated?

- |        |       |                  |   |
|--------|-------|------------------|---|
| 1. Yes | 0. No | 99. I don't know | 77. Not applicable: Did not sleep under a bed net |
|--------|-------|------------------|---|

23. In this past week, have you slept with a bed net every night?

- |        |       |                  |   |
|--------|-------|------------------|---|
| 1. Yes | 0. No | 99. I don't know | 77. Not applicable: Did not sleep under a bed net |
|--------|-------|------------------|---|

24. If you did not sleep with a bed net every night, why not? (Circle all that apply )

- |                           |                                 |
|---------------------------|---------------------------------|
| 1. Too warm/stuffy        | 4. I want to be able to see out |
| 2. I don't have a bed net | 5. There is no malaria anymore  |
| 3. Just don't like it     | 88. Other, specify: _____       |

25. What strategies have you used to get better when you had malaria in the past 1 ½ year (2012-2013)?  
(Circle all that apply )

- |                  |                        |
|------------------|------------------------|
| 1. Nothing       | 3. Use auto medication |
| 2. Go for a test | 4. Other _____         |

26. If you used auto-medication in the past 1 1/23 years (Jan. 2014-now), what medicine did you take?

- |            |                           |                |                    |
|------------|---------------------------|----------------|--------------------|
| 1. Artecom | 88. Other, specify: _____ | 99. Don't know | 77. Not applicable |
|------------|---------------------------|----------------|--------------------|

27. What were the reasons you started to treat yourself without seeing a health professional or health worker, the last time you did this?

1. I got malaria but I tested negative and the health worker did not want to provide medication.
  2. I was too far away from a health post when I had malaria, and it would be too costly and/or time consuming to go see a health worker/MSD and take the test.
  3. I knew/suspected I had malaria and I did not want to bother to take the test
  4. The medication I bought works better than the one the health workers give.
88. Other reason: \_\_\_\_\_
77. Not applicable. Did not use auto-medication in the past 1 ½ years.

28. Did you get tested the last time you suspected to have malaria?

- |                                       |   |
|---------------------------------------|---|
| 1. Yes, by an MSD                     | 4. Yes, at other official test location in Par'bo (e.g. Brahma) |
| 2. Yes, by health worker in Fr Guiana | 5. Yes, by a health worker in Brazil                            |
| 3. Yes, by MZ                         | 6. No I did not go for a test                                   |
| 4. Yes, at Tourtonnen lab             | 88. Other, specify _____  |

29. If you did not go testing, why did you not go for testing?(circle all that apply)

- |                                     |   |
|-------------------------------------|---|
| 1. I knew my status without testing | 5. Didn't know where to go                |
| 2. Too far from health services     | 6. Takes too much time to get there       |
| 3. Results take too much time       | 7. Financial reasons                      |
| 4. Bad experiences in the past      | 8. I take medication anyway, namely _____ |
| 5. No MSD in the area               | 9. Other _____                            |

30. How many pills were left when you stopped taking medication, the last time you used malaria medicine?

- |  |                    |
|--|--------------------|
| 1. No pills were left – <b>Go to Question 32</b> | 3. Some pills left |
| 2. One pill was left                             | 4. Can't remember  |

31. Why did you have left over pills?

- |                                   |                           |                             |
|-----------------------------------|---------------------------|-----------------------------|
| 1. I felt better and stopped      | 3. I forgot to take pills | 88. Other reason: _____     |
| 2. I experienced bad side effects | 4. They did not work      | 77. N.A. No left over pills |

32. Do you know where to go for testing and treatment of malaria around here? If yes, please state where? (Please circle all answers that are mentioned but do NOT READ the ANSWERS)

1. French Guiana (Maripasoula) health centre
2. MSD in the mining area
88. Other, specify: \_\_\_\_\_
99. Don't know

33. Do you know where to go for testing and treatment of malaria **in Suriname**? If yes, please state where? (Please circle all answers that are mentioned but do NOT READ the ANSWERS)

- |                          |                                |                            |
|--------------------------|--------------------------------|----------------------------|
| 1. MSD                   | 4. BOG                         | 7. Hospital                |
| 2. Health clinic MZ      | 5. General clinic/Practitioner | 88. Other, specify: _____  |
| 3. Malaria Lab Tourtonne | 6. Brahma/Medilab              | 99. Don't know where to go |

34. Are you familiar with the malaria lab at Anamoestraat? If so, can you explain how you get there?

- 0.** I have never heard of it, **Go to 36**
1. I heard of it but I do not know exactly where it is
  2. I know where it is (next to Transamerica, up the stairs)
  3. I know where it is (next to Transamerica, up the stairs) and I have been there
  88. Other: \_\_\_\_\_

35. If you are familiar with the Tourtonne malaria lab, do you know what medical services they provide? (Circle all that apply)

- |                       |   |                |
|-----------------------|---|----------------|
| 1. Malaria testing    | 4. General health services  | 99. Don't know |
| 2. HIV testing        | 88. Other: _____  |                |
| 3. Leishmania testing | 77. Not applicable. Not familiar with the Tourtonnen malaria lab. |                |

36. The Suriname malaria programme trained persons in the mining areas to test for and treat malaria. Do you know where to find such a person in this mining region?

0. No, have no idea
1. They sometimes come visit but I do not know where they stay
2. Yes, there is such a person at: \_\_\_\_\_
88. Other, specify: \_\_\_\_\_

**END OF SURVEY**