



Ministerie van Volksgezondheid



Malaria KAP study

Knowledge of, attitudes towards, and behaviour in relation to malaria among mobile migrant populations in Suriname

Final Report, April 2023

Table of Contents

Abbreviations and foreign words	5
Executive Summary	6
1 Introduction	9
1.1 This report	9
1.2 Study Purpose and Scope	10
2 Background on malaria in Suriname	12
2.1 Malaria in the Americas	12
2.2 Malaria in Suriname	13
2.2.1 Malaria incidence	13
2.2.2 The Suriname Malaria Program	17
2.3 Summary of findings from earlier Malaria KAP studies	19
3 Study design and Methodology	20
3.1 Quantitative survey	20
3.1.1 Survey locations	20
3.1.2 Sampling method and sample characteristics	20
3.1.3 Analysis of Quantitative survey	22
3.2 Limitations and challenges	24
3.3 Ethical considerations	24
3.4 Quality assurance	24
4 Results	26
4.1 Population demographics and characteristics	26
4.1.1 Demographics	26
4.1.2 Professions	27
4.2 General public health issues in the ASM areas and Tepu	28
4.2.1 Frequency of selected health problems	28
4.2.2 Use of antibiotics	29
4.2.3 Pap smear or VIA	30
4.3 Malaria knowledge	31
4.3.1 Venues of knowledge transfer	31
4.3.2 Knowledge of symptoms	34
4.3.3 Knowledge of the cause of malaria	35
4.3.4 Misperceptions	37
4.3.5 Knowledge of protection against malaria	39
4.4 Risk perception	41
4.5 Use of bed nets	43
4.5.1 Bed net coverage and use	43
4.5.2 Reasons to not sleep with a bed net	46

4.6	Malaria incidence	47
4.7	Testing and treatment	48
4.7.1	Malaria test behaviour	48
4.7.2	Treatment behaviour	48
4.7.3	OTC medication	51
4.7.4	Medication intake	51
4.8	Malaria and mobility	52
4.9	Familiarity with malaria test locations	53
4.8.1	Knowledge of malaria test locations in the interior	53
4.8.2	Knowledge and use of the Tropclinic	55
4.10	Malakit	55
4.11	Perceptions of Intimate Partner violence	57
5	Discussion and conclusion	60
5.1	Discussion	60
5.2	Conclusions	62
	Annexes	63
	Annex 1: Malaria symptoms mentioned by different sub-populations	63
	Annex 2: Numbers with Figure 23	64

List of Tables

Table 1.	Summary of quantitative results.....	8
Table 2.	Origin of malaria cases in Suriname, 2010-2021.....	16
Table 3.	Number of individuals surveyed per survey location	21
Table 4.	Sample characteristics (NA=Not applicable), distinguishing different population sub-groups	22
Table 5.	Jobs performed by women and men in the indigenous community Tepu	27
Table 6.	Professions in the ASM areas, by sex.....	28
Table 7.	Frequency of occurrence of selected health issues among mobile migrant populations	29
Table 8.	Information people remembered from the malaria awareness campaign	33
Table 9.	Named causes of malaria, by sub-population.....	36
Table 10.	Ways to prevent getting malaria named by different subgroups, wrong answers shaded orange.....	40
Table 11.	Bed net coverage: Average number of bed nets possessed by persons of different sub-populations.	43
Table 12.	International malaria indicators, by sub group.....	45
Table 13.	Reasons to not take a malaria test, ASM populations (N=10)	51

List of Figures

Figure 1. Malaria incidence in the Americas, selected countries	12
Figure 2. Trend of malaria prevalence in Suriname and neighbouring countries (per 1000 population at risk).....	13
Figure 3. Number of malaria cases of different Plasmodium types, autochthonous and imported cases 2000-2021	14
Figure 4. Number of malaria cases of different Plasmodium types, autochthonous and imported cases, 2012-2021	14
Figure 5. Number of Imported and autochthonous Malaria cases in Suriname, 2000-2021	15
Figure 6 Number of Imported and autochthonous Malaria cases in Suriname, 2011-2021	15
Figure 7. Places where people tested positive for malaria 2019-2021	18
Figure 8. Location of main ASM sites in Suriname and French Guiana, with survey locations indicated as yellow stars	23
Figure 9. Country of birth of the respondents in the different study areas, number of respondents	26
Figure 10. Share of ASM populations who used antibiotics in 2022, with their method of accessing medication	30
Figure 11. Venues through which mobile migrant populations received malaria information in 2022.....	32
Figure 12. Most mentioned malaria symptoms, by sub-population	34
Figure 13. Share of persons who know that malaria is only transmitted by a mosquito	35
Figure 14. Share of respondents who know that malaria is ONLY transmitted by a mosquito, by age group	37
Figure 15. Share of correct answers to statements about malaria in the different subpopulations	38
Figure 16. Answers to different knowledge questions about malaria.....	38
Figure 17. Share of respondents answering correctly to four malaria questions, by age group.....	39
Figure 18. Do you believe you are at risk, here and now, to get infected with malaria?	42
Figure 19. Malaria incidence in the target populations.....	47
Figure 20. Number of respondents and the year of their most recent malaria experience.....	48
Figure 21. Responses to suspected malaria among Indigenous peoples	49
Figure 22. Responses to suspected malaria among ASM populations	50
Figure 23. Share of person completing malaria medication, by whether the person had bought OTC medication without testing.	51
Figure 24. People who have experienced malaria in the years 2019-2023, with the country where they probably were infected and the country where they were when they first felt symptoms – the last time they had malaria. .	52
Figure 25. Is it possible to conduct a malaria test in this mining area/village or nearby (<1 hour travel)?	53
Figure 26. Places where members of the different sub-populations would go to test for malaria if they were to feel ill at the time of the survey. Numbers presented in Annex 2.....	54
Figure 27. Share of persons who used the Malakit among those who received one (N=50)	56
Figure 28. Malakit pouches with diagnostic tests and malaria medication.....	57
Figure 29. Number of men and women who believe that a man has a right to beat or hit his female partner under certain circumstances.....	58
Figure 30. Number of men and women who believe that a woman has a right to beat a male partner under certain circumstances.....	58

Abbreviations and foreign words

ABS	General Bureau of Statistics (Algemeen Bureau voor de Statistiek)
ACD	Active Case Detection
<i>bita</i>	Forest medicine popular among Maroons, made of a bitter tree bark.
BOG	Bureau for Public Health (<i>Bureau voor Openbare Gezondheidszorg</i>)
<i>busidrrresi</i>	Forest medicine
CBvS	Central Bank of Suriname
CMWO	Committee for Scientific Research with Human Subjects - <i>Commissie Mensgebonden Wetenschappelijk Onderzoek</i>
<i>Currutela</i>	Gold miners' village
<i>Garimpeiros/ garimpo</i>	Gold miner (Por.)/ Gold mining area
GDP	Gross Domestic Product
IDB	Inter-American Development Bank
KAP	Knowledge, Attitudes and Practices
ITN	Insecticide Treated Nets
Malakit	A small pouch containing all materials to self-diagnose and self-treat malaria, specifically designed for inhabitants of ASM areas in French Guiana.
MDA	Mass Drug Administration
MoH	Ministry of Health
MP	Malaria Program
MSD	Malaria Service Deliverer
N_{total}	Total valid sample for the indicated question
OTC	Over-The-Counter (medicine)
RDT	Rapid Diagnostic Test
RGD	Regional Health Service
ASM	Small-Scale Gold Mining
TropClinic	Malaria clinic at Geyersvlijt with outpost at the Anamoestraat
USD	United States Dollars
VIDS	Association of Indigenous Village Leaders in Suriname
<i>wataki</i>	Forest medicine made by indigenous peoples
WHO	World Health Organization

On the Cover

Top left: Hammocks with bed nets of Indigenous family in Tepu. (Picture by Marieke Heemskerk, 2023)

Bottom left: Field interview with Indigenous woman. (Picture by Marieke Heemskerk, 2023)

Top middle: Field interviews of mining populations in Montanha de Robson. (Picture by Deborah Hordijk, 2023)

Bottom middle: Field interview of gold miner in Bewojo (Picture by Marieke Heemskerk, 2023)

Right: Mining area, Lawa region (Picture by Marieke Heemskerk, 2021)

Executive Summary

Introduction: This report presents the results of a *malaria KAP survey among mobile migrant populations in and near small-scale gold mining (ASM) areas in Suriname*, which was executed between December 2022 and June 2023. Suriname is on its way to eliminate malaria, with a very low number of malaria cases. The main challenge in working towards malaria elimination is now management of imported cases. The purpose of this study is to collect and present data that will contribute to public health policies aimed at further reducing malaria in Suriname. Key statistics from this study are presented in table 1 below.

Methods: A quantitative survey was conducted with three distinct populations: (1) Trio indigenous peoples from the village of Tepu (N=71), (2) Surinamese persons working and living in ASM areas (N=66), and (3) foreign migrants in ASM areas (N=183). Of the inhabitants of ASM areas (N=249), 95 were working in French Guiana, one had most recently worked in Guyana, and the remaining 153 were working in Suriname. The large majority of foreign migrants in the ASM areas were Brazilian (93.4%). One third (32.5%) of interviewees were women.

General Health and Intimate Partner Violence: In 2022, back pains were the most common health problem for both gold miners and Indigenous peoples, followed by COVID-19 and kidney and liver pains. Antibiotic use is high; especially gold miners tend to buy antibiotics Over-The-Counter (OTC) and tend to take medication haphazardly. Questions on perceptions of intimate partner violence suggest that the large majority of people disapprove of such behaviour. All women in the ASM sector, both Surinamese and foreign migrants, reported that a man was not justified to hit or beat his wife under any circumstance. A woman beating her male partner was more often accepted than the reverse; a man beating his female partner, especially among women. Among Indigenous peoples, violence between partners was, on average, more often justified than among other groups. Surinamese men were more likely than men from the other sub-groups to justify wife-beating under different circumstances.

Malaria knowledge: In 2022, the MoH-MP launched a malaria awareness campaign. As compared to gold mining populations, Indigenous peoples had relatively more often heard or seen a malaria message; mostly through the village speakers or a local health worker. The best retained message in both populations was that one should sleep with a bed net.

Suriname ASM populations had less knowledge about malaria than either Indigenous peoples or foreign migrants in the ASM areas. They were less likely to be able to name malaria symptoms, or to know the cause of malaria. Two-thirds of Surinamese ASM populations knew that malaria is only transmitted by a mosquito, versus more than 80% of foreign migrants in the ASM areas and Indigenous peoples. Also, young people (16-24) were relatively worse informed than older persons. Nearly one quarter of young people was unable to name any symptom of malaria (22.6%. 12/53), and an even larger share (28.3%, 15/53) did not know that malaria is only transmitted by a mosquito. In all three sub-populations, use of a bed net was the most frequently mentioned way to prevent becoming infected with malaria. Quite some people in all sub-groups erroneously believed that keeping the surroundings clean, using a mosquito

candle, staying away from dirty water/standing water, and not drinking dirty water/creek water/untreated water were effective ways to prevent malaria infection. The study revealed a strong belief in forest remedies as a means to protect oneself against malaria, especially among Indigenous peoples.

Use of bed nets: The study shows large differences in bed net possession and use. All (100%) of surveyed Indigenous persons possessed an Insecticide Treated net (ITN), and every single person had slept with this ITN all nights of the week prior to the interview. Numbers were much lower in the gold mining populations, with 28.4% of foreign migrants and 4.5% of Surinamese owning an ITN. The main excuse for not sleeping with a bed net was that the person did not have a bed net.

Malaria and test behaviour: Indigenous peoples of Tepu and ASM populations working in French Guiana were more likely than ASM populations working in Suriname to have experienced malaria in the four years preceding the interview (2019-2022). People who believed they had (suspected) malaria took different measures when they were confronted with malaria symptoms, with large differences in responses between the sub-populations. All Tepu inhabitants with (suspected) malaria went to a health clinic to get tested the last time they felt symptoms. Among the 34 persons from ASM populations with (suspected) malaria in the past four years, 10 had used OTC medication the last time they had felt malaria symptoms; 9 persons had used the Malakit; 6 persons had been tested and treated for malaria in French Guiana; 5 persons had been tested and treated in Brazil; and 4 in Suriname. The main reason to take OTC medication was that the person had been far from a health post. Persons who had obtained medication through medical prescription were significantly more likely to complete the cure than persons who had bought malaria medicines OTC without testing. Particularly among ASM populations, mobility is high, and people frequently experience malaria symptoms in another country than where they were most likely infected.

Access to test facilities and methods: Almost all indigenous persons of Tepu knew that it was possible to conduct a malaria test nearby, and named MZ as the place where they would go. Among ASM populations, those in Brokopondo north were least likely to know a place to test for malaria. In the transit areas (Albina, Antonio do Brinco/Peruano) people were most familiar with malaria test locations. In these areas, more than three-quarters of the interviewees reported that they would go test with an MSD if experiencing malaria symptoms at that moment. As compared to the other sub-populations, foreign migrant ASM populations were relatively most likely to be familiar with the Tropclinic. The Malakit is a pouch with malaria tests and medication for self-diagnosis and self-treatment against Plasmodium infections in cross-border areas, specifically developed for ASM populations working in French Guiana. Half of those working in French Guiana had heard of the Malakit, and one quarter had received at least one Malakit. User reports demonstrate that the Malakit is easy to use and highly appreciated.

Discussion and conclusions: The study highlights the importance of malaria awareness activities and calls for an intensified focus on young people in the interior, also in places that have been malaria free for some time. Migratory movements of both ASM populations and Indigenous Peoples challenge the detection and control of malaria outbreaks. In this context, cross-border cooperation and communication among policy makers and health professionals is vital to reaching Suriname's goal of malaria elimination.

Table 1. Summary of quantitative results

Population	ASM-Suriname	ASM-foreign	Indigenous
N	66	183	71
Indicator	% (N/D)	% (N/D)	% (N/D)
General health	ASM-Suriname		ASM-foreign
Used antibiotics in the year preceding the interview	49.4%, 123/249		76.1%, 54/71
Bought antibiotics Over-The-Counter in 2022	70.7%, 87/123		4% 2/54
Women who have taken a pap smear of VIA in past three years (2020-Jan 2023)	57.1%, 4/7	70.8%, 46/65	3.1%, 1/32
Malaria Knowledge	ASM-Suriname	ASM-foreign	Indigenous
Seen or heard at least one malaria message	36.1% (90/249)		97.2%, 69/71
Being able to name at least one malaria symptom	78.8%, 52/66	98.9%, 181/183	97.2%, 69/71
Know that only the mosquito transmits malaria	65.2%, 43/66	85.8%, 157/183	80.3%, 57/71
Know that bats cannot transmit malaria	59.1%, 39/66	61.5%, 112/182	40.8%, 29/71
Believe that forest or home medicine is effective against malaria	48.5%, 32/66	41.2%, 175/182	66.2%, 47/71
Name sleeping with a bed net as an effective way to protect oneself against malaria	77.3%, 51/66	78.7%, 144/183	66.2%, 47/71
Bed nets	ASM-Suriname	ASM-foreign	Indigenous
In possession of at least one bed net	22.7%, 15/66	37.6%, 69/183	100%, 71/71
In possession of an Insecticide Treated Net	4.5%, 3/66	28.4%, 52/183	100%, 71/71
Slept under an ITN in the previous night	1.5%, 1/66	14.8%, 27/182	100%, 71/71
Slept under an ITN all night of the previous week	1.5%, 1/66	13.7%, 25/182	100%, 71/71
Received an ITN from the MoH-MP/MZ in 2022	6.1%, 4/66	25.1%, 46/183	98.6%, 70/71
Experience with malaria and the Malakit	Work in SU	Work in FG	Indigenous
Confirmed most recent malaria with a positive test	87.5%, 7/8	69.2%, 18/26	95.2%, 20/21
Have heard about the Malakit	3% (2/66)	49.7%, 91/183	NA
Have received at least one Malakit	0%	27.3%, 50/183	NA
Knowledge of test locations and methods	ASM-Suriname	ASM-foreign	Indigenous
Know that it is possible to conduct a malaria test near the location where they are interviewed.	76.3%, 190/249		97.2%. 69/71
Is familiar with the Tropclinic	6.1%, 4/66	25.7%, 47/183	2.8%, 2/71

1 Introduction

1.1 This report

This report presents the results of a *malaria KAP survey among mobile migrant populations in and near small-scale gold mining (ASM) areas in Suriname*, which was executed between December 2022 and June 2023. In 2004, Suriname, South America, had the highest annual parasite incidence (API) and concentration of *Plasmodium falciparum* cases in the Americas. Since then, the country has reported a significant decline in the number of cases. Suriname managed to bring its malaria numbers down so rapidly due to prevention and control intervention from the Ministry of Health Malaria Programme (MoH-MP), in collaboration with the Medical Mission Primary Health Care clinics in interior communities, and with support of the Interamerican Development Bank (IDB), Global Fund, the Pan American Health Organization and other partners.

In the 2000s, as it became evident that the remaining point sources of malaria infection were artisanal and small-scale gold mining (ASM) areas, malaria interventions became focused on these remote locations in the Suriname interior. Remote gold mining communities are disproportionately at risk for malaria transmission at risk due to (1) limited access of the remote populations to health services, (2) the many pools with standing water that miners leave behind, and (3) the high mobility of miners. This movement encourages disease spread.

