



GOLD MINERS' KNOWLEDGE,  
ATTITUDES & PRACTICES WITH  
REGARD TO MALARIA IN SURINAME

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Health, Malaria  
Programme

# GOLD MINERS' KNOWLEDGE, ATTITUDES & PRACTICES WITH REGARD TO MALARIA IN SURINAME

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## Abbreviations

ABS	Generla Bureau of Statistics (Algemeen Bureau voor de Statistiek)
ACD	Active Case Detection
BOG	Bureau of Public Health (Bureau Openbare Gezondheidszorg)
CBvS	Central Bank of Suriname
FG	French Guiana
<i>Garimpeiros/ garimpo</i>	Gold miner (Por.)/ Gold mining area
GDP	Gross Domestic Product
IDB	Inter-American Development Bank
ILO	International Labour Organizations
KAP	Knowledge, Attitudes and Practices
LLIN	Long-Lasting Insecticidal Nets
MoH	Ministry of Health
MP	Malaria Program
MSD	Malaria Service Deliverer
MZ	Medical Mission Primary Health Care Suriname ( <i>Medische Zending</i> )
N <sub>total</sub>	Total valid sample for the indicated question
OTC	Over-The-Counter (medicine)
PAHO	Pan American Health Organization
RDT	Rapid Diagnostic Test
RGD	Regional Health Service
SSGM	Small-scale gold mining
TropClinic	Malaria clinic at Geyersvlijt (previously Anamoestraat)
USD	United States Dollars
WHO	World Health Organization

# Summary

**Introduction and methodology:** This report presents the results of a survey on malaria knowledge, attitudes and practices (KAP survey) in small-scale gold mining (SSGM) areas in Suriname, South America. Despite Suriname's successes in fighting malaria, SSGM areas continue to pose risks for malaria transmission. This study helps understand the effects of Malaria Program (MP) health outreach activities in SSGM areas, and contains lessons for future efforts aimed at malaria elimination. A quantitative survey was conducted with inhabitants of four SSGM areas: Brokopodo North, Sella Creek, Benzdorp area, and Pikin Saramacca. A total of 425 survey interviews were done with 68 women (16%) and 357 men (84%), among whom 239 Suriname gold miners (56.2%) and 186 migrants (43.8%). Respondents were on average 37.2 years of age. Most men worked as gold miners (equipment owners and workers), and most women worked as cooks, brothel owners, sex workers, and shop owners/assistants.

**Results:** Respondents displayed extensive SSGM experience; 45.2 percent of respondents had entered the SSGM sector more than 10 years ago. In the five years preceding the interview (2012-17), 16.7 percent of survey respondents had also worked in other countries than Suriname. The data suggest that malaria has become rare: 83.3 percent of respondents had either never, or more than ten years ago, been ill with malaria. None of the interviewees had experienced malaria in the year preceding the interview (2017-18). Of those who had been ill with malaria in the past six years, one third had experienced malaria abroad - mostly in French Guiana- and another third in the Suriname-French Guiana border region.

Forty-two percent of respondents reported that they had seen or heard a malaria message in the past six months. Among those who had been informed ( $N_{total}=179$ ), two-thirds had been informed about malaria by MP workers in the SSGM areas. Messages had mostly focused on bed net use, and to a lesser extent on general malaria prevention, the dangers of malaria, and malaria treatment. A core strategy in working towards malaria elimination has been to expand the network of Malaria Service Deliverers (MSD). In the Benzdorp area, where 3 MSD are stationed, 76.4 percent of respondents were able to locate an MSD ( $N_{total}=105$ ). In Sella Creek (1 permanent MSD) this figure was 32.7 percent ( $N_{total}=104$ ). Respondents from Pikin Saramacca and Brokopondo were not very familiar with MSDs, probably because none were stationed in these areas. As compared to Suriname nationals, migrants were relatively more familiar with the TropClinic; the Malaria Test and Treat center in Paramaribo (resp. 19.2% versus 52.2%). Because malaria has become so rare, only 23 respondents (5.4% of total;  $N_{total}=425$ ) had ever visited the TropClinic.

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 Test and Treat locations in Suriname. Seventy-one percent of the total surveyed SSGM population correctly named *only the mosquito* as the cause of malaria; 88.5 percent were able to name one or more malaria symptoms; 86.2 percent of respondents were able to name at least one effective method to protect themselves against malaria; and 76.2% percent were able to name a Malaria Test and Treat location in Suriname. Forty-six percent of respondents scored positive on the composite measure "Optimal Malaria Knowledge", which combined the above-mentioned four items ( $N_{total}=421$ ).

With regard to gold miners' perceptions of a malaria threat, 57.9 percent of respondents believed that there was no malaria anymore in the area they worked in ( $N_{total}=425$ ). In line with this perception, 52.4 percent of surveyed inhabitants of mining areas indicated not to be worried at all about malaria ( $N_{total}=420$ ). A majority of respondents believed that it is possible to completely eradicate malaria from

Suriname (62.6%; N<sub>total</sub>=425), mostly because there is hardly any malaria anymore in their working area. Those who believed that malaria eradication was impossible (30.5%; N<sub>total</sub>=425) reasoned, among others, that the forest is huge so you cannot fight malaria everywhere, and that one cannot kill all mosquitos.

Half of respondents had taken action to protect themselves against malaria (49.9%); most often sleeping with a bed net (N<sub>total</sub>=425). Malaria prevention behaviour differ in different areas, with people in Benzdorp being most likely to use malaria prevention measures. Just over half of surveyed inhabitants of SSGM areas possessed a bed net (55.8%; N<sub>total</sub>=450), and 45 percent owned a Long Lasting Insecticidal Net (LLIN). In the night prior to the interview, 36.2 percent of respondents slept under an LLIN. There is no doubt that the MP has significantly contributed to elevated bed net use. Of those who received an LLIN from the MP, 80.5 percent had slept with a bed net in the night preceding the interview, versus 16.7 percent of persons who had not obtained an MP bed net. Bed net use was positively associated with being a woman, being a migrant, and sleeping on a bed (rather than in a hammock). Motivations to sleep with a bed net included to protect oneself against mosquitoes, against other insects and pests –incl. bats- and against malaria and other diseases. The main reasons to not sleep with a bed net were not having a bed net ((53.7%); feeling too warm/suffocated under a bed net (15.3%), and just not liking it (10%; N<sub>total</sub>=238).

In terms of public health services for SSGM areas, most desired were a general clinic (40.8%), a family physician (22.2%), and a place to perform lab tests/blood tests (20%; N<sub>total</sub>=424). At this moment, medical assistance is mostly sought in Paramaribo (14.6%), in French Guiana (13.2%) or at an MZ clinic in one of the interior communities (10.6%; N<sub>total</sub>=424).

**Conclusions:** This study arrives at three broad conclusions. In the first place, malaria is no longer part of people’s daily life realities in Suriname’s SSGM areas, and of little concern to its inhabitants. The limited (perceived) malaria threat explains limitations in knowledge of Malaria Test and Treat locations, both in Paramaribo and in the interior. A second conclusion is that, even though bed net use is still far from universal, the Malaria Program LLIN distribution campaign has had a measurable positive impact on bed net use. Additional bed net benefits, other than protection against malaria, should be the focus of continued bed net campaigns. A third conclusion is that, as compared to 2010, malaria knowledge has improved on all fronts. Finally, the data reveal significant differences between the different SSGM areas. Future program activities and research focussing on SSGM must consider and integrate these differences. A summary of key numeric results is presented in Table 1.

*Table 1. Summary of key statistical results 2018 malaria KAP study*

Indicator	Value	N
Seen or heard a malaria message in the past 6 months	42.1%	425
Can name location of the nearest MSD (only areas with MSD presence)	54.8%	210
Familiar with TropClinic and/or knows location, Migrants	52.5%	186
Surinamese	19.2%	239
Knows that malaria is caused by a mosquito (and no other causes)	71.1%	425
Able to name a correct location to test for malaria in Suriname	76.2%	425
Optimal malaria knowledge; about cause, symptoms, prevention and testing	46.4%	420
Possess a bed net (any type)	55.8%	425
Slept under a LLIN in the night prior to the interview	36.2%	425
Believe that there is no malaria anymore in the area where they work	57.9%	425
Worried about malaria risk, a little or a lot	47.6%	420
Believe that it is possible to eradicate malaria from Suriname	62.6%	425

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# Country map and key statistics

Figure 1. Map of Suriname with its districts





Table 2. Fact sheet Suriname

Variable	Value
<b>General</b>	
Total Population, 2015 (Mid-year population)	567,291 (ABS 2017)
Land area	163,820 km <sup>2</sup> (ABS 2017)
<b>Economic</b>	
GDP market prices, 2015 (market prices, in SRD Mln)	16,667.3 (USD 4845.7 Mln)(ABS 2017)
Real GDP growth, 2015	-2.7% (ABS 2017)
Per capita national income, 2015	SRD 29,215 (USD 8492.7)(ABS 2017)
Unemployment rate, total 15+ (2017)	9.9% (ILO modeled estimate)
Male, 15+	6.8% (ILO modeled estimate)
Female, 15+	15.1% (ILO modeled estimate)
<b>Gold Mining</b>	
Multinational gold mining companies active in Suriname	IAMGOLD (CANADA) Newmont Mining Cooperation (US)
Government mining revenue in % of GDP	6,2%
<i>Mining sector government revenue, 2015</i>	
Gold	58%
Oil	33%
Bauxite	9% (CBvS 2016, 2015 data)
<b>Small-scale gold mining (SSGM)</b>	
Estimated number of SSGM, incl. service sector in the interior	11-15 thousand (Heemskerk et al., 2016)
Amount of gold produced by ASM in 2015	18.9 tonnes (CBvS, 2016)
ASM gold production as a percentage of total gold production, 2014	65.4% (CBvS, 2016)
Royalty on gold produced by ASM	2.75%
<b>Malaria</b>	
Confirmed malaria cases, 2017	Falciparum: 145 Vivax: 368 Mix: 26 } Total: 539
% of 2017 malaria cases with suspected transmission outside of Suriname.	Falciparum: 139 Vivax: 335 Mix: 25 } Total: 539
Number of malaria deaths, 2013-2017	2013: 1 case (local) 2017: 1 case (import case)
Malaria hotspots based on cases tested positive in Suriname	Border region Suriname – French Guiana 1. Sophie 2. Eau Claire 3. Tampoqui } all in French Guiana
<b>Suriname Malaria Programme</b>	
Total number of bednets distributed in SSGM areas during the 2015-17 malaria campaign.	2016: 31865 2017: 6022
Number of ACDs performed 2015-2017	2015: 17 2016: 15 2017: 19
Number of Malaria Service Deliverers working in the interior areas (incl. Albina), 2018	Full time: 7 Mobile: 4 Volunteers: 22



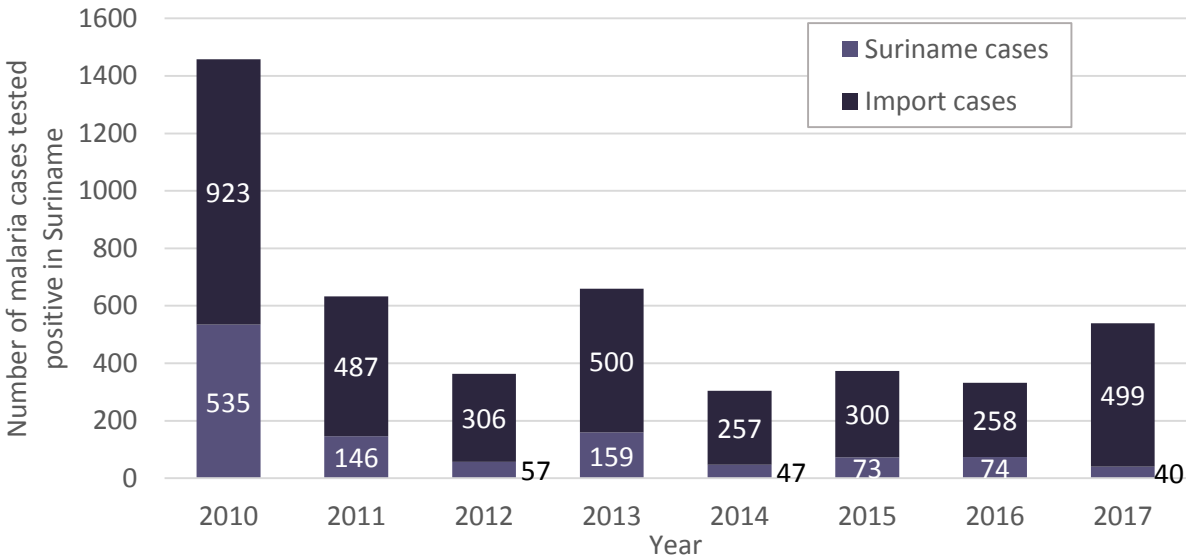
# 1. Introduction

## 1.1 Background

This report presents the results of a Knowledge, Attitudes and Practices (KAP) survey on malaria, among the inhabitants of small-scale gold mining (SSGM) areas in Suriname, South America. In both 2010 and 2016, the WHO/PAHO awarded the Suriname Malaria Program as “Malaria Champion of the Americas”, and with reason<sup>1</sup>. In the past decade, Suriname’s malaria figures have dropped dramatically and more recently, malaria has become virtually eliminated from large parts of Suriname (Figure 2).

Despite these successes in fighting malaria, small-scale gold mining (SSGM) areas are still considered at risk. The small-scale gold mining areas are largely concentrated in the Greenstone Belt area of Suriname. Risks of spreading or re-introducing malaria in these areas are real, due to (1) limited access of the remote populations to health services and (2) the high mobility of miners. This movement within Suriname and between Suriname and neighbouring countries encourages disease spread. Indeed, of the 539 malaria cases recorded in Suriname in 2017, 92.6 percent (499 cases) were most likely the result of transmission abroad – mostly in French Guiana (Figure 2).

Figure 2. Number of positive malaria cases tested in Suriname, by year and area of likely infection; either within Suriname (Suriname cases) or in other countries (import cases).



Estimates of the size of the SSGM population vary. The total number of inhabitants of SSGM areas has been estimated at about 12-15 thousand, including service providers (Heemskerk et al., 2016). This figure excludes persons outside SSGM areas (e.g. in Paramaribo) who indirectly earn a living from the SSGM sector, such as bar- and restaurant owners, equipment sellers and so forth. Suriname nationals active as gold miners in the gold fields are most often of Maroon ethnic descent, though the owners of mining concessions are typically non-Maroon Surinamese. About two-thirds to three-quarters of SSGM sector workers are migrants, mostly Brazilian *garimpeiros* (gold miners). Smaller numbers of migrant gold miners

<sup>1</sup> The history of the Suriname malaria programme and its main achievements have been described in earlier KAP studies, notably Heemskerk and Duijves 2016

and mining service providers come from Guyana, other Latin American and Caribbean countries and in exceptional cases from elsewhere.

