



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

Impact study on the MSD strategy

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Abbreviations

ACD	Active Case Detection
ASGM	Artisanal and small-scale gold mining
BOG	Bureau of Public Health (Bureau Openbare Gezondheidszorg)
FG	French Guiana
<i>Garimpeiros/garimpo</i>	Gold miner (Por.)/ Gold mining area
IDB	Inter-American Development Bank
KAP	Knowledge, Attitudes and Practices
LLIN	Long-Lasting Insecticidal Nets
MoH	Ministry of Health
MP	Malaria Program
MP I	First malaria program, executed by the Medical Mission
MP II	Second malaria program “Looking for gold, finding malaria”, executed by the BOG Malaria Program
MP III	Third malaria program “Malaria Elimination program”, executed by the BOG Malaria Program
MSD	Malaria Service Deliverer
MZ	Medical Mission Primary Health Care Suriname (<i>Medische Zending</i>)
N_{total}	Total valid sample for the indicated question
OTC	Over-The-Counter (medicine)
RDT	Rapid Diagnostic Test
RGD	Regional Health Service
TropClinic	Malaria clinic at Anamoestraat

Summary

Introduction and background: This report presents the impact evaluation of the activities of the Suriname Ministry of Health (MoH) Malaria Program (MP) aimed at elimination of malaria in Suriname (hereafter: Malaria Elimination program). This IDB funded program was executed between June 2015 and March 2016. Because existing data and earlier report suggest that the largest share of malaria cases detected in Suriname today are probably the result of transmission in French Guiana, the Malaria Elimination program focused specifically on the Suriname-French Guiana border region. Intervention strategies included:

- Strengthening of the Malaria Service Deliverer (MSD) network;
- Establishment of two new test and treat facilities at places where migrants enter Suriname, Albina/Papatam and Zorg en Hoop local airport;
- Distribution of 11,495 Long Lasting Insecticidal Nets (LLIN);
- Expansion of MP services to include HIV testing and counseling; and
- Behavior Change Communication.

Methodology: the researchers conducted a quantitative survey 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. A team of surveyors conducted a total of 152 valid surveys with 52 women (34.2%) and 100 men (65.8%). Respondents were on average 38.4 years of age, and all but four respondents were born in Brazil (97.4). Most men worked as gold miners and transport providers, and most women worked as traveling vendors or cooks.

Results and conclusions: Quantitative study results are presented and compared with results from the baseline assessment (2015) in Table 1. The researchers conclude that one year is too short of a time to see dramatic changes, particularly in this extremely mobile, difficult to reach population. Notwithstanding, the results suggest that the Malaria Elimination campaign has raised consciousness about malaria prevention among inhabitants of small-scale gold mining areas along the Suriname-French Guiana border: today relatively more people know about, own and use LLINs.

As compared to the 2015 baseline, we observed small positive changes in Test and Treat behavior. When comparing the figures to 2013, a more significant change is visible; today relatively more people take a test when they experience malaria symptoms and a larger share of individuals complete the cure. Testing with MP staff in the field (MSD) and Paramaribo (TropClinic) has increased in popularity.

Remaining challenges include: motivating people to use LLINs when malaria rates drop, the disparity between French Guiana and Suriname with regard to malaria strategies and policy, and program sustainability.

Table 1. Comparison of malaria indicators between the 2015 baseline study and the present 2016 impact evaluation survey for the Malaria Elimination program

% of at risk population who:	2015 (N=141)	2016 (N=152)
Name mosquitoes as the cause for malaria ^a	87.2%	92.7%
Name <i>only</i> mosquitoes as the cause for malaria	81.6%	80.8%
Know the main symptoms of malaria ^a	99.3%	100%
Can name at least one effective method to prevent malaria ^a	73.6%	85.5%
Name the bed net as an effective way to protect oneself against malaria	69.5%	82.2%
Can name a malaria testing and treatment facility <i>in their present vicinity</i>	99.3%	95.4%
Have correct knowledge of the causes, symptoms, prevention and treatment of malaria	59%	61.6%
Possess a Long Lasting Insecticide Treated Net (LLIN) ^b	10.6%	36.8%
Slept under a bed net in the night prior to the interview ^a	12.8%	13.8%
Slept under an ITN in the night prior to the interview ^{a,b}	6.4%	13.2%
Did a malaria test the last time they suspected to be ill with malaria	65.2%	69.7%
Got tested for malaria with an MSD, among those who got tested for malaria the last time they suspected malaria	33.7%	45.3%
Self-medicated for (suspected) malaria at least once in the past 1 ½ years	54.6%	51.7%
Completed malaria treatment last time the person had (suspected) malaria	65%	64.4%
Completed malaria treatment, among those who had self-medicated	37.5%	41.3%
Completed malaria treatment, among those who had been tested by a health worker	79.3%	77.4%
Were in French Guiana, the last time they had (suspected) malaria	64.5%	79.6%
Recall hearing or seeing any malaria message within the past 6 months ^a	64.5%	62%
Recognize the MP logo (and no other logos)	12.1%	32.2%
Know where to find an MSD	45.4%	55.9%
Is familiar with the TropClinic (Malaria clinic at Anamoestraat) and its location	22.7%	25%
Used the services of the TropClinic	7.8%	21.1%

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

1.1 The malaria elimination program

This evaluation report assesses the impact of the activities of the Suriname Ministry of Health (MoH) Malaria Program (MP) aimed at complete elimination of malaria in Suriname, fully named: “Malaria elimination: expanding test, track and treat in mining areas” (hereafter: Malaria Elimination) program, 12 months¹ after its inception (July 2015). The Malaria Elimination program is supported by the IDB, as Technical Cooperation project “Support for Active Malaria Case Detection Program” (SU-T1072) and by the Global Fund to fight HIV, Tuberculosis and Malaria (SUR-M-MoH, 2015-2018). It is a logical follow-up of earlier programs to fight malaria in Suriname’s interior (Figure 1).

The Malaria Elimination program (MP III) focuses on key populations for malaria transmission, which are mostly Artisanal and Small-scale Gold Mining (ASGM) populations in the Suriname-French Guiana border region. Suriname’s ASGM sector is concentrated in South-East Suriname and employs an estimated 13,000 miners and service providers (e.g. cooks, mechanics, transport providers). It has been estimated that about 10,000 individuals work in the ASGM sector in French Guiana. An important pillar of the Malaria Elimination program is to minimize the distance between patient and diagnosis, by improving access to fixed, mobile and volunteer Malaria Service Deliverers.

1.2 Findings from the 2015 baseline study

The 2015 Malaria Elimination baseline study suggested, in line with earlier malaria Knowledge Attitudes and Practices (KAP) studies, that malaria knowledge of ASGM populations had increased significantly in previous years. The increase in malaria knowledge, however, had not translated to more malaria conscious behavior. Self-diagnosis and the use of Over The Counter (OTC) medication remained high, incomplete treatment was common, and the use of bed nets was suboptimal.

The malaria risk behaviors that were identified in the 2015 Malaria Elimination baseline report are strongly related to the French zero tolerance policy vis-à-vis clandestine ASGM and the (consequently) limited access to health services in French Guiana *garimpos*. For individuals working in French Guiana ASGM areas, travel to the nearest health post is often expensive, risky, and may take several days. In this context, using OTC drugs is a logical choice. When malaria medication is not prescribed by a health worker, treatment compliance is typically low. Those who rely on OTC medication typically take two to four pills from the pack and stop taking medication because they feel better, experience negative side effects, or wish to save some pills for a next malaria episode. Furthermore, because the ASGM population in French Guiana is continuously hiding and running from the *gendarmes*, they have little time to put up a bed net, which can even hinder escape. Several individuals also accounted that the *gendarmes* had burned their bed nets.

The limited access to malaria services and high malaria transmission rates in French Guiana, however, are not merely a French problem. Indeed, individuals who work in the ASGM sector in French Guiana continuously cross the –unprotected- border into Suriname to take a break, rest, buy supplies or merchandise, visit family or for other reasons. A share of ASGM miners working in French Guiana actually

¹ This date marks termination of IDB support for the Malaria Elimination program

lives in Suriname, with their families residing in Paramaribo. This cross-border mobility allows for the entry of malaria-positive persons into Suriname, thereby posing a risk for transmission to others.

Data from the Malaria Program confirm that most new malaria cases come from ASGM areas near the border with French Guiana, and that the largest share of transmission takes place in this neighboring country (Table 2). For this reason, the Malaria Elimination program focusses on locations where gold miners working in French Guiana enter Suriname and assemble, such as the Zorg en Hoop national Airport, Albina, and the cluster of settlements along the Lawa river around Antonio do Brinco.

Table 2. Cases of malaria with suspected country of transmission

Suspected country of infection	2010	2011	2012	2013	2014	2015
French Guiana	900	458	275	409	229	274
Suriname	535	146	57	159	47	73
Guyana	16	25	28	76	18	13
Brazil	3	3	1	3	0	5
Venezuela	2	1	2	3	0	0
Ghana	0	0	0	0	0	4
Zambia	0	0	0	0	1	0
Unknown	2	0	0	9	9	4
Total	226	633	363	659	304	373

The aim of the Malaria Elimination program is to completely eliminate malaria in Suriname. This goal is pursued 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 MSD, and the distribution of free Long Lasting Impregnated Nets (LLINs).

The objective of the impact evaluation is to:

Document the impact of the Suriname Ministry of Health Malaria Elimination program on ASGM populations in the Suriname-French Guiana border regions, one year after the onset of program activities in July 2015.

Impacts were measured in the following areas:

- Malaria knowledge in the target population.
- Malaria prevention behavior of the target population, particularly the use of bed nets.
- Malaria treatment behavior among the target population, particularly in terms of self-medication and incomplete treatments.
- Exposure to Behavior Change Communication 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 Program posts and their services.

This report proceeds as follows. The introduction is followed by a description of the Malaria Elimination program intervention and a summary of findings from the baseline assessment (Section 2). Section 3 presents the methods that were used for data collection and analysis, and describes the study sample. The results are delivered in Section 4. The conclusions and recommendations are presented in section 5.

2. Background

2.1 The Malaria Elimination program

In the past decade, the Suriname Ministry of Health (MoH) has stepped up its malaria control efforts in an effort to completely eliminate malaria and meet international targets for malaria control (Figure 1). In 2007, as a result of the 2006 Medical Mission² Malaria Program, Maroon and Indigenous communities in the interior had become almost malaria-free. However, Artisanal and Small-scale Gold Mining (ASGM) areas continued to exist as untreated point sources of malaria transmission. Gold miners were minimally reached by the regular malaria campaigns because travel to the mining areas is logistically difficult and expensive, and the population consists largely of migrants who do not speak the local languages. Malaria re-entered interior villages as local gold miners from these villages returned home, and through social and economic contacts between gold miners and local people.

In 2009, the Suriname Ministry of Health (MoH) started the Global Fund funded “Looking for gold, finding malaria” program, which had as its main purpose to reduce the transmission of malaria in Suriname’s ASGM areas, and thereby prevent its relapse in interior villages. Main program activities included free testing and treatment of people with malaria symptoms in the small-scale gold mining areas; active case detection (ACD); an information and awareness campaign; and the free distribution of Long-Lasting Impregnated Nets (LLIN) in ASGM areas. These activities are ongoing.

Interventions of the “Looking for gold, finding malaria” took place in ASGM areas throughout Suriname but varied in intensity. In recent years, as malaria transmission rates in Suriname ASGM areas dropped rapidly, the program began to focus on the Benzdorp area and other locations along the Suriname-French Guiana border where new malaria cases continued to enter Suriname. In addition, a malaria clinic with Portuguese speaking staff was established in a neighbourhood in Paramaribo where many Brazilian gold miners and mining service providers stay and/or buy supplies. The Paramaribo malaria clinic offers malaria testing and treatment free of charge.