The initial “Looking for Gold, Finding Malaria” programme (MP I, 2009-2012) was followed up by different malaria intervention programmes: MP II (2012-2015), MP III (2015-2018), MP IV (2018-2021) and the current MP V (2021-2024). Through the years, the focus has shifted from reducing malaria to malaria elimination. One major risk is the continuous import of malaria by mobile migrant miners; mostly Brazilians working in ASM in French Guiana (De Theije and Heemskerk, 2009; Hiwat, et al. 2012; Hiwat, et al. 2018; Van Eer, et al. 2018; Douine, 2020). In an effort to identify, test and treat these migrant gold miners as they cross the border into Suriname, the more recent malaria intervention programs have adopted a strong focus on the Suriname-French Guiana border region.

A more recent risk is the new influx of *garimpeiros*, Brazilian gold miners, from the Brazilian state of Roraima. In February 2023, the newly elected Brazilian government launched an immense operation to remove *garimpeiros* from Yanomami Indigenous lands, which cover parts of the states of Amazonas and Roraima. Over the span over several years, an estimated 25,000 *garimpeiros* had invaded the Yanomami Indigenous reserve, causing disease, malnutrition and death among this isolated tribal group. The expelled *garimpeiros* are now dispersing across other Amazon regions, including Guyana, Suriname and French Guiana, in search for new work areas. Early march, 2023, the coordinator of the Suriname Malaria Programme, Dr. Hiwat, reported that several cases of malaria had been discovered among Brazilian gold miners who had recently travelled from Roraima to Suriname¹.

¹ Newspaper article in De West, 03-03-2023. <https://dagbladdewest.com/2023/03/03/goudzoekers-met-malaria-wijken-uit-naar-suriname/>

Recent malaria outbreaks in highland Indigenous communities suggest that there is contact between the gold mining communities and Indigenous communities in south Suriname, with the risk of spreading malaria throughout the Suriname interior. This idea was confirmed during fieldwork, when the research team encountered Indigenous men and women from Sipaliwini, Palumeu and Kwamalasamutu who were working in gold mining. Therefore the most recent MP V (2021-2024) includes Indigenous communities in its outreach activities.

In order to capture the diverse experiences of at risk populations, this KAP study was conducted in locations representative of these different malaria risk areas: Suriname gold mining areas, the Suriname-French Guiana border region, and a south-Suriname Indigenous community. The study was commissioned by the Ministry of Health Malaria Program (MoH-MP) as part of the Inter-American Development Bank (IDB) financed Health Services Improvement Project (IDB Project SU-L1054). The broader aim of this Government of Suriname (GoS) project is to help Suriname's health sector to deal with challenges posed by non-communicable and communicable diseases. One of the three components of the IDB/GoS Health Services Improvement Project is to increase access to priority health services for at-risk populations affected by communicable diseases like malaria (and HIV). The malaria KAP survey covers component 3.1.4.1: *Consultancy for Malaria KAP Survey in Small-Scale Gold Mining Areas*.

The remainder of this report proceeds as follows.

- This introduction continues by listing the study purpose and scope.
- Chapter 2 describes the situation of malaria in Suriname, presenting data on the number of malaria infections by plasmodium type, longitudinal trends, and suspected countries of infection. It also describes current efforts to fight malaria by the Suriname by the MoH-MP.
- Chapter 3 covers the study methodology and includes a map of the study locations.
- Chapter 4 presents the KAP study results, distinguishing the mining areas, Suriname-French Guiana border region, and Indigenous community where relevant.
- The conclusions (Chapter 5) synthesize the findings and provide directions for future interventions.

1.2 Study Purpose and Scope

The purpose of the malaria KAP survey is to collect and present data that will contribute to public health policies aimed at further reducing, and eventually eliminating, malaria in Suriname. Such public health policies require a better understanding of:

- Malaria transmission dynamics;
- Knowledge, attitudes and practices related to malaria prevention, health seeking behaviour and drug adherence;
- Impact and reach of the Malaria Program interventions.

This Malaria KAP study focusses on ASM communities and one Indigenous community in the Suriname interior. The objectives of the malaria KAP study are to:

- o Identify and prioritize the different sources and channels used by the communities to access malaria prevention and control information;

- Identify relationships between demographic characteristics and knowledge, attitudes and practices in relation to malaria prevention and control.
- Analyse the use of malaria prevention measures in the target population, specifically use of bed nets.
- Assess the access to general health services for mining populations and Indigenous populations in different more and less isolated locations in Suriname.
- Evaluate knowledge of, and experiences with, the Malakit testkits.
- Assess knowledge and use of the trop-clinic, as well as additional health needs among the inhabitants of ASM areas.

In addition, the study aims to shed light on a limited number of other public health issues in the remote ASM communities, which may have broader public health implications for Suriname, namely:

- Research the use of antibiotics, focussing on mode of acquisition (Over-The-Counter or through prescription) and cure completion.
- Assess women's access to, and use of, the pap smear.
- Collect limited information on attitudes towards gender-based violence in the target communities².

Gender will be a crosscutting theme in the analysis of these various questions.

² The scope of work asks for assessment of knowledge about, and experience with, Gender Based Violence (GBV). As indicated in the earlier submitted response to the TOR, a thorough assessment of GBV would require a separate study. GBV is a very broad concept, encompassing emotional, physical, economic and sexual violence, by either the intimate partner or others. Also within these categories, experience may be diverse. For example, emotional violence alone may encompass psychological and verbal abuse, threats of physical or sexual violence or harm, coercion, controlling behaviours, name calling and insults, intimidation, isolation and bullying. There is no space in this study to discuss all of such details in depth. The study will be limited to inclusion of the questions about GBV listed in the Multiple Cluster Indicator Survey.

2 Background on malaria in Suriname

2.1 Malaria in the Americas

In 2020, Venezuela reported the highest number of presumed and confirmed malaria cases in Latin America, with over 273 thousand infections (Figure 2). Brazil and Colombia ranked respectively second and third among countries with the most malaria cases in Latin America. The high number of malaria cases in Suriname's neighbouring countries and regions, coupled with the porous borders, complicates malaria elimination. In 2020, Brazil registered 145,188 registered cases and Guyana 17,230 cases (Statistica, 2022. Figure 1). French Guiana recorded 154 cases, but this figure may not accurately reflect the true number of cases in this region because there is a high level of self-medication among the thousands of migrant gold miners in the country's illegal mining areas (Douine et al., 2018, Nacher et al., 2013).

With 28.2 malaria cases/1000 population at risk, Guyana has the highest malaria incidence in the Americas, followed by Venezuela with 16.3 malaria cases/1000 population at risk (World Bank, 2022; 2020 data). For Suriname, the 2020 malaria incidence rate was 1.7 cases/1000 population at risk (Figure 1).

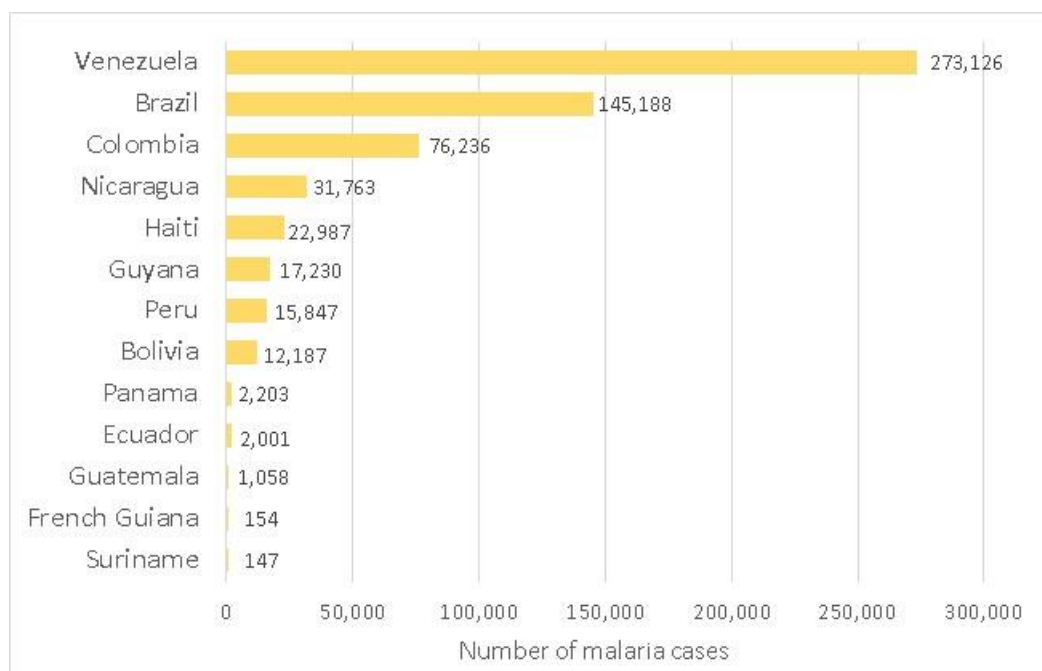


Figure 1. Malaria incidence in the Americas, selected countries

Source: data from statistica, 2022

2.2 Malaria in Suriname

2.2.1 Malaria incidence

Prior to 2006, Suriname was regarded as the country in the Americas, with the highest concentration of *P. falciparum* malaria (Mergiory et al., 2021) (Figure 2). This situation has changed dramatically, with Suriname being elected the Malaria Champion of the Americas in 2010, 2016 and 2018. The number of autochthonous (or indigenous) malaria cases dropped from 8,618 in 2005 to 1,509 in 2009 (Hiwat et al. 2012; Figure 5). In 2022, the number of autochthonous malaria cases had dropped to 0 (zero), while 60 positive malaria cases had been imported from other countries (Figure 6). No malaria deaths had been recorded since 2017.

Indeed, Suriname is on its way to eliminate malaria, with a very low number of malaria cases. Particularly the number of *P. falciparum* has decreased dramatically (Figures 3 and 4). Since 2019 no national *P. falciparum* cases have been recorded. Since 2014, no single case of *P. malariae* has been reported (Figure 4). Areas where malaria still occurs are mostly ASM communities. Yet even in many of these areas, there have not been any malaria cases for several years.

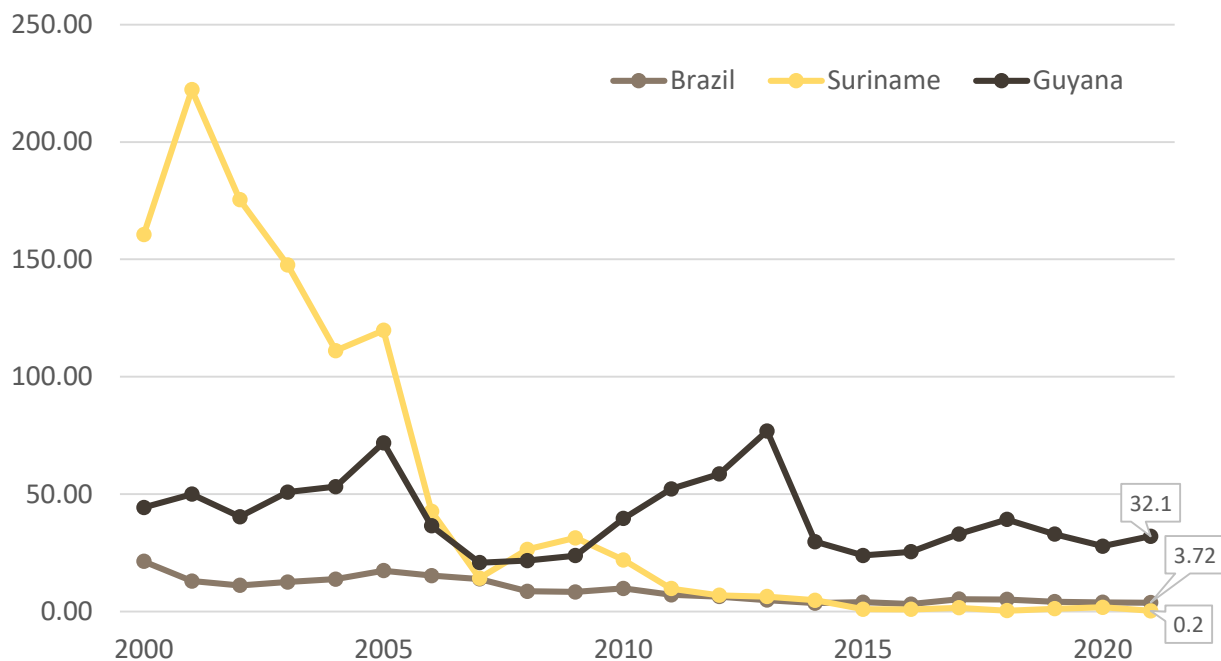


Figure 2. Trend of malaria prevalence in Suriname and neighbouring countries (per 1000 population at risk)

Source: World Bank. Incidence of Malaria (per 1,000 population at risk)³

³ <https://data.worldbank.org/indicator/SH.MLR.INCD.P3?view=chart>

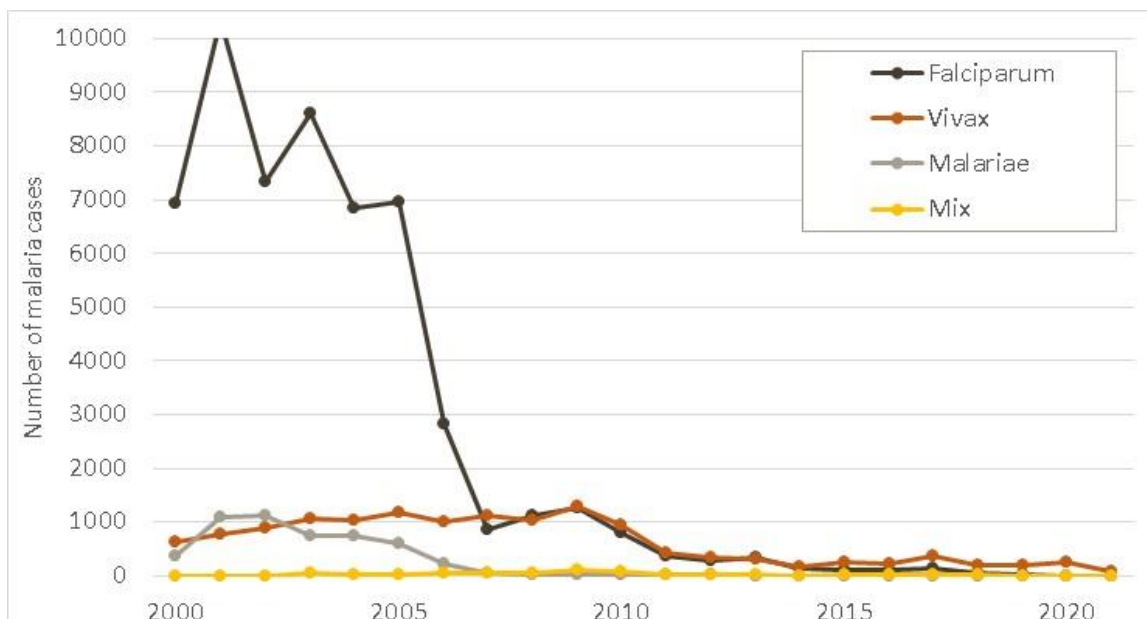


Figure 3. Number of malaria cases of different *Plasmodium* types, autochthonous and imported cases 2000-2021

Source: Ministry of Health Malaria Program, unpublished data

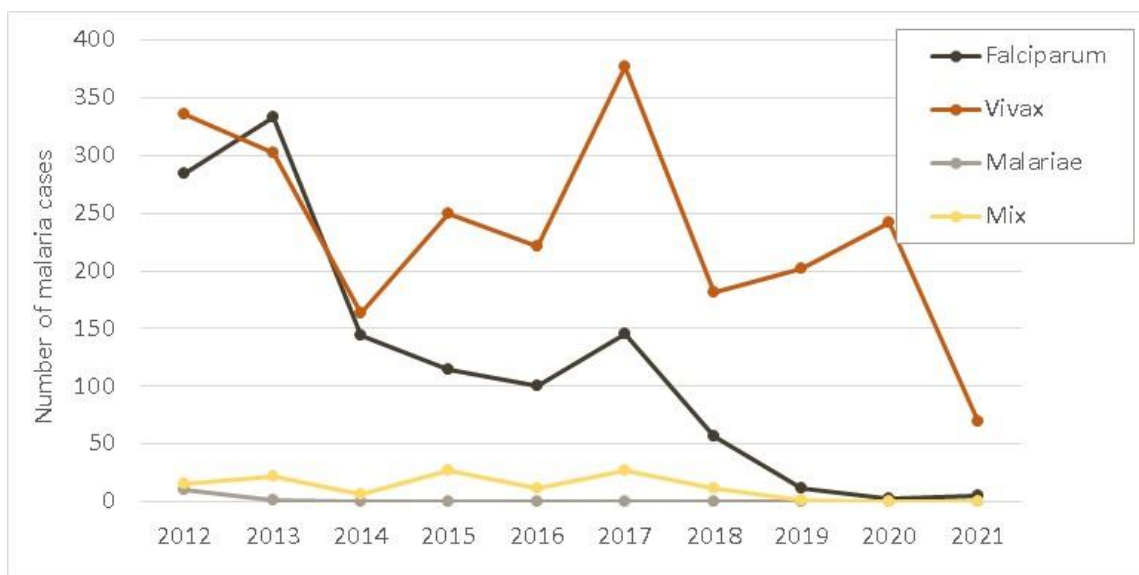


Figure 4. Number of malaria cases of different *Plasmodium* types, autochthonous and imported cases, 2012-2021