The number of women working in the SSGM sector seems to have increased over the years, and is larger among migrants than among local people. Women are most prominently present in the mining service sector as (traveling) saleswomen; shop owners; hairdressers and beauticians (e.g. nail salons); owners and managers of hotels, bars, restaurants and brothels; cooks; Commercial Sex Workers (CSW); transport providers (e.g. ATV driver) and so forth. In addition, women are equipment owners and mine managers, or they may be present as the spouse of a gold miner. Counting women in these various professions, they may constitute 15-20 percent of the SSGM population (incl. service sector) (Heemskerk et al, 2016). Youngsters under the age of 18 are seldom encountered as workers in the SSGM sector and related service economy (ibid.).

It is a challenge to reach gold miners with public health messages and interventions because travel to the mining areas is often expensive and difficult, and because the population consists largely of migrants who do not speak the local languages. There are Medical Mission health centres, which have wide area coverage, but are often at some distance from SSGM areas and few staff speak Portuguese, the language of most migrant miners.

The overall aim of the Suriname Malaria Program is to eliminate malaria in Suriname. In order to reach this goal, the Programme focusses its efforts specifically on SSGM areas, where it works with a network of Malaria Service Deliverers (MSD). These MSD are typically persons who already work and live in SSGM areas. They usually do not have a medical background, and often may not even have completed elementary school. These persons expressed willingness to help their communities, and subsequently were trained in malaria testing and treatment, and provided with medication to treat the positive cases. In 2018, the Suriname Malaria Programme employed seven full-time MSDs, four mobile MSDs (who serve a larger area using All Terrain Vehicles), and twenty-to volunteer MSDs. All MSD working in the interior are fluent in Portuguese and/or local languages, and are supervised by malaria workers in Paramaribo.

In addition to providing free malaria testing and treatment throughout the mining areas, the Suriname Malaria Programme uses other strategies to fight malaria, including the distribution of free Long Lasting Impregnated Nets (LLINs), information and awareness campaigns, and Active Case Detection (ACD) missions. During the most recent 2015-17 malaria campaign, close to 40 thousand<sup>2</sup> LLINs were distributed in SSGM areas throughout Suriname, with a specific focus on the malaria hotspots along the Suriname-French Guiana border. As part of this same campaign, the Suriname Malaria Programme organized a total of 51 ACDs, during which the entire population in target area(s) was tested for malaria.

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<sup>2</sup> More precisely: 37.887

## 1.2 Objectives

The design of effective interventions to eliminate malaria requires enhanced understanding of the perceptions of the target populations about malaria and the risks of contracting this disease, and about ways to prevent and/or treat malaria. At the same time, the Malaria Programme would like to acquire information about its impact and reach. In this context, the objectives of the present KAP survey were to:

*Document the knowledge, attitudes and practices with regard to malaria and the malaria programme among persons living and working in Suriname small-scale gold mining areas.*

More specific objectives included:

- Evaluate knowledge about the cause and prevention of malaria among persons living and working in Suriname SSGM areas.
- Document malaria prevention behaviour in SSGM areas, specifically with regard to use of LLINs.
- Record knowledge of, access to, and use of Malaria Service Deliverer (MSD) services in the mining areas.
- Analyse exposure to Behaviour Change Communication about malaria - in general and by the Suriname Malaria Programme in particular.
- Evaluate familiarity with, and recognition and use of, Malaria Program posts and their services.

## 1.3 Findings from earlier studies on malaria and SSGM in Suriname

Earlier malaria KAP surveys among SSGM populations were performed in 2010, 2012, 2015 and 2016. These surveys were primarily executed to guide and evaluate activities of the Suriname Malaria Program (Figure 1). The data collected through these various studies are not necessarily comparable though, because targeted different groups, and questions slightly differed between the different years. Table 3 summarizes these details.

Even though the various KAP studies targeted different areas and populations, several general conclusions can be drawn from the data collected about malaria in SSGM areas over the past eight years:

- In the past decade, the share of persons with correct knowledge of the causes, prevention, symptoms, and treatment of malaria has increased. It is likely that the Malaria Programme information and communication campaigns have contributed to this change.
- Among SSGM working in French Guiana, inconsistent and incomplete use of OTC medication without proper malaria testing is common.
- Nevertheless, the most recent studies suggest slight improvement of malaria Test and Treat behaviour among persons working in French Guiana mining areas, that is, slightly higher numbers of individuals who take a malaria test and decreased use of Over The Counter (OTC) malaria medication. This change could not be measured among persons working in Suriname because very few gold miners working exclusively in Suriname have a recent malaria history.
- 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 underlines the importance of an extensive network of locations where the at-risk population can access Test and Treat services.

- The extension of MSD services pays off; in areas where MSD were present, use of their services has increased in recent years.
- After 2015, the Suriname Malaria Program has become increasingly known among the inhabitants of small-scale gold mining areas in the Suriname-French Guiana border region.
- Malaria risk behaviours including the use of OTC medication are strongly related to the French zero tolerance policy vis-à-vis clandestine SSGM and the (consequently) limited access to health services in French Guiana SSGM areas. Malaria behaviours in French Guiana directly affect public health conditions Suriname, as gold miners working in this neighbouring country seek refuge and buy supplies in Suriname.
- The 2015-2016 assessments concluded that even though malaria transmission rates had lowered and malaria was no longer a prime health concern for SSGM populations in the target areas, continuation of malaria testing, treatment and monitoring is crucial to keep malaria under control in Suriname.

Table 3. Malaria KAP studies in Suriname SSGM areas, 2010-2018

KAP survey year	Target population	Sampling method	Study areas
2010	Persons 16 years and older who were business owners, head of household and/or camp owners present in the selected mining areas.	Random: Decision-making person in every third camp, household or business; N=160	Sella Creek, Benzdorp/Lawa, and the Lake area
2012	Persons 16 years and older who were business owners, head of household and/or camp owners present in the selected mining areas.	Random: Decision-making person in every third household or business in population centres, and of every camp in the forest. N=268	Benzdorp/Lawa River, Sarakreek and Maripaston
2013 (PAHO)	Persons working and/or living in a small-scale gold mining area, who had (suspected) malaria in the past 1 ½ year.	Purposive sampling; any person meeting the inclusion criteria. N=216	Oelemari, Benzdorp general area, Sur-FG border (Peruano, Antonio do Brinco, Papaiston, etc)
2015 (baseline)	Persons 16 years or older, who worked or lived in small-scale gold mining areas along the Lawa River (either Suriname or French Guiana) for at least the past 6 months, and had (suspected) malaria in the past 1 ½ year	Purposive sampling; any person meeting the inclusion criteria. N=141 (2015) and N=152 (2016)	Sur-FG border areas; Lawa (Peruano, Antonio do Brinco, etc) and Albina
2016 (evaluation)			
2018 (present)	Persons 18 years and over, living and working in a Suriname mining area for at least the year preceding the interview.	Max of 2 persons per mining camp/business, including owner.	Brokopondo (North of lake), Benzdorp area, Sella creek, Pikin Saramacca.

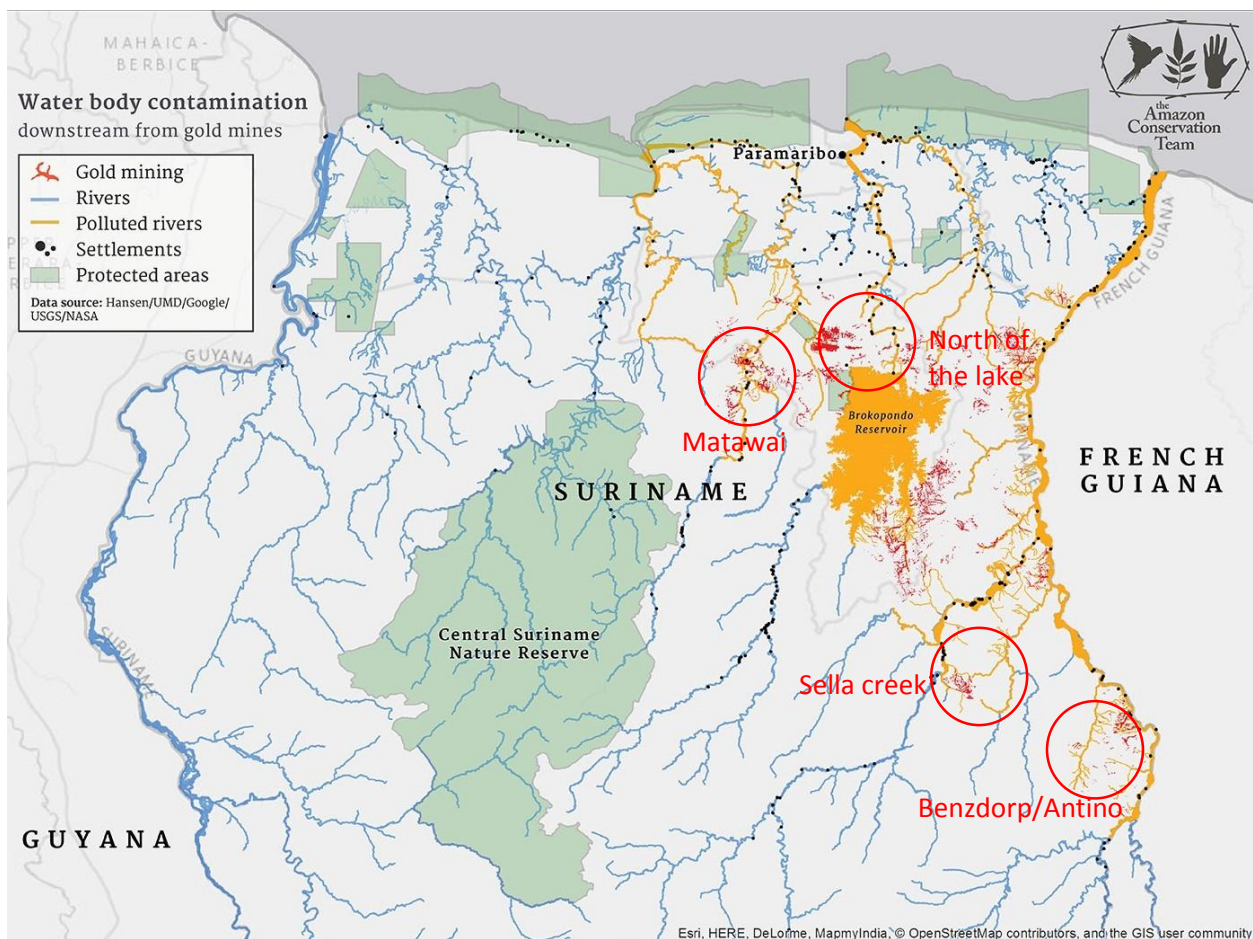
## 2. Methods

### 2.1 Approach and study locations

Prior to starting the fieldwork, a work plan was presented to, and subsequently approved by, the Suriname Malaria Programme and the technical working group (TWG). The TWG comprises key representatives of relevant MoH programs in Suriname. Input from the TWG was integrated in the final work plan and research tool.

Field work for the KAP study took place in February-March 2018. The research team visited four SSGM areas that differed in accessibility, composition of the mining population, mining history, and exposure to Suriname Malaria Programme outreach activities (Figure 3).

Figure 3. Map of KAP study locations (in red circles)



Source basemap: The Amazon Conservation Team

In the district of **Brokopondo, north of the lake**, the research team visited three mining areas: Bewojo (near the community of Klaaskreek), Drepada/Asigrón, and Nieuw Koffiekamp. All of these areas are relatively well accessible, within 2 hours driving from Paramaribo. Small-scale gold miners in Asigrón and Nieuw Koffiekamp were mostly of Maroon ethnic descent; in the Bewojo mining area the mining

population consisted of both local Maroons and Brazilian migrant gold miners. Because of their proximity to local villages and the capital city, the visited Brokopondo mining areas featured relatively few auxiliary services, such as hotels, bars/brothels and supermarkets. During the 2015-16 malaria elimination campaign, 401 LLINs were distributed in Nw. Koffiekamp, and another 520 LLINs in the surroundings of Drepada/Asigron. No MSDs are active in the SSGM areas that were targeted in this region (H. Hiwat, director Malaria Program, pers. com. 21/03/18).

**Sella Creek** is part of the traditional territory of the Ndyuka Maroons, and most SSGM in this area were Ndyuka. The area is isolated; getting there requires a combination of plane and boat travel, and may take about half a day<sup>3</sup>. As dictated by the Ndyuka tribal chief (*granman*), there are no migrant gold miners or brothels in this area. Also the number of stores and other services is limited and as a result, also the number of women active in this SSGM area. In the past five years, no malaria cases have been recorded in this area. One volunteer MSD is active at Sella Creek.

The **Benzdorp area** is an ancient mining area, with more than a century of gold mining history. The area is composed of several smaller mining zones including Antino, Buese, and Benzdorp itself. The area can be reached by plane (airstrips of Tabiki or Antino) or a 1-2 day boat ride from Albina. The gold miners' community of Benzdorp features a large diversity of services, including bars and brothels, ATV repair shops, clothing stores and supermarkets, hair and nail salons, and so forth. The gold mining population consists predominantly of Brazilian migrant miners. Three MSDs are active in this area: one mobile MSD who visits remote camps on an All Terrain Vehicle (ATV); one MSD supervisor, who has a fixed post but also transportation to visit places along the Lawa River; and one volunteer MSD.

The area known as **Pikin Saramacca** is part of the customary lands of the Matawai Maroons. The area can be reached from Paramaribo either by car (~ 6 hr. drive) or by a combination of plane (flying to Nw. Jacobkondre) and boat travel. The area is composed of several smaller mining zones including *Vila Brasil*, *Pompu kampu* and *Agua Azul*. The mining population consists predominantly of Brazilian migrant miners. In the past five years, a few malaria cases have been registered for this area; two cases in 2017 and seven cases in 2015. One person is currently in training to become a volunteer MSD for this area.

## 2.2 Survey Interviews with SSGM populations

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

**General demographic and socioeconomic background:** Age, gender, profession, work location.

**Health issues:** Time since most recent malaria episode, number of malaria experiences; perception of personal malaria risks.

**Exposure to Malaria Elimination program interventions:** Knowledge of MSD locations, exposure to malaria information, familiarity with the Malaria Programme test and treat location in Paramaribo.

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<sup>3</sup> The area also can be reached by boat only, but in that case the travel would take about two to three days, depending on the size of the outboard motor, the load carried, and water level in the rivers. .



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

**Protective behaviour:** Possession and use of regular bed nets or LLINs.

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 or a survey supervisor reviewed every completed survey form in the field to ensure high data quality. Completed survey forms were entered in an SPSS data base and analysed using summary and bivariate statistics.