Statistics on malaria rates suggest that the malaria interventions of the MZ Malaria Program and its follow-up, the MoH “Looking for gold, finding malaria” program have been highly successful. The number of autochthonous malaria cases dropped from 8,618 in 2005 to 1,509 in 2009 (Hiwat et al. 2012). In 2015, the number of autochthonous malaria cases had dropped to 73, while another 300 positive malaria cases had been imported from other countries (Table2, Figure 2). In this same year, Suriname counted zero recorded deaths that could be attributed to malaria. Data from the Malaria Program also show that as the total number of malaria cases dropped, the share of cases with suspected transmission in French Guiana

² Fully named: Medical Mission (*Medische Zending*) Primary Health Care Suriname, publicly known by its abbreviation “MZ”.

rose. In 2015, 73.5% of positive tested malaria cases were the result of transmission in French Guiana (Figure 2)

Figure 1. History of the malaria program in Suriname

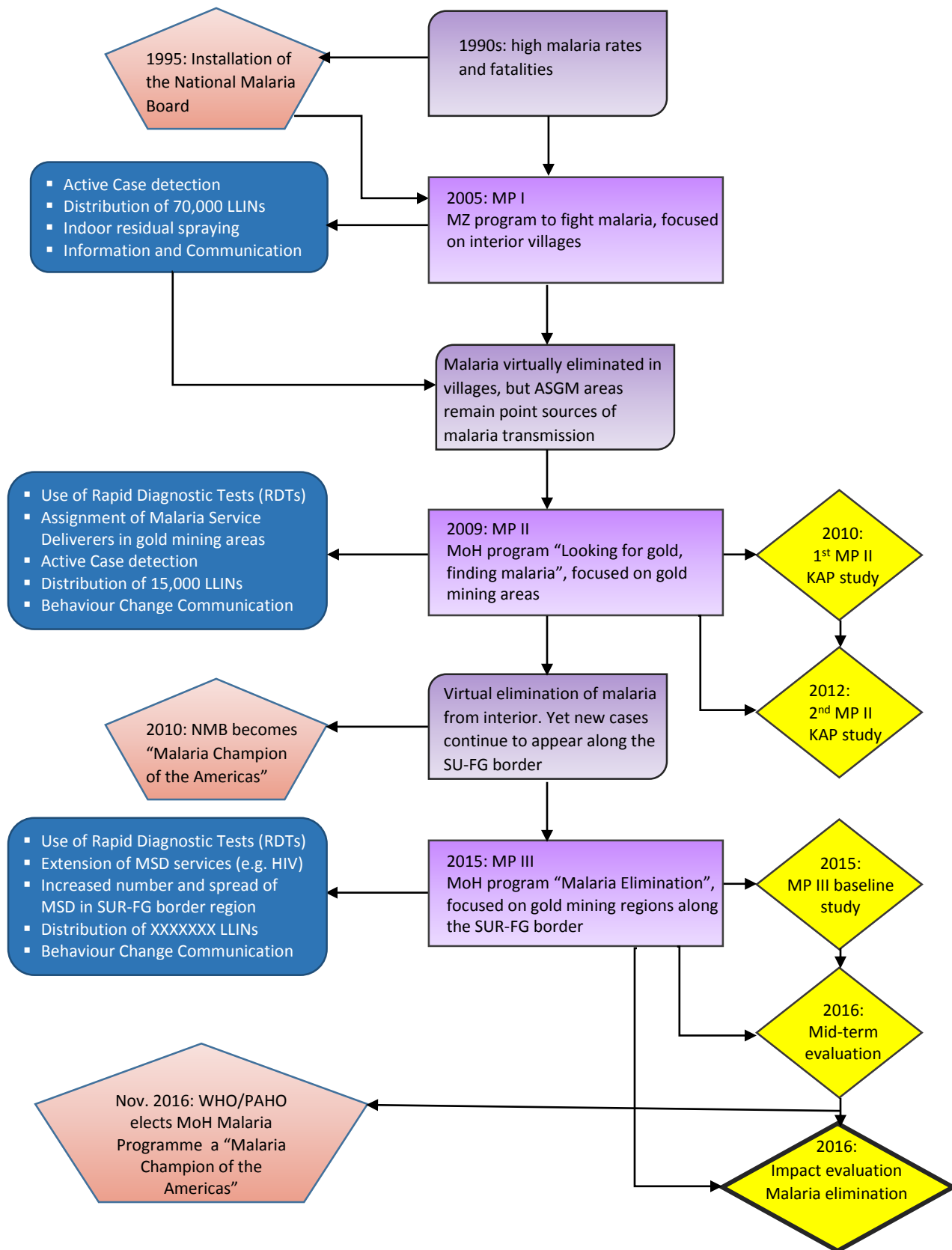
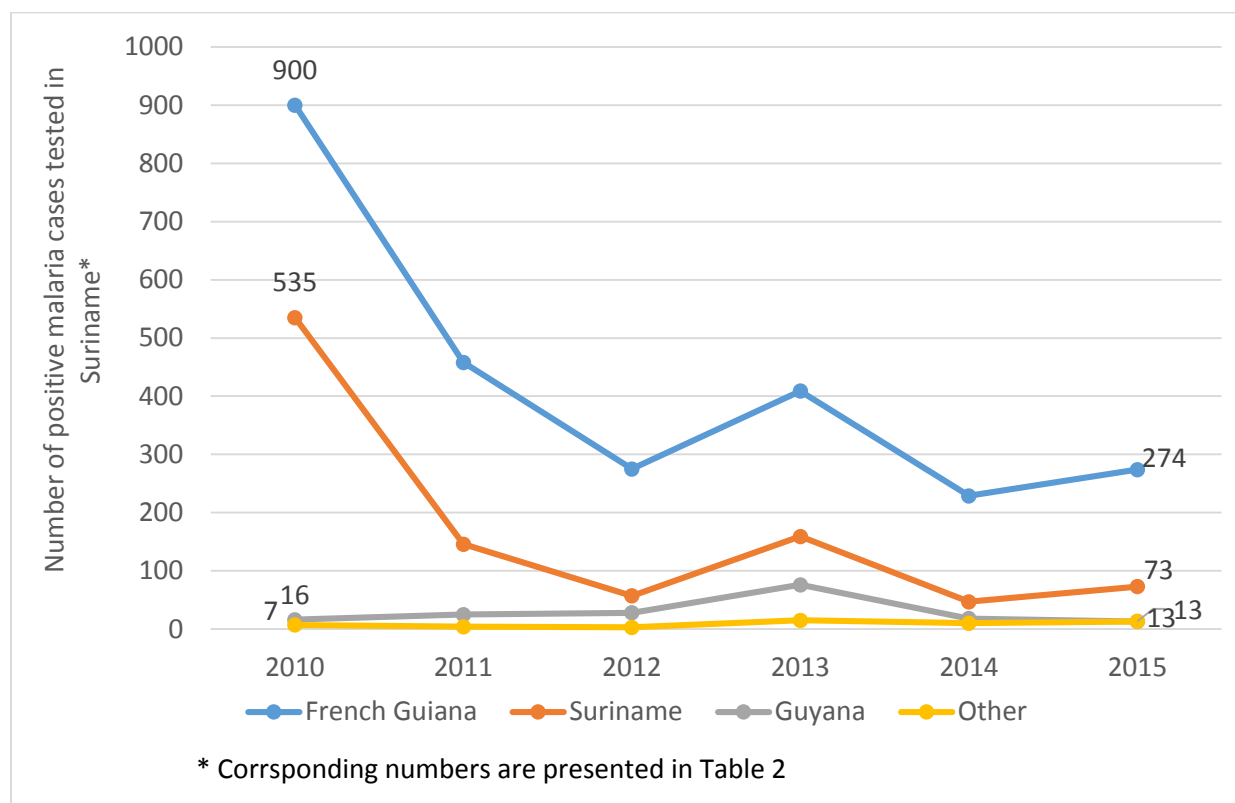


Figure 2. Number of positive malaria cases tested in Suriname, by year and likely country of infection



The Malaria Elimination program (MP III) started in April 2015. It continued the success formula of the MP II, but now with an even stronger focus on the Suriname-French Guiana border region. At the core of the Malaria Elimination strategy is expansion of the Test, Treat and Track (T3) strategy at locations where individuals working in French Guiana ASGM areas enter and/or stay in Suriname. The expanded T3 strategy includes the following:

- 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. They are situated in Benzdorp (2) and Peruano and the Brokopodo Lake areas
- 6 “Fixed Post” Malaria Service Delivers, situated at key locations where many miners stay and/or pass through, namely: Antonio do Brinco, Benzdorp, Papatam/Albina. Sensikondre, Villa Brazil and the Lake area (this latter post has not yet been established).
- Three new volunteer MSD were recruited and trained and 14 existing MSD were retrained. These volunteer MSDs provide more informal Testing and Treatment in remote mining communities.
- Expansion of services offered to (migrant) mining populations. The Malaria Clinic (now named: TropClinic) now also provides HIV counseling and testing. Meanwhile leishmaniasis training of personnel is ongoing, and already two screenings have been done at Langatabiki
- 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 (since August 2015).
- A Medische Zending run Medical Clinic at the Airport in Lawatabiki, funded and overseen by the Ministry of Health. This clinic is not yet active.

The T3 network of malaria service providers (MSDs, TropClinic, MZ and Zorg en Hoop airport cabin) uses a combination of RDTs and thick smear microscopy (in labs) to test for Malaria, and the delivery of ACTs plus Primaquine to treat positive malaria cases. The entire network is overseen by Ministry of Health Malaria Program Staff in Paramaribo, and relies heavily on the work of three field “supervisors” who live and work in the mining areas. Expansion and maintenance of the T3 network has been complemented by the following support interventions:

- Distribution of 37,000 LLINs in malaria risk areas, notably the mining areas, with the Benzdorp region and Papatam/Albina as specific area of attention.
- Design and implementation of a Malaria communication campaign to promote the Malaria Program Primary health messages by;
 - Sending out of a text message to 10,000 phone numbers of users who fitted the profile of the target groups. The first set of SMS messages was sent on March 10th and 11th, and provided information about: mosquito net usage, malaria testing, completion of treatment, and contact information TropClinic. The next set of SMS messages was sent out on March 14th and 15th. 2016. This second SMS provided information about the Malaria Program, mainly free testing, and TropClinic contact information and opening hours.
 - Broadcasting two radio commercials, each of them in two languages (Portuguese and Sranantong). Radio commercial #1 provided general information about the services of TropClinic (free testing), its opening hours and contact information. The second Radio commercial provided information about the distribution of mosquito nets, encouragement of the usage of mosquito nets, and contact information and opening hours of TropClinic.
 - Video messaging. Two existing videos from TropClinic were updated and re-edited to communicate the key messages for the promotion campaign. In addition, two new video messages were produced, about the TropClinic in general and about the field services of the malaria program.
 - Development of a large billboard for placement near Zorg & Hoop local Airport. Two designs were developed; one showing activities of the TropClinic, the other one promoting bed net use.
 - Two A3 posters were designed, derived from the billboard layouts.
 - Promotional material was purchased and branded with the logo of TropClinic, including regular t-shirts, polo shirts and baseball caps.

(Chetskeys Production 2016)

2.2 Findings from the 2015 baseline assessment

In June 2015, at the onset of the Malaria Elimination program, the MoH Malaria Program commissioned a KAP study to assess baseline conditions among ASGM populations in target areas along the Suriname-French Guiana border. The baseline assessment was conducted in the greater Benzdorp area (incl. Antonio do Brinco, Peruano, Kabanavo, Benzdorp) and Papatam/Albina (Figure 3), and targeted individuals of at least 16 years of age who were working in the ASGM sector - either as a gold miner or as a mining service provider.