Source: Ministry of Health Malaria Program, unpublished data

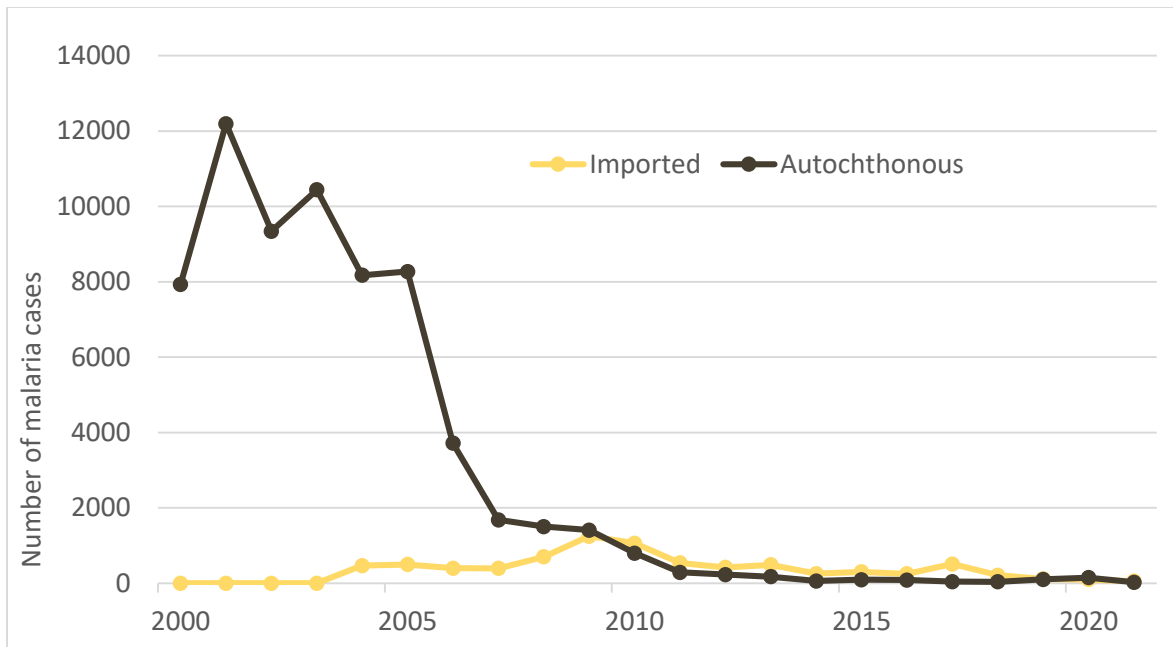


Figure 5. Number of Imported and autochthonous Malaria cases in Suriname, 2000-2021
 Source: Ministry of Health Malaria Program, unpublished data

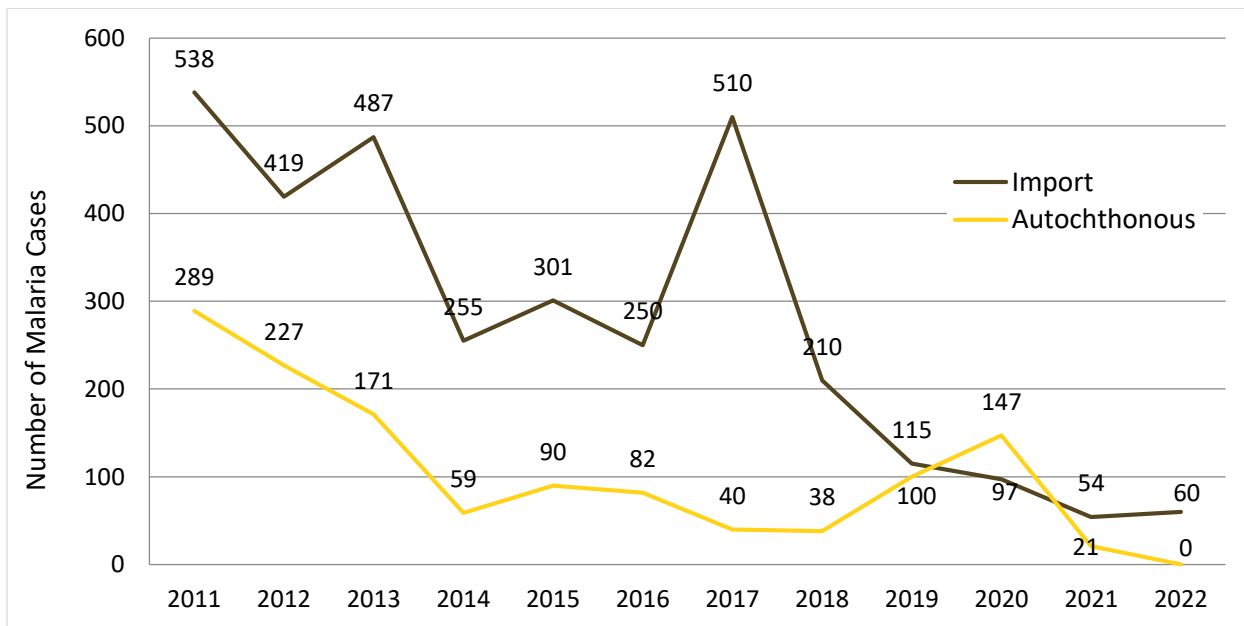


Figure 6 Number of Imported and autochthonous Malaria cases in Suriname, 2011-2021
 Source: Ministry of Health Malaria Program, unpublished data

Today, the main challenge in working towards malaria elimination is management of imported cases. French Guiana and Guyana have high malaria incidence, and the borders are porous. The negative impact of cross-border movements is reflected in the malaria data. Comparing indigenous versus imported cases in the past two decades, we see a steady decline of autochthonous malaria infections, while the number of

imported cases remains relatively steady. Starting in 2010, the number of imported cases surpasses the number of autochthonous cases (Figure 5). The relative burden of imported malaria cases becomes particularly visible when zooming in on the past decade (Figure 6). Between 2011 and 2021, on average 71.8% of malaria cases were imported.

Of particular concern is the high number of (undocumented) malaria cases in ASM areas in French Guiana (Heemskerk and Duijves, 2016). French Guiana executes a zero tolerance policy vis-à-vis clandestine ASM. Access to health services in French Guiana ASM areas is limited and the tendency to self-medicate is high (Heemskerk and Duijves, 2016). Moreover, gold mining populations working in French Guiana cannot easily sell gold or buy supplies in French Guiana; hence they travel to Suriname for such transactions. A share of ASM miners working in French Guiana actually live in Suriname with their families residing in Paramaribo. This situation leads to cross-border mobility, which in turn allows for the entry of malaria-positive persons into Suriname, thereby posing a risk for transmission to others (Heemskerk and Duijves, 2016). An additional risk is that many malaria-infected gold miners in French Guiana are asymptomatic (40–84%), thus constituting a significant Plasmodium reservoir (Douine et al., 2018). A closer look at the imported cases and their origin confirms that French Guiana constitutes the main source of malaria infections in Suriname (Table 2).

Table 2. Origin of malaria cases in Suriname, 2010-2021

Suspected Country of Infection	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	Grand Total
French Guiana	1014	485	359	406	236	279	225	487	168	73	74	37	3843
Suriname	795	289	227	171	59	90	82	40	38	100	147	24	2062
Guyana	33	49	53	76	18	13	16	15	28	26	12	12	351
Brazil	12	3	4	2		5	8	3	5	9	6	2	59
Venezuela	3	1	2	3				4	5	4	5	2	29
Ghana						4	1						5
Africa			1					1	2				4
Cameroon										1			1
Congo										1			1
Papua									1				1
Sierra Leone										1			1
Togo									1				1
Zambia					1								1
Grand Total	1857	827	646	658	314	391	332	550	248	215	244	77	6359

As a result of the discrepancy between Suriname and French Guiana malaria control measures, Suriname's main point sources for malaria transmission now are settlements along the Suriname-French Guiana border, where gold miners working in French Guiana enter Suriname. For this reason, the Malaria Elimination program focusses on locations where gold miners working in French Guiana assemble, such as

Albina and the cluster of settlements along the Lawa river around Antonio do Brinco/Peruano (Heemskerk and Duijves, 2016).

Due to imported cases, mostly related to ASM activity, Suriname remains vulnerable to the re-introduction and spread of malaria in interior communities that have been free of malaria infection for some time. These interior Indigenous and Maroon communities are in contact with gold miners (and their diseases) when Indigenous gold miners return to their home communities, or through commercial interactions such as selling items or services in the ASM areas. In 2019, for example, two indigenous communities in Suriname's interior, which had not recorded any malaria cases for several years, experienced *P. Vivax* malaria outbreaks (Mergiory et al., 2021). During fieldwork, three persons from southern Indigenous communities were encountered in Albina; a woman from the village of Sipaliwini, a man from the village of Palumeu, and a woman from the village of Kwamalasamutu.

2.2.2 The Suriname Malaria Program

✓ Malaria Service Deliverers: Free Test & Treat services nearby

It is a challenge to reach gold miners with public health messages and interventions because travel to the mining areas is difficult, and because the population consists largely of migrants who do not speak the local languages and are partially illiterate. Medical Mission health centres provide primary health care to Indigenous and maroon communities in the interior, but are often out of reach of gold miners. The Malaria Program has addressed this challenge by developing a network of Malaria Service Deliverers (MSD) in the remote mining areas. These MSDs are typically members of the ASM communities. 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. All MSD working in the interior are fluent in Portuguese and/or local languages. The MSDs are contracted to provide malaria test and treat services to their communities, and are supervised by malaria workers in Paramaribo. Through the MSDs, at risk populations in Suriname can always find MoH-approved malaria services nearby, and free of charge.

✓ Tropclinic

In Paramaribo, a malaria clinic with Portuguese speaking staff, the Tropclinic, was established near the neighbourhood where many Brazilian gold miners and mining service providers stay and/or buy supplies. The Tropclinic offers malaria testing and treatment free of charge, as well as HIV testing, COVID-19 testing, and Leishmania diagnosis. Free Long Lasting Insecticidal Nets (ITN) are also available at the Tropclinic.

✓ Test & Treat services

If we look at the place where people who tested positive for malaria were tested in the past seven years (2015-2022), we find that the MoH-MP program test locations (MSD, TropClinic, ACD) have made a significant contribution to increasing access to malaria test services (Figure 7). It is important to note that the persons tested by the MSDs would most likely not have tested but rather self-medicated if the MSDs would not have been at location in the ASM areas. Widespread self-medication, coupled with haphazard medication intake (i.e. not completing the cure) increase the risk of malaria strains becoming medication resistant (Nacher et al., 2013).

It is worth noting that the data for 2019-2021 is atypical for the malaria trend in Suriname. In these years, malaria was re-introduced in the Indigenous population, and therefore the people who were tested at an MZ clinic was relatively high. In earlier years, and in 2022, the number of people tested at MZ clinics was much lower.

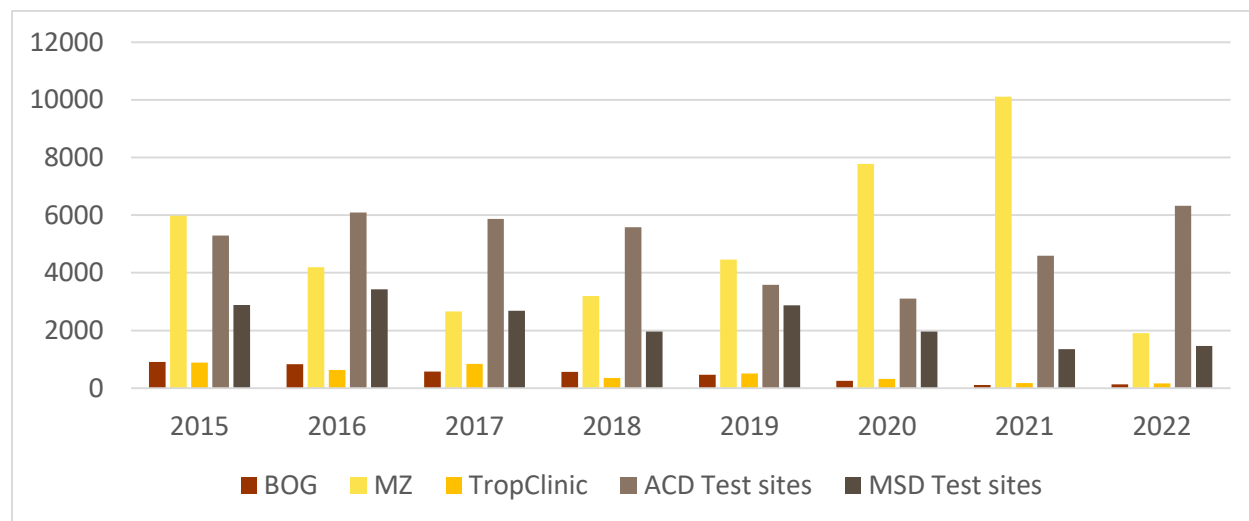


Figure 7. Places where people tested positive for malaria 2019-2021

Source: Ministry of Health Malaria Program, unpublished data

✓ Other malaria services

In addition to providing free malaria testing and treatment throughout the ASM areas, the Suriname Malaria Programme uses other strategies to fight malaria, including the distribution of free ITNs, information and awareness campaigns, and Active Case Detection (ACD) missions. These activities were mainly executed in ASM areas, and specifically focused on the malaria hotspots along the Suriname-French Guiana border.

The present Malaria Program intervention, MP V (2021-2024), includes a strong information and awareness component. This information and awareness program contains the following activities:

- Production of educational booklets for school children
- Radio infomercials in different languages, including Portuguese and indigenous and Maroon languages
- TV infomercials
- Health promotion fair, in Paramaribo and different places in the interior. During the fair, health workers provide information about malaria, HIV, and other diseases.
- Training of MZ health workers and MSDs to more effectively engage in outreach

✓ Malakit

Starting April 2018, Suriname, French Guiana and Brazil have implemented an innovative project based on the distribution of kits for self-diagnosis and self-treatment of Plasmodium infections, the so-called Malakits. The Malakit intervention is based on the distribution of kits for self-diagnosis and self-treatment against malaria infections in cross-border areas, after training of the target population by health workers.

The kits contain three Rapid Diagnostic Tests (RDTs) and one complete artemisinin-based combination therapy (ACT)/single-dose primaquine (15 mg) treatment. A strip of acetaminophen tablets is also included to offer an alternative if the RDT is negative while the miner experiences fever. Kit-distribution occurs at “resting sites” on the Surinamese side of the Marowijne (Maroni) river, in Peruano/Antonio do Brinco and Albina. In earlier years, Malakit distribution also took place on the Brazilian side of the Oyapock river, but this intervention has stopped.

Through this project, the governments of the three countries hope to increase proper malaria diagnosis and treatment in difficult to reach illegal ASM sites in French Guiana, and thereby reduce cross-border malaria transmission (Douine et al., 2018). The present KAP study asks gold miners about their experience with Malakit.

2.3 Summary of findings from earlier Malaria KAP studies

Since 2010, Malaria KAP studies have been performed regularly, including in 2012, 2013, 2015, 2016, 2018, and 2020. The results of these various KAP studies are not necessarily comparable, because different groups were targeted in different years. For example, one of the studies exclusively focused on people who had experienced malaria in the past 1 ½ years, another study focused primarily on persons working in French Guiana, and yet another study focused on gold miners exclusively working in Suriname. Despite these differences, a couple of general trends can be identified:

- Malaria knowledge has increased over the years, with >80% of persons now knowing that malaria can only be transferred by a mosquito.
- Increased knowledge has not translated to more malaria-conscious behavior. The use of bed nets was lower in later years than in earlier years.
- In line with the earlier presented statistical data, those who had experienced malaria in the recent past were virtually all working in French Guiana.
- Persons working in French Guiana are likely to self-medicate when feeling malaria symptoms, usually taking Artecom or other OTC malarial drugs.
- People who received malaria medication from a health worker are more likely to complete the malaria cure than people who self-medicate.

These themes will be explored further in the current malaria KAP study.

3 Study design and Methodology

3.1 Quantitative survey

The study followed a quantitative approach, using a survey with mostly closed ended questions to collect data. Data collection took place in the period of January-March 2023.

3.1.1 Survey locations

A quantitative survey was conducted with two distinct populations:

1. Trio indigenous peoples from the village of Tepu (N=71)
2. Inhabitants of ASM areas (N=249), among whom 95 were working in French Guiana, one had most recently worked in Guyana, and the remaining 153 were working in Suriname (see Table 3).

The survey team targeted people working in French Guiana in the mining service centres in Suriname on the border with French Guiana: Papatam (Figure 8; Albina) in the north, and Ronaldo/Antonio do Brinco in the south (Figure 8; area 4). In these locations, gold miners and mining service providers who work in French Guiana come to rest or buy supplies, or wait for a suitable moment to cross the river.

One man working in French Guiana was interviewed in Gran Kreek. He had worked in French Guiana and from there had travelled to Roraima. Next he travelled to Gran Kreek, where his wife and inlaws were working, with the idea to return to French Guiana to work. In Gran Kreek he started to feel ill, and he was tested positive on malaria at the time of the research. This story is exemplary of the high mobility of some of the gold miners in the study region.