### 2.3 Survey sample size and sampling strategy

The three previous malaria KAP studies in SSGM areas (2015, 2014, 2012) only included respondents who had experienced expected malaria in the 1 ½ year prior to the interview. Even though they were interviewed in Suriname, these people were mostly working in French Guiana mining areas. The present study took a different approach by including in the sampling frame any adult working in SSGM areas in Suriname, either as a gold miner or in the SSGM service sector. The inclusion criteria are:

- Person is currently working in a Suriname SSGM area, and has been working in SSGM in Suriname for at least the past two years.
- Person is 18 years of age or older.

A purposive sampling design was used. In the selected study locations, the researchers visited the different mining camps and other economic units (e.g. bars, brothels, hotels, restaurants). In each economic unit, the team interviewed the boss or manager<sup>4</sup>, as well as one other person. In very large mining camps (> 10 persons) one or two additional persons were interviewed. In total, 364 respondents were part of a mining team, and 61 were service providers (Table 4). As part of the mining team were considered all persons living in the different mining camps, including gold miners (workers), the equipment owner, the camp manager, the backhoe excavator operator, the cook, non-working spouses of gold miners, *puipuizeiros* (working with metal detector) and “oekum men”<sup>5</sup>. The label “Independent service providers” was used to indicate individuals who were not a fixed part of a certain mining team, but rather provided services to different teams, including shop owners and helpers, brothel owners and sex workers, mechanics, transport providers, welders and other odd jobs (Table 5).

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<sup>4</sup> The reason to interview the camp bosses/manager is that this person may have most influence on malaria prevention methods applied in the camp.

<sup>5</sup> “Oekum” refers to an activity where the gold miners scavenge the workings of others. This activity was only observed in the community of Nw. Koffiekamp, which is situated within a multinational mining concession. In this case, the oekum men typically hide out in the forest near the firm’s mining pit. After the company blows dynamite, oekum men run into the pit to collect loose stones, which they carry with them in a backpack to crush at a hidden location.



Table 4. Sample size in the four study areas

Name of SSGM area	Part of mining team	Ind. Service providers	Men	Women	Total
Benzdorp area	85	20	88	17	105
Brokopondo, North of the Lake	101	15	101	15	116
Sella Creek	101	3	101	3	104
Pikin Saramacca	77	23	67	33	100
<b>Total number of valid surveys</b>	<b>364</b>	<b>61</b>	<b>357</b>	<b>68</b>	<b>425</b>

## 2.4 Sample characteristics

Four hundred and twenty-five valid surveys were conducted, with 68 women (16%) and 288 men (84%). Respondents were between 18 and 76 years of age, with a Mean age of 37.2 years ( $N_{\text{total}}=423$ ). There was hardly any difference between women and men in terms of their Mean age (resp. 38.4 and 37.0). Fifty six percent of the total sample (239 individuals) consisted of Surinamers and the remaining gold miners were foreign nationals. Migrants were for the largest share Brazilians (38.8% of total), with smaller numbers of Dominicans (7 persons), Guyanese (5 persons), Chinese (5 persons), French (From French Guiana, 3 persons), and Philippine (1 person) ( $N_{\text{total}}=425$ ).

Table 5. Main professions performed by respondents in SSGM areas, by gender

Profession	Men (N=357)	Women (N=68)	Total
<b>Part of the mining team</b>			
Small-scale gold miner (worker)	234	0	234
Gold equipment owner (boss)	48	3	51
Cook	3	33	36
Excavator operator	14	0	14
Gold camp manager/administrator	9	0	9
Non-working spouse of gold miner/camp inhabitant	0	5	5
Oekum man	4	0	4
Other (All-rounder, <i>piupiuzeiro</i> , technical supervisor)	3	0	4
<b>Independent service providers</b>			
Shop owners	7	5	12
Shop assistant	7	3	10
Brothel (Cabaret) owner	2	6	8
Sex worker	0	8	8
Mechanic	8	0	8
Transport provider	6	0	6
(Traveling) Vendors of snacks and other items	1	3	4
Welder	3	0	3
Security	3	0	3
Other (church workers, fisher, farmer)	5	2	7
<b>TOTAL</b>	<b>357</b>	<b>68</b>	<b>425</b>

The most common profession among surveyed women was cook (48.5%;  $N_{total}=68$ , Table 4). Other women were, among others: shop owners or employees, cabaret owners, sex workers, gold equipment owners; vendors; and wives of gold miners without an income generating activity. Men were most often gold miners (workers, 65.4%); followed by equipment owners; excavator operators; manager of the gold camp; traveling vendors; or transporters of people, supplies and/or fuel. Others performed a wide variety of other professions, including equipment owner, brothel owner, hairdresser, tunnel constructor, and operator (Table 5).

## 2.5 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. 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.

## 2.6 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. Even spread of the sample population across the target areas was introduced by interviewing merely two persons per mining camp (of  $\sim 10$  persons, and disproportionately more in larger camps). Because a purposive sampling design was used (interviewing the boss/decision-maker and one 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 working in Suriname SSGM areas.

Survey responses are subject to self-report. Responses may be influenced by response bias if respondents are familiar with desired behaviour and respond in the 'correct' way as opposed to according to their true actions. We 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.

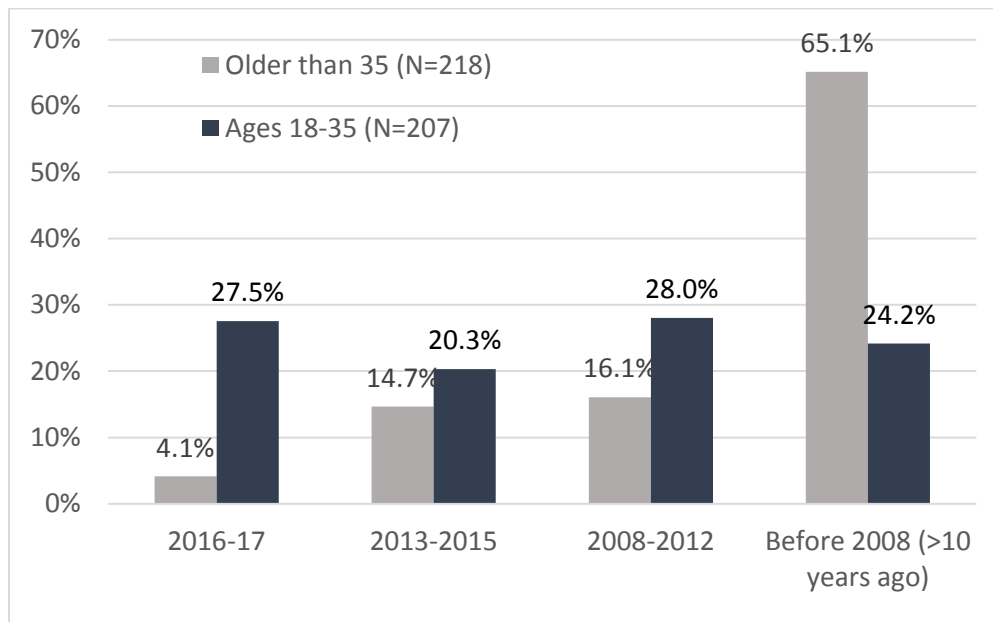
Some questions may be subject to bias/confounding due to probing by interviewers. Probing/prompting styles are not uniform across interviewers. Discussion of all the questions with the team of interviewers both prior to, and during, fieldwork helped reduce probing bias. This bias was further minimized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

### 3. Results

#### 3.1 Gold mining and Malaria History

The typical respondent had quite some years of experience working in the SSGM sector; 45.2 percent of respondents had entered the SSGM sector more than 10 years ago. Some of the older persons even had been working in the sector for more than 30 years. Older persons were relatively more likely than youngsters to have more than 10 years of SSGM experience. Yet even in the younger group, most respondents (52.2%) had been working in the SSGM sector for at least five years.

Figure 4. Year in which respondents first entered the SSGM sector, by age group. Percentages of total.



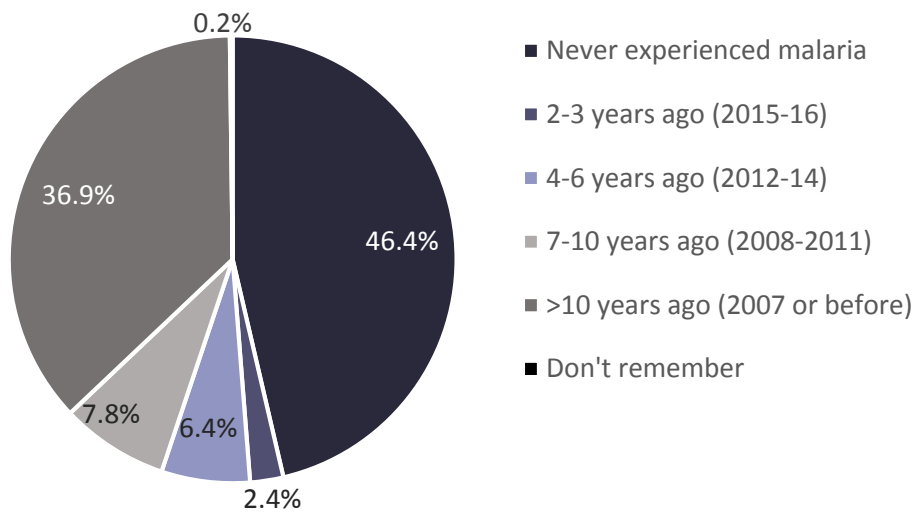
At the time of the survey, all interviewees were living and working in a Suriname gold mining area. Nevertheless, 16.7 percent of survey respondents had experience working in other countries in the five years preceding the interview (2012-17). Other countries where respondents had worked included: French Guiana (51 persons), Brazil (23 persons), Guyana (10 persons), Venezuela (2 persons) and Bolivia (1 person). Suriname nationals were significantly less likely than foreign small-scale gold miners to have working experience in SSGM outside of Suriname (resp. 6.7% vs. 25.6%,  $X^2$ ;  $P < 0.001$ ).

The survey data suggests that malaria has become extremely rare in the Suriname interior. Almost half of respondents (46.4%) reported that they had never experienced malaria ( $N_{total}=425$ ; Figure 5). There were no differences between Suriname inhabitants of SSGM areas and migrants. Another 36.9 percent of respondents reported that it had been more than 10 years ago that they last suffered from malaria. Hence altogether, 83.3 percent of respondents had either never, or more than ten years ago, been ill with malaria. None of the interviewees had experienced malaria in the year preceding the interview (2017-18), and only 2.4 percent had been ill with malaria between two and three years ago (2015-16) (Figure 5).

Of the ten persons who had malaria relatively recently (2015-16), four had been ill with malaria abroad; one in Guyana, one in Brazil, and two in French Guiana. In addition, four persons had become ill with

malaria in the Suriname-French Guiana border region. A similar pattern can be observed among those whose most recent malaria was experienced between four and six years ago (2012-2014). Of these 27 persons, nine had been ill with malaria abroad; among whom seven in French Guiana<sup>6</sup>. Of the remaining eighteen persons, seven had malaria in the Suriname-French Guiana border region (Benzdorp area; Langa Tabiki/Nassau). Given that the respondents were gold miners and mining service providers throughout four “typical” SSGM areas, dispersed over Suriname, these data strongly suggest that becoming infected with malaria in Suriname is extremely rare nowadays.

Figure 5. Most recent malaria experience (N=425)

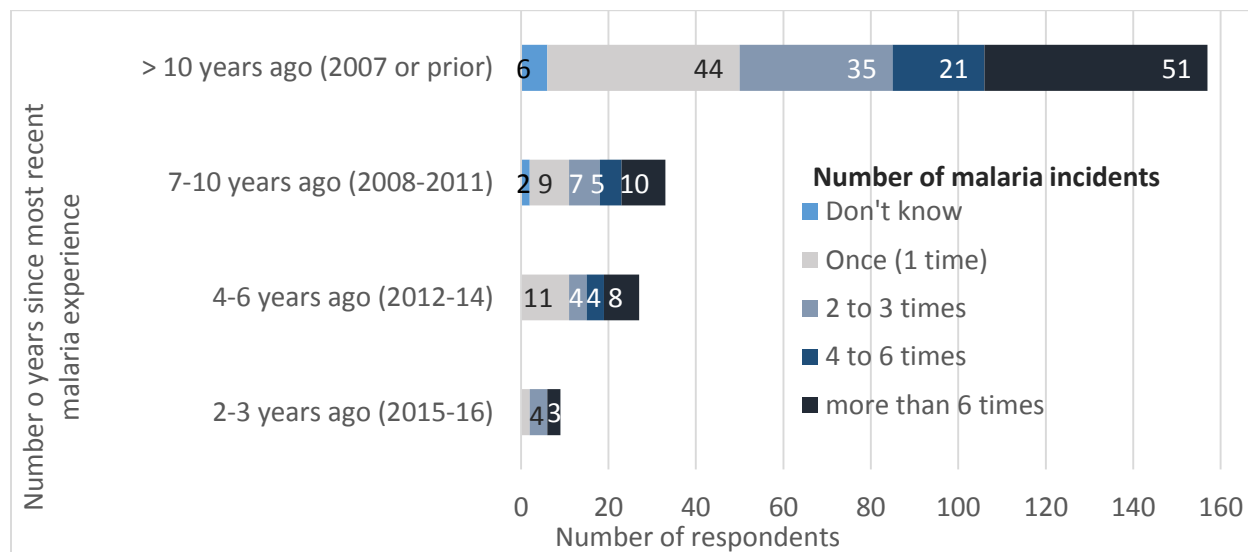


Respondents who reported that they had been ill with malaria at least once, also were asked how often they had experienced malaria (N=227; excl. 1 missing). Almost one third of this group had been ill with malaria often; at least more than six times. For the largest share, however, all these malaria incidents had been experienced more than ten years ago (Figure 6).

A similar percentage of respondents (30.8%) among those who had at least one malaria experience, had experienced malaria only once (N<sub>total</sub>=172). Also in this group, the largest share of individuals had experienced that malaria incident more than ten years ago.

<sup>6</sup> One missing observation where country was not recorded

Figure 6. Number of times the person experienced malaria, by time lapse since most recent malaria. Only counting persons with at least one malaria incident (N=227, 1 missing)



### 3.2 Familiarity with the malaria program and exposure to outreach services

Even though outreach activities of the Suriname Malaria Programme have concentrated along the Suriname-French Guiana border, the Program has distributed bed nets and delivered Behaviour Change Communication (BCC) in all known Suriname mining areas. Familiarity with the malaria program was measured by asking about exposure to Malaria Program outreach activities; 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.

Forty-two percent of respondents reported that they had seen or heard a malaria message in the past six months ( $N_{total}=425$ ). Among those who had been informed ( $N=179$ ), two-third had been informed about malaria by Malaria Program workers in the SSGM areas (68.2%). Others had heard or seen malaria messages on Suriname television (5%), Brazilian television (6.1%), on the radio (4.5%), on posters (11.2%), from malaria workers at the Malaria Program clinic in Paramaribo (5%), and from friends, colleagues and family (2.8%;  $N_{total}=179$ ). One person mentioned the billboards in Paramaribo and Albina.