The baseline assessment found that overall malaria knowledge had increased as compared to malaria knowledge measured in earlier years. In 2015, 81.6 percent of respondents correctly named the mosquito as the only cause of malaria, and 59 percent had correct knowledge of the causes, symptoms, prevention and treatment of malaria. Nevertheless, treatment behavior remained sub-standard. More than half of 2015 respondents had relied on Over The Counter (OTC) malaria medication at least once in the year and a half preceding the interview, and over one third of respondents had not completed their most recent malaria treatment (Table 3).

Table 3. Selected indicators used in the 2015 baseline assessment for the Malaria Elimination program.

% of at risk population who:	2015
Name <i>only</i> mosquitoes as the cause for malaria	81.6%
Know the main symptoms of malaria ^a	99.3%
Can name at least one effective method to prevent malaria ^a	73.6%
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	59%
Possess a Long Lasting Insecticide treated Net (LLIN) ^b	10.6%
Slept under a bed net in the night prior to the interview ^a	12.8%
Slept under an ITN in the night prior to the interview ^{a,b}	6.4%
Did a malaria test the last time they suspected to be ill with malaria	65.2%
Self-medicated for (suspected) malaria at least once in the past 1 ½ years	54.6%
Completed malaria treatment last time the person had (suspected) malaria	65%
Completed malaria treatment, among those who had self-medicated	37.5%
Completed malaria treatment, among those who had been tested by a health worker	79.3%
Were in French Guiana, the last time they had (suspected) malaria	64.5%
Recall hearing or seeing any malaria message within the past 6 months ^a	64.5%
Recognize the MP logo and know what it stands for	12.1%

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

The baseline assessment also highlighted the importance of easy, nearby access to malaria test services. The single most important reason for not taking a malaria test was the cost in terms of time and money to travel to the nearest test location. Another telling finding was that malaria patients who had received malaria medication by an MSD or other health worker were more than twice as likely to complete their malaria cure as people who had taken OTC malaria medication. This result provided additional support for the improving access to proper malaria treatment services. The Malaria Elimination program strategy of creating a network to provide as many opportunities for early diagnosis and treatment as possible, is well aligned with these findings.

The baseline assessment also revealed that possession and use of bed nets was low. Despite earlier distributions of large numbers of LLIN, only one out of every ten respondents reported possession of an LLIN, and only one out of every eight respondents had slept with a bed net (any type) in the night preceding the interview.

The 2015 baseline assessment concluded that even though malaria transmission rates had lowered and malaria was no longer a prime health concern for ASGM populations in the target areas, continuation of malaria testing, treatment and monitoring is crucial to keep malaria under control in Suriname.

3. Methods

3.1 Approach

The impact evaluation took place one year after start of the Malaria Elimination program interventions. Its aim was to measure program impact on knowledge, attitudes and practices with regard to malaria in the target population. A second motive of the impact evaluation was to inform the general scope and format of continues MP efforts aimed at malaria control and elimination. The impact evaluation followed the 2015 baseline assessment and the May 2016 intermediate evaluation (Figure 1)

The 12-month impact evaluation consisted, like the baseline study, of a survey to measure malaria (treatment) knowledge and behavior, health care seeking behavior and familiarity with the Malaria Program among the target population. The baseline survey and impact survey asked largely the same questions, but the impact survey included additional questions about the specific interventions of the Malaria Elimination program. This impact evaluation report compares the answers before initiation of the Malaria Elimination program interventions and after 12 months, to provide a quantitative measure of program impact. Qualitative interviews with MSD and malaria program staff provided additional input to the impact evaluation.

Prior to the 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 was integrated in the final work plan and research tool.

3.2 Survey Interviews with ASGM populations

A survey with mostly closed ended questions was used to collect data on malaria knowledge, attitudes and practices among members of the ASGM population. The survey consisted of the following sections:

General demographic and socioeconomic background: Age, gender profession, employment record and location, malaria history.

Exposure to Malaria Elimination program interventions: Knowledge of MSD location, exposure to malaria information, having seen posters with malaria messages, receipt of SMS malaria message, participation in All Case Detection (ACD), familiarity with MP logo.

Malaria knowledge: knowledge of the causes and symptoms of malaria, and ways to protection oneself, and familiarity with treatment locations nearby and in Paramaribo.

Protective behavior: Possession and use of regular and insecticide treated bed nets.

Treatment behavior: Access and use of test and treat facilities, use of OTC medication, adherence to treatment regime.

The survey form is attached as Annex I.

The surveys were conducted by experienced and trained surveyors who were fluent in Portuguese and/or Sranantongo. The lead researcher reviewed every completed survey form to ensure high data quality. Completed survey forms were entered in an SPSS data base, which has been submitted to the Malaria Program alongside this impact evaluation report

3.3 Survey sample size and sampling strategy

Inclusion criteria for participation in the survey were:

- (1) The person works in an ASGM area.
- (2) The person has experienced (suspected) malaria in the past 1 ½ years (January 2015-July 2016).
- (3) The person is 16 years of age or older.

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 behavior are more meaningful if the surveyed person actually had a recent experience with malaria. The experiences of individuals who, for example, had malaria ten years ago in Brazil were not relevant for this evaluation. 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.

Respondents were recruited in economic centers along the Suriname-French Guiana border where members of ASGM populations who work in French Guiana enter Suriname and/or hang out for some days, namely: Papatam/Albina, Antonio do Brinco, and Peruano (Figure 3). The population concentrations in and around Benzdorp and Kabanavo were visited during the baseline survey but not during the impact evaluation survey because they have been largely abandoned and virtually malaria free in the past couple of years.

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, Papatam) is very mobile, random sampling was impossible. Instead, the survey team made use of a purposive sampling³; 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 the two other inclusion questions. If answers to those questions were also positive, he or she was asked to participate in the survey. Each person who completed the survey received an SRD 20- (USD 3.7) mobile phone recharge card to express gratitude for their time and information. An MSD was present during the survey activities to provide individuals in the target areas with an opportunity to test for malaria.

In total, 153 persons were interviewed; 80 in Peruano (52.6%) and 61 in Papatam/Albina (39.5%), 5 in Antonio do Brinco, and 7 in Paramaribo ($N_{total}=152$). The team did not visit Benzdorp and Kabanavo, which were visited during the baseline assessment. A year ago we encountered very few people who met the inclusion criteria in these locations, and there were no reasons to believe that this had changed (Table 5). The higher number of respondents from Papatam may be explained by the fact that Papatam was visited only one day for the baseline assessment and on two days during the evaluation survey. The reason for the additional day visit was that the team had not encountered the target number of people who met the inclusion criteria in the Antonio do Brinco area. In order to reach the target of 150 surveys, an additional 7 survey interviews were performed in Paramaribo upon completion of the fieldwork in Papatam and the Antonio do Brinco area. One survey form was removed from the sample because the researchers doubted the reliability of this respondent.

³ 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 3. Map of the border region between Suriname and French Guiana, with the main research locations indicated as yellow stars

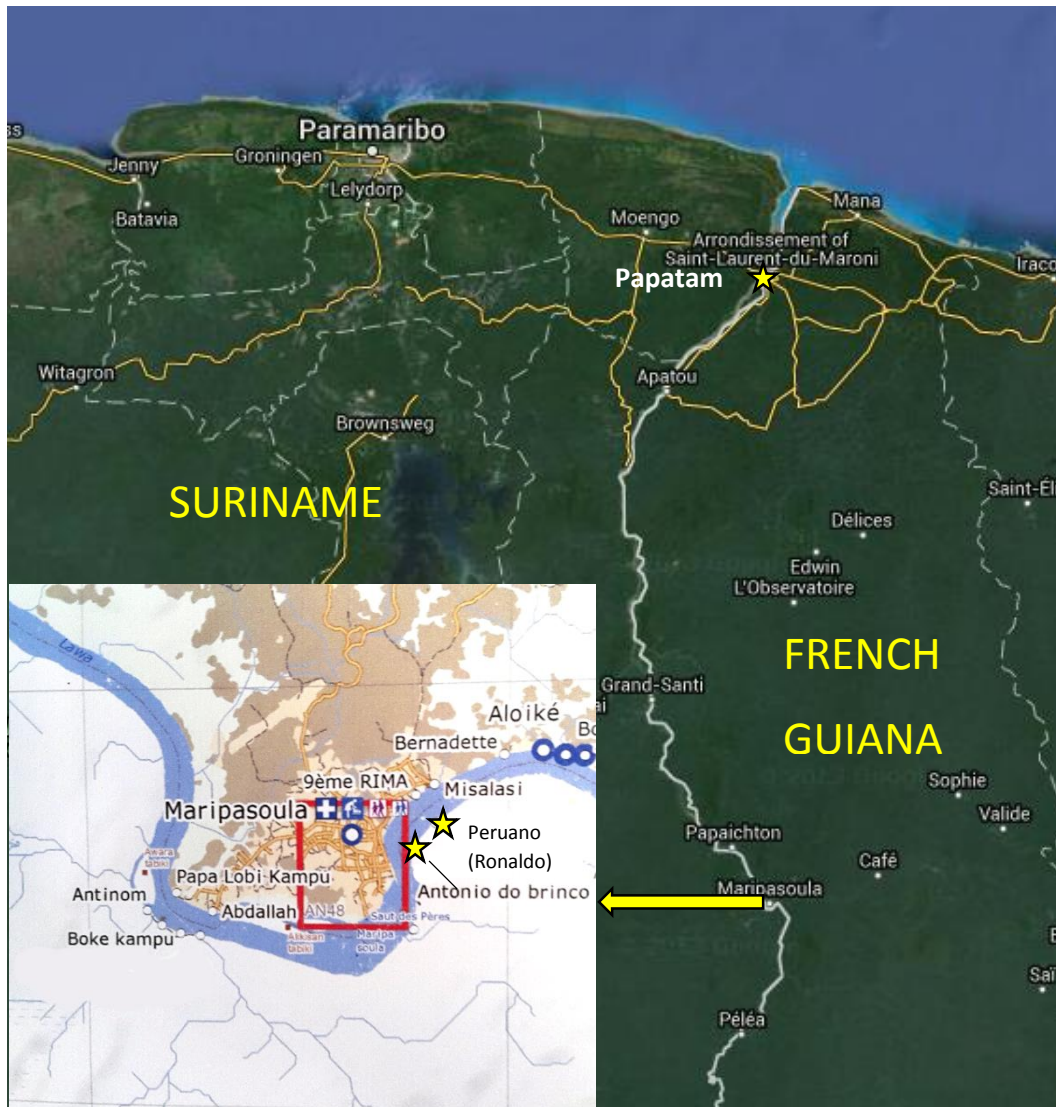


Table 4. Total population and target sample size in different sites within the target area

Name of site/camp	Sample size baseline assessment	Sample size impact evaluation
Peruano (also named Ronaldo)	92	80
Benzdorp	4	0
Kabanavo	2	0
Antonio do Brinco	25	5
Papatam	18	61
Paramaribo	0	7
Total number of respondents	144	153
Invalid surveys	3	1
Total number of valid surveys	141	152

3.4 Sample characteristics

One hundred and fifty-two valid surveys were conducted, with 52 women (34.2%) and 100 men (65.8%). Respondents were between 17 and 60 years of age, with a Mean age of 38.4 years ($N_{\text{total}}=152$). The Mean age (38.4) and age range (17-60) were almost exactly the same as those from the baseline assessment. There was hardly any difference between women and men in terms of their Mean age (resp. 39.4 and 37.9). All but four persons were born in Brazil (97.4%, $N_{\text{total}}=152$). Of these four, two were Surinamers, one was from the Dominican Republic and one from Guyana.

Like during the baseline assessment, most surveyed women were traveling vendors ($N=25$) and cooks ($N=19$). Other women were gold miners (equipment owners); sex workers; housewives; or shop, brothel or hotel owners. Men were most often gold miners (workers, 59); traveling vendors (23); or transporters of people, supplies and/or fuel (12). Others performed a wide variety of other professions, including equipment owner, brothel owner, hairdresser, tunnel constructor, and operator.