Persons working in Suriname were interviewed in:

- The area of Morro de Macaco, Montanha de Robson, and Grankreek south-east of the Brokopondo lake (Figure 8, area 3 on the border of Brokopondo and Sipaliwini), and
- Mining communities in Brokopondo district: Nw. Koffiekamp and Bewojo (Figure 8, area 1) .

3.1.2 Sampling method and sample characteristics

Inclusion criteria for the quantitative survey were that:

- (1) In 2022, the person had worked in a gold mining area in either Suriname or French Guiana for at least 6 months.
- (2) The person was 16 years or older.

In addition, the objective was to include in the quantitative survey:

- A least 240 inhabitants of ASM areas
- 80 women and 160 men working in the ASM sector
- 30 women and 30 men living in an Indigenous village in south Suriname
- At least 40 persons who had experienced malaria in the past four years, including 10 Indigenous individuals.

- At least 30 persons who had used the malakit

The final sample included slightly fewer women than projected, mostly because the ASM population is heavily male dominated. Particularly among the Surinamese ASM populations, there were few women.

Table 3. Number of individuals surveyed per survey location

Survey location	District / Region Fig. 1	Total N (% of ASM)	Work in FG (% of ASM)
Antonio do Brinco/ Ronaldo	Sipaliwini, region 4 (transit area)	65 (26.1%)	52 (20.9%)
Albina	Marowijne (transit area)	49 (19.7)	42 (16.9%)
Koffiekamp	Brokopondo, region 1	24 (9.6%)	-
Bewojo	Brokopondo, region 1	37	-
Morro de Macaco	Sipa/Brokopondo, region 3	17 (6.8%)	-
Montanha de Robson	Sipa/Brokopondo, region 3	49	-
Grankreek	Sipa/Brokopondo, region 3	8	1 (0.4%)
Total ASM areas		249 (100%)	95 (38.2%)
Tepu	Sipaliwini	71 (no gold miners)	
Total		320	

Table 4 below summarizes the sample characteristics. The largest share of foreign migrants was born in Brazil, but also five Indigenous persons had been born in a Brazilian Trio community. Almost all persons in the gold mining business who were working in French Guiana were foreign migrants, predominantly Brazilians. Nevertheless, also three Surinamese persons were working in French Guiana gold mining areas. Two of them were southern Indigenous persons; a man from Kwamalasamutu and a woman from Palumeu.

The average age and the age range in the different sub populations was comparable. When looking at age groups in the ASM populations, we find that there are relatively fewer adolescents and young adults (ages 16-24) among the foreign migrants than among the Surinamese. This observation suggests that relatively more young Surinamese are entering gold mining.

Apart from the indigenous inhabitants of Tepu, all but one persons who reported that they had been ill with malaria in the past four years (2019-2022) were foreign migrants.

Table 4. Sample characteristics (NA=Not applicable), distinguishing different population sub-groups

	ASM populations - Surinamese	ASM populations – foreign migrants	Tepu	Total
Total N	66	183	71	320
Gender				
Women	7 (10.6%)	65 (35.5%)	32 (45.1%)	104 (32.5%)
Men	59 (89.4%)	118 (64.5%)	39 (54.9%)	216 (67.5%)
Country of ASM activity				
Suriname	63 (95.5%)	90 (49.2%)	NA	NA
French Guiana	3 (4.5%)	92 (50.3%)	NA	NA
Guyana	-	1 (0.5%)	NA	NA
Age group				
16-24	16 (24.2%)	17 (9.3%)	20 (28.2%)	53 (16.6%)
25-44	39 (59.1%)	101 (55.2%)	18 (25.4%)	158 (49.4%)
>=45	11 (16.7%)	65 (35.5%)	29 (40.8%)	105 (32.8%)
Don't know	-	-	4 (5.6%)*	4 (1.3%)
Average age				
Average age women	36.1 (24-60)	40.4 (18-66)	37.7 (17-77)**	39.3 (17-77)
Average age men	32.8 (16-64)	41.2 (20-76)	41.8 (16-61)**	39.0 (16-76)
Born in what country				
Brazil	-	171 (93.4%)	5 (7.0%)	176 (55%)
Suriname	66 (100%)	-	64 (90.1%)	130 (40.6%)
French Guiana	-	3 (1.6%)	1 (1.4%)	4 (1.3%)
Dominican Republic	-	6 (3.3%)	-	6 (1.9%)
Guyana	-	1 (0.5%)	-	1 (0.3%)
Cuba	-	1 (0.5%)	-	1 (0.3%)
Don't know, somewhere in the forest	-	-	1 (1.4%)	1 (0.3%)
Missing	-	1 (0.5%)	-	1 (0.3%)
Malaria data				
Experienced malaria 2019-2022	1 (1.5%)	33 (18%)	21 (29.6%)	55 (17.2%)
Used Malakit	-	33 (18%)	NA	NA

* All over 45 years of age

** Excluding unknown ages (N=4)

3.1.3 Analysis of Quantitative survey

Survey data were entered in the statistical software package SPSS (version 22) and analysed using descriptive univariate and bivariate statistics. In order to capture the diversity in health knowledge, perceptions and experiences in the report, data are often separated for the three different sub-populations: Indigenous Peoples from Tepu, Surinamese people working in the gold mining sector, and foreign migrants in the gold mining sector. Because health conditions in gold mining areas in Suriname and French Guiana are very different, we also distinguish, for selected questions, persons working in these different countries. Where the results for women and men differ significantly, data are also separated by gender.

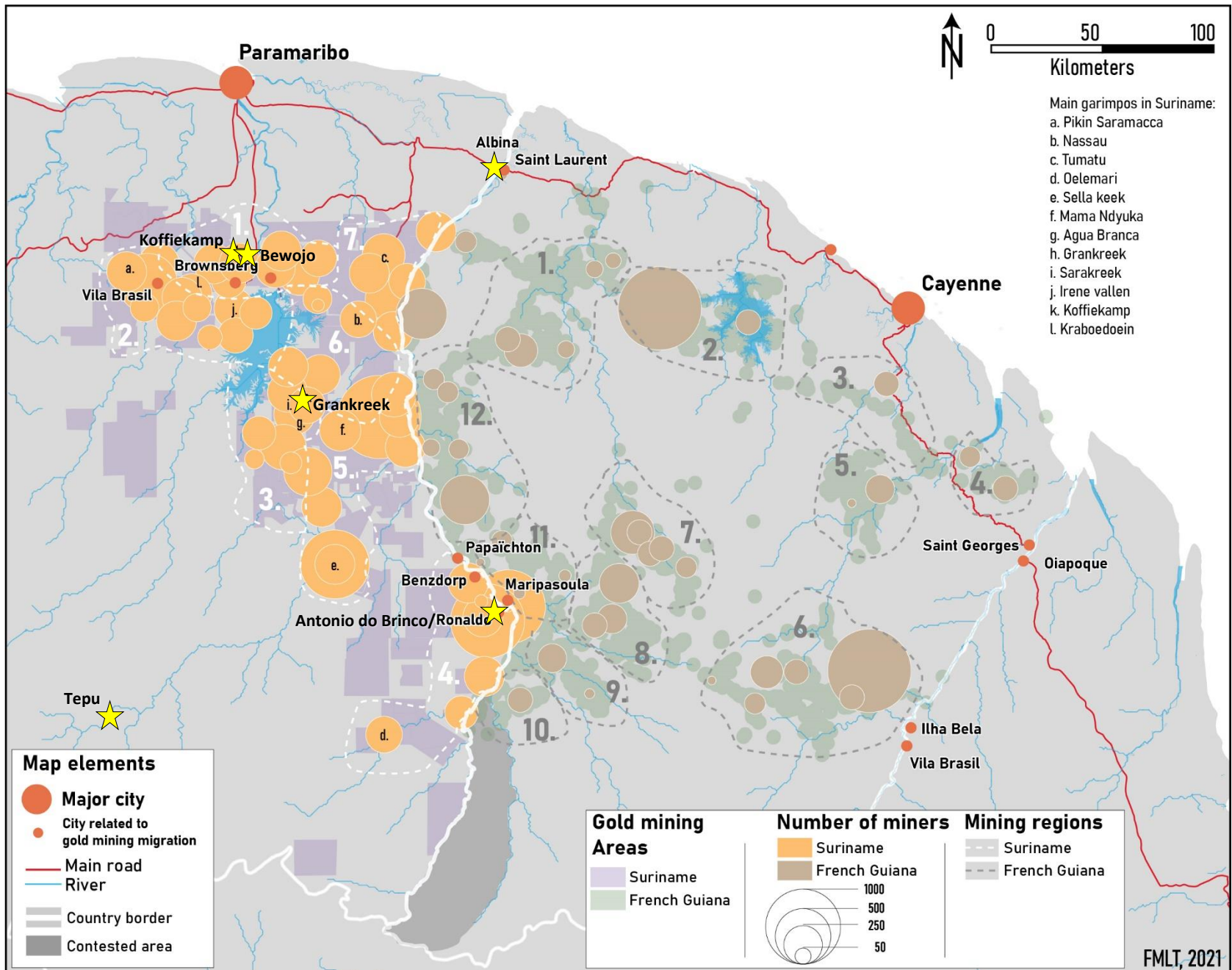


Figure 8. Location of main ASM sites in Suriname and French Guiana, with survey locations indicated as yellow stars

Source: Base map produced by François-Michel Le Tourneau

3.2 Limitations and challenges

Data from the ASM population in French Guiana were collected in Suriname. In other words, our results about gold miners and mining service providers in French Guiana represent the situation of persons traveling to the transition sites along the border of French Guiana with Suriname. These people were typically working in the Western part of French Guiana.

The Interamerican Development Bank (IDB) had asked the Consultant to include questions about Gender Based Violence (GBV) in the survey. Because GBV is a very broad, multifaceted topic, which can be experienced in multiple settings and involving different persons, it was not possible to include a thorough analysis of GBV in a survey focussing on malaria. Instead, it was decided to include a number of questions on intimate partner violence from Suriname's Multiple Indicator Cluster Survey (MICS).

3.3 Ethical considerations

The study protocol and research instrument were approved by the Committee for Scientific Research with Human Subjects (CMWO - *Commissie Mensgebonden Wetenschappelijk Onderzoek*) of the Ministry of Health, Suriname. For work in the Indigenous community of Tepu, permission was obtained from the Association of Indigenous Village Leaders in Suriname (*Vereniging van Inheemse Dorpshoofden in Suriname* -VIDS), as well as from the village head of Tepu.

Informed consent was obtained from every interviewee and survey respondent. Each interviewee was informed of the study objectives and was offered the possibility to refrain from answering or withdraw from the interview/discussion at any point without further consequences. All results in any reports' tables, charts, graphs, figures or maps are presented in a way which protects confidentiality and anonymity of individual respondent data.

3.4 Quality assurance

To ensure that the research instrument measured what we wanted to measure, and that the questions were well-understood by the target populations, the instrument was tested in a neighbourhood in North Paramaribo where many gold miners congregate to rest, buy supplies and establish contacts with work teams. The survey was tested with six persons: three Brazilian nationals, two Surinamese and one Cuban. These test interviews are not part of the study sample. Based on the first round of test interviews, the survey questions were slightly modified.

All surveyors for the ASM areas were fluent in Dutch, Sranantongo and Portuguese, and experienced in survey work in similar conditions. The two surveyors for Tepu were fluent in the Trio language. One of them was a Trio native speaker, and the second person had worked for 30 years in a Trio Indigenous community. This familiarity with the local context and the people was critical in accessing survey participants in the Indigenous community.

As part of the training, each field worker conducted one or two test interviews with persons from the target group who were in Paramaribo at the moment; in total five women and three men. Also these test interviews are not part of the study sample. Based on the second round of test interviews, final adjustments were made to the survey instrument. These adjustments mostly concerned the exact wording of questions, and additional instructions for the field workers in the document.

In the field, either the research leader or the survey supervisor travelled with the field researchers at all times. Each survey form was reviewed on location and, where necessary, omissions and inconsistencies were marked. Errors were corrected immediately by returning to the survey participants. This approach ensured the production of high quality data.

The data entry assistant had been trained in SPSS at the Anton de Kom University of Suriname (AdeKUS).

4 Results

4.1 Population demographics and characteristics

4.1.1 Demographics

Surveyed inhabitants of Suriname ASM areas had mostly been born in either Brazil or Suriname. In the Brokopondo area north of the Brokopondo lake (Koffiekamp, Bewojo), most participants in the gold sector were native Surinamese (91.8%, 54/61) (Figure 9). In the area south of the lake, the majority of the mobile migrant population was Brazilian (86.3%, 63/73), with smaller groups of Surinamese, 8.2 8/73) and others. Persons working in the ASM sector in French Guiana were mostly Brazilian (92.6%, 88/95).

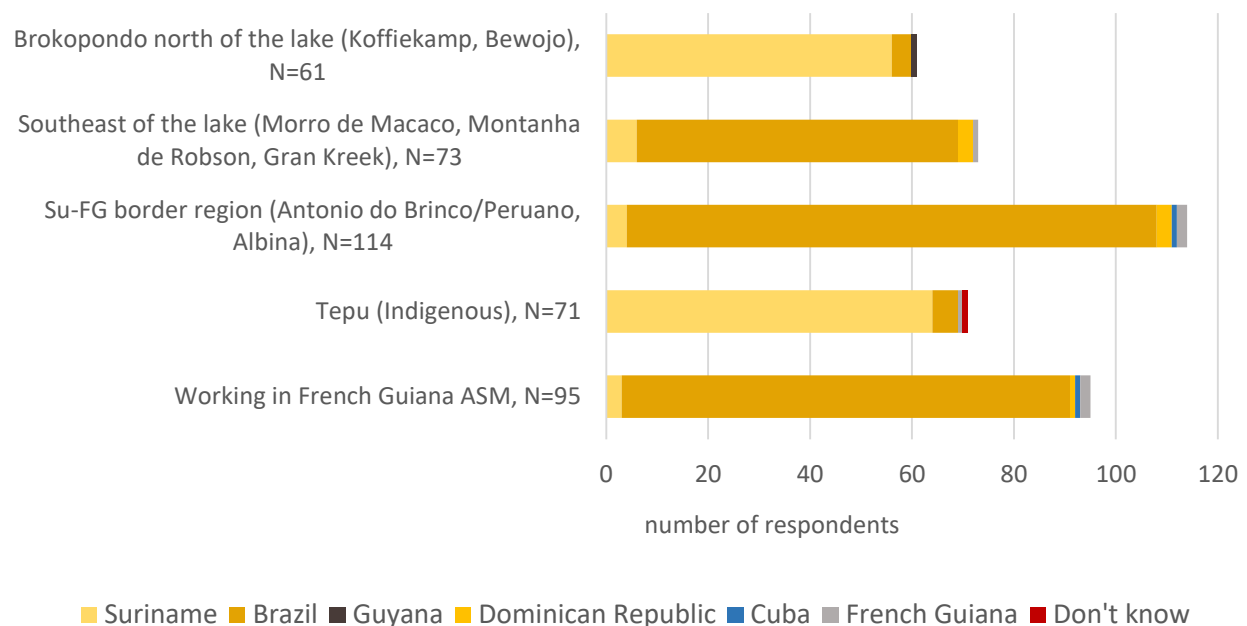


Figure 9. Country of birth of the respondents in the different study areas, number of respondents

Most (90.1%, 64/71) surveyed Indigenous persons from Tepu were born in Suriname. Five individuals were born in Brazil, where part of the Trio Indigenous Peoples live. One woman from Tepu was born in French Guiana, and an elderly man reported that he did not know in what country he was born, as he was born somewhere in the forest.

The average age of men working in ASM was 38.4 (Range 16-76). Women were, on average, 39.9 years of age (Range 18-66). There was no significant difference in age between ASM populations working in Suriname, and those working in French Guiana (Table 4, t-test).

Among Indigenous individuals, the average ages for men and women were, respectively, 41.8 (Range 16-61) and 37.7 (Range 17-77). It is possible that older persons were [art of the sample, as four old-aged persons did not know their age.

4.1.2 Professions

✓ Indigenous peoples

In Tepu, as in other southern Indigenous communities, gender shapes who does what to make a living. Women are primarily involved in subsistence agriculture, work in and around the house, and care for the children (Table 4). Men are responsible for providing fish or meat. They were, as compared to women, more often active in paid jobs such as work for the government or an NGO, gardening, teaching and construction. Table 5 lists the primary jobs listed by surveyed women and men in Tepu.

Table 5. Jobs performed by women and men in the indigenous community Tepu

Professions Indigenous peoples	Women (N=32)		Men (N=39)	
	N	%	N	%
Subsistence agriculture	13	40.6%	3	7.7%
Hunting/fishing			10	25.6%
Planting, hunting and fishing	1	3.1%	1	2.6%
Work in and around the house/ household, clearing around home	8	25.0%	2	5.1%
Government	1	3.1%	5	12.8%
Taking care of the children	6	18.8%		
NGO in the village	1	3.1%	5	12.8%
Household/Work in the house	3	9.4%	1	2.6%
Gardener			4	10.3%
Traditional authority			3	7.7%
Teacher at elementary school			3	7.7%
Construction work			2	5.1%
Student			1	2.6%

✓ Gold mining populations

Also jobs in the gold mining areas are strongly shaped by gender. Table 6 lists the main jobs of the respondents in the gold mining areas, ranking the jobs from the most to the least frequently performed. Work as a gold miner, either as part of a team or alone as a *puipuizeihro* (metal detector worker) or panner, is exclusively performed by men. Other jobs that were men often performed were mobile salesperson (*marreteiro*) and excavator operator. Women, like men, can be the owner of the operation, but they do not actually extract the gold. The top three most performed jobs by women in the ASM sector were mobile sales person (*marreteira*), cook, and sex worker.