With regard to the content of the malaria messages, 7.3 percent of those who had seen or heard a message reported that they could not remember what it had said ( $N_{total}=179$ ). Those who did remember the message most often reported that they had been told to sleep with a bed net (40.8%). Others had been informed about other malaria prevention methods, such as keeping the surroundings clean/cleaning up breeding places (2.8%) or generally about malaria prevention (5.1%). Respondents also had been informed that malaria is dangerous (20.1%) and/or can kill (10.6%); that one should take a malaria test when feeling ill (18.4%) and complete medication (2.2%); that malaria is spread by mosquitoes (10.1%); and about the general malaria situation in Suriname (3.4%) and the work of the Malaria Program (2.8%).

Several persons mentioned that staff from the Malaria Program had come to test and distribute LLIN's but did not provide any information (4.2% of total; 18 persons). Because we did not explicitly ask about this, we do not know how common this observation was.

To test recognition of the malaria program logo, the respondents were presented with three logos of malaria programs in different countries and one image of the Suriname coat of arms (Annex 2). The respondents were asked whether they recognized one of the symbols, and if so, what they meant or what organization they pertained to. The best-known logo was the logo of the Malaria Program, which was recognized by half of respondents (54.3%,  $N_{total}=416$ ). There was no significant difference between migrant miners and Suriname nationals in their likelihood to recognize the Malaria Program logo. Fifty-seven percent of those who reported that they recognized the MP logo, correctly identified it as the logo for the Suriname Malaria Program/Malaria Campaign (57.3%;  $N_{total}=225$ ). In addition, several individuals reported that they had seen the logo on MP materials, such as malaria posters in the mining areas, villages, or clinics (MZ/BOG/RGD); on the packaging of the LLINs that had been distributed; and on TV infomercials. Others did not provide a meaningful answer<sup>7</sup>.

A similar number of interviewees recognized the Suriname coat of arms (51.4%,  $N_{total}=416$ ), with Surinamese nationals being significantly more likely than migrants to recognize this image. It must be noted that not all persons knew the meaning of this image; some reported that they knew it, for example, from Parbo Beer or an Indigenous Reserve.

A core strategy for the Malaria Elimination program has been to expand the network of Malaria Service Deliverers (MSD). In this context, it must be taken into account that in the year preceding the interviews, MSDs were only active in two out of the four visited regions; three in the Benzdorp area and one in Sella Creek. In addition, one MSD for the Pikin Saramacca area (Vila Brasil) was in training.

The larger Benzdorp area, especially the locations right on the border with French Guiana (e.g. Antonio do Brinco, Peruano) is among the Suriname locations with the largest share of positive malaria cases<sup>8</sup>. This relatively elevated exposure to malaria, in combination with the presence and visibility of three MSDs, likely affected respondents' familiarity with the Malaria Program. In the Benzdorp area, more than three-quarters of respondents could name an actual location where they would be able to find an MSD (Table 6). A smaller share of respondents from this area reported that they had seen the MSD, but did not know where he was located. They often said that they knew the phone number of the mobile MSD so that they could call if they needed him. Fifteen percent of respondents in this area reported that they did not know about an MSD in their surroundings. In this and other areas, respondents who did not know where to find an MSD (or other malaria service location) often added that they or their colleagues had not been ill with malaria for a long time, and hence they simply had not made an effort to figure out where one might be able to test for malaria.

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<sup>7</sup> For example, they mentioned that it was the map of Suriname, the symbol for dengue or yellow fever, or just did not know.

<sup>8</sup> The top-3 locations where patients have been tested positive for malaria in recent years are the Benzdorp area, Albina, and the TropCliic in Paramaribo (Malaria Program, pers. com. 16/04/18)

Also in Sella Creek a volunteer MSD is present, but this person was less known; about one third of respondents from this SSGM area could name the location of this MSD. The fact that there no malaria cases have been recorded in Sella creek in the past five years, probably affected this result.

In the areas without an active MSD in the past year (Brokopondo North of the Lake, Pikin Saramacca), very few individuals could name the location of an MSD (Table 6). Those who named an MSD location often said that they were not sure if the person was still active in the area or referred to other regions where they had worked before.

Persons with a relatively recent malaria experience (2-3 years ago) were not significantly more or less likely than others to know where to find an MSD<sup>9</sup>.

Table 6. Share of respondents who could name location of nearest MSD

	Brokopondo North	Benzdorp	Sella Creek	Pikin Saramacca
<i>Do you know where to find the nearest MSD?</i>	N (% of area total)	N (% of area total)	N (% of area total)	N (% of area total)
No, I have no idea	87 (75%)	16 (15.1%)	57 (54.8%)	95 (95%)
They come visit but I have no idea where they are located	19 (16.4%)	8 (7.5%)	13 (12.5%)	1 (1%)
Yes I know where	10 (8.6%)	81 (76.4%)	34 (32.7%)	4 (4%)
<b>N</b>	<b>116 (100%)</b>	<b>106 (100%)</b>	<b>104 (100%)</b>	<b>100 (100%)</b>

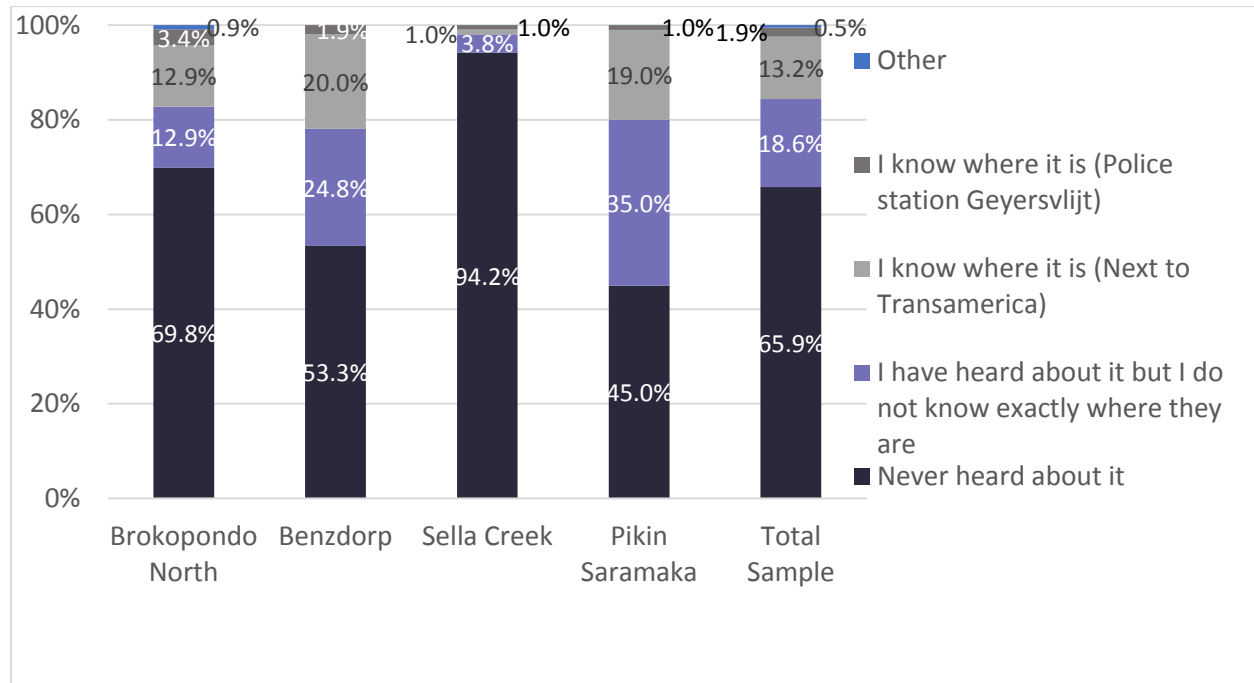
Respondents also were asked whether they had heard about, and knew the location of, the malaria clinic (TropClinic) in Paramaribo. Almost three-quarters of interviewed inhabitants of gold mining areas had never heard about the TropClinic. Again, several interviewees explained that since they had not been exposed to malaria, they had not looked into places to go test for malaria. The data show differences between areas in the extent to which the TropClinic is known. In the Selle Creek area, where malaria has been absent for years, hardly anyone was familiar with the TropClinic. In the Benzdorp area and in Pikin Saramacca, on the other hand, almost half of respondents either knew where to find the TropClinic or had at least heard of it.

Due to the Malaria Program focus on areas with a predominantly migrant mining population, migrants were -on average- more familiar with the TropClinic than Surinamese inhabitants of gold mining areas. Indeed, 19.2% of Surinamese versus 52.2% of migrants had heard about the Tropclinic and/or knew its location. Whether the person ever had malaria, and time passed since most recent malaria experience, did not affect familiarity with the TropClinic.

<sup>9</sup> It is difficult to make the comparison because of the low number of persons with a relatively recent malaria experience (N=10).



Figure 7. Percentage of respondents who are familiar with the Malaria Program TropClinic, by area (N=325).



Most of those who reported that they knew where to find the malaria clinic, referred to the old location at Anamoestraat (13.2% of total sample). Only 1.9 percent of respondents knew about the new TropClinic/Malaria Program location in the Geversvlijt neighbourhood.

A mere 23 respondents (5.4% of total; N=425) had visited the TropClinic. Others simply had not had a need for it. At the time of the survey, the TropClinic at Anamoestraat had extended its services to other areas to include HIV/AIDS testing and counselling. Among those who were familiar with the TropClinic and could name its location (N=64), 18 persons (28.1%) were aware that they could also visit the TropClinic for HIV testing and counselling. Another four persons mentioned that the TropClinic could be visited to obtain an LLIN and for malaria information. Three persons erroneously believed that the tropClinic could be visited for general health services.

Of the 23 persons who had visited the Malaria Program TropClinic, 17 had gone to test for malaria, four to ask for an LLIN, and two to test for HIV.

### 3.4 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 in Suriname.

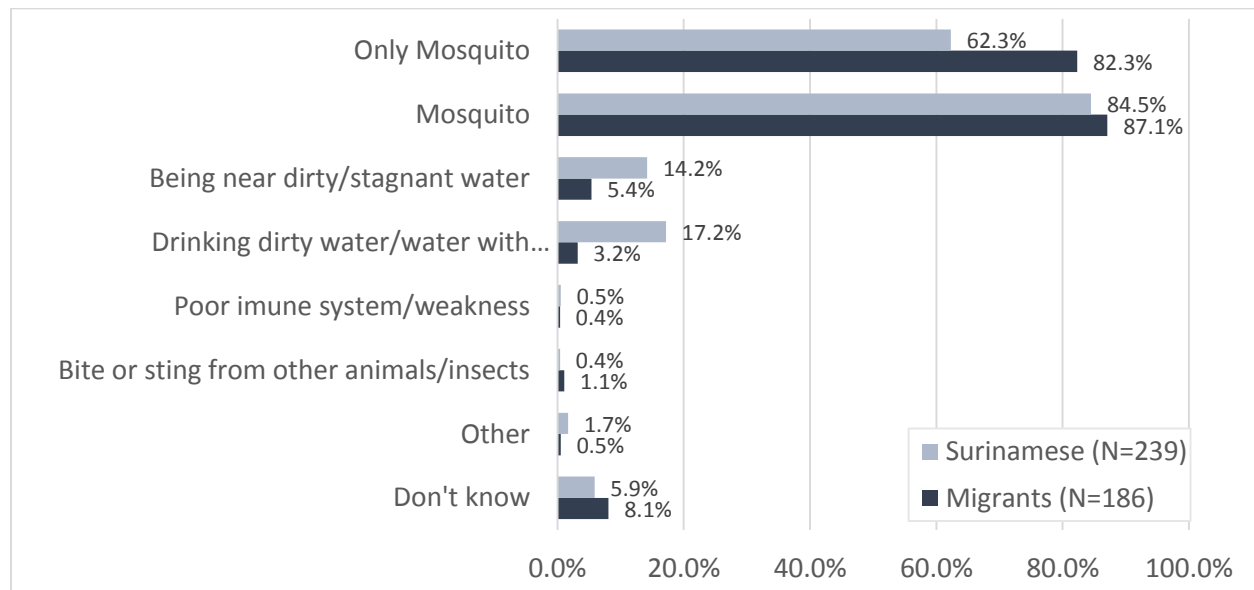
The grand share of respondents correctly cited the mosquito as the cause of malaria (85.6%; N<sub>total</sub>=425) (Figure 10). This figure is much higher than in 2010, when only 60.6 percent of respondents from a similar sample named the mosquito as the cause of malaria. In 2015 and 2016, among only persons in the

Suriname-French Guiana border area who had suffered from malaria in the 1 ½ years preceding the interview, respectively 87.2 percent and 92.7 percent of respondents named the mosquito as the cause of malaria. It is possible that these persons were better informed because malaria was a part of their everyday lives, while current respondents had very little recent experience with malaria. Also in the present sample, we find that 91.9 percent of persons (N<sub>total</sub>=37) with a recent malaria (2012 until 2018) as compared to 85.1 percent of others (N<sub>total</sub>=388) were informed that malaria is transferred through a mosquito, but this difference was not statistically significant<sup>10</sup>.

Among the 362 persons who had named the mosquito as a cause of malaria during the present (2018) malaria KAP survey, 62 persons also named additional causes, such as drinking dirty water or being near (stagnant, dirty, creek) water. Hence 71.1 percent of the total surveyed SSGM population correctly named *only the mosquito* as the cause of malaria (Figure 8). As compared to Suriname inhabitants of SSGM areas, migrant gold miners appeared relatively better informed about the cause of malaria, with 82.3 percent of migrants naming the mosquito as the only cause versus 62.3 percent of Surinamese (X<sup>2</sup>, p<0.001). The data show a moderately significant difference between persons with recent malaria, among whom 89.2 percent (N<sub>total</sub>=37) knew that the mosquito is the only cause of malaria, and others, among whom 69.3 percent (N<sub>total</sub>=388) provided the correct answer (X<sup>2</sup>, p<0.05).

In total, 11.1 percent of respondents named drinking dirty or water with mosquito larvae as a cause of malaria and 10.4 percent of respondents believed that proximity to (dirty, stagnant) water caused the infection. Twenty-nine persons (6.8%) reported that they did not know what caused malaria (N<sub>total</sub>=425).

Figure 8. Causes of malaria named by Suriname and Migrant inhabitants of SSGM areas (N=425)



<sup>10</sup> The lack of statistical significance is in part due to the small number of persons with a malaria experience in the past six years (37), coupled with the small actual difference.

We also asked inhabitants of mining areas if they could name the symptoms of malaria. Of all respondents, 88.5 percent were able to name one or more malaria symptoms ( $N_{total}=425$ ), as compared to 85.6 percent in 2010. By far the most named malaria symptoms mentioned in the present (2018) malaria KAP survey were fever (60.2%) and a headache (51.1%) (Table 7). Not surprisingly, we find that persons who experienced malaria before were able to name more malaria symptoms as compared to those who never had malaria (Table 6). On average, persons who never had malaria named 2.2 malaria symptoms, while persons who had experienced malaria named –on average- 3 symptoms.