3.5 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 was 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 Program according to national standards for such procedures. The MSD also extended medication to positive patients. All MSD involved spoke Portuguese and were able to explain the testing and treatment procedures in the patients' own language.

3.6 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 internal consistency (within survey forms), consistency of answers between different respondents, our research experience in the region and conversations with local MSD, we are confident that the persons we interviewed were representative of the population living and/or working in the mining areas along 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 behavior and respond in the 'correct' way as opposed to according to their true actions. We 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.

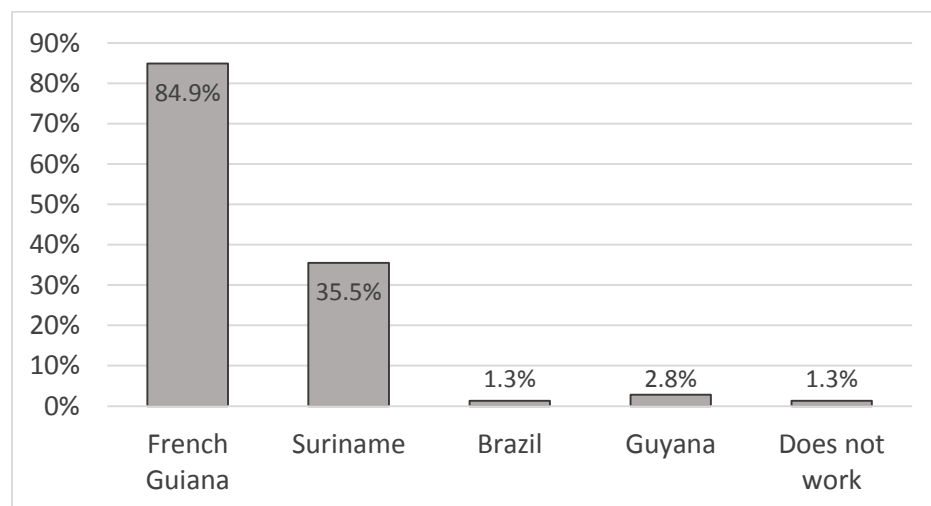
4. Results

4.1 Mobility

The research population is mobile and that a large share of the persons with a recent (suspected) malaria incident were only temporarily in Suriname. While the interviews were conducted on the Suriname site of the border, 73.8 percent of respondents named French Guiana as their primary work location ($N_{\text{total}}=148$), as compared to 59.6 percent in 2015. The difference is statistically significant (χ^2 , $P<0.01$) and suggests – just like the MP national statistics- that French Guiana has become increasingly important as country of possible malaria transmission. Twenty-two percent of interviewees worked primarily in Suriname at the time of the interview, four persons (2.6%) reported working equally in both Suriname and French Guiana, and one person considered Brazil as his main working location. Two women reported that they were housewives and not working a paid job. Both resided in Suriname.

Looking at what countries respondents had worked in the past 1 ½ years (January 2014-july 2015), the largest share of respondents referred to French Guiana as one of the countries where they had worked (84.9%). This figure is somewhat lower than during the baseline evaluation, when 93.6 percent of respondents reported that they (also) worked in French Guiana. About one third of respondents (35.5%) had (also) worked in Suriname during this time period, and small numbers of individuals had worked in Brazil or Guyana (Figure 4). Two women were housewives (in Suriname) and reported they were not working.

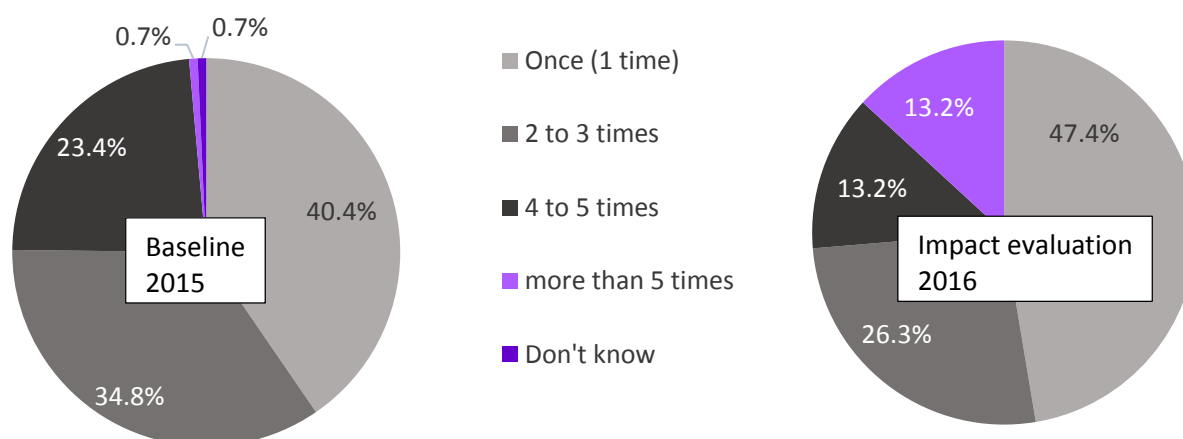
Figure 4. Countries where respondents had worked in the past 1 ½ years ($N=152$)



4.2 Malaria History

Figure 5 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 (47.7%). Others had experienced (suspected) malaria two to three times (26.3%, four to five times (13.2%), or more than five times (13.2%) in the past 1 ½ years ($N_{\text{total}}=152$; Figure 12 –right circle)⁴. One significant difference between 2015 and now, is the relative larger share of respondents who had been ill with suspected malaria for more than five times in the 1 ½ years preceding the interview (Figure 12- right circle). Some of these respondents reported that they had had malaria for more than 20 times, or that they had “incubated” malaria. We have no plausible explanation for the differences in reported malaria incidences between 2015 and 2016. People who reported one malaria incidence were not more or less likely to have relied on OTC medication in the past 1 ½ years than who had experienced more than five malaria incidences. High numbers of malaria incidences are more common among men; 16 percent of men versus 7.7 percent of women reported more than five suspected cases of malaria in the past 1 ½ years.

Figure 5. Number of malaria incidents in the past 1 ½ years



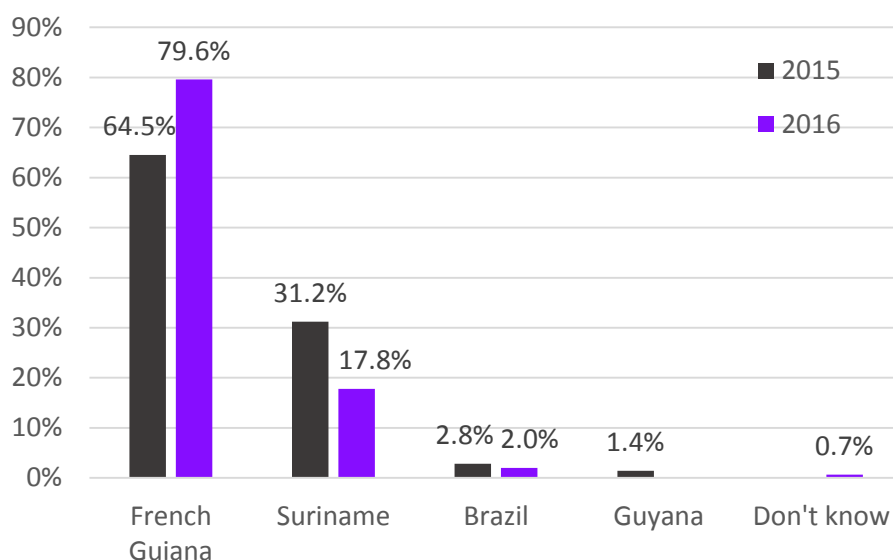
Four out of every five of respondents had been in French Guiana the last time they suspected being ill with malaria (79.6%; $N_{\text{total}}=152$). This is a slight yet statistically significant increase from 2015, when 64.5% of respondents had been in French Guiana during their most recent malaria episode (χ^2 , $p<0.05$) (Figure 6). This could indicate that between 2015 and 2016, the chances of getting malaria in Suriname have been reduced relative to the chances of getting malaria in French Guiana. Eighteen percent of respondents had been in Suriname when they experienced their most recent (suspected) malaria (17.8%); three individuals had experienced their most recent (suspected) malaria in Brazil (2 %) and one person could not tell because he traveled between Suriname and French Guiana continuously (0.7%; $N_{\text{total}}=152$).

For 12.6 percent of respondents, their most recent (suspected) malaria episode had been experienced in the month preceding the interview ($N_{\text{total}}=152$). Forty-four percent of interviewees had been ill with

⁴ Remember that 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.

(suspected) malaria in the past one to six months (36.9%), and another 33.1 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 ($N_{\text{total}}=152$). Very similar numbers resulted from the baseline survey.

Figure 6. Country where the respondent was when he or she most recently experienced malaria symptoms, in the baseline year (2015) and the evaluation year (2016)



4.3 Familiarity with the malaria program and its services

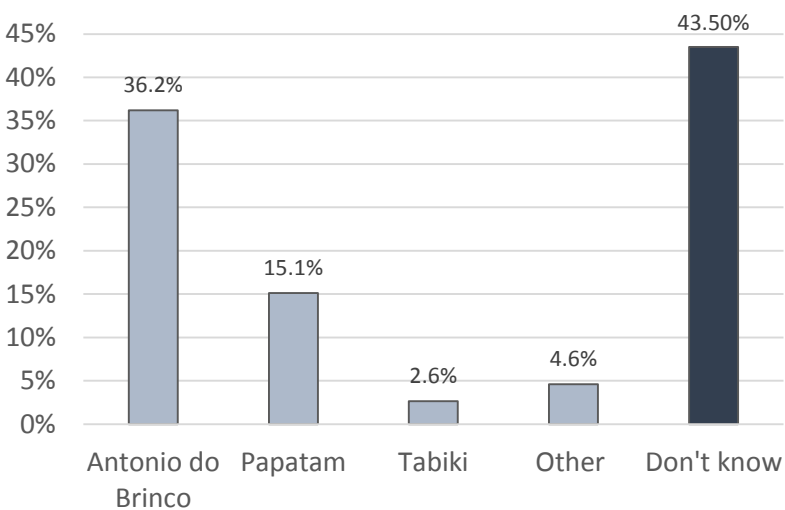
Given the increased intensity of malaria program services, we wanted to know how well known the malaria program is among the target population. Familiarity with the malaria program was assessed by testing recognition of the malaria program logo, by asking about the location of MSDs, and by assessing the respondents' knowledge of the TropClinic in Paramaribo.

To test recognition of the malaria program logo, the respondents were presented with four logos of malaria programs in different countries (Annex 2), and asked whether they recognized one of them. Other than the malaria program logo, it was extremely unlikely that the target population had seen any of the other logos before. One third of respondents reported that they only recognized the malaria program logo (32.2%), and five other respondents (4%) reported that they recognized both the malaria program logo and one or more other logos ($N_{\text{total}}=124$). About the same share of respondents reported that they had never seen any of the logos (33.1%, $N_{\text{total}}=124$). In comparison, during the baseline assessment 44.7 percent of respondents pointed at the logo of the Malaria Program, among the four logos they were presented with, as a logo they recognized ($N=140$). The remaining people indicated that they recognized one of the other logos, which is highly unlikely.

We asked the respondents who had pointed at the malaria program logo only, about its meaning. The largest share of these respondents said that they did not know (30%, $N_{\text{total}}=40$), while others mostly said it meant "malaria", "stop/eliminate malaria" or "malaria mosquito". Only one respondent indicated that the logo was the symbol of the malaria program. These results suggest that despite the various malaria campaigns, the target population does not associate the logo with the malaria program.