Table 6. Professions in the ASM areas, by sex

Professions gold miners	Women (N=72)		Men (N=177)	
	N	%	N	%
Gold miner			136	76.8%
Mobile salesperson - <i>marreteira/o</i>	25	34.72%	9	5.1%
Cook	28	38.89%	4	2.3%
Operation owner	5	6.90%	5	2.8%
Excavator operator			9	5.1%
Sex worker	8	11.10%		
Transport (ATV/boat/car)			7	4%
Owner of shop or bar	2	2.80%		
Wood worker			2	0.6%
Carrier			2	1.1%
Mechanic			1	0.6%
Consession owner			1	0.6%
Owner of cabaret	1	1.4%		
Pastor in church	1	1.4%		
Welding			1	0.6%
Beautician	1	1.4%		
Shop help	1	1.4%		

When comparing jobs by those working in Suriname versus those working in French Guiana, several patterns appear. As a *Marreteiro/a* or traveling sales person, one typically walks with a large backpack (or a cooler) through the mining areas to sell necessities. This job is more common in French Guiana than in Suriname: of the nine male *marreteiros*, only one worked in Suriname. Also 17 of the 25 female *marreteiras* in the sample worked in French Guiana. The explanation for this difference is probably that in Suriname, where ASM is tolerated by the government, people can operate small shops or larger supermarkets. In French Guiana, where gold miners hide out in the forest, sales persons cannot operate shops in fixed locations, and have to walk around with their merchandise. On the other hand, the beautician, the welder, the wood workers and the mechanic, among others, were all active in Suriname, where they can establish a workshop in one of the *curratelas* (gold miners' villages).

4.2 General public health issues in the ASM areas and Tepu

4.2.1 Frequency of selected health problems

In order to obtain a better understanding of the health problems among mobile migrant populations in Suriname, we asked survey respondents whether they had experienced specific illnesses or injuries in the past year 2022. Responses are listed in Table 7.

Back pains are the most common health problem for both gold miners and Indigenous peoples. The second most common health problem experienced in 2022 was COVID-19. Between a quarter and half of

gold mining populations and Indigenous peoples reported that they had been ill with COVID-19 (own account, not all proven by test) in the year preceding the interview. In addition, pain in the kidneys and the liver were named by quite a few persons in both groups. It is possible that some of these complaints were not related to the kidney or the liver, but were pains in the general area where people believed these organs to be. Particularly Brazilians were quite often taking liver or kidney medication, usually procured Over The Counter (OTC). The high consumption of OTC (and possibly not validated) liver medication was confirmed by the Surinamese epidemiologist Dr. Vreden, who has conducted various health studies among gold mining populations (pers. com. 04/04/2023).

Table 7. Frequency of occurrence of selected health issues among mobile migrant populations

	Gold mining population		Indigenous	
	Male (N=177)	Female (N=72)	Male (N=39)	Female (N=32)
Back pains	104 (58.8%)	49 (68.1%)	18 (46.2%)	20 (62.5%)
COVID-19	44 (24.9%)	29 (40.3%)	18 (46.2%)	9 (28.1%)
Pain in kidneys	46 (26%)	21 (29.2%)	12 (30.8%)	14 (43.8%)
Pain in liver	22 (12.4%)	15 (20.8%)	13 (33.3%)	16 (50.0%)
High blood pressure	20 (11.3%)	16 (22.2%)	18 (46.2%)	7 (21.9%)
Work related injuries	7 (39.5%)	17 (23.6%)	11 (28.2%)	6 (18.8%)
Skin infections, fungi, or rashes	19 (10.7%)	5 (6.9%)	7 (17.9%)	7 (21.9%)
Leishmania	11 (6.2%)	5 (6.9%)	5 (12.8%)	6 (18.8%)
Violence related injuries	2 (1.1%)	3 (4.2%)	2 (5.1%)	1 (3.1%)

Injuries due violence were relatively rare. Women in the gold mining areas were more likely than others to have experienced violence-related injuries in the year preceding the interview, but the numbers for all groups are too small to draw definite conclusions.

4.2.2 Use of antibiotics

The target groups consumed a worrisome amount of antibiotics, often without doctor's prescription. Half of the respondents working in gold mining areas had used antibiotics in the year preceding the interview, 2022 (49.4%, 123/249). Women were relatively more likely than men to have used antibiotics (resp. 62.5% versus 44.1%; χ^2 , $p < 0.05$). Only a quarter of these persons had obtained the antibiotics on medical prescription (25.2%, 31/123) and another 4.1% had received the antibiotics in a hospital—usually in French Guiana- during treatment. The largest group of persons had procured the antibiotics OTC at a pharmacy or store in the mining areas (65%, 80/123). Others had either received it from someone, or bought it from a person in the mining areas (Figure 10).

Among those who had received the antibiotics on prescription, the grand majority had completed the regimen (91.9%, 34/37). Those who had bought OTC antibiotics could not be asked about completion of the regimen because the medication had not be prescribed by a medical doctor (i.e. there was no

regimen). From conversations with this group, we know that many take antibiotics haphazardly, taking a couple of pills when they feel bad or suffer from pain.

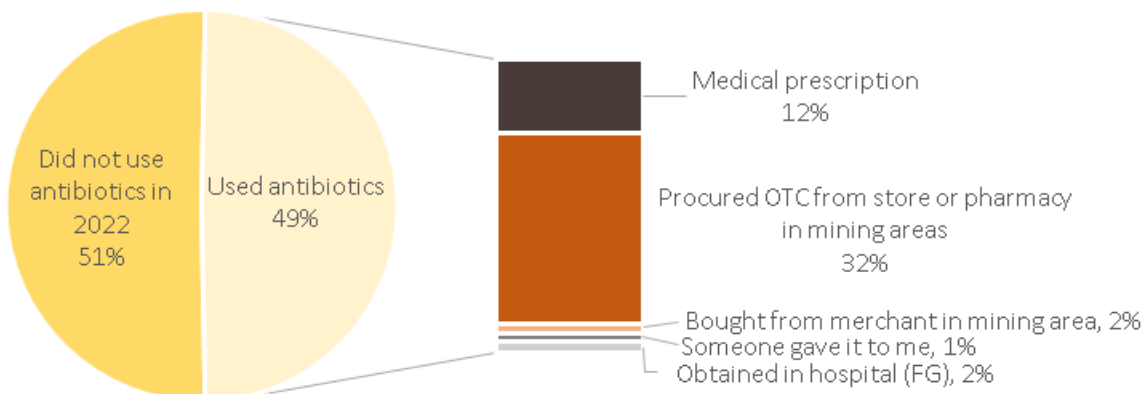


Figure 10. Share of ASM populations who used antibiotics in 2022, with their method of accessing medication

Among the indigenous peoples of Tepu,, three-quarters reported that they had taken antibiotics in the year prior to the interview (2022) (76.1%, 54/71). Almost everyone from Tepu (96.3%, 52/54) had obtained these antibiotics from the local MZ health clinic. The two remaining person had received the antibiotics from someone else, who had given it to them. Allmost all Tepu inhabitants who had taken antibiotics reported that they had completed the cure as prescribed (92.6%, 50/54). Three persons reported that they had taken some pills, but stopped the treatment half-way, and one person conveyed that he took some pills once in a while, whenever he experienced pain.

4.2.3 Pap smear or VIA

Women of all sub-populations were asked about the most recent Pap smear or VIA (Visual Inspection with Acetic Acid) they had taken. From a public health perspective, it is important to know whether women take these tests, as in Suriname, cervical cancer is the 2nd most frequent cancer among women⁴. In Suriname, about half of the women diagnosed with cervical cancer die, a number that could be lowered with more rapid detection.

Among Indigenous women, 40.6% (13/32) had never conducted a cervical cancer test. All of these women were younger than 45 years. For another 40.6% of Indigenous women, it had been more than 5 years ago that they took either a pap smear or a VIA. Only one woman had taken a Pap smear/VIA in the year preceding the interview (2022). Two others reported that they had taken the test in 2018-19 and three women could not remember when they had taken one most recently.

Women in the mining areas were much more conscious about testing for cervical cancer, with 40.3% (29/72) of women having taken a test in 2022, and another two women (2.8%) even having taken one in the month prior to the interview. Even though the number of Surinamese women in the sample of ASM populations was low, the data do suggest a difference between Surinamese and foreign migrant women.

⁴ PAHO website "It takes a village to save a woman's life from cervical cancer". URL: <https://www.paho.org/en/stories/it-takes-village-save-womans-life-cervical-cancer>

Among the seven Surinamese women, one woman in her 50s had never performed a cervical cancer test and did not know what it was, and for two it was more than five years ago. Only two women (28.3%) had performed a pap smear or VIA in 2022 or 2023 (surveys conducted jan-feb 2023). Among the foreign migrant women, 45.3% had taken a cervical cancer test in 2022-23 (27/64), and only 3.1% (2/64) had never taken one. Particularly Brazilian women seemed to be very conscious about cervical cancer testing, with 71.9% (41/57) having performed a pap smear or VIA in the past three years (2020-feb 2023).

4.3 Malaria knowledge

4.3.1 Venues of knowledge transfer

In 2022, the Suriname Malaria Program launched a multifaceted malaria awareness campaign. Malaria information messages were voice recorded in different languages, including Sranantongo, Brazilian Portuguese, Trio, and different Maroon languages. These messages were aired on national and local radio stations, and distributed as WhatsApp voice messages. In addition, in the southern Indigenous villages, village leaders used the village loudspeaker system to spread the information (Not applicable for mining populations).

Also as part of the MoH-MP malaria awareness campaign, Medical Mission (MZ) health workers and Malaria Service Deliverers (MSD) were trained in behaviour change communication. Posters and children's booklets with easy to understand messages have been distributed in the Indigenous communities, and the posters have been placed on the MSD work locations.

Interviewees were asked which ones of these messages they had seen or heard. The data show that the Indigenous peoples of Tepu have been reached extensively by the outreach campaign. More than 9 out of every 10 inhabitants had heard a malaria message through the village loudspeakers, or heard a malaria message from the local MZ health worker. The WhatsApp voice message and the radio message, both provided in the Trio language, had each been heard by about 40% of the adult village population (Figure 11). The radio messages are sometimes played through the village loudspeakers, so there is some overlap in these categories. Many others had attended a presentation by health workers who had come from the city, and/or seen a malaria poster.

Fewer gold mining populations had been reached by the MoH-MP malaria awareness messages. Virtually no-one had receive the WhatsApp message. A quarter of Surinamese persons working in the gold mining sector reported that they had heard the malaria awareness message on the radio, but foreign migrants rarely listen to Suriname radio (Figure 11). About 28% of both Surinamese and foreign migrant ASM populations had seen the malaria posters. In addition, just over 10% of each sub-population had received malaria information from a local health worker, either MZ staff in the traditional villages or an MSD in the gold mining areas.

Among ASM populations, 36.1% (90/249) had seen or heard at least one malaria awareness message; among the Indigenous people of Tepu this was 97.2% (69/71). We asked respondents what they still

remembered from the messages they had seen or heard. Among gold mining populations, more than a third of those who had seen or heard a malaria message, reported that they did not remember what it said (36.7%, 33/90). Among Indigenous peoples, the malaria messages had been retained better. Of those Indigenous individuals who had seen or received at least one malaria message, six persons reported that they did not remember anything from the message (8.7%, 6/69). The messages that people still remembered, or believed they remembered, were diverse and are listed in Table 8. Not all messages in the table are truly part of the malaria awareness information, but may rather be personal interpretations.

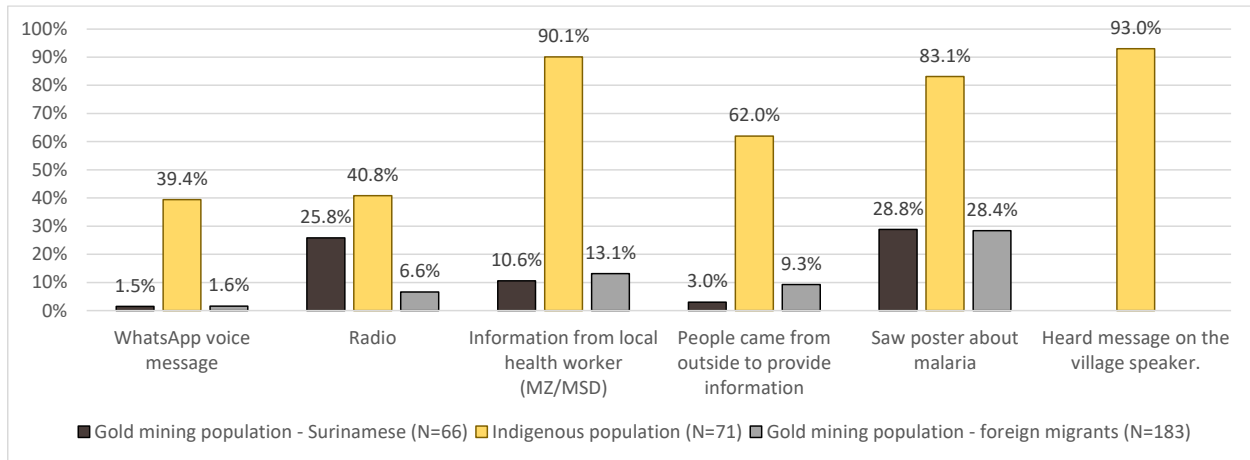


Figure 11. Venues through which mobile migrant populations received malaria information in 2022

The most common piece of information that both groups (gold mining populations and Indigenous Peoples) remembered from the malaria awareness messages was that one should sleep with a bed net. Other messages that people of both groups remembered often were that malaria is dangerous, and that one should take a test when feeling symptoms.

Many Indigenous Peoples reported that they had been told that one should clean the surroundings, remove breeding places (empty cans etc.), and remove long grasses and weeds. Four persons from Tepu reported that one should only drink clean water, or boil drinking water. While these are generally good health measures, they are not proven methods to prevent malaria. MZ has emphasized such measures as part of their broader health communication interventions.

Among ASM populations, the second most remembered message was that malaria is transmitted by a mosquito. They also referred to keeping one's surroundings clean and free of cans and other items with standing water. All other "remembered" messages were only mentioned by one person. Some of these pieces of information were correct (e.g. about malaria symptoms or the services of the MSD) but others had been misunderstood or misinterpreted. For example, one person had taken away from the malaria awareness campaign that there is no malaria anymore in Suriname.

Several persons seemed to confuse the malaria information with COVID-19 information. They reported that you should wash your hands to prevent getting infected, stay at home when you have malaria, and not come near malaria patients.

Table 8. Information people remembered from the malaria awareness campaign

Malaria message (Only those who had seen or heard one form of malaria awareness communication)	ASM populations (N=90)		Indigenous, Tepu (N=69)	
	N	%	N	%
You can use a bed net to protect yourself against malaria	26	28.9%	39	56.5%
Malaria is dangerous	17	18.9%	14	20.3%
You should keep your surroundings clean	2	2.2%	25	36.2%
Malaria is transferred by a mosquito	20	22.2%	5	7.2%
If you think you might have malaria, go take the test	11	12.2%	12	17.4%
Make sure there are no bottles, cans and other items with standing water	4	4.4%	14	20.3%
Drink clean drinking water; boil the water before you drink it			4	5.8%
Weeding/mowing grass			4	5.8%
Do not just take any medication, go test first and take the correct medication	2	2.2%	1	1.4%
Suriname is working towards elimination/Malaria is more under control now	2	2.2%		
Cover your drinking water so that mosquitoes cannot breed inside	1	1.1%	1	1.4%
Eat well/be conscious about what you eat			2	2.9%
Go under the bed net early/go sleep early (at 18h, 19h)	0	0.0%	1	1.4%
There is no malaria anymore in Suriname	1	1.1%		
Information about the symptoms	1	1.1%		
MSD provides test and treat services	1	1.1%		
Wash your hands	1	1.1%		
use repellent between 18h and 19h	1	1.1%		
They are working on making stronger medication	1	1.1%		
They talked about Malakit	1	1.1%		
If you have malaria you should stay at home			1	1.4%
If the water is dirty, it breeds mosquitoes and this way malaria will return			1	1.4%
Malaria returned to Tepu			1	1.4%
Do not sleep outside			1	1.4%
Take medication to prevent malaria			1	1.4%
You will only feel the malaria a couple of weeks after you have been infected			1	1.4%
use repellent between when you go hunt			1	1.4%
Clean your plates			1	1.4%
Do not go to other people to eat			1	1.4%
Do not get near malaria patients			1	1.4%
Nothing, cannot remember anything	33	36.7%	6	8.7%

4.3.2 Knowledge of symptoms

The symptoms of malaria include fever, vomiting, and/or headache, among many other pains and discomforts. *P. falciparum* has the most severe disease impact, which may lead to cerebral malaria, severe malarial anaemia, and death. Interviewees were asked what symptoms of malaria they knew. The answers are listed Figure 12, with more detail provided in Annex 1, distinguishing the Indigenous people of Tepu, Surinamese gold mining populations, and foreign migrant mining populations.