*Table 7. Malaria symptoms named by respondents, comparing individuals who never had malaria with other who had at least one experience with malaria.*

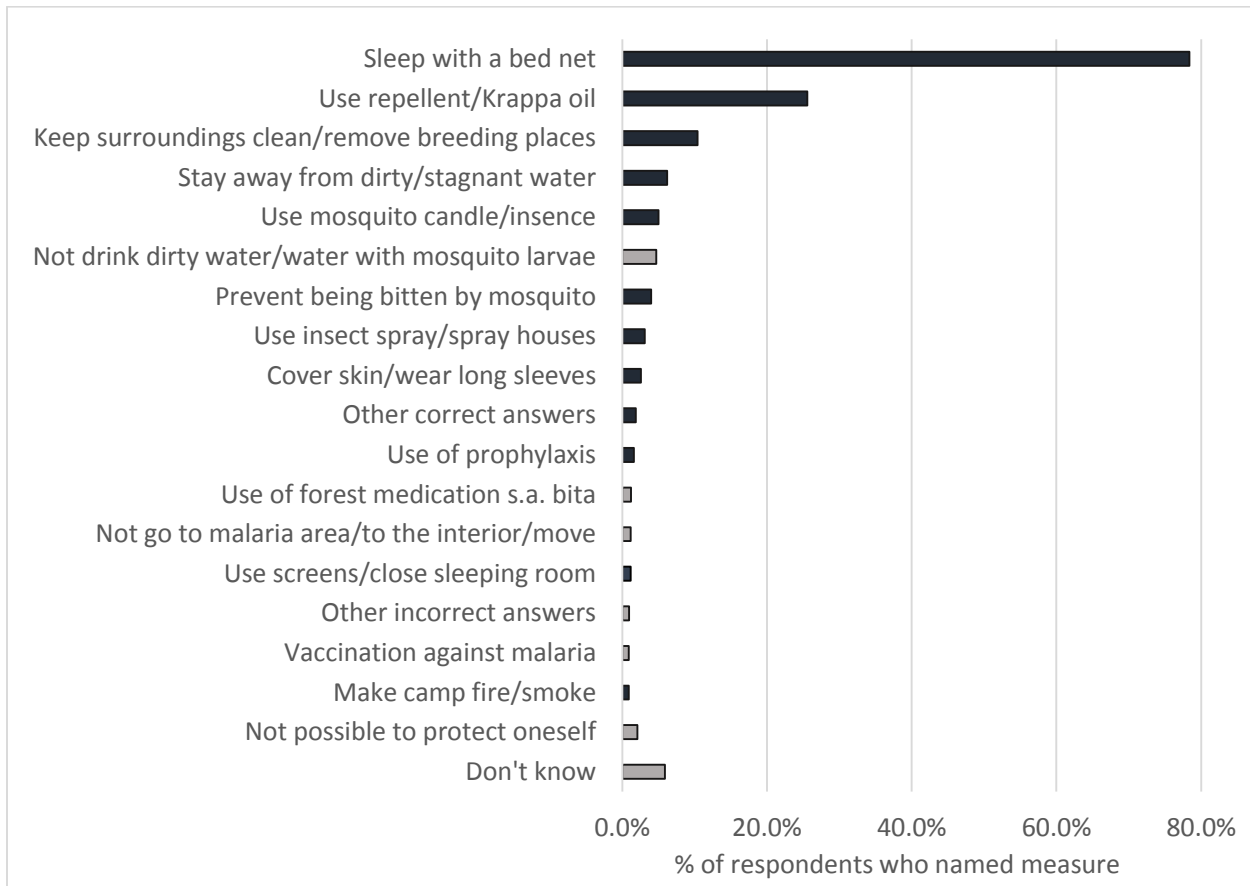
Malaria symptoms	Never had malaria (N=197)		At least 1 malaria (N=228)	
	N	%	N	%
Fever	99	50.3%	157	68.9%
Headache	67	34%	150	65.8%
Vomiting/Nausea	39	19.8%	72	31.6%
Cold/Trembling	38	19.3%	73	32.0%
Body pain	47	23.9%	65	28.5%
Weakness/Tiredness	34	17.3%	47	20.6%
No appetite	14	7.1%	38	16.7%
Joint pains	14	7.1%	35	15.4%
Diarrhea	21	10.7%	23	10.1%
Don't know	34	22.5%	0	0%
Bitter taste	6	3.0%	20	8.8%
Other	16	8.1%	13	5.7%
Dizziness	2	1.0%	3	1.3%
Thirsty / Dry throat	0	0.0%	3	1.3%

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 Figure 9. The answers we considered to be a correct answer are displayed in the dark blue coloured bars.

Thirty-six persons (8.5%) reported that they could not mention any measure to protect themselves from malaria ( $N_{total}=422$ ). Among those who did mention protective measures, the best known protective measure is to sleep with a bed net (78.4 %;  $N_{total}= 422$ , Figure 9). Other valid protective measures included any measure aimed at reducing the number of mosquitos, or reducing contact with mosquitos. These measures included using repellent (incl. forest repellents), prevent being bitten by a mosquito, not being near stagnant water, keep the surroundings clean/remove breeding places, use a mosquito candle or insect spray, and take prophylaxis (Figure 9). Nine respondents (2.1%) were 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. Answers that were considered incorrect answers included not drinking dirty

water/water with mosquito larvae, using forest medicine, vaccination, use liver medication, and use laxatives. Impractical answers included “not go to the interior” and “move elsewhere, for example to the USA”. In total, 86.2 percent of respondents were able to name at least one effective method to protect themselves against malaria ( $N_{total}=421$ ).

Figure 9. Measures that might be taken to protect oneself against malaria

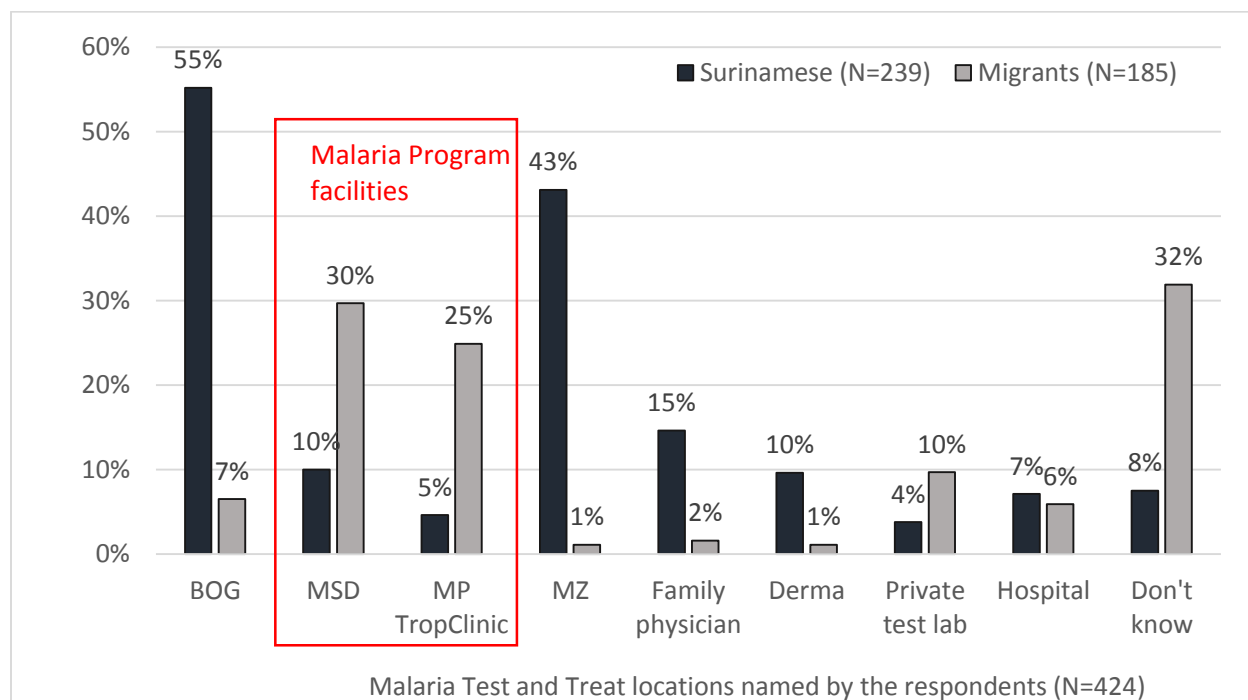


To test malaria knowledge respondents also were asked about their knowledge of malaria Test & Treat locations in Suriname. In response, three quarters of interviewed inhabitants of SSGM areas were able to name a correct location to test for malaria in Suriname (76.2%;  $N_{total}=425$ ). In this regard, there was no significant difference between persons who had been ill with malaria in the past six years (2012-present) and others. Surinamese were significantly more likely than migrants to be acquainted with Suriname malaria Test and Treat locations (resp. 83.3% versus 67%;  $X^2$ ,  $p < 0.001$ ). In interpreting this response, one must take into account that the grand majority of respondents had not been confronted with malaria for a long time, and hence had not bothered to figure out where to test for malaria. Several migrant gold miners indicated that in case they did want to test for malaria, they would simply go to Paramaribo and ask a cab driver to take them to the adequate location.

Among the various existing malaria Test and Treat places, the Bureau for Public Health (BOG) was best known (34%;  $N_{total}=424$ ). The BOG has been performing malaria services for several decades, and currently tests for malaria in its Medical Centre. The BOG was particularly well-known among Suriname inhabitants

of mining areas<sup>11</sup>, though it has been reported that Brazilian individuals also frequent the BOG for malaria testing (H. Hiwat, director Malaria Program, pers. com. 9 April 2018). Next best known were the Medical Mission (MZ) clinics (24.8%), MSD from the Malaria Program (18.6%), the Malaria Program TropClinic (13.4%) and family physicians<sup>12</sup> (9%). Relatively fewer persons mentioned one of the various hospitals (6.6%) or private test labs (6.4%). Several persons erroneously named the dermatological department (“Derma”; 6.1%), the Red Cross (0.7%), and Lobi Foundation (0.5%) as malaria test locations.

Figure 10. Malaria Test and Treat locations named by Suriname and migrant inhabitants of SSGM areas.



The results suggest that as compared to Suriname inhabitants of gold mining areas, migrants are familiar with—and possibly use—very different malaria extension services (Figure 10). For example, about one third of migrant respondents referred to MSD as a location for malaria services (30%;  $N_{total}=185$ ), but only a relatively small group of Suriname named the MSD. On the other hand, more than half of Suriname inhabitants of gold mining areas (55,2%) named the BOG as a malaria service location, while this place was relatively unknown by migrants. Furthermore, while 43.1 percent of Suriname referred to the MZ clinics in the traditional communities, this health services was mentioned by only two migrants. Migrants, on the other hand, were more likely than Suriname gold miners to be familiar with the Malaria Program TropClinic. It would be useful for future studies to investigate whether use of other health services displays a similar distinction between migrants and Surinamese.

Respondents also were asked what they would do if, at this very moment, they would start to feel malaria symptoms. Projected actions differed largely based on the working area, and background of the gold

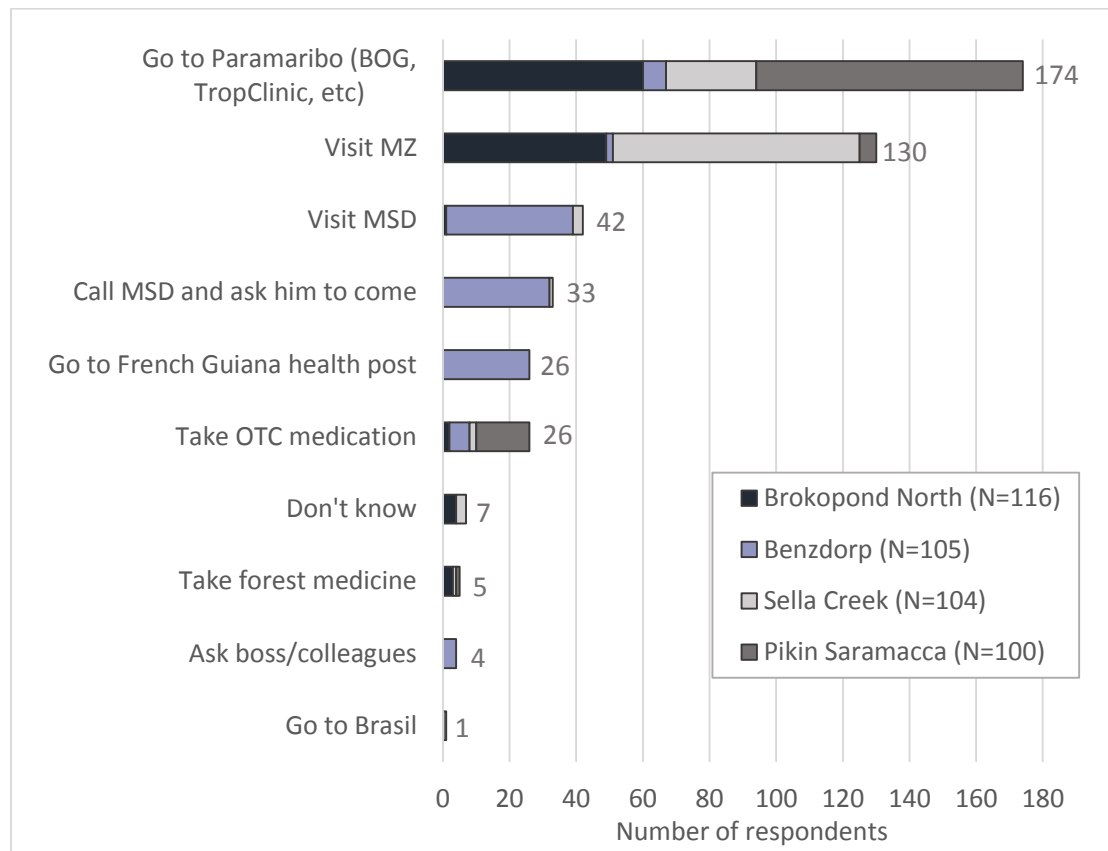
<sup>11</sup> 55.5% of Surinamese named BOG, versus 6.5% of migrants ( $X^2$ ,  $p<0.001$ )

<sup>12</sup> Family physicians do not test for malaria, but recommend patients to one of the medical labs.

miners in that area (Figure 11). For example in Brokopondo and Sella Creek, where almost all gold miners are Surinamese of Maroon ethnic descent, a large share of respondents reported that they would visit the nearest MZ clinic (resp. 42.2%,  $N_{total}=116$  and 71.2%,  $N_{total}=104$ ). In the Benzdorp area, by contrast, only two persons named MZ. Because of their relatively easy access to Paramaribo, the largest share of Brokopondo and Pikin Saramaka respondents reported that they would go to the city if they would feel ill with suspected malaria (resp. 51.7% and 80%).