A core strategy for the Malaria Elimination program has been to expand the network of MSDs. Respondents were asked whether they knew where to find an MSD⁵. Just over half of respondents knew where to find an MSD (55.9%, $N_{\text{total}}=152$). Two persons reported that they had seen the MSD, but did not know where they stayed, and 42.8 percent of respondents indicated that they had no idea of where to find an MSD (Figure 7). Those who knew where to find an MSD most often mentioned Antonio do Brinco as an MSD location (36.2% of total, $N_{\text{total}}=152$). Others named Papatam (15.1%), Tabiki (2.6%) or other places such as Benzdorp, Yaw Pasi, Kabanavo, Langetabiki, Afobaka and Ocrea (FG).

Figure 7. Respses to the question: “Do you know where to find an MSD and if so, where?”

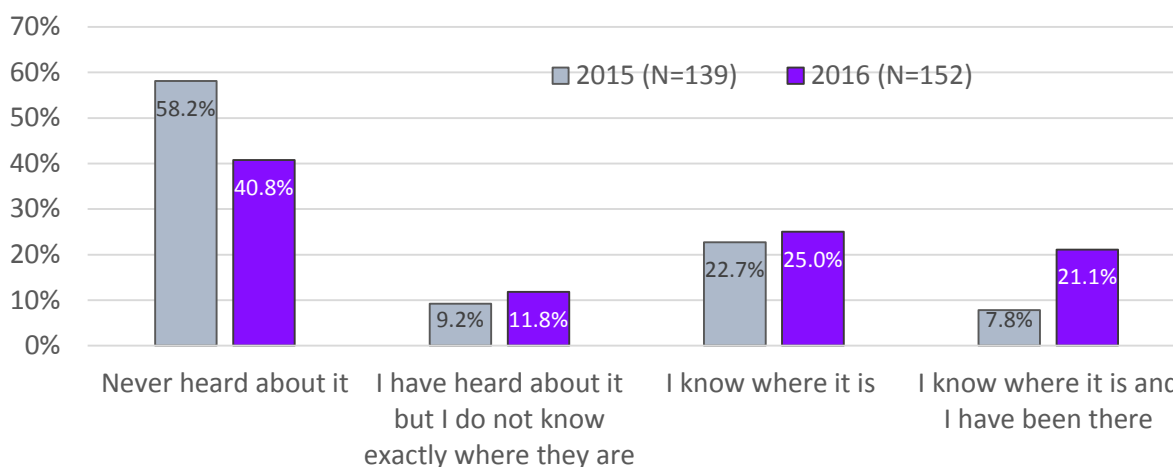


Respondents were also asked whether they had heard about, and knew the location of, the malaria clinic (TropClinic) in Paramaribo. The results suggest that the various outreach activities have resulted in more widespread knowledge of the TropClinic. The share of respondents who had never heard about this malaria test and treat facility decreased from 58.2 percent during the baseline assessment to 40.8 percent during the evaluation study. It must be reported that some of the respondents indicated that they had never been to Paramaribo, so logically they were not informed about the location of the TropClinic. Vice versa, the number of respondents who had actually visited the TropClinic almost tripled from 7.8 percent of baseline assessment respondents to 21.1 percent of inhabitants of mining areas who were interviewed for the evaluation study (Figure 8).

At the time of the survey, the TropClinic at Anamoestraat had extended its services to other areas to include HIV/AIDS testing and counseling. Only 40 percent of those who were familiar with the TropClinic were aware that they could also visit the TropClinic for HIV testing and counseling.

Figure 8. Answers to the question: “Are you familiar with the Suriname Malaria Clinic at Anamoestraat, in Paramaribo?”, 2015 (baseline) and 2016 (evaluation).

⁵ The interviewers did not use the word “MSD” since the target group was not familiar with this concept, but rather referred to persons from the Suriname malaria program who were testing and treating people for in proximity of the mining areas



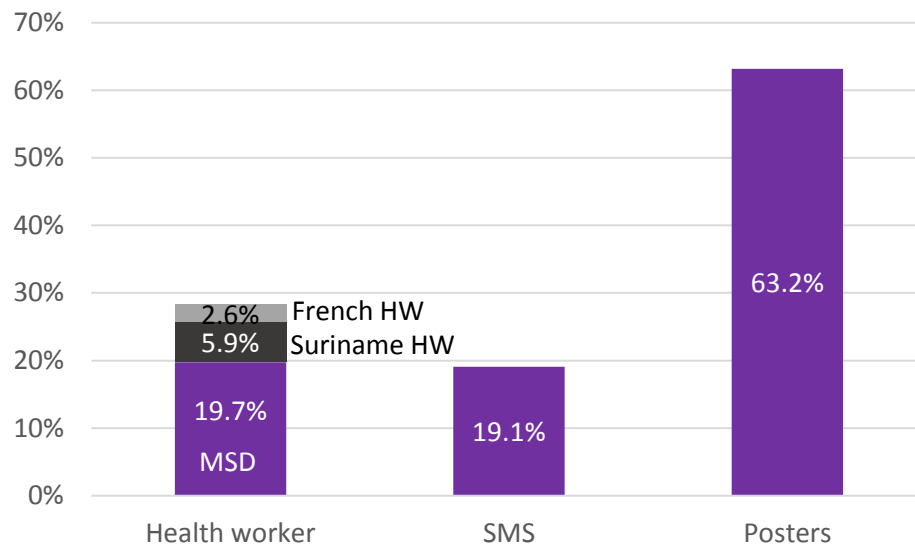
4.4 Exposure to outreach activities

Respondents were asked about their exposure to several intervention activities that were executed in 2015/16 as part of the Malaria Elimination program. These intervention activities were described in greater detail in Chapter 2, and include: expansion of MSD services, personal communication about malaria by MSDs, sending of an SMS message, distribution of posters, All Case Detection campaigns, and the distribution of LLINs.

When asked about their exposure to malaria awareness messages, 62 percent of respondents reported that they had seen or heard a malaria message in the past six months ($N_{\text{total}}=150$); about the same figure as in 2015 (64.5%). In the six months prior to the interview, 28.3 percent of respondents had been informed about malaria by a health worker ($N_{\text{total}}=152$). They mostly had received malaria information by staff from the Suriname Malaria Program (69.8% of those who had been informed, $N_{\text{total}}=43$). During the baseline assessment, relatively more respondents had reported that they had received malaria information from an MSD (35.5% of total, vs. 19.7% of total during the impact study). Others had been informed by unspecified health workers from Suriname or French Guiana.

One out of every five respondents reported that they had received a malaria-related text message on their phone, informing the recipient in Portuguese that they could obtain a free LLIN from the malaria program and providing the phone number of the TropClinic (19.1%, $N_{\text{total}}=152$). Some persons who had not received the message explained that the signal does not reach far in the forest, while others had lost their phone or had it confiscated by the French gendarmerie. More than half of respondents had seen the malaria posters (63.1), most often at the location where the MSD was stationed but also on walls of supermarkets in the mining areas. The share of respondents who reported that they had seen the malaria posters increased substantially as compared to the number of respondents who reported exposure to such posters during baseline assessment (38.9%).

Figure 9. Sources of malaria information in the six months preceding the interview



When asked about the content of the malaria messages, one quarter of those who had seen or heard a message reported that they could not remember what it said (23.7%, $N_{\text{total}}=93^6$). Some had just not paid attention and a couple of individuals mentioned that they were illiterate. Others mentioned that the message called upon the inhabitants of mining areas to sleep with a bed net (34.4%), test for malaria when you feel ill (26.9%), to always complete malaria medication (19.1%; $N_{\text{total}}=93$). Other were informed that malaria is caused by a mosquito (12.9%), is dangerous (11.8%) and can kill (2.2%; $N_{\text{total}}=93$). Others had heard or read about malaria prevention, free malaria exams at the TropClinic, among others.

Almost a quarter of respondents indicated that they had participated in an ACD in the six months preceding the interview (23%; $N_{\text{total}}=152$). Of those who had been tested during the ACD, 68.6 percent had been tested negative and the remaining 31.4 percent had tested positive for malaria ($N_{\text{total}}=35$).

4.4 Malaria knowledge

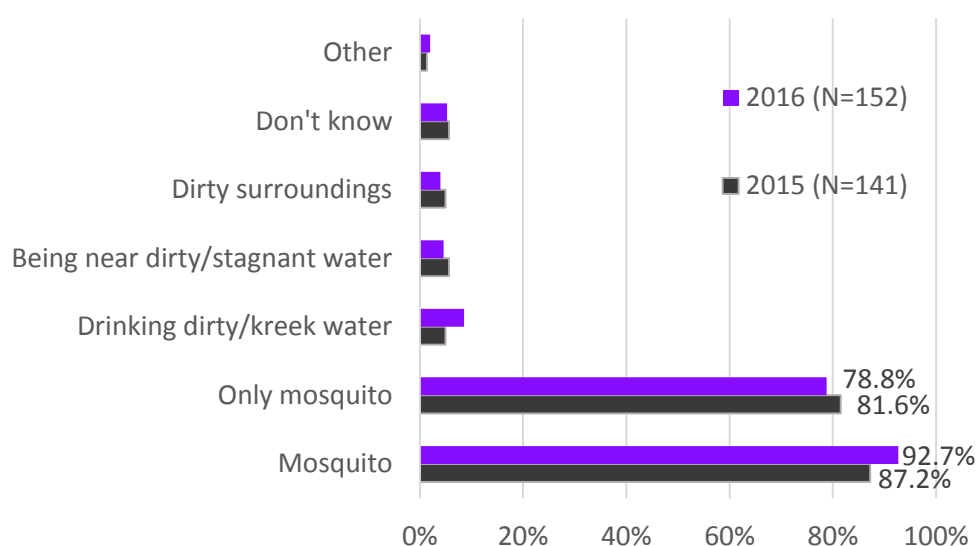
Malaria knowledge was tested by asking inhabitants of gold mining areas about the cause and symptoms of malaria, about measures to protect oneself against this disease, and about their knowledge of malaria testing and treatment locations –either in in Suriname or anywhere in the area.

The grand share of respondents correctly cited the mosquito as the cause of malaria (92.7%; $N_{\text{total}}=151$) (Figure 10). Eighteen of these persons also named additional causes, such as drinking dirty water or being near (stagnant, dirty, creek) water. In total, 6.6 percent of respondents named drinking dirty or creek water as a cause of malaria and 4.6 percent of respondents believed that proximity to (dirty, stagnant) water caused the infection. “Other” named causes of malaria were drinking alcohol (2x) and fever due to an inflamed liver. Four percent of respondents blamed the dirty environment. Eight persons (5.3%) reported that they did not know what caused malaria ($N_{\text{total}}=151$).

⁶ Only counting persons who had received a malaria information from a health worker, received an text message about malaria on their phone, and/or had seen malaria posters.

When we compare these figures with the figures from the baseline assessment, we find that relatively more inhabitants of mining areas identified the mosquito as the cause for malaria, but a smaller percentage named the mosquito as the sole source of malaria. Differences are small though. Also the shares of people who blamed malaria on drinking dirty water, being in proximity of dirty water, or a dirty environment have been rather constant.

Figure 10. Causes of malaria named by the respondents in 2015 (N=141) and 2016 (N=151)



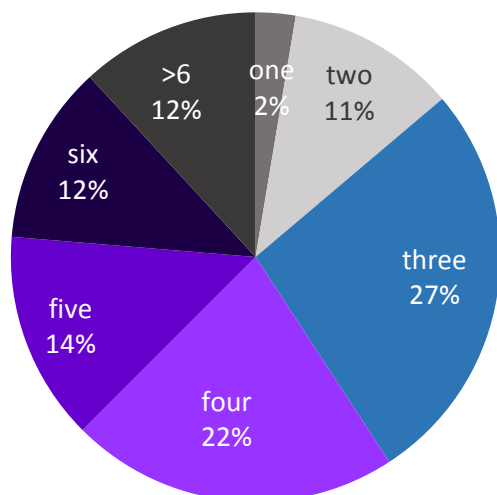
We also asked inhabitants of mining areas if they could name the symptoms of malaria. All interviewed inhabitants of mining areas were able to name one or more malaria symptoms (100%). The most named malaria symptom was a headache (91.4%), followed by fever (90.1%), feeling cold/shivering (59.9%), throwing up/nausea (42.1%), body pains (36.8%), and pains in the joints (24.3%; $N_{total}=139$) (Table 6). Respondents also named a bitter taste in the mouth (17.8%), having no appetite (15.8%), and diarrhea (15.8%), as well as an inflamed liver or liver pain (2.6%). The largest share of respondents were able to name three or more symptoms of malaria (83.6; $N_{total}=152$) (Figure 11).