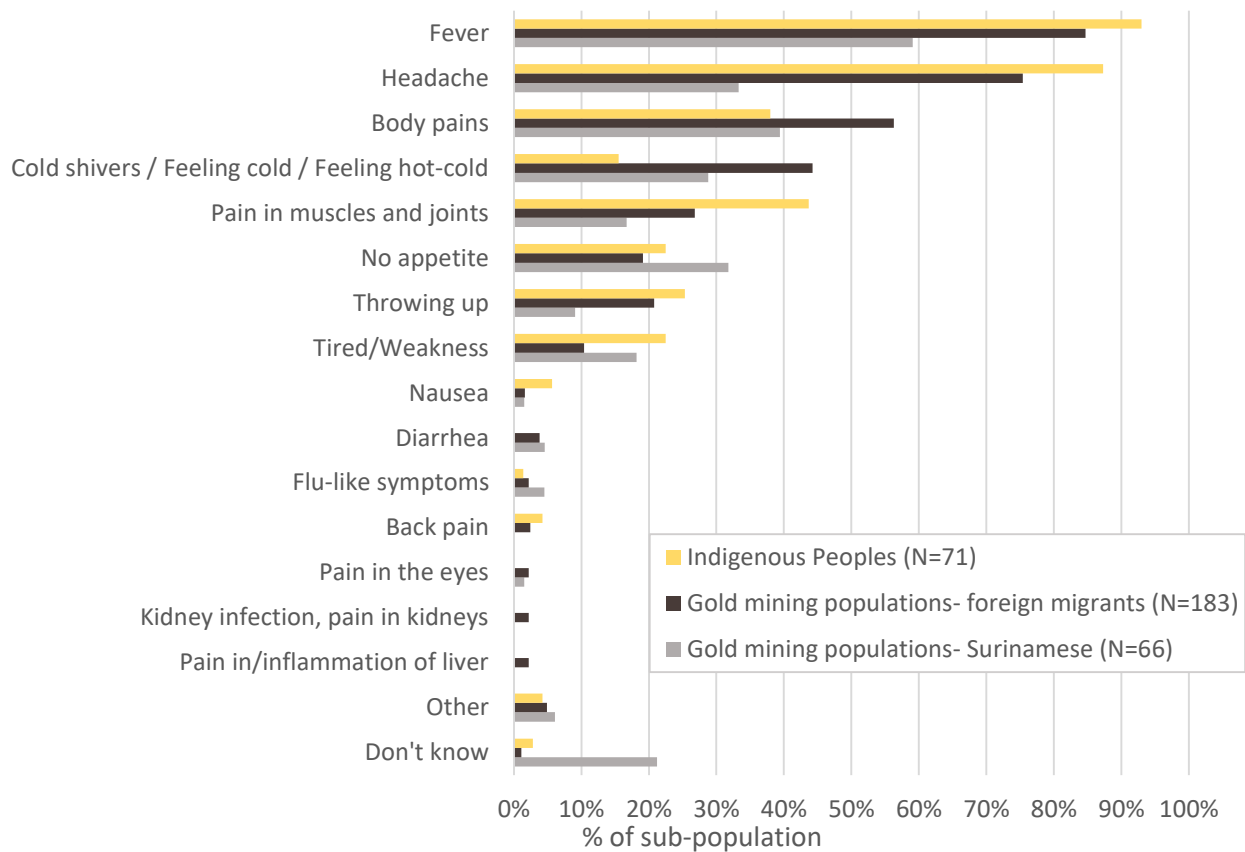


Figure 12. Most mentioned malaria symptoms, by sub-population

The Indigenous people of Tepu were better able than gold mining populations to list main malaria symptoms. This was most likely the direct result of the re-introduction of malaria in Tepu and Palumeu, and the subsequent more extensive malaria campaign. Surinamese mining populations named fewer symptoms, and were more likely than the other two sub-groups to state that they could not name any symptom (21.2%, 14/66). Young people (15-24) were relatively more likely than older people to not be able to name any malaria symptoms: half of the Suriname ASM population in the ages 16-24 were unable to name any symptom of malaria (50%. 8/16). In the total sample, 22.6% (12/53) of young people ages 16-24 were unable to name any malaria symptoms, as compared to 3.8% of adults ages 25-44 (6/158), and none of the persons older than 45 (0/109).

Fever, head ache and body pains are overall the best known malaria symptoms. Also regularly named were cold shivers / Feeling cold / Feeling hot-cold; pain in muscles and joints, having no appetite, throwing

up, and feeling tired/weakness. All of these are potentially symptoms of malaria. Some people named peculiar symptoms. For example, four migrant gold miners named kidney infection/kidney pains, two persons (one Surinamese, one foreign migrant) named jaundice (yellow eyes, yellow skin), one person referred to wounds in the mouth, and one person referred to haemorrhages, which all are very rare but possible outcomes of malaria, particularly in severe cases.

Among the “other” symptoms were all items that were mentioned less than 3 times total. These items included a wide variety of ailments of which some could be attributed to malaria, but others probably not. For example, two persons mentioned, separately from one another, that a person with HIV who gets malaria, will experience changes in skin colour. We have not found evidence for this statement.

4.3.3 Knowledge of the cause of malaria

Malaria is transmitted to humans by female mosquitoes of the genus *Anopheles*. The majority of study participants knew that malaria is transmitted by a mosquito, but some also named other (erroneous) additional transmission ways, and others did not name the mosquito at all. In line with the earlier findings about knowledge of symptoms of malaria, we find that as compared to Surinamese in the gold sector, both indigenous peoples and foreign migrants working in ASM are much better informed about the cause of malaria. Among Surinamese ASM populations, 7.6% (5/66) could not tell the cause of malaria, and another 9.1% (6/66) gave an answer that did not involve the mosquito. One two thirds of Surinamese gold mining populations knew that only the mosquito transmits malaria (43/66). Among Indigenous Peoples and Foreign Migrants in the gold sector respectively 80.3% (57/71) and 85.8% (157/183) only named the mosquito as the cause of malaria.

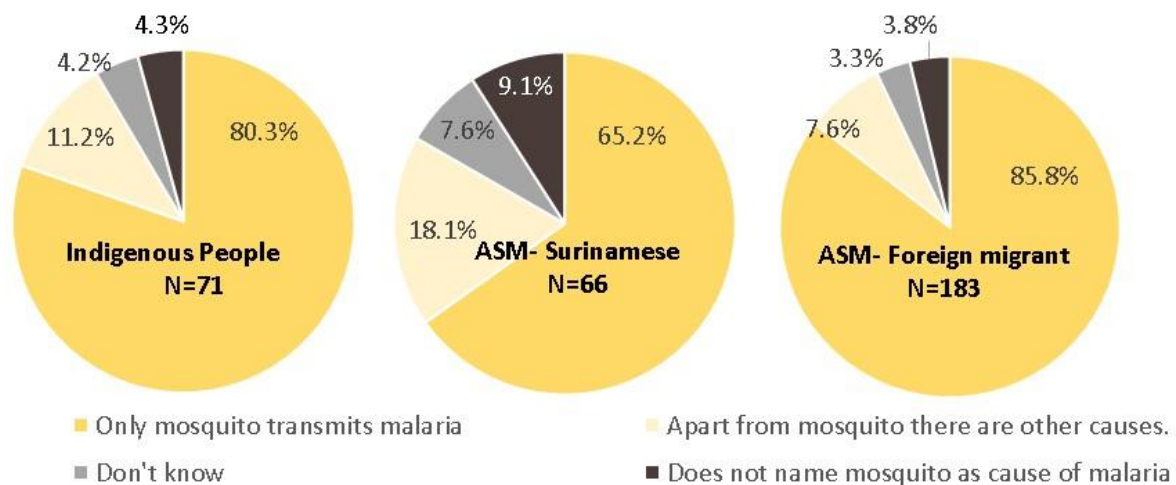


Figure 13. Share of persons who know that malaria is only transmitted by a mosquito

Table 9 lists all items that were mentioned by respondents as causes for malaria. The idea that drinking water that has some problem causes malaria is persistent. People named drinking creek water, drinking polluted or dirty water, drinking water that has not been boiled first, and drinking water with mosquito

larvae all as causes for malaria. Also being near polluted water or dirty surroundings was mentioned in all subgroups as a possible cause of malaria. The idea that dirty surroundings and dirty water cause malaria is rooted in two misunderstandings. In the first place, in campaigns to fight dengue, people have been informed that to prevent breeding of the dengue mosquito, one has to make sure there are no basins (empty bottles or cans, old tires) with standing water. This strategy, however, is not effective against malaria mosquitoes in Suriname, since the primary malaria vector, *Anopheles darlingi*, breeds in rivers and creeks. Secondly, in some people's minds, this message had been translated to the water itself being the problem. Hence drinking water or being near it is viewed as a cause of mosquito-induced diseases, including malaria.

Among the "other" answers, there was only one correct answer: malaria during pregnancy may result in foetal exposure to malaria if parasites are transmitted across the placenta, and could result in congenital malaria. Except for this answer, interviewees listed a large number of erroneous answers, including that malaria is transferred by mice in the forest, through sex, or drinking *kasiri* – an Indigenous alcoholic drink made of fermented cassava.

Table 9. Named causes of malaria, by sub-population

Named causes of malaria	Gold mining population-Surinamese, N=66	Gold mining population-foreign migrants ((N=183)	Indigenous, N=71
Mosquito	55 (83.3%)	170 (92.9%)	65 (91.5%)
ONLY mosquito	43 (65.2%)	157 (85.8%)	57 (80.3%)
Dirty surroundings, lot of garbage	1 (1.5%)	4 (2.2%)	3 (4.2%)
Drinking dirty/polluted/untreated water; drinking water with mosquito larvae; drinking creek water.	12 (18.2%)	9 (4.9%)	7 (9.9%)
Rain, cold weather	1 (1.5%)		2 (2.8%)
Being near dirty/polluted water	3 (4.5%)	4 (2.2%)	1 (1.4%)
Other, all mentioned once: drinking <i>kasiri</i> (alcohol), comes through the air; people from Brazil bring it here; mice from the forest; dengue mosquito; bacteria; an insect; blood transfusion; unprotected sex; when you are pregnant the child may be born with malaria.	2 (3%)	5 (2.7%)	4 (5.6%)
Don't know	5 (7.6%)	6 (3.3%)	5 (7.6%)

In the field, it was noticed that particularly young people seemed poorly informed about malaria, both Surinamese and foreign migrants. Surinamese in their 30s and older usually could remember the time that malaria was still widespread, and several persons recounted that they had malaria as a child. Likewise, gold miners who had been working in Suriname for more than a decade, remembered that there used to be a lot of malaria, but they had not experienced any malaria for a very long time. For many adolescents

and young adults (ages 16-24), however, malaria was something from a far past, from stories by their grandparents. They had never experienced, or seen anyone with, malaria.

The data confirm this age-gap in malaria knowledge (Figure 14). People in the oldest age group (>45) were most likely to correctly state that only the mosquito transmits malaria, and least likely to either not know the cause of malaria, or state a cause without naming the mosquito.

Among those who had experienced malaria in the past 4 years, 90.6% (48/53) knew that the only vector for malaria transmission is the mosquito, as compared to 78.9% of others (209/265). This difference was not statistically significant.

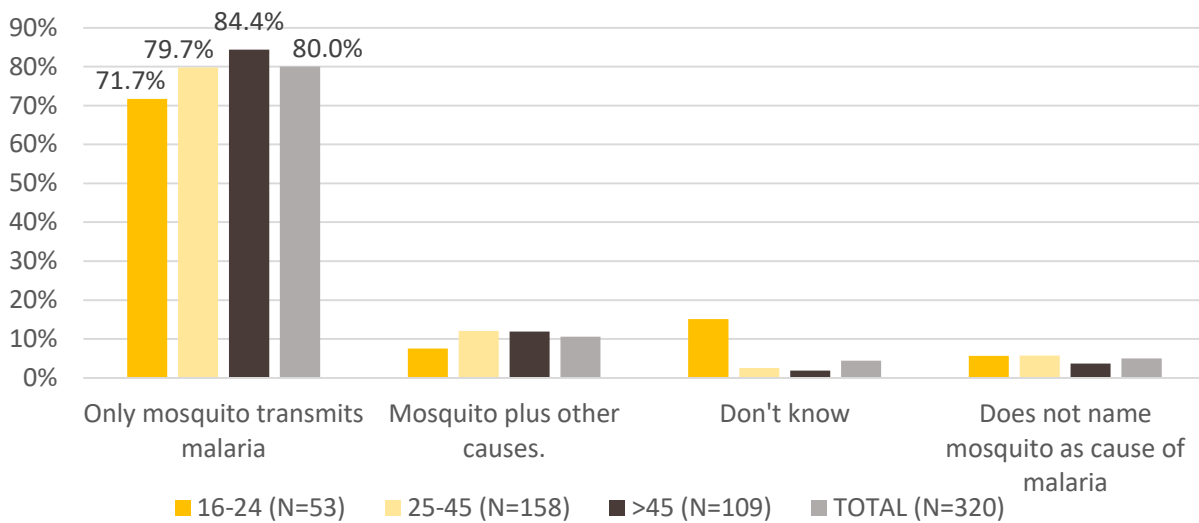


Figure 14. Share of respondents who know that malaria is ONLY transmitted by a mosquito, by age group

4.3.4 Misperceptions

In order to further test malaria knowledge, study participants were presented with four yes-no questions about malaria. The questions and the answers are presented below, distinguishing Surinamese gold mining populations, foreign migrants working in gold mining, and Indigenous peoples (Figure 15). The largest share of respondents in all sub groups were aware that malaria is a potentially deadly disease. Several individuals specified that malaria could kill someone if the person does not take proper treatment.

There was a lot of uncertainty about bats as a vector for malaria transmission (Figure 15). Even though people did not name the bat as a cause of malaria, when specifically asked if a bat could transmit malaria, they started to doubt. Apart from the people who believed that bats could transmit malaria (30.1%, 30/96), 13.5% of persons said they did not know.

There was also much doubt about the question of whether there still is malaria in Suriname (Figure 16). Particularly among the Indigenous peoples a significant share reported that there is no malaria anymore in Suriname (21.1%, 15/71), or that they did not know (18.3%, 13/71). This is curious, because there were

malaria outbreak in the village only 3 to 4 years ago. Surinamese ASM populations were most likely to answer this question correctly (Figure 15).

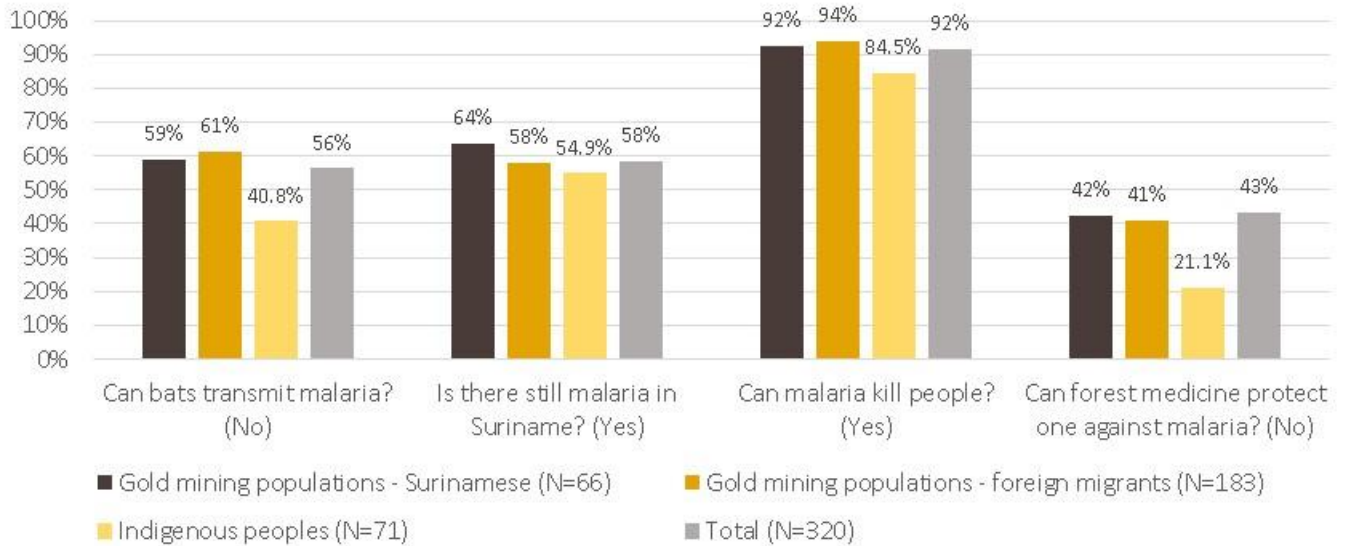


Figure 15. Share of correct answers to statements about malaria in the different subpopulations

About half of respondents (48.3%, 154/319), and even two-thirds of Indigenous individuals (66.2%, 47/71) had no doubt that forest medicine was effective against malaria (Figure 15 and 16). Indigenous peoples were particularly adamant about the working of certain kinds of *wataki* (Indigenous forest medicine) to prevent malaria⁵. Among Surinamese working in the gold sector, most of whom were ethnic Maroons, 48.5% (32/66) believed in the protective powers of *bita* (bitter type of forest medicine). Among foreign migrants in the gold sector, 41.2% (75/182) believed that home remedies were effective in protecting people against malaria.