Inhabitants of the Benzdorp area indicated that they would either call or visit and MSD (resp. 30.5% and 36.2%), or else go to a French Guiana health post (21.9%) if they would fall ill with suspected malaria ( $N_{total}=105$ ). In the other regions, no one mentioned French Guiana, and also seeking MSD services was hardly mentioned (Figure 11).

Figure 11. Actions respondents anticipated taking if they were to fall ill with malaria at this very moment, by SSGM area



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 only* cause of malaria<sup>13</sup>, AND
2. Listed at least one symptom of malaria, AND
3. Named at least one effective method to protect oneself against malaria, AND
4. Knows where to go for malaria testing and treatment.

With regard to the latter point (4), we only included persons who could name a correct Test & Treat facility in the Suriname.

In total, 46.6 percent of respondents displayed optimal malaria knowledge (N<sub>total</sub>=322). That is, they named the mosquito as *the only* cause of malaria AND they named at least one malaria symptom AND they knew at least one valid measure to protect oneself against malaria AND they knew where to find malaria testing and treatment services near their location at the time of the interview (Table 8).

The data displayed no significant differences in malaria knowledge between migrants and Surinamese, or between women and men.

*Table 8. Proportion of the target population with optimal malaria knowledge (Global Fund Indicator)*

Proportion of respondents who	%	N
Knows that malaria is caused by a mosquito (and no other causes)	71.1%	425
Can name at least one symptom of malaria	88.5%	425
Knows at least one way to protect oneself against malaria	86.2%	421
Is informed about where to get malaria treatment in Suriname	76.2%	424
<b>Has optimal malaria knowledge:</b>	<b>46.0%</b>	<b>420</b>

### 3.5 Perceptions

Behaviour is partly shaped by knowledge, but also in large part driven by perceptions. Indeed, beliefs and perceptions of risk, in this case malaria risk, act as mediators between knowledge and behaviour factors.

Respondents’ perceptions of malaria risks were measured by asking people whether: (a) they believed that there was still malaria in the SSGM area they worked in; (b) were worried about malaria; and (c) believed that it would be possible to eradicate malaria from Suriname altogether. With regard to the first question, 57.9 percent of respondents believed that there was no malaria anymore in the area they worked in (N<sub>total</sub>=425). Several others were more careful, stating that if there was malaria, it was very little (1.2%); that there was “maybe” still malaria (2.1%); that one cannot be 100 percent certain (0.5%); or that they did not know (6.4%). Slight difference were noticeable between the different SSGM regions, with

<sup>13</sup> exclusively persons who named only the mosquito and no other supposed cause(s) for malaria were counted



inhabitants of Pikin Saramacca being relatively most confident about the absence of malaria in this area (71%), versus 49.5 percent in the Benzdorp area. This difference is logical, since the larger Benzdorp area, especially the gold miners' settlements along the border with French Guiana, is among the areas in Suriname with most registered malaria cases. There were no significant differences between Surinamese and migrants, or between women and men, with regard to these perceptions.

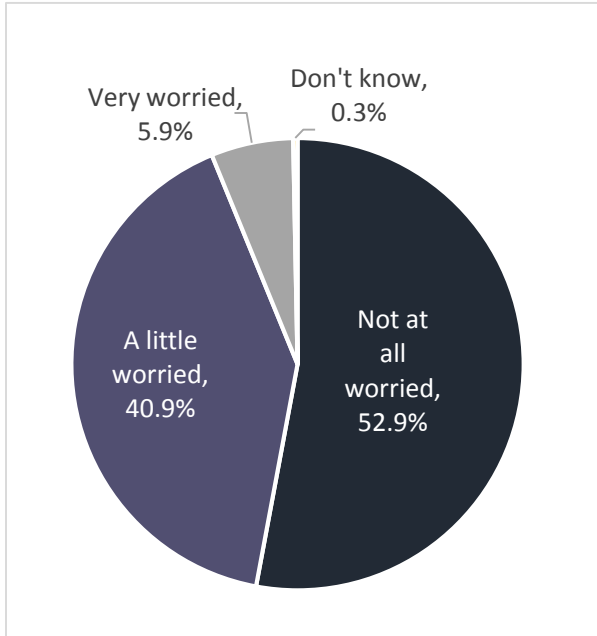


Figure 12. Responses to the question: "Are you worried about the risk of contracting malaria?"

Given the considerable share of respondents who believed that their working area was malaria-free, it is not surprising to find that a slight majority of surveyed inhabitants of mining areas indicated not to be worried at all about malaria (52.4%;  $N_{total}=420$ ; Figure 11). Only 7.9 percent of surveyed inhabitants of SSGM areas indicated that they were very worried about the risk of contracting malaria.

A majority of respondents believed that it is possible to completely eradicate malaria from Suriname (62.6%;  $N_{total}=425$ ). The individuals who voiced this opinion mostly provided as motivation that there is hardly any malaria anymore (27.1%;  $N_{total}=266$ ). Respondents also indicated that it has happened in other countries (10 persons, 3.8%).

Other mentioned reasons were more like conditions that needed to be in place for malaria elimination to happen. Most often mentioned were:

- If everyone collaborates and behaves responsibly (15%).
- With continued malaria control efforts / work of the Malaria Program (16.5%).
- If they spray the forest/gold mining areas with insecticide (9.4%).
- With more information/awareness campaigns (9.4%).
- If distribution of bed nets and dispensing of medication continues (3.4%).

Many individuals named other reasons and preconditions, including the need to protect the borders, more research, genetic manipulation of mosquitos, there are many ways to protect oneself, and so forth.

Just under one third of interviewees voiced the opinion that malaria elimination in Suriname is impossible (30.5%;  $N_{total}=425$ ). The four main reasons for this stance were that:

- The forest is huge / you cannot get to everywhere/ there are many isolated places where there is still malaria (26%).
- You cannot kill all mosquitos (25.2%).
- There will always be cases coming from across the borders/ the borders are open (11.4%)
- You can control but not eliminate; there will always be breeding places (6.5%)
- It is difficult (5.7%)
- There will always be people who do not collaborate (2.4%)

( $N_{total}=123$ )

Also here, many respondents named other reasons for their belief that malaria cannot be eliminated from Suriname, including: Malaria has been here since I was young; It is too expensive/the government cannot afford it; It is part of nature; It will always come back; and It continues to breed.

### 3.6 Practices

In earlier malaria studies in Suriname SSGM areas it was concluded that enhanced malaria knowledge does not necessarily lead to malaria risk avoidance behaviour in the form of increased bed net usage. This observation was also made in the current study. In section 3.4 it was shown that 86.2 percent of respondents was able to name a valid strategy to protect oneself against malaria. Nevertheless, when respondents were asked what they themselves had done in the week preceding the interview to protect themselves against malaria, half of respondents (50.1%) reported that they had not done anything ( $N_{total}=425$ ).

Respondents who had taken action to protect themselves against malaria, most often reported that they had slept with a bed net (38.8%;  $N_{total}=425$ ). Smaller numbers of surveyed gold miners and mining service providers had: used repellent (4.7%); kept the surroundings clean/cleaned breeding places (3.5%); used a mosquito candle/incense/insecticide spray (6.4%); covered with a sheet at night (1.6%); worn long sleeves (1.6%); or not drunk polluted water/water with larvae (1.5%) ( $N_{total}=425$ ). Very few individuals used home/bush remedies, such as “bita” (a bitter plant extract) or some drips of creoline (cleaning agent) in the drinking water.

The data show significant differences in malaria prevention behaviour between different areas. Whereas less than a third of respondents from Brokopondo had taken measures to protect themselves from malaria (31.9%;  $N_{total}=116$ ), in Benzdorp two-thirds of interviewees reported the use of malaria prevention strategies in the week preceding the interview (64.8%;  $N_{total}=105$ ).

Comparing women and men, one observes that women are less likely than men to do “nothing” to protect themselves against malaria, and are more likely to sleep with a bed net and use repellent (Figure 13).

An important international malaria research indicator is the proportion of the target population that slept under an LLIN the previous night. Table 9 lists the value of this indicator, as well as values for related indicators, in total and by gender.

Figure 13. Measures respondents had taken to protect themselves from malaria in the week preceding the interview, by gender

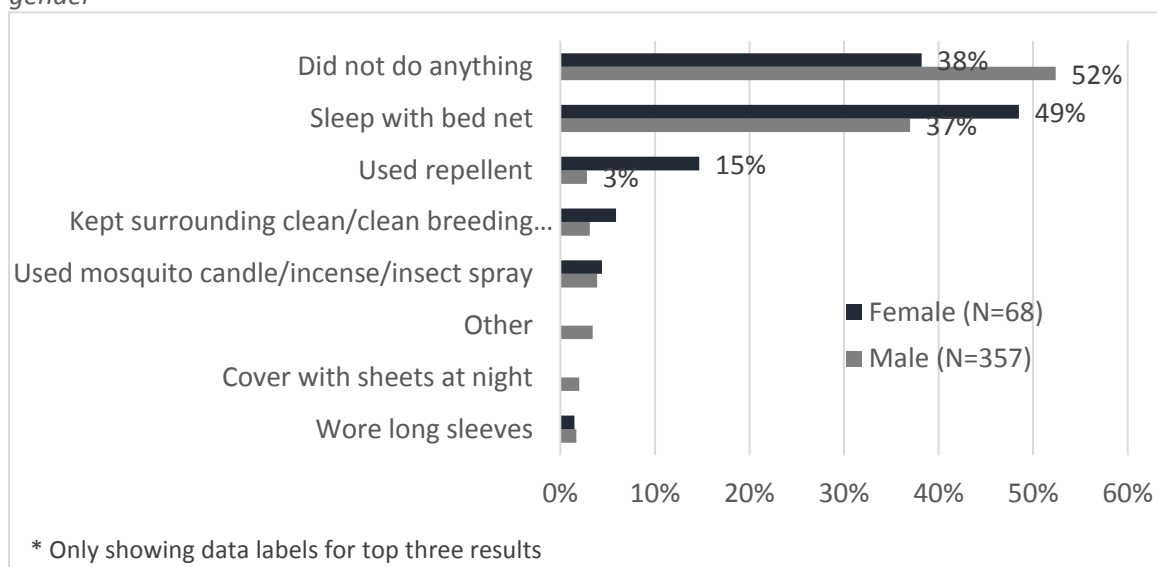


Table 9. Bed net use

Indicator	Women	Men	Total
N	68	357	425
% of interviewees who possess a bed net (any type)	69.1%	53.3%	55.8% <sup>1</sup>
% of interviewees who possess an LLIN	51.5%	43.7%	45% <sup>2</sup>
% of interviewees who had slept under a bed net in the night prior to the interview	59.7%	41.7%	44.6%
Global Fund Indicator: % of interviewees who had slept under a LLIN in the night prior to the interview	41.2%	35.3%	36.2%
% of interviewees who had slept with a bed net consistently in the week prior to the interview	57.4%	40.1%	42.8%

<sup>1</sup> 3.3% of respondents reported possessing more than 1 bed net

<sup>2</sup> 43.5% of total sample had obtained LLIN from MP; 0.9% had obtained an LLIN from MZ; and two persons reported that the LLIN was already present in their room when they arrived at their work location.

A little over half of the surveyed inhabitants of SSGM areas possessed a bed net, any type. Thanks to the many bed nets that have been distributed by the Suriname Malaria Program<sup>14</sup>, 45 percent of respondents indicated that they owned an LLIN (N<sub>total</sub>=425; Table 8). This figure exceeds the share of respondents who reported possession of an LLIN in any previous malaria KAP study (2010, 20112, 2015 and 2016).

Indeed, the results suggest that the Malaria Program LLIN distribution program pays off. Four out of every five individuals who had slept with a bed net in the night prior to the interview, had obtained this bed net from the Malaria Program

<sup>14</sup> The Medical Mission (MZ) also has distributed LLINs, but these efforts focused on the traditional communities in the interior, and less than 1 percent of the respondents from the present survey reported having obtained an MZ bed net.

(78.8%<sup>15</sup>, N<sub>total</sub>=189). Also, the data show that **80.5 percent of persons who possessed a bed net from the Malaria Program had slept with a bed net in the night preceding the interview, versus only 16.7 percent of persons who had not obtained an MP bed net.** Similarly, 77.8 percent of those in possession of a Malaria Program LLIN had used this bed net consistently in the week preceding the interview, while only 15.8 percent of others had slept with a bed net every night of the week. These figures suggest that obtaining a free LLIN *does* motivate inhabitants of SSGM areas in Suriname to use a bed net.

Several factors affect the likelihood of individuals sleeping with a bed net. In the first place, gender plays a role; women were more likely than men to sleep with a bed net (resp. 57.4%, N<sub>total</sub>=68 vs. 40.1%, N<sub>total</sub>=357). This difference is partly due to relatively more women than men buying their own bed net to take to the mining area; 16.2 percent of women versus 8.5 percent of men reported possession of a bed net that they had bought in the supermarket. When only considering persons who possessed an LLIN, the shares of women and men sleeping with an LLIN were equal (resp. 76.5% and 78.7%).

Secondly, we find 59.5 percent of migrants versus only 33 percent of Surinamese inhabitants of SSGM areas slept with a bed net in the night preceding the interview; this difference is statistically significant (N<sub>total</sub>=425;  $\chi^2$ , P<0.001). We have no explanation for this observation, other than migrants dominated the mining areas with relatively more malaria cases.

A third factor of influence is where the person sleeps: in a hammock or in a bed. In the night prior to the interview, 53.3 percent of respondents had slept in a hammock and 46.0 percent had slept in a bed (N<sub>total</sub>=424). The remaining three persons had slept in the car, in a tent, or not slept at all. The data suggest that those who slept on a bed were significantly more likely than those who slept in a hammock to have used a bed net in the night preceding the interview (resp. 61.9% vs. 30.1%,  $\chi^2$ , p<0.001). This finding is curious, because the Malaria Program LLINs, which are the predominant type of bed net possessed by mining area inhabitants, were designed specifically for use with a hammock. The fact that people sleeping in a hammock may be more likely to be in temporary camps and less “settled”, may play a role.

Persons not consistently sleeping with a bed net in the previous week were asked why not. Just over half of individuals among those who had not slept with a bed net, named as their main reason that they did not have a bed net (53.7%). Others indicated that they felt too warm/suffocated under a bed net (15.3%), just did not like it (10%) or were not used to it (3.2%). The perception that there is no malaria anymore (4.2%), and the feeling that there are no mosquitos (6.2%), also play a role (N<sub>total</sub>=238; Table 10). Other reasons were mentioned by fewer individuals.