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 (82.2%), followed by the use of repellent (55.9%; $N_{total}=141$, Table). Other valid protective measures included prevent being bitten by a mosquito, not being near stagnant water, keep the surroundings clean, and use a mosquito candle or insect spray. About one out of every eight respondents, however, was of the opinion that it is not possible to protect oneself against malaria. They argued that particularly in the forest, one cannot 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. Comparing the answers from the baseline assessment (2015) with those of the impact evaluation (2016), we find that the share of people who gave correct answers has increased. In total, 85.5 percent of respondents were able to name at least one effective method to protect themselves against

malaria, as compared to 73.6 percent in 2015. Women were more likely than men to provide correct answers (resp. 92.3% and 82%).

Figure 11. Number of symptoms named by respondents ($N_{total}=152$)



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 Peruano and Antonio do Brinco, the closest malaria testing and treatment facilities were the MP Malaria Service Deliverers (MSD) in the mining area or the hospital/health center in Maripasoula (FG). For people interviewed in Papatam (Albina) the nearest malaria testing and treatment facilities were the fixed MSD post at Papatam, the hospital in St. Laurent (FG), or the Regional Health Service (RGD) health clinic in Albina.

When asked about a malaria testing and treatment facility nearby, only 4.6 percent of respondents could not name any location nearby. Most respondents named an MSD (81.6%); in Papatam, Antonio do Brinco, Benzdorp, or Tabiki. In addition, 46.7 percent of respondents named a testing facility in French Guiana; typically St. Laurent or Maripasoula. Three persons named Paramaribo.

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 malaria⁷, 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.

⁷ exclusively persons who named only the mosquito and no other supposed cause(s) for malaria were counted

Table 5. Known means to protect oneself against malaria (N=152)

Protective measure	2015 (N=141)	2016 (N=152)
Sleep with a bed net	69.5%	82.2%
Use repellent	22.7%	55.9%
Prevent being bitten by a mosquito	1.4%	15.1%
It is not possible to protect oneself against malaria	12.1%	11.8%
Keep surroundings clean/ Destroy breeding sites	4.3%	5.9%
Use mosquito candle/insect spray	1.4%	5.2%
Not get near dirty/stagnant water	4.3%	2.6%
Not drink dirty water	2.8%	2.6%
Take medication to strengthen the liver	1.4%	1.3%
Wear long sleeves/protective clothing	1.4%	-
Use medication; bed nets cannot protect during the day	0.7%	0.7%
Window screens (but difficult in the forest)	0.7%	-
Not bath daily	0.7%	-
Stay out of reach of mosquitoes between 5 and 6 pm	0.7%	-
Sleep with air-conditioning in the city	0.7%	-
Not travel to the interior/remain in the city	0.7%	0.7%
Stay away from creeks in the early morning and evening	0.7%	-
Rub skin with burned oil	-	0.7%
Don't know	10.6%	4.6%

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.

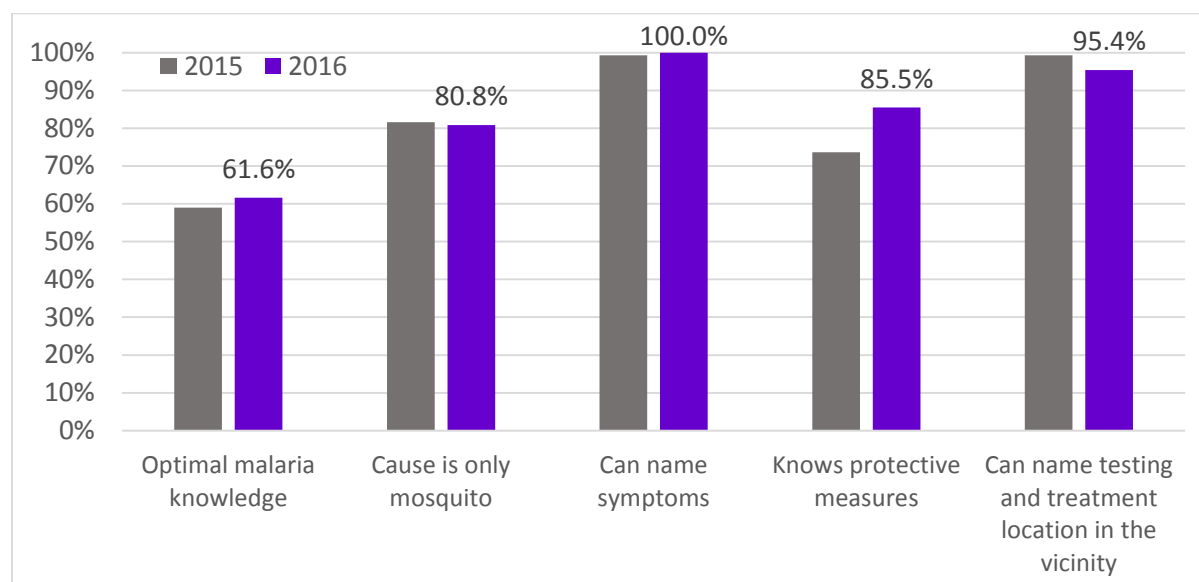
In total, 61.6 percent of respondents displayed optimal malaria knowledge. That is, they named the mosquito as *the only* cause of malaria AND they named at least one malaria symptom AND they knew at least one valid measure to protect oneself against malaria AND they knew where to find malaria testing and treatment services near their location at the time of the interview (Table 6).

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 (and no other causes)	80.8%
Can name at least one symptom of malaria	100%
Know at least one way to protect oneself against malaria	85,5%
Are informed about where to get malaria treatment <i>in the vicinity</i>	95.4%
N	152
Has optimal malaria knowledge:	61.6%

When we compare the results from the baseline assessment and those from the impact evaluation, we find that malaria knowledge has remained rather constant. Neither the separate indicators nor the composite measure “optimal malaria knowledge” show significant differences when we look at figures for 2015 and 2016 (Figure 13).

Figure 12. Malaria knowledge indicators in 2015 and 2016



4.4 Bed net use

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 LLIN the previous night. Table 7 lists the value of this indicator, as well as values for related indicators.

When asked whether they possessed a bed net, any type, 40.1 percent of respondents answered affirmatively. Thanks to the many bed nets that have been distributed by the Suriname Malaria Program and by French health workers, 36.8 percent of respondents indicated that they owned an LLIN ($N_{\text{total}}=152$; Table 6). This figure more than triples the share of respondents who reported possession of an LLIN in 2015.

Table 7. Bed net use

Indicator	2015	2016	2016- women	2016- men
N	141	152	52	100
% of interviewees who possess a bed net (any type)	28.4%	40.1%	50%	35%
% of interviewees who possess an LLIN	10.6%	36.8%	46.2%	32%
% of interviewees who had slept under a bed net in the night prior to the interview	12.8%	13.8%	19.2%	11%
% of interviewees who had slept under a LLIN in the night prior to the interview	6.4%	11.8%	15.4%	10%
% of interviewees who had slept with a bed net consistently in the week prior to the interview	11.3%	13.2%	17.3%	11%

When asked whether they had slept with a bed net in the night prior to the interview, only 13.8 percent of respondents answered affirmatively ($N_{\text{total}}=152$). For almost all of them (11.8% of total) the bed net was insecticide treated. We already established in 2015, that many people do not like to sleep with a bed net because they find it too hot/suffocating or just don't like it. Respondents also indicate that they only used a bed net in the *garimpo*, and not when they were at their resting location out of the forest. It is possible that we would have found a higher rate of bed net use if we would have interviewed persons at their working location. The data suggest that as compared to men, women are relatively more likely to possess a bed net and to use it.

4.5 Malaria treatment behavior

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 (47.4%). Others had experienced (suspected) malaria two to three times (26.3%), four to five times (13.2%), or more than five times (13.2%) in the past 1 ½ years ($N_{\text{total}}=152$). 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.

Respondents were asked what type of treatment strategies people had used during this past 1 ½ years when they had malaria. The results suggest that as compared to the year before, relatively more individuals had taken a malaria test in the 1 ½ years preceding the interview (72.8% in 2016 vs. 66% in 2015). On the other hand, a slightly lower number of interviewed inhabitants of gold mining areas had (also) relied on OTC medication (51.7% in 2016 vs. 54.6% in 2015). One out of every four persons had both tested and used OTC medication against malaria in the year and a half preceding the interview. These people included persons who had fallen ill in an isolated *garimpo* and took OTC medication to bridge the time to get to a test and treat location. This finding suggests that inhabitants of mining areas are not necessarily consistent in their treatment choices. Instead, these choices are defined by opportunities, challenges and risks.

In line with the findings from the baseline assessment, women were more likely than men to take the malaria test, and men were relatively more likely to self-medicate (Figure 13). Gender differences in the propensity to rely on OTC medication were, however, small.

Among persons who self-medicated the drug of choice was Artecom, which had been used by 89.7 percent of respondents in this group ($N_{\text{total}}=78$). This finding is consistent with results from the baseline assessment. Other drugs that had been used to treat suspected malaria (without testing) included Paracetamol (2 persons), Coartem (7 persons), Nivaquine (2 persons), Quinine (1 person), and Doreplan⁸ (1 person).

Respondents also were asked about their treatment choice the last time they believed they had malaria. Just under one third of respondents reported that they had used OTC medication the last time when they suspected to have malaria (30.3%; $N_{\text{total}}=152$). Respondents who had experienced their most recent (suspected) malaria in French Guiana were three times as likely as those who had fallen ill in Suriname to have relied on OTC medication the last time they suspected to have malaria (35.5 vs. 11.1%). This finding

⁸ We have not been able to detect what kind of medication this is. It is not listed among regular malaria medications.

suggests that the MSD strategy has succeeded in improving access to test facilities in Suriname, but that people working in French Guiana continue to face many barriers to go test for malaria.