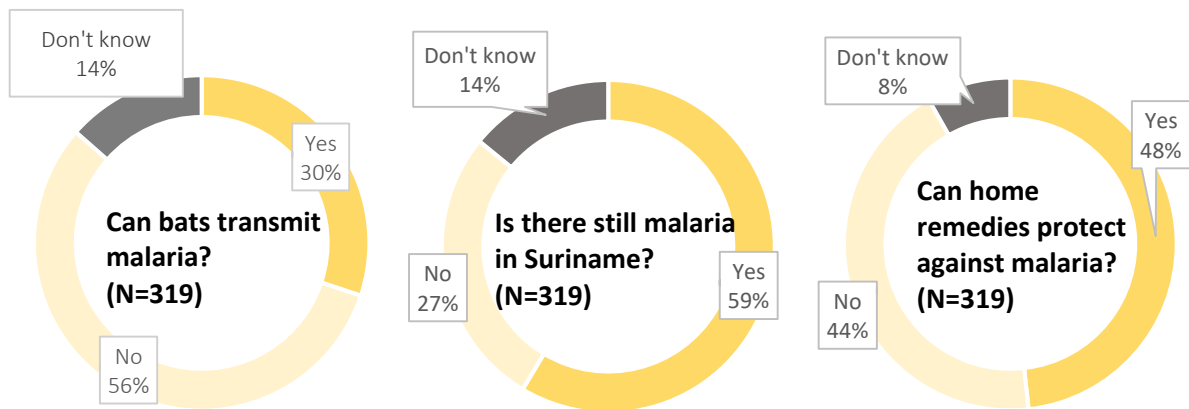


Figure 16. Answers to different knowledge questions about malaria.

⁵ During the presentation of this report, the consultant hired by the MoH-MP to design the malaria awareness campaign confirmed that people in the Indigenous villages have a strong believe in their forest medicines, as well as quite some aversion against Western medication (Pers. pom. 04/04/2023).

When we look at the answers to the different questions by age categories, we see again that particularly adolescents and young adults (ages 16-24) are poorly informed about malaria. As compared to adults (25-45) and people over 45 years of age, young people scored consistently worse on all indicators. They were relatively more likely to believe that bats can transmit malaria, more likely to believe that forest medicine can protect one against malaria, and less likely to know that malaria can be deadly (Figure 19).

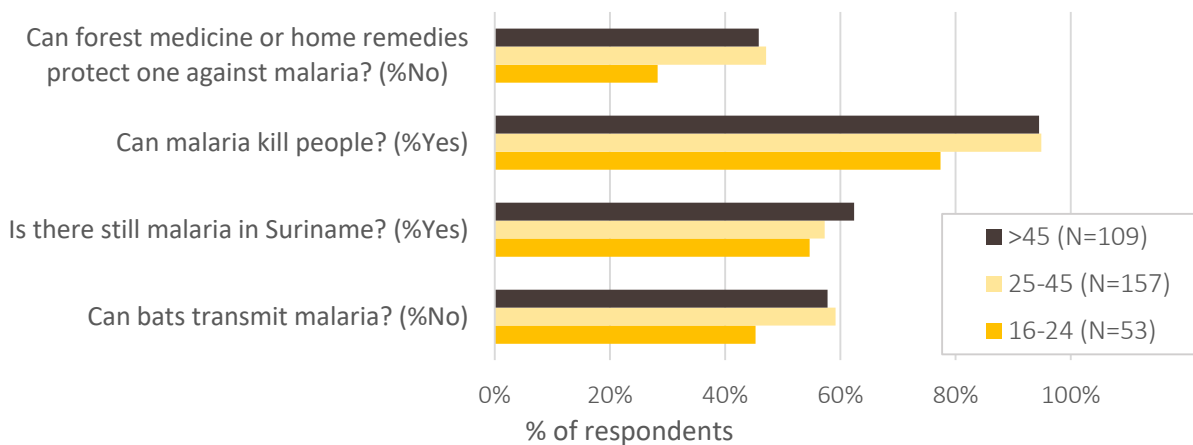


Figure 17. Share of respondents answering correctly to four malaria questions, by age group

4.3.5 Knowledge of protection against malaria

The MP malaria awareness campaign motivates people to sleep with a bed net, preferably one that is insecticide-treated (ITN- Insecticide Treated Net). We asked survey respondents what measures they knew to prevent malaria. The responses are listed in Table 10 below. The answers that do not present effective ways to prevent malaria are shaded orange, and listed at the bottom of the table (Not valid answers). These answers included, for example, “use condoms” or “smoke marihuana”.

In all three sub-populations, use of a bed net was the most frequently mentioned way to prevent becoming infected with malaria. Several persons provided additional details related to their bed net use. For example, several persons reported that it was important to go to sleep early, or go under the bed net at dusk, around 6 or 7 pm. One Indigenous man said that he did not share his bed net to prevent getting malaria.

In the top three best known correct ways to prevent malaria were, apart from “sleeping with a bed net”, also the “use of repellent” (especially among foreign migrants) and to “wear long sleeves, long trousers”. Both are reasonable methods to lower the chances of being bitten by a malaria mosquito. Many persons believed that “keeping the surroundings clean” and “remove breeding places for mosquito, remove standing water” are effective methods to prevent malaria. These are good ways to reduce dengue but have no proven impact on malaria transmission in Suriname. Keeping the surroundings clean was mentioned relatively most often in Tepu, where the MZ has recommended this in the context of broader health education about malaria and other diseases.

Table 10. Ways to prevent getting malaria named by different subgroups, wrong answers shaded orange.

	ASM population - Surinamese (N=66)		ASM population - foreign migrants (N=183)		Indigenous (N=71)	
	N	%	N	%	N	%
Valid methods						
Sleep with a bed net	51	77.3%	144	78.7%	47	66.2%
Use repellent	21	31.8%	95	51.9%	10	14.1%
Wear long sleeves, long trousers	5	7.6%	15	8.2%	5	7.0%
Do not stay up late, be under the bed net at 18h/19h	1	1.5%	2	1.1%	10	14.1%
Not go to the <i>garimpo</i>	1	1.5%	10	5.5%	-	
Take medication to prevent malaria	0		1	0.5%	10	14.1%
Do not go out at night	1	1.5%	-		-	
Invalid answers						
Keep your surroundings clean	11	16.7%	13	7.2%	15	21.2%
Use forest medicine/home remedies	9	13.6%	6	3.3%	17	23.9%
Use mosquito candle / Veep	9	13.6%	9	4.9%	7	9.9%
Stay away from dirty water/standing water	5	7.6%	8	4.4%	-	
Do not drink dirty water/creek water/untreated water	10	15.2%	5	2.7%	3	4.2%
Use insecticide spray	4	6.1%	7	3.8%	1	1.4%
Remove breeding places for mosquito, remove standing water.	6	9.1%	3	1.6%	-	
It is not possible to protect yourself	-	-	6	3.3%	-	
Take liver medication	-	-	4	2.2%	-	
Eat healthy/vegetables	1	1.5%	1	0.5%	1	1.4%
Check your body regularly (with a medical doctor).	2	3.0%	-		-	
Make fire / smoke	-	-	1	0.5%	1	1.4%
Eating pingo that was bitten by a mosquito	-		-		1	1.4%
Make sure your food is stored properly.	-		-		1	1.4%
Stay away from places with a lot of garbage	-		-		1	1.4%
Smoke marihuana or jonko	1	1.5%	-		-	
Cover drinking water so that mosquitoes cannot breed inside	1	1.5%	-		-	
Use condoms	-		1	0.5%	-	
Rub clay over your body	-		1	0.5%	-	
Take vaccination against malaria (not available yet in Suriname)	-		1	0.5%	-	
Sleep well	-		1	0.5%	-	
Wear socks	-		1	0.5%	-	
Do not go to riverside at 18h	-		1	0.5%	-	

Not share bed net with others	-				1	1.40%
Drink alcohol	1	1.5%	-		-	
Don't know	3	4.5%	8	4.4%	2	2.8%

In line with the earlier findings (§4.3.4), quite some individuals in all sub-groups referred to the use of home remedies or forest medicine. Overall this is the fourth most often named way to prevent malaria, and first among the not valid answers (Table 10). This is not to say that it is impossible that forest medicine could be effective in reducing the chances of getting malaria or diminishing malaria symptoms. Bark of *Cinchona ledgeriana*, which contains the active ingredient quinine, was used by forest peoples long before quinine became the basis of early malaria medication. Yet at this moment, there is no scientific evidence that *wataki* or *bita* protect people against malaria.

Ten persons from Tepu reported that in order to prevent getting malaria, one can take the medication from the Medical Mission clinic (14.1%, 10/71). Yet MZ does not distribute malaria prophylaxis, and in this context, the answers reflected a misunderstanding. In 2019-2020, there was a malaria outbreak in Tepu. In 2020 and 2021, in an effort to get the outbreak under control, MZ in collaboration with the MP launched a Mass Drug Administration (MDA) effort. The objective of this intervention was to break the lifecycle of the plasmodium parasite in the community. All community members, regardless of whether they had symptoms or were tested positive, were asked to complete a chloroquine and primaquine treatment. This way, also asymptomatic persons who carry the plasmodium parasite, were treated. Because this approach helped curb the malaria epidemic, these answers are listed among the correct answers.

Among the foreign migrants in the ASM areas, one person also mentioned preventative medication, and one person referred to vaccination against malaria.

Among the “correct” answers, there are several answers that are a bit questionable. For example, rubbing one’s body with clay can possibly reduce the chance of being bitten by a mosquito, but is not a proven effective method to prevent malaria. Also, not going to the mining areas is effective, but not a practical option for those whose livelihood depend on ASM.

4.4 Risk perception

It is important to know whether people feel that they are at risk of getting infected with malaria, as this is likely to affect their likelihood to use protective measures. Individuals working in the ASM sector in French Guiana (or Guyana, 21 person) were relatively more likely than others to report that they believed they were at (some) risk of malaria infection (59.3%, 57/96). Among Indigenous Peoples and gold mining populations in Suriname only respectively 31% (22/71) and 45.4% (72/152) felt themselves at risk of malaria infection (Figure 18). There was no significant difference between the age groups in terms of risk perception.

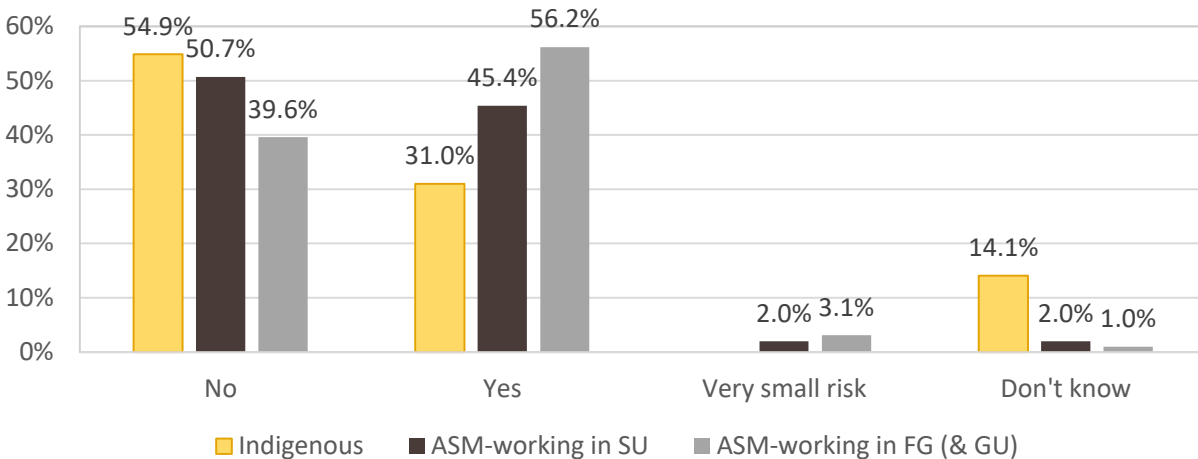


Figure 18. Do you believe you are at risk, here and now, to get infected with malaria?

Overall, main reasons to believe to be at risk for malaria transmission were that:

- There is still malaria (47%, 71/151),
- Anyone can get it (15.9%, 24/151),
- There are (many) mosquitoes here (13.2%, 20/151)
- There is a lot of garbage here / unhygienic surroundings (10.6%, 16/151)
- There are places with standing water here (9.3%, 14/151)
- We are in the forest/Amazone here (6%, 9/151)
- People come here with malaria, from the forest/Brazil (5.3%, 8/151).
- There are people with malaria here and they can infect me/it is contagious (3.3%, 5/151)
- Many people/Brazilians/garimpeiros here (3.3%. 5/151)
- We are close to the river (2.6%, 4/151)
- Other (named less than 4 times): I do not/cannot protect myself; we sleep without bed nets; people do not take care of their health, they only think about money; people do not protect themselves; if you had it before it can return; there are many pests here and they can transmit malaria; it can come from everywhere, we also share drinking glasses; I drink dirty water; people can infect me when I talk with them (through saliva); we are in the mining areas here (17.9%, 27/151)

Main reasons to believe that one was not at risk for malaria transmission were that:

- There is (almost) no malaria anymore in Suriname – 18.8% (29/154)
- There is no malaria in this mining area/this village – 61.7% (95/154)
- There are (almost) no mosquitoes here (5.8%, 9/154)
- I never got it here/never heard that someone got it here (4.5%, 7/154)
- Take the MZ medication against malaria/follow the rules of MZ (3.9%, 6/154)
- Other (named less than 4 times): I use forest medicine; I use a bed net; everyone here uses bed nets; here we are not in the forest (e.g. Albina); I am continuously moving; this place is tidy; we sleep in a room that can be closed off; when I am in the forest I use repellent; not a lot of standing water here, I protect myself; I do not go far into the forest; I only work on the Suriname side; few

insects here; I do not mingle with people here; mosquitoes only come at night; I live healthy/ eat healthy / am strong (15.6%, 24/154)

4.5 Use of bed nets

4.5.1 Bed net coverage and use

The average numbers of functional (no rips or tears) bed nets possessed by people in different study populations, as well as the average number of ITNs, are listed in Table 11. The data show large differences between the different research populations. Among the Indigenous peoples of Tepu, every single person possesses at least one bed net, and this bed net is an ITN. With an average of 1.5 bed nets per person, this population has a more than 100% bed net coverage. Indeed, many persons possess more than one bed net. For example, they keep one bed net at home, and one they take with them when they go hunting. All but one inhabitants from Tepu had received an ITN from the local MZ clinic in the year prior to the interview, 2022 (98.6%,70/71) (Table 12). This one person reported that he had not been in the village when the ITNs were handed out.

Table 11. Bed net coverage: Average number of bed nets possessed by persons of different sub-populations.

Population	% population with at least one bed net	Mean # bed nets/ person	Mean number of ITN obtained from MZ or MP
ASM population- Surinamese N=66	22.7%	0.23 (range: 0-1)	0.06 (range: 0-1)
ASM population – foreign migrants N=183	37.6%	0.42 (range: 0-3)	0.31 (range: 0-3)
ASM population working in Suriname, N=156	30.7%	0.31 (range: 0-2)	0.24 (range: 0-2)
ASM population working in French Guiana or Guyana (1 person), N=96	38.5%	0.45 (range: 0-3)	0.29 (range: 0-3)
Indigenous peoples N=71	100%	1.5 (range: 1-5)	1.5 (range: 1-5)
Total	48.4%	0.61 (range: 0-5)	0.55 (range: 0-5)

Bed net coverage was much lower among the gold mining populations. Only one fifth of Surinamese working in the small-scale gold mining sector possessed a bed net (22.7%, 15/66), and none of the interviewees from this group possessed more than one bed net. Only three Surinamese in the ASM areas possessed an ITN (4.5%, 3/66). Foreign migrants were more likely to possess a bed net (Table 11). As compared to mining populations working in Suriname, those working in French Guiana were more likely to possess either a regular bed net or an ITN (Tables 11 and 12). This difference may be an outcome of the relatively intense MoH-MP activities, including ITN distribution, in the Suriname-French Guiana border areas. These activities are designed to reduce the import of malaria cases.

Given the high bed net coverage in Tepu, it is not surprising that the use of bed nets in this community was high. Indeed, *all* surveyed respondents (100%) reported that they had slept under an ITN the previous night, as well as all nights of the week prior to the interview (Table 12).

Bed net use among other groups was lower, particularly among the Surinamese ASM population. In this group, 12.1% had slept with a bed net in the night prior to the interview. Only one out of 66 surveyed Surinamese persons in the gold mining areas had slept with an ITN in the night preceding the interview (1.5%). None of the five surveyed Surinamese women in reproductive ages (15-49) in this group had slept with an ITN in the previous night.

In comparison, foreign migrants were much more likely to possess an ITN (28.4%, 52/183) and to have slept under an ITN in the night preceding the interview (14.8%, 27/182) (Table 12).

Among the ASM populations, persons working in French Guiana were best reached with ITN outreach activities. One quarter of persons working in the French Guiana ASM sector reported that they had received an ITN in 2022, the year before the interview (26%, 25/96). Yet only 9.4% of this sub-population had slept with an ITN in the previous night.

There was no significant difference between women and men in their likelihood of sleeping with a bed net.