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<sup>15</sup> This is excluding the two persons who found a bed net in their room/camp when they arrived at their work locations

Table 10. Reasons for not sleeping with a bed net in the week prior to the interview (N=238)

Reason for not consistently using a bed net	N	%
I do not have a bed net	128	53.8%
To warm/stuffy/suffocating	41	17.2%
Just do not like it	23	9.7%
There are not a lot of mosquitos/not bothered by mosquitos	15	6.2%
There is no malaria anymore	10	4.1%
Just not used to it	7	2.9%
I used other measures to keep mosquitos away, e.g. screens, fan, mosquito candle	7	2.9%
It is inconvenient when I travel/move around	6	2.5%
Other; I want to be able to look out, I am allergic, my bed net is ripped, I lent my bed net to someone else, I was in Paramaribo, I worked at night, nonchalance/just not thought of it, I wanted to read, etc.	26	10.9%

All respondents were asked what they, in general, considered to be disadvantages of sleeping with a bed net. Three-quarters of respondents, including persons who did not use a bed net themselves, indicated that there were no general disadvantages (76.2%;  $N_{\text{total}}=425$ ). The main disadvantages mentioned included that a bed net is to warm/stuffy/suffocating (16.9%), that it prevents one from escaping rapidly (e.g. when a tree falls) (4.2%), and that it is inconvenient when one is mobile/moving around a lot (1.4%). Other general disadvantages were mentioned by just one or two individuals and included, among others, “I do not feel free”, “It is annoying when you have to use the restroom at night”, and “I get an allergic reaction/itchiness”.

Persons who had indicated that they had slept with a bed net at least once in the month prior to the interview were asked about their main and secondary motivations to do so. Their answers are listed in Table 11.

Table 11. Reasons for using a bed net at least once in the month prior to the interview (N=246)

Protection against ...	Main motivation	Secondary motivations
Mosquitos	125 (50.8%)	43 (17.5%)
Any (other) insects	18 (4.2%)	81 (32.9%)
Bats	22 (5.2%)	95 (38.6%)
Malaria	69 (28%)	16 (6.5%)
All pests and insects	2 (0.8%)	4 (1.6%)
Various diseases (dengue, chikungunya, zika, malaria)	4 (1.6%)	19 (7.7%)
Snakes	1 (0.4%)	5 (2.0%)
Other (e.g. general health, slept elsewhere, scorpions, against cold, just likes it, feels safe/protected)	5 (2%)	7 (2.8%)
No other motivations		43 (17.5%)

The main reason for using a bed net was to protect oneself against mosquitos. This was the primary motivation for half of respondents (50.8%) and a secondary motivation for another 17.5% of persons who had used a bed net at least once during the past month ( $N_{\text{total}}=246$ ). Another important reason to use a bed net is to protect oneself against any (other) insects, including cockroaches, spiders, and so forth, or to protect oneself against any pests or insects in general. In this

context, several individuals specifically mentioned protection against bats, which have been a nuisance in different SSGM areas (Table 10).

Respondents were asked what they believed could be done to motivate more inhabitants of SSGM areas to use a bed net. Twenty-eight persons (6.6%;  $N_{\text{total}}=425$ ) indicated that nothing could be done. They often explained that gold miners do not listen anyways, and whatever you say, they will not change their behaviour. Others did believe that something could be done. By far the most frequently recommended strategy was providing more information about the advantages/awareness campaign (70.8%). Some individuals added that information could be provided through TV and radio, personal conversation with gold miners, through gold miners' groups (e.g. Makambo in Koffiekamp), and more frequent visits to the SSGM areas. It also was mentioned that it is important to use visual materials in BCC. In this context, respondents also suggested informing people that bed nets can also be used to protect oneself against bats and other pests, not only mosquitoes and malaria.

The distribution of bed nets was the second most often mentioned way to motivate gold miners to use bed nets (14.6%;  $N_{\text{total}}=425$ ). Other strategies were mentioned by fewer individuals and included: making bed nets from other material or with larger openings to make them less stuffy (2.4%); involving camp bosses/equipment owners (1.2%); more control and monitoring (0.7%); having persons provide the correct example (0.5%), and issuing a law to oblige bed net use (1 person).

### 3.7 Other medical services

Apart from the Malaria Program MSD, there are no public health services available in the Suriname SSGM areas. When asked about the most pressing needs in terms of health care provision, the largest share of respondents reported the need for a general clinic (40.8%), a family physician (22.2%) and a place to perform lab tests/blood tests (20%;  $N_{\text{total}}=424$ ). Others indicated the need for a first aid clinic (5.7%). Other public health needs were mentioned only once or twice and included a dentist, an ambulance, treatment of leishmaniasis, a doctor who can stitch, a hospital, a traditional healer, and Non Communicable Diseases treatment (i.e. diabetes, blood pressure). Six persons were of the opinion that in their area, no more health services were needed. Twenty persons indicated that it was not necessary to provide additional health services because they would just travel to Paramaribo (Pikin Saramacca and Brokopondo) or French Guiana (Benzdorp) if they needed medical assistance (4.7%).

The last time respondents had needed medical assistance in the SGM area, they had mostly sought treatment in Paramaribo (14.6%), in French Guiana (13.2%) or at an MZ clinic in one of the interior communities (10.6%;  $N_{\text{total}}=424$ ), or they had treated themselves with OTC medication (10.6%). Smaller shares of persons had used forest medicine, relied on Malaria Program staff, gone abroad (Brasil, Guyana), or just waited until it passed. Almost half of respondents reported that they had not needed medical assistance in the SSGM areas since working there (46.8%;  $N_{\text{total}}=425$ ).

## 4. Conclusions

This study presented data on knowledge, attitudes and practices with regard to malaria and the Suriname Malaria Program, among gold miners and mining service providers in Suriname. Surveys were conducted among a non-random sample of inhabitants of four Suriname SSGM areas. Given that the selected mining areas covered a range of local SSGM contexts (e.g. far from the city versus nearby; mostly migrant miners versus mostly nationals), and because survey respondents were interviewed dispersed across the selected areas, researchers are confident that the results are representative for the Suriname SSGM sector at large.

One conclusion that may be drawn from this study is that malaria is of minimal concern in Suriname SSGM areas. Over 90 percent of respondents had either never suffered from malaria, or else been ill with malaria more than seven years ago.



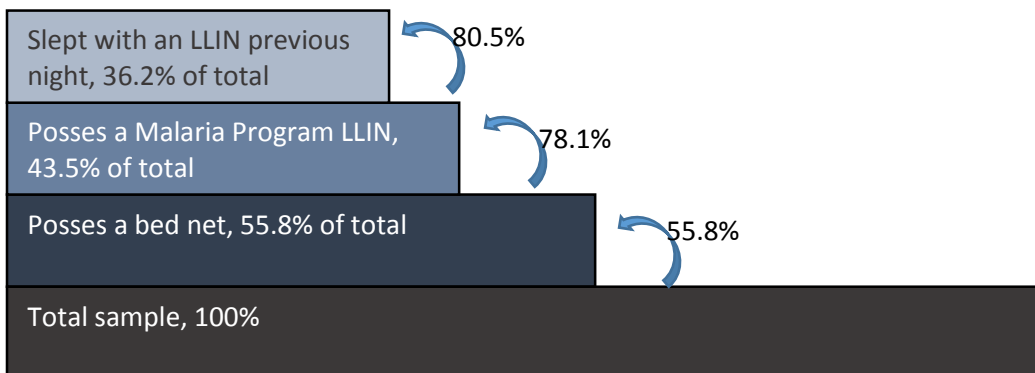
No single person in the complete sample had been ill with malaria in the year of the interview or the previous year (2017-18). Of those persons who had been infected with malaria relatively more recently, about one third had become ill abroad, and another third had become ill in the Suriname-French Guiana border area. More than half of respondents (58%) believed that there was no malaria anymore in the area where they worked, and a similar share of individuals were not at all worried about malaria risks. These outcomes, coupled with Suriname malaria statistics of recent years (Figure 2), speak to the success of the Malaria Program in working towards malaria elimination.

The limited presence of malaria in gold miners' everyday lives has affected the outcomes of this study. Indeed, the data suggest that knowledge of Suriname malaria Test & Treat locations –including the Malaria Program TropClinic- is limited not because of poor outreach, but simply because respondents did not need these places. The low malaria threat in Suriname SSGM areas must be taken into account in interpreting the results.

A second conclusion of this study is that, even though bed net use is still far from universal, the Malaria Program LLIN distribution campaign has had a measurable positive impact on bed net use. In two past malaria KAP studies in the Suriname-French Guiana border region, bed net use was found to be very low; 12.8 percent in 2015 and 13.8 percent in 2016<sup>16</sup>. These studies were conducted among inhabitants of SSGM area who mostly worked in French Guiana SSGM areas. In comparison, in the present study among a more “typical” sample of persons living and working in Suriname SSGM areas, the share of persons who reported using a bed net was much higher: 45 percent. Thirty-six percent of respondents had slept with an LLIN in the night preceding the interview.

Four out of every five individuals among those who had slept with a bed net in the night prior to the interview, had obtained this bed net from the Malaria Program (Figure 14). Also, the data show that 81 percent of persons who possessed a bed net from the Malaria Program had slept with a bed net in the night preceding the interview, versus only 17 percent of persons who did not possess a MP bed net (Figure 14). Also, 78 percent of those in possession of a Malaria Program LLIN had used this bed net consistently in the week preceding the interview, while only 16 percent of others had slept with a bed net every night of the week preceding the interview.

Figure 14



Reasons to not use a bed net included perceptions that there is no malaria anymore, and that there are no mosquitoes. Hence, ironically, the success of the Malaria Program in eliminating malaria simultaneously threatens its efforts; in light of the perceived absence of malaria, inhabitants of mining areas do not feel the need to use a bed net. This finding suggests that in motivating inhabitants of SSGM to use an LLIN, emphasis should be on bed net benefits other than protection against malaria. These benefits include protection against all kinds of insects and pests, protection against a variety of

<sup>16</sup> Share of persons who had slept with a bed net in the night prior to the interview.

mosquito-borne diseases, and protection against bats. Many of those who used a bed net already indicated that they used it for such purposes.

A third conclusion is that, as compared to 2010, malaria knowledge has improved on all fronts. Relatively more individuals can name the cause of malaria, symptoms, protective measures and places to take a malaria test. Also these improvements can be attributed to the Malaria Program, which has had a consistent presence in virtually all Suriname SSGM areas since 2010. Nevertheless, in the area of Behaviour Change Communication (BCC) there is room for improvement. Even though the Malaria Program visited most areas in the months prior to the survey, less than half of respondents conveyed that they had received information about malaria in the past six months. Strengthened integration of BCC in regular MP health outreach activities can contribute to education of the target population on malaria and motivate bed net use. In this context, it is important that the inhabitants of SSGM areas understand that the virtual absence of malaria in their surroundings constitutes a vulnerable status quo, which can change very rapidly if people do not consistently protect themselves and their environment.

Finally, the study revealed significant differences between different SSGM areas, based on their location, accessibility, and ethnic composition of the mining population. In the Benzdorp area, which is situated relatively near the Suriname-French Guiana border, malaria is a latent threat due to the influx of gold miners working in French Guiana. In this area, the target population was much better aware of the location of MSDs and other Malaria Program activities as compared to, for example, gold miners in Sella Creek, where there has not been a single case of malaria in the past five years. When asked about places to test for malaria, the –mostly Suriname- gold miners and mining service providers in Sella Creek and Brokopondo typically referred to the Bureau of Public Health (BOG) and the Medical Mission clinics in the traditional communities. These locations were rarely mentioned by migrant gold miners, who formed the majority of the population in the Benzdorp area and Pikin Saramacca. Migrant miners were much more familiar with the –Portuguese speaking- MSD and Malaria Program staff. Others reported that they did not know and would just ask around when the need presented itself. These area differences must be taken into account in both Malaria program outreach activities, and future studies among the target population.

## References

Heemskerk, M. (2010). *“Searching for gold, finding malaria”*. Baseline study in three small-scale gold mining areas in the Suriname interior. Report produced for the Suriname Malaria Program. Paramaribo, Suriname.

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

Heemskerk, M., and C. Duijves (2015). *Malaria elimination: expanding test, track and treat in mining areas. Impact study on the MSD strategy*. Baseline Report submitted to the Ministry of Health, Malaria Programme. Paramaribo, Suriname

Heemskerk, M. E. Negulic, and Celine Duijves (2016). *Reducing the Use and Release of Mercury by Artisanal and Small Scale Gold Miners in Suriname*. Review of the Suriname ASGM sector. Report produced for the Artisanal Gold Council. Paramaribo, Suriname.

Heemskerk, M., and C. Duijves (2016). *Malaria Elimination: Expanding test, track and treat in mining areas. Impact study on the MSD strategy*. Final evaluation report submitted to the Ministry of Health, Malaria Programme. Paramaribo, Suriname

# Annexes

## 1. Survey form

**Inclusie van de respondent:** Stel de vragen hieronder om te bepalen of de respondent kan meedoen aan het onderzoek;

Heb je in het afgelopen jaar op de goudvelden in Suriname gewerkt?

1. Ja                      2. Nee (Participant is geen deel van de target groep. Beëindig het interview).

Ben je 18 jaar of ouder?