Figure 13. Treatment regimes used by women and men when having or suspecting malaria in the 1 ½ years preceding the interview

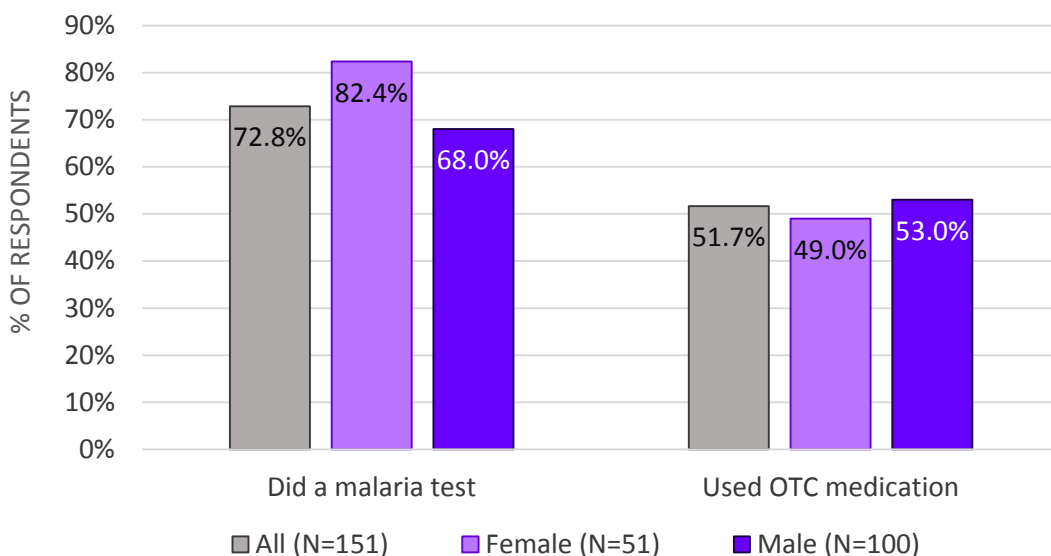
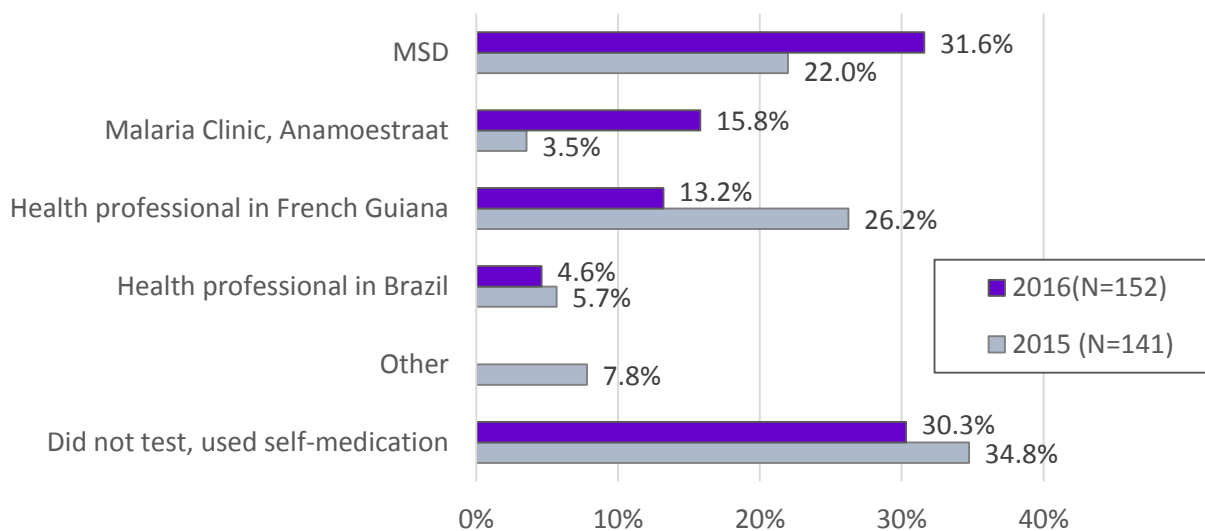


Figure 14. Treatment strategies used in response to the most recent (suspected) malaria episode, 2015 and 2016



Those who had tested for malaria the last time they fell ill, most often did so with an MSD. This is an important change as compared to the baseline situation, when the majority of those who got tested had visited a French Guiana health facility (Figure 14). We also see a significant increase in the number of persons who had visited the malaria clinic at Anamoestraat, even when excluding the ten surveys that had been conducted at this clinic. Meanwhile in 2016, relatively fewer respondents reported seeking malaria services in French Guiana during their most recent (suspected) malaria experience.

As we found in the baseline assessment and during earlier KAP studies with the target population, the most mentioned reason for selecting a specific test location was proximity; people with suspected malaria who wanted to test mostly went to the place that was nearest (84.8%; $N_{\text{total}}=105$, only counting persons who took a malaria test the last time they suspected to be ill with malaria). Other reasons to select a specific health service were mentioned by just a couple of persons and included: good medical care (7 persons), rapid results (5 persons), friendly staff (3 persons), it was known location (3 persons), and service is free (2 persons). Three persons mentioned that they had tested in a French Guiana clinic because the MSD in Suriname had been absent at the time they wanted to test, and two persons tested in Paramaribo because they had already planned to travel there.

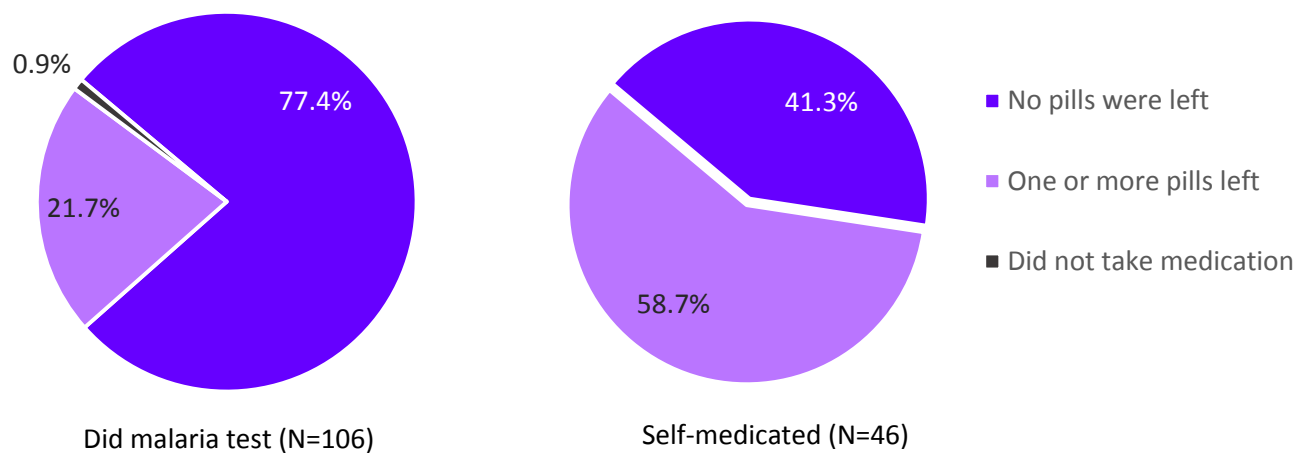
Vice-versa, also for those who had not tested the last time they had fallen ill with (suspected) malaria, distance was their single most important motivator. In this group, 82.5 percent reported that they had omitted to test because they had been too far from a health post when they had fallen ill ($N_{\text{total}}=80$). Some people in this group explained that Artecom is the only available malaria medication in the forest. Others had not tested because they knew they had malaria and did not want to bother with a test (6 persons). Other reasons were mentioned by just one person. One man said that he knew he had malaria but tested negative, and since the health worker did not want to provide malaria medication he bought Artecom (1 person). One person had heard that the OTC medication worked well so he wanted to try it; one man did not know where to go for a test; and one person mentioned that he took OTC medication because it is most popular in the gold mines.

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. Just over one third of respondents reported that they had some pills left when they had stopped taking their malaria medication (35.6%; $N_{\text{total}}=152$). Sixty-six percent of respondents reported that they had taken the complete dose, five persons reported that they had one pill left, and one person had not taken the malaria medication at all.

In line with findings from the baseline and earlier studies (e.g. Heemskerk and Duijves, 2013), we find that people who rely on self-medication are less likely than those who go for a test to complete their malaria cure (Figure 15). Three quarters of people who had been tested and obtained medication from a health professional versus 41.3 percent of those who had taken OTC medication, reported completion of the cure. These figures were very similar during the baseline assessment.

Of the persons who had pills left when they quit their malaria treatment, 72.1 percent had stopped taking medication because they already felt better ($N_{\text{total}}=43$). The second most mentioned reason to not complete the dose was experience of, or fear for, side effects (20.9%). In addition, three persons mentioned they had forgotten to take the medication, one person just wanted to feel good enough to take the test, and one person explained that the OTC medication was just for suppression of malaria and not for healing it.

Figure 15. Share of respondents who completed their malaria treatment, by use of self-medication



5. Conclusions and Recommendations

5.1 Conclusions

This impact evaluation investigates knowledge, attitudes and behavior with regard to malaria and malaria treatment among the inhabitants of mining areas in the Suriname-French Guiana border region, one year after initiation of the Malaria Elimination program. The Malaria Elimination program is executed by the Suriname Ministry of Health (MoH) Malaria Program (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. Just like the baseline assessment, the impact evaluation focused on the Suriname-French Guiana border region, which is a remaining point source of malaria transmission. Yet even in these locations, many persons conveyed that they had not experienced malaria for many years, and some had never contracted this disease.

As compared to the baseline assessment, we do not see huge changes – and this also cannot be expected in such a short time. Also, because the target population is extremely mobile, many of the people who were reached by the outreach activities may have been in the forest during the survey period and vice versa. We find that malaria knowledge had remained constant. In 2015 and 2016, similar shares of persons named the mosquito as the (only) cause of malaria, were able to name symptoms, and were familiar with test and treat locations in the vicinity.

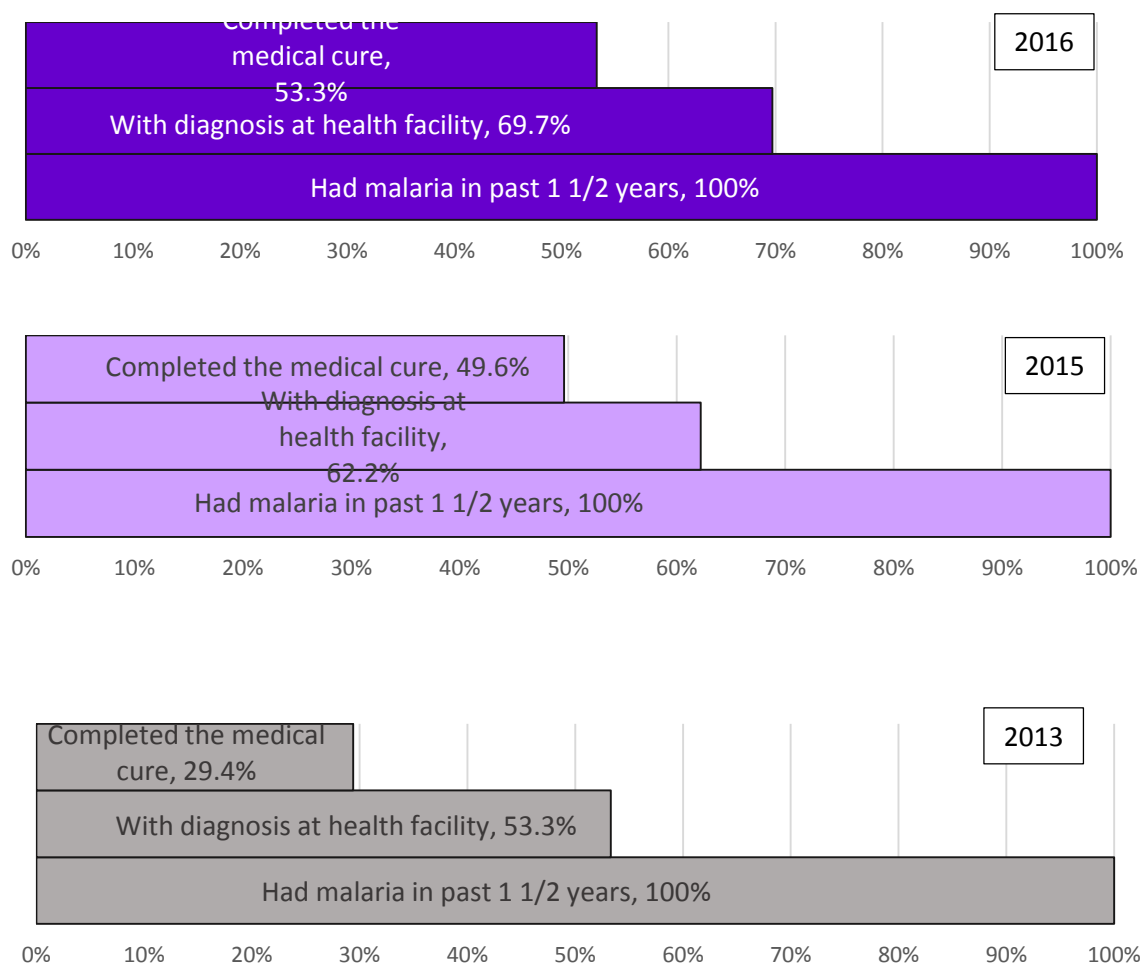
The main impact of the Malaria Elimination campaign may have been in enhanced knowledge of malaria prevention and related behavior. Significantly more persons interviewed during the impact evaluation were able to name measures to prevent malaria (χ^2 , $p < 0.005$), and also the share of persons who named the bed net as an effective preventive measure had increased significantly (χ^2 , $p < 0.001$). Also, during the 2016 (impact) survey three times as many persons reported possession of an LLIN as during the 2015 (baseline) survey. The share of respondents who had slept under an LLIN had doubled.