1. Ja                      2. Nee (Participant is geen deel van de target groep. Beëindig het interview)

Datum: \_\_\_\_\_ Gebied: \_\_\_\_\_ Kamp/Locatie \_\_\_\_\_

1. Gender (omcirkel) : 0 = Vrouw      1 = Man

2. Wat is je geboortedatum (vul in: dag/maand/jaar) :    . . / . . / . . . .

3. Waar ben je geboren?

1. Suriname  
Ga verder met Q4

2. Brazilië  
3. Guyana  
4. China  
5. Dominicaanse Republiek  
88. Anders, namelijk: \_\_\_\_\_

} Ga naar Q5

4. Wat is je etniciteit?

1. Marron  
2. Creool  
3. Hindoestaan  
4. Javaan

- 88: Anders, nl: \_\_\_\_\_  
77. Niet van toepassing

5. Wat is op dit moment je belangrijkste bezigheid in dit goudwinningsgebied? (Slechts één antwoord kiezen)

1. Goudzoeker (arbeider)                      5. Cabaret eigenaar                      9. Kok  
2. Goudzoeker (machine eigenaar)                      6. Winkelmedewerker                      10. Reizend verkoper  
3. Sekswerker                      7. Winkel eigenaar                      88. Anders, nl: \_\_\_\_  
4. Transport aanbieder                      8. Vrouw van goudzoeker, geen inkomen

6. Wanneer ben je voor het eerst in de goudsector gaan werken?

1. Tussen 1 en 2 jaar geleden (2016-2017)  
2. Tussen 2 en 5 jaar geleden (2013-2015)  
3. Tussen 5 en 10 jaar geleden (2008-2012)  
4. Meer dan 10 jaar geleden (voor 2008)

7. In welke landen heb je in de goudsector gewerkt in de afgelopen 5 jaren (2013-2017)? (Meerdere antwoorden mogelijk, omcirkel alles wat van toepassing is)

- |                 |             |                      |
|-----------------|-------------|----------------------|
| 1. Suriname     | 3. Brazilië | 5. Anders, nl; _____ |
| 2. Frans Guyana | 4. Guyana   |                      |

8. Heb je in de afgelopen 6 maanden berichten gezien of gehoord over malaria?

0. Nee, Ga naar 11      1. Ja      99. Weet niet

9. Als je een bericht hebt gezien of gehoord, van wie was dit bericht afkomstig? (omcirkel alles wat van toepassing is – GEEN antwoorden oplezen)

- |   |                            |
|---|----------------------------|
| 1. MSD/malariawerker op de goudvelden       | 5. Poster op de goudvelden |
| 2. Malaria kliniek Anamoestraat/Geyersvlijt | 6. Vrienden/Familie        |
| 3. Surinaamse TV                            | 77. Niet van toepassing    |
| 4. Surinaamse Radio                         | 88. Anders, nl:            |

10. Als je een bericht hebt gezien of gehoord, waar ging dit over? (omcirkel alles wat van toepassing is – GEEN antwoorden oplezen)

- |   |                                       |
|---|---------------------------------------|
| 1. Malaria is gevaarlijk                  | 5. Als je je ziek voelt, doe een test |
| 2. Malaria is dodelijk                    | 6. Maak je kuur af                    |
| 3. Malaria wordt door muskieten verspreid | 7. Houd je omgeving schoon            |
| 4. Slaap onder een klamboe                | 77. Niet van toepassing               |
|   | 88. Anders, nl: _____                 |

11. Herken je deze logo's (laat zien)? (omcirkel alles wat van toepassing is)

- |  |                 |
|--|-----------------|
| 0. Nooit één van gezien - > GA NAAR 13 | 3. Nr. 3 gezien |
| 1. Nr. 1 gezien                        | 4. Nr. 4 gezien |
| 2. Nr. 2 gezien                        |                 |

12. Bij welke organisatie hoort dit logo? (ALLEEN vragen voor logo's die genoemd zijn bij 11).

1. Logo Nr. 1 is het logo van: \_\_\_\_\_
2. Logo Nr. 2 is het logo van: \_\_\_\_\_
3. Logo Nr. 3 is het logo van: \_\_\_\_\_
4. Logo Nr. 4 is het logo van: \_\_\_\_\_
77. Niet van toepassing
99. Weet van geen enkel logo welke organisatie er bij hoort.

13. Wat denk je dat de oorzaak is van malaria? (omcirkel alles wat van toepassing is – GEEN antwoorden oplezen)

- |   |                       |
|---|-----------------------|
| 1. Prik/beet van een (malaria) muskiet            |                       |
| 2. Drinken van vies/vervuild water (rivier/kreek) |                       |
| 3. Dichtbij vies/vervuild water zijn              | 99. Weet niet         |
| 4. Vieze omgeving (afval)                         | 88. Anders, nl: _____ |

14. Kun je symptomen van malaria noemen? (omcirkel alles wat van toepassing is – GEEN antwoorden oplezen)

- |                                   |                  |                       |
|-----------------------------------|------------------|-----------------------|
| 1. Hoofdpijn                      | 6. Bittere smaak | 99. Weet niet         |
| 2. Koorts                         | 7. Geen eetlust  | 88. Anders, nl: _____ |
| 3. Koud gevoel/beven              | 8. Diarree       |                       |
| 4. Gevoel van zwakte/vermoeidheid | 9. Spierpijn     |                       |
| 5. Braken/misselijkheid           | 10. Lichaamspijn |                       |

15. Wanneer heb je voor het laatst malaria gehad (de **laatste** keer)?
1. Nooit gehad
  2. Afgelopen jaar (2017-2018)
  3. 2-3 jaar geleden (2015-2016)
  3. 4-6 jaar geleden (2012-2014)
  4. 7-10 jaar geleden (2008-2011)
  5. Meer dan 10 jaar geleden (2007 of langer terug)
  99. Weet niet
16. Waar was je de laatste (meest recente) keer dat je malaria had?
1. In dit goudwinningsgebied: \_\_\_\_\_ (Naam gebied)
  2. In een ander Surinaams goudwinningsgebied: \_\_\_\_\_ (Naam gebied)
  3. Ander land/locatie, nl: \_\_\_\_\_
  77. Niet van toepassing, nooit malaria gehad
  99. Weet niet/kan me niet herinneren
17. Hoe vaak heb je (vermoedelijk) malaria gehad?
1. Eenmalig
  2. 2-3 keer
  3. 4-6 keer
  4. > 6 keer
  5. Ben nooit beter geworden / heb malaria in mijn lichaam
  88. Anders: \_\_\_\_\_
  77. Niet van toepassing, nooit malaria gehad
  99. Weet niet/kan me niet herinneren
18. Hoe kan IEMAND zichzelf tegen malaria beschermen? (omcirkel alles wat van toepassing is – GEEN antwoorden oplezen)
1. Het is niet mogelijk jezelf te beschermen
  1. Onder klamboe slapen
  2. Muskietenbeet voorkomen
  3. Muskieten kaars gebruiken
  4. Gebruik van Baygon etc. (insecten spray)
  5. Geen vies/vervuild water drinken (kreek/rivier)
  6. Zijn/haar omgeving schoonhouden
  7. Muskieten crème gebruiken
  8. Wegblijven van vies/vervuild water
  88. Anders, nl: \_\_\_\_\_
  99. Weet niet
19. Wat heb JIJ afgelopen week gedaan om JEZELF te beschermen tegen malaria? (omcirkel alles wat van toepassing is – GEEN antwoorden oplezen)
1. Niets gedaan
  1. Onder klamboe geslapen
  2. Geen vies/vervuild water gedronken (kreek/rivier)
  3. Muskietenkaars gebrand
  4. Baygon etc. gebruikt (insecten spray)
  6. Mijn omgeving schoon gehouden
  7. Muskieten crème gebruikt
  8. Weggebleven van vies/vervuild water
  88. Anders, nl: \_\_\_\_\_
  99. Weet niet
20. Heb je afgelopen nacht in een bed of in een hangmat geslapen?
1. In een bed
  2. In een hangmat
  88. Anders, nl: \_\_\_\_\_

21. Heb je (bezit je) een klamboe hier op de goudvelden?

1. Nee -> **GO TO 23**
2. Ja, ik heb er 1
3. Ja ik heb er méér dan 1

22. Hoe ben je aan deze klamboe(s) gekomen? (omcirkel alles wat van toepassing is – GEEN antwoorden oplezen)

77. N.v.t. Ik heb geen klamboe

1. Ik heb een (groene) klamboe van Malaria Programma gekregen
2. Ik heb een klamboe van MZ gekregen
3. Ik heb een klamboe in de supermarkt gekocht.
4. Een vriend/familie heeft het voor me gekocht.
88. Anders, nl: \_\_\_\_\_
99. Weet niet/kan me niet herinneren

23. Heb je afgelopen nacht onder een klamboe geslapen?

1. Ja                      0. Nee **GO TO 26**                      99. Ik weet het niet

24. Als je afgelopen nacht onder een klamboe hebt geslapen, was dit dan een geïmpregneerde klamboe? (LEG UIT WAT HET BETEKENT DAT EEN KLAMBOE GEÏMPREGNEERD IS)

0. Nee  
1. Ja  
99. Ik weet het niet  
77. N.v.t.: Heb niet onder klamboe geslapen

25. Heb je in de afgelopen week elke nacht onder een klamboe geslapen?

0. Nee  
1. Ja **GA NAAR 27**  
99. Ik weet het niet  
77. N.v.t.: Heb niet onder klamboe geslapen afgelopen nacht

26. Als je niet iedere nacht van de afgelopen week onder een klamboe hebt geslapen, waarom dan niet? (omcirkel alles wat van toepassing is – GEEN antwoorden oplezen)

1. Te warm/te benauwd
2. Ik heb geen klamboe
3. Ik hou er gewoon niet van
4. Er is geen malaria meer
4. Ik wil om me heen kunnen kijken/kunnen zien
5. Het is onhandig wanneer ik reis/me veel verplaats
6. Ik ben allergisch/ kan niet tegen de geur
88. Anders, nl: \_\_\_\_\_

27. Wat beschouw je in het algemeen als nadelen van het slapen onder een klamboe? (omcirkel alles wat van toepassing is – GEEN antwoorden oplezen)

1. Geen nadelen
2. Te warm/te benauwd
3. Teveel bagage om mee te dragen
4. Je kan niet snel bewegen, bv. om te ontsnappen van een vallende boom
4. Muskieten bijten toch wel, ondanks de klamboe
5. Het is onhandig wanneer ik reis/me veel verplaats
88. Anders, nl: \_\_\_\_\_
99. Weet niet

28. Als je in de afgelopen maand in ieder geval één keer onder een klamboe hebt geslapen, wat was dan de belangrijkste reden om dit te doen? (ÉÉN ANTWOORD – GEEN antwoorden oplezen)

1. Bescherming tegen malaria
2. Bescherming tegen andere ziektes (Zika, Dengue, Chikungunya)
3. Bescherming tegen muskieten
4. Bescherming tegen andere insecten (spinnen, kakkerlakken)
5. Bescherming tegen vleermuizen
88. Anders, nl.: \_\_\_\_\_

77. N.v.t. Ik heb de afgelopen maand niet onder een klamboe geslapen.

29. Als je in de afgelopen maand tenminste één keer onder een klamboe hebt geslapen, wat waren andere redenen om dit te doen? (Omcirkel alles wat van toepassing is – GEEN antwoorden oplezen)

1. Geen andere redenen
2. Bescherming tegen malaria
3. Bescherming tegen andere ziektes (Zika, Dengue, Chikungunya)
4. Bescherming tegen muskieten
5. Bescherming tegen andere insecten (spinnen, kakkerlakken)
6. Bescherming tegen vleermuizen

88. Anders, nl.: \_\_\_\_\_

77. N.v.t. Ik heb de afgelopen maand niet onder een klamboe geslapen.

30. Wat kan gedaan worden om meer mensen te motiveren om een klamboe te gebruiken? VERWIJS TERUG NAAR ANTWOORDEN IN Q27)(Omcirkel alles wat van toepassing is – GEEN antwoorden oplezen)

1. Niets
2. Klamboes maken van andere stof/ander materiaal
3. Maak klamboes groter zodat ze over een 2-persoons bed passen
4. Meer informatie over voordelen/belang van de klamboe

88. Anders, nl: \_\_\_\_\_

99. Weet niet

31. Als je op dit moment malaria symptomen zou beginnen te voelen, wat zou je doen? (Omcirkel alles wat van toepassing is – GEEN antwoorden oplezen)

1. Een MSD bellen en hem/haar vragen om me te komen testen
2. Een MSD opzoeken om te testen
3. Naar de dichtstbijzijnde MZ poli gaan, in: \_\_\_\_\_
4. Medicijn nemen zoals Artecom, dat ik zonder recept kan kopen
5. Naar een kliniek in Frans Guyana gaan

88. Anders: \_\_\_\_\_

99. Weet niet

32. Weet je waar je in Suriname terecht kunt voor testen op en behandeling van malaria? Zo ja, waar? (Omcirkel alles wat van toepassing is – GEEN antwoorden oplezen)

- |   |                            |
|---|----------------------------|
| 1. MSD                                  | 6. Ziekenhuis              |
| 2. MZ kliniek                           | 7. Brahma/Medilab          |
| 3. Malaria Lab Anamoestraat/Geyersvlijt | 88. Anders, nl.: _____     |
| 4. BOG                                  | 99. Weet niet waar te gaan |
| 5. Huisartsen post/huisarts             |                            |



33. Ken je de malaria kliniek in Paramaribo? Zo ja, kun je uitleggen hoe je er kunt komen?
0. Ik heb er nooit van gehoord, **Ga naar 36**
- Ik heb er van gehoord maar ik weet niet precies waar het is
  - Ik weet waar het is (naast Transamerica, trap op)
  - Ik weet waar het is (bij de politiepost van Geyersvlijt)
88. Anders, nl.: \_\_\_\_\_
34. Als je bekend bent met de malaria kliniek, weet je dan welke medische diensten ze aanbieden? (Omcirkel alles wat van toepassing is – GEEN antwoorden oplezen)
- |                      |   |               |
|----------------------|---|---------------|
| 1. Malaria testen    | 4. Algemene gezondheidsdiensten               | 99. Weet niet |
| 2. HIV testen        | 88. Anders, nl.: _____                        |               |
| 3. Leishmania testen | 77. N.v.t. Niet bekend met de malaria kliniek |               |
35. Heb je in de afgelopen 3 jaar gebruik gemaakt van de diensten van de malariakliniek in Paramaribo?
0. Nee geen gebruik gemaakt
- Ja ik ben gaan testen op malaria
  - Ik ben gegaan voor een andere dienst, nl: \_\_\_\_\_
88. Anders, nl.: \_\_\_\_\_
77. N.v.t. persoon kent de malaria kliniek niet
99. Weet niet
36. Het Surinaamse malaria programma heeft mensen getraind op de goudvelden om op malaria te testen en malaria te behandelen. Weet je zo'n persoon te vinden in dit goudwinningsgebied?
0. Nee, geen idee
- Ze komen soms op bezoek maar ik weet niet waar ze verblijven
  - Ja, er is zo'n persoon in: \_\_\_\_\_
88. Anders, nl: \_\_\_\_\_
37. Aan welke medische diensten is de meeste behoefte in dit goudwinningsgebied? (Omcirkel alles wat van toepassing is – GEEN antwoorden oplezen)
- |   |                      |
|---|----------------------|
| 1. Huisarts   | 4. Anders, nl: _____ |
| 2. Bloed testen   | 5. Anders, nl: _____ |
| 3. Kliniek voor primaire gezondheidsdiensten (zoals MZ) | 99: Weet niet        |
38. Waar ben je de laatste keer toen je in een goudwinningsgebied ziek was of medische hulp nodig had naartoe gegaan voor behandeling? Of wat heb je gedaan om beter te worden? (Eén antwoord, doorvragen mag)
- Heeft geen medische hulp nodig gehad sinds hij/zij op goudvelden werkt.
  - Heeft zichzelf behandeld / zelf medicijnen genomen (zonder recept)
  - Naar een niet geregistreerde zuster/apotheker gegaan in het goudgebied
  - Naar de dichtstbijzijnde MZ kliniek gereisd
  - Anders, nl: \_\_\_\_\_
39. Denk je dat er nog steeds malaria in dit goudgebied is?
- Nee
  - Ja
88. Anders, nl.: \_\_\_\_\_
99. Weet niet
40. Ben je bezorgd over malaria? Maak je je zorgen over de kans om malaria op te lopen?
- Nee, helemaal niet

2. Ja een beetje
3. Ja heel erg; het houdt me dagelijks bezig

88. Anders, nl: \_\_\_\_\_

41. Denk je dat het mogelijk is malaria uit te roeien in Suriname?

1. Nee, want: \_\_\_\_\_

2. Ja, want: \_\_\_\_\_

88. Anders, nl.: \_\_\_\_\_

99. Weet niet

**EINDE VAN HET SURVEY**