Analysis of malaria Test and Treat behavior in the target group suggests slight improvements; but behavioral change takes time (Figure 16). In 2016, just under one third of respondents in the present study had used OTC medication the last time they had experienced (suspected) malaria. This figure is only slightly lower than the figure for 2015, but significantly lower than the figure for 2013. The main and virtually only reason to use OTC medication is that the person is in the deep forest when he or she experiences symptoms, without any nearby health services. This finding underlines the importance of the MSD strategy; with more places to test the chance that people will rely on OTC medication decreases.

In line with the findings from the baseline assessment and earlier studies, we find that people who obtain medication from a health provider -after testing- are about twice as likely as people who rely on OTC medication to complete their cure. This result emphasizes once again that the importance of an extensive network of locations where the at-risk population can access Test and Treat services.

Overall, just over half of the target population⁹ during the evaluation survey reported correct Test and Treat behavior. That is; they tested when they experienced malaria symptoms and subsequently completed the malaria cure. This figure implies a minimal improvement in malaria Test and Treat behavior as compared to 2015, but a more significant change since 2013 (Figure 16).

Figure 16. Test and Treat behavior; 2013, 2015 and 2016



The results suggest that the extension of MSD services pays off. Among those people who had taken a malaria test the last time they experienced malaria symptoms, the share of respondents who had tested with an MSD had increased with 34.4 percent as compared to the baseline value. It is also evident, however, that the strategy only is effective if and where MSD are located in the vicinity of 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. This logic implies that (a) the presently low malaria figures can only be maintained with continuation of the MSD strategy, and (b) without support from French Guiana complete Malaria Elimination is impossible.

⁹ persons working in mining areas along the Suriname-French Guiana border who have experienced malaria in the past 1 ½ years

The impact evaluation suggests that the Suriname Malaria Program becomes increasingly known among the inhabitants of small-scale gold mining areas in the Suriname-French Guiana border region. As compared to 2015, three times as many respondents recognized the MP logo, slightly more respondents knew where to find an MSD and the TropClinic, and considerably more respondents had used the MP facilities. The share of respondents who had visited the TropClinic even tripled between 2015 and 2016. Visibility in the field may be further improved by painting the MP boat with the logo, placement of an MP flag at the MP test location, and promotional materials.

Finally, the MP faces several challenges. One main challenge is that malaria rates are very low. As a result, people are less motivated to sleep with a bed net, and contracting MSDs has been difficult. A second challenge is program sustainability. The Ministry of Health and the Medical Mission do not have the staff, infrastructure and resources to provide continued malaria services to mobile populations. Hence if or once external funding ends, 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 document the impact of the Malaria Elimination program interventions.
- III. The data collected in the framework of this consultancy and our key findings reported here above

The researchers assert that the Malaria Elimination program made important progress towards the elimination of malaria in Suriname, however, targeted malaria monitoring and control remain necessary to prevent new malaria outbreaks in Suriname. Recommendations are organized in four sections: Quick wins, Behavior 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 "Behavior 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 ongoing under auspices of the MP 2015-16.

Quick Wins:

- 1) Improve access to and use of LLINs among most at risk populations
 - a. Continue bed net distributions, as still large numbers of inhabitants of mining areas do not possess a bed net.
 - b. Ensure that the 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.

- 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 Program and its logo
- a. Place a MP flag at the fixed MSD posts, and on the MSD boat and ATV. The clinic at Anamoestraat also could be made more visible with an eye-catching billboard outside pointing to the clinic.
 - b. If cubicles, kiosks, or houses are used as a fixed MSD post, paint them in the MP colors and add the logo (e.g. at Papatam, Zorg en Hoop, Atonio do Brinco)

Behavior 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. Group sessions could be an excellent way to provide information and answer questions.
 - 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 behavior and adherence to treatment regimes through simple and clear messages that are consistent across organizations (ongoing).
- 5) Reach populations by speaking their language (ongoing)
- 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. 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. Continue the wide network of MSD services, using fixed MSD, mobile MSD and volunteer MSD
 - b. 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.
 - c. 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.
- 8) An extension of MSD services could enhance familiarity of the target population with the MP, and motivate visiting the test locations. Nowadays HIV testing is already provided at TropClinic, and Leishmaniasis training of personnel is ongoing. Possible additional services that could be considered include:
 - a. Performance of HIV testing and counselling by MSD supervisors in the field.
 - b. The establishment of a small pharmacy could make a visit to the MSD more worthwhile.

Collaboration:

- 9) 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 Program staff, medical staff), as well as meetings that include practitioners, politicians, anthropologists, representatives of international organizations and other stakeholders.
- 10) 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.

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Annexes

1. Survey form

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 in Suriname or French Guiana for at least the past 6 months (Since January 2016)

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 kind of work do you do (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 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

6. In what countries have you worked 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 | |

7. The Suriname malaria programme trained persons in the mining areas to test for and treat malaria; so-called MSD. 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
 0. Yes, there is such a person at: _____
 88. Other, specify: _____
8. In the past six months (2016), have you been informed about malaria by a health professional or MSD?
- | | |
|------------------------------------------------|--------------------------------------------------|
| 0. No, not been informed | 3. Yes, by a health professional from Fr. Guiana |
| 1. Yes, by an MSD | 88. Other: _____ |
| 2. Yes, by a health professional from Suriname | 99. Don't know |
9. In the past half year (2016), have you received a text message on your phone with malaria information?
- | | |
|--------|---------------------------|
| 1. Yes | 99. Don't know |
| 2. No | 88. Other, specify: _____ |
10. In the past half year (2016), have you seen posters with malaria information? If so, where?
- | | |
|---------------------------------------------------------|---------------------------|
| 1. No, seen no posters | 4. Yes, in Paramaribo |
| 2. Yes, at the MSD booth/test location | 99. Don't know |
| 3. Yes, at a store or other location in the mining area | 88. Other, specify: _____ |
11. 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 | 5. When you feel ill, take the test |
| 2. Malaria can kill | 6. Complete your medication |
| 3. Mosquitoes spread malaria | 7. Clean your surroundings |
| 4. Sleep with a bed net | 88. Other, specify: _____ |
12. In this past half year, have you participated in an ACD (All Case Detection - EXPLAIN)?
1. No, I have not participated in an ACD in the past ½ year
 2. Yes, I was tested by an MSD during the ACD, and was tested negative
 3. Yes, I was tested by an MSD during the ACD, and was tested positive
 88. Other: _____
 99. Don't know
13. Do you recognize any of these Logos (show)
- | | |
|-------------------------------------------|----------------------------|
| 0. No, never seen any of them | 4. Yes, I have seen Logo 3 |
| 1. I may have seen them but I am not sure | 5. Yes, I have seen Logo 4 |
| 2. Yes, I have seen Logo 1 | 99. Don't know |
| 3. Yes, I have seen Logo 2 | |
14. If you have seen one of these logo's, can you tell me what it means/what it stands for?
- _____
15. 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 | 3. Being near to dirty water | 99. Don't know |
| 2. Drinking dirty water (river/creek) | 4. Dirty surroundings (trash) | 88. Other, specify: _____ |

16. Can you name symptoms of malaria? (circle all that apply – do NOT read the answers)
- | | | | |
|---------------------------|-----------------------|----------------|---------------------|
| 1. Headache | 4. Feeling weak/tired | 7. No appetite | 10. Body pain |
| 2. Fever | 5. Vomiting/Nausea | 8. Diarrhea | 99. Don't know |
| 3. Feeling cold/shivering | 6. Bitter taste | 9. Joint pains | 88. Other, specify: |
17. How often have you been ill with malaria in the past 1 ½ year (2012-2013)?
- | | | |
|------------------|----------------------|---------------------------|
| 1. Once (1 time) | 3. 4 to 5 times | 99. Don't know |
| 2. 2 to 3 times | 4. more than 5 times | 88. Other, specify: _____ |
18. When is the last time you were ill with malaria?
- | | | |
|---------------------------|-------------------------|----------------|
| 1. In this past month | 3. 7-12 months ago | 99. Don't know |
| 2. In the last 1-6 months | 4. More than a year ago | |
19. The last time you fell ill with malaria, in what country were you?
- | | | |
|-------------|------------------|-----------------------------|
| 1. Suriname | 3. Guyana | 88. Other country, specify: |
| 2. Brazil | 4. French Guiana | |
20. 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: _____ | |
21. Do you have (possess) a bed net, and if so, is it a Malaria Programme net?
- | | |
|----------------------------------------------------|-----------------------------------|
| 1. No, I do not have a bed net | 2. I have another type of bed net |
| 2. Yes, I have a Malaria Programme (green) bed net | 88. Other: _____ |
22. Did you sleep under a bed net last night?
- | | | |
|--------|-------|------------------|
| 1. Yes | 0. No | 99. I don't know |
|--------|-------|------------------|
23. If you slept under a bed net last night, was that bed net insecticide treated (e.g. MP bed net)?
- | | | | |
|--------|-------|------------------|---------------------------------------------------|
| 1. Yes | 0. No | 99. I don't know | 77. Not applicable: Did not sleep under a bed net |
|--------|-------|------------------|---------------------------------------------------|
24. 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 |
|--------|-------|------------------|---------------------------------------------------|
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 OTC medication |
| 2. Go for a test | 88. Other _____ |
26. If you used OTC medication in the past 1 1/2 years (Jan. 2015-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
 2. Yes, by MZ
 3. Yes, at malaria clinic, Anamoestraat
 4. Yes, at other official test location in Par'bo (e.g. Brahma)
 5. Yes, by health worker in Fr Guiana
 6. Yes, by a health worker in Brazil
 7. No I did not go for a test. **Go To 30**
88. Other, specify _____

29. Why did you test at that location?

- | | | |
|------------------|------------------------------------|--------------------|
| 1. Closest place | 4. Good price/free | 7. Rapid results |
| 2. Good care | 5. They spoke my language | 8. Other, specify: |
| 3. _____ | 6. The health workers are friendly | |

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

- | | |
|--------------------------------------------------|--------------------|
| 1. No pills were left – Go to Question 33 | 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
reason: _____ | 3. I forgot to take pills | 88. Other |
| 2. I experienced bad side effects
pills | 4. They did not work | 77. N.A. No left over |

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/St. Laurent) health centre
 2. MSD clinic in Papatam
 3. 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 Paramaribo**? If yes, please state where? (Please circle all answers that are mentioned but do NOT READ the ANSWERS)

1. Malaria Lab Anamoestraat
2. Brahma/Medilab
3. BOG
4. General clinic/Practitioner
5. Hospital
88. Other, specify: _____
99. Don't know where to go

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

0. I have never heard of it, **End of survey**

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. Apart from malaria testing, do you know what other medical services they provide? (Circle all that apply)

- | | | |
|------------------------------------|------------------------------------------------------|----------------|
| 1. Nothing else know | 4. General health services | 99. Don't know |
| 2. HIV testing | 88. Other: _____ | |
| 3. Leishmania testing malaria lab. | 77. Not applicable. Not familiar with the Tourtonnen | |

End of survey

Annex 2. Malaria Logos