Table 12. International malaria indicators, by sub group

Measure	Indicator	ASM population- Surinamese	ASM population- foreign migrants	ASM population working in SU	ASM population working in FG & GU	Indigenous
Number	N	66	183	153	96	71
Use of bed nets	Population in malaria-endemic areas who slept under a bed net the previous night (%)	12.1%	19.8%	19.7%	14.6%	100%
Use of bed nets	Population in malaria-endemic areas who slept under an insecticide-treated bed net (ITN) the previous night (%)	1.5%	14.8%	12.5%	9.4%	100%
Use of bed nets by women in reproductive ages	Women age 15-49 who slept under a mosquito net or an insecticide-treated net the night before the survey (%)	0% (0/5)	13.5% (7/52)	13.3% (4/30)	11.1% (3/27)	100%
Consistent bed net use.	Population in malaria-endemic areas who slept under an ITN every night of the week preceding the survey.	1.5%	13.7%	12.5%	9.4%	100%
Bed net coverage	Population with access to a bed net in their household (or place where they sleep) (%)	22.7%	37.6%	30.7%	38.5%	100%
Bed net distribution	Population at risk potentially covered by distributed ITNs (%)*	4.5%	28.4%	20.3%	25%	100%
Bed net distribution	Population at risk receiving ITN in the year prior to the interview (2022) (%)	6.1%	25.1%	16.3%	26%	98.6%

* % of population who own at least one ITN, distributed by MZ or MoH-MP

4.5.2 Reasons to not sleep with a bed net

Those who had not slept with a bed net every night in the week before the interview, were asked why they had not done so. These were only gold mining populations, as all Indigenous interviewees had slept with a bed net.

The main excuse for not sleeping with a bed net was that the person did not have a bed net. Half of the persons who had not consistently slept with a bed net in the previous week provided this reason (50.5%, 104/206). It is possible that part of this group will indeed use a bed net when they receive one. Several persons an ITN from the MoH-M, they did not have one anymore because it had been burned by the French authorities. In French Guiana, the gendarme and army track down and destroy illegal ASM operations and camps in an effort to discourage uncontrolled gold mining in its interior region.

Particularly people who were interviewed in Albina or Antonio do Brinco, but working in French Guiana, reported that they did sleep with a bed net in the *garimpo*, but they did not use it at the rest site. Hence 14.1% (29/206) of respondents reported that they had not consistently used a bed net because they had not slept at “home” or the place where they usually stayed, and 4.4% (9/206) of respondents indicated that generally, they only used a bed net in the forest/*garimpo*, not at the place where they were interviewed. Likewise, five persons reported that a bed net was “not necessary” at the place where they were interviewed (resting site) because they slept in a (closed) room (2.4%, 5/206).

Other reasons to not use a bed net were related to the malaria risk perception. They explained that there were that there were no mosquitos at the place there they slept (4.3%, 9/206), or the person had used other measures against mosquitos, such as insect spray or a mosquito candle (4/206). Two persons conveyed that there was no malaria in the location where they stayed (1%).

There is also a sizable share of the target population who do not sleep with the bed net because of preference. They either find it too suffocating (7.3%, 15/206) or simply do not like it (10.2%, 21/206). Seven persons mentioned that they found sleeping with a bed net in the forest dangerous because tree branches or entire trees may fall, and several *garimpeiros* have lost their lives that way (3.4%). It is unlikely that these persons will be motivated to use a bed net, even if they receive one for free.

Other reasons for not sleeping with a bed net were diverse and mentioned by only one or two persons:

- Washed the bed net and it was still wet.
- The MSD would only give her a bed net if she would go test, but she did not want to test.
- Believe in *bita* (forest medication)
- Bed net is ripped
- Does not sleep with light in the room, so the mosquitoes do not come.
- Forgot it at home.
- Believes that criminals will rob the people in the bed nets first.
- Fell asleep in front of the TV

- Sometimes forgets it when she is really tired.

4.6 Malaria incidence

An effort was made to survey sufficient persons who had been ill with malaria in the past four years. In Antonio do Brinco, this meant that the team specifically looked for people with a recent malaria experience. In Albina, sufficient persons with recent malaria were encountered when simply interviewing any person who met the research criteria. Around the lake (north and south), we had not anticipated finding any persons with a recent malaria incidence.

In the Indigenous community of Tepu, the surveyors went door to door, interviewing persons who fit the selection criteria and who were available. Also without specifically targeting people with a recent malaria experience, more than a quarter of Tepu respondents had been ill with (suspected) malaria at least once in the period 2019-Feb 2023. Most of these persons had gotten malaria once (61.9%, 13/21), but one man reported that he had experienced malaria five times, and one man reported chronic malaria that would come and go. Excluding the person with self-reported chronic malaria, those who had experienced malaria had had it, on average, 1.6 times. In the study population at large, the mean annual malaria incidence over the past four years and two months was 110/1000 (excl. one chronic malaria).

Population	N (%) experienced malaria	N (%) who suspect, but are not sure if they had malaria	N (%) of “chronic” malaria (or >10 episodes)	Self-reported mean annual malaria incidence per 1000 population (2019-Feb 2023) ⁶
ASM population-Surinamese N=66	1 (1.5%)	-	-	4
ASM population – foreign migrants, N=183	32 (17.5%)	1 (0.5%)	8 (4.4%)	168
ASM population working in Suriname, N=153	8 (5.2%)	-	3 (2%)	55
ASM population working in French Guiana, N=96	25 (26%)	1 (1%)	5 (5.2%)	235
Indigenous peoples (N=71)	20 (28.2%)	1 (1.4%)	1 (1.4%)	144

Figure 19. Malaria incidence in the target populations

Among Surinamese persons working in the ASM sector, only one person had experienced malaria once in the past 4 years. Among foreign migrants, 32 persons reported that they had experienced malaria, and one person believed so but was not sure (18%). Eight persons in this group reported that they had experienced more than 10 malaria episodes in the past four years. Relatively most malaria had been experienced by the group working in French Guyana. In this sub-population, about a quarter had experienced malaria in the past four years (26%, 25/96). As compared to Indigenous Peoples, persons working in ASM in French Guiana had more often experienced multiple malaria incidents, and five persons

⁶ Reported chronic malaria was included in the calculation as 10 incidents

indicated that they had chronic malaria. We emphasize that these numbers concern self-reported malaria cases, and particularly those in French Guiana often do not test when they feel symptoms.

We asked respondents who had been ill with malaria, when they had experienced their most recent malaria. The data conform the outbreaks of malaria in Tepu, in 2019 and 2020 (Figure 20). Nevertheless, also in later years there were a few cases, which underscores the risk of a new outbreak. Persons working in the gold mining sector in French Guiana were more likely than others to have experienced malaria recently (2022 or 2023- up to February).

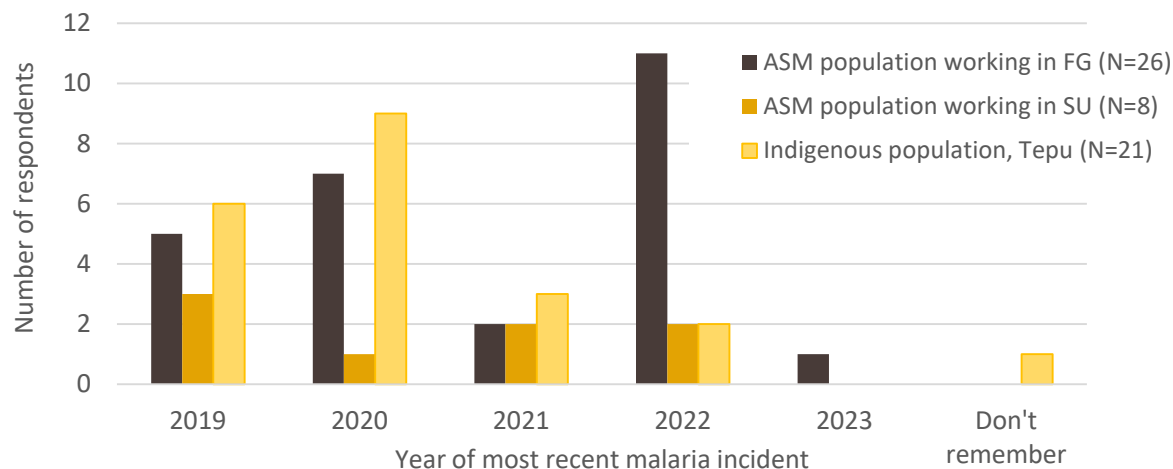


Figure 20. Number of respondents and the year of their most recent malaria experience

4.7 Testing and treatment

4.7.1 Malaria test behaviour

Among the 55 interviewees who reported that they had (probably) been ill with malaria in the period 2019-Feb 2023, 81.8% (45/55) had confirmed the malaria with a positive test. There was some difference between the different subgroups in the population share that had confirmed their malaria with a test, but the numbers are too small for statistical significance. Among the Indigenous peoples of Tepu, all but one persons had tested positive the last time they had suspected they had malaria (95.2%, 20/21; only persons who had been ill with malaria at least once in 2019-Feb 2022). Among ASM populations working in Suriname, seven out of eight persons who had experienced suspected malaria 87.5% had been tested positive. Among ASM populations working in French Guiana, 69.2% had confirmed their most recent suspected malaria with a test.

4.7.2 Treatment behaviour

People who believed they had (suspected) malaria took different measures when they were confronted with malaria symptoms. We see a large difference in responses between the Indigenous people, ASM populations working in Suriname, and ASM populations working in French Guiana (Figures 20 and 21).

All Tepu inhabitants with (suspected) malaria went to a health clinic to get tested the last time they felt malaria symptoms. Eighteen of the 21 Tepu respondents with a malaria episode in the past four years,

had been in the village when they felt symptoms (85.7%). They went to the MZ clinic in their village, where all but one were tested positive. The 17 positive cases were treated with antimalarial drugs, the negative case received Paracetamol. In addition to these 18, one person in the village had been asymptomatic. This person's malaria was discovered during an All Case Detection (ACD) mission from MZ and the MP in Tepu. Both persons who had fallen ill with malaria in Brazil, had been tested at a Brazilian health post (Figure 20).

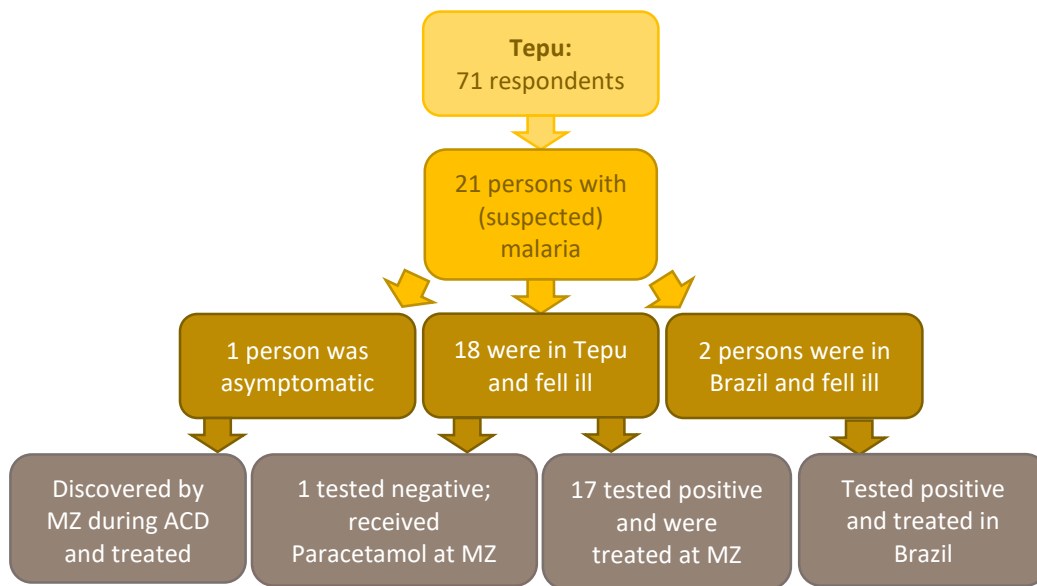


Figure 21. Responses to suspected malaria among Indigenous peoples

The behaviour in response to suspected malaria was quite different among gold mining populations, particularly those working in French Guiana. With 25% (26/96) of respondents having experienced malaria at least once in the past four years (2019-2022), the malaria burden of those working in French Guiana (& Guyana) was much higher than that of those working in Suriname (5.2%, 8/153). Among the 34 persons from ASM populations who had experienced malaria in the past four years, 10 (29.4%) had used OTC medication the last time they felt malaria symptoms (Figure 21). There is no significant difference in the chance of using OTC medication between those working in Suriname and those working in French Guiana, or between those who fell ill in French Guiana and others.

Eight persons working in French Guiana, and one person working in Suriname but who had experienced malaria in French Guiana, had used the Malakit to test and treat for malaria, the last time they had felt malaria symptoms (26.5%, 9/34). Five persons (4.7%) had been tested and treated for malaria at a French Guiana health post, and also five in Brazil. Figure 21 shows all responses to (suspected) malaria in different sub groups. The MoH-MP services were not mentioned much; only two persons had been tested with an MSD and no-one had visited the Tropclinic when they had felt malaria symptoms.

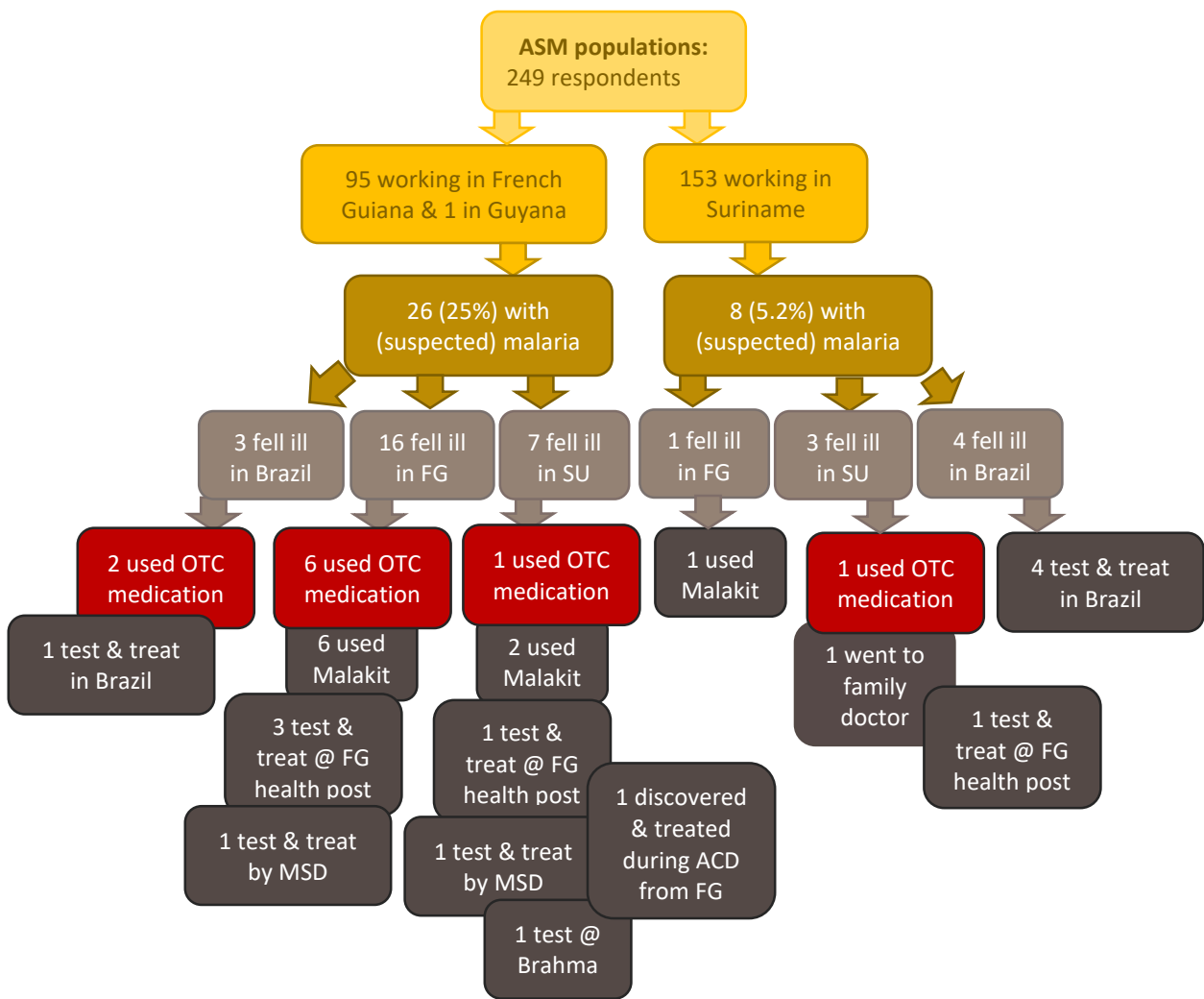


Figure 22. Responses to suspected malaria among ASM populations

4.7.3 OTC medication

Ten persons, all from the gold mining populations, had not taken a malaria test the last time when they become ill with malaria symptoms (29.4% of gold mining population that had experienced malaria). The main reasons to not get tested and use OTC medication are listed in Table 13 below.

Table 13. Reasons to not take a malaria test, ASM populations (N=10)

Reason	N	%
Where I was, was too far from a health post	7	70%
I knew I had malaria without testing	3	30%
The OTC medication is as good as, or better than, what the health workers provide	1	10%

In the past four years, 8.0% (20/249) of the ASM population, and none of the Indigenous Peoples, had taken OTC medication against malaria, without testing. Sixteen of the 20 persons who had used OTC medication were working in French Guiana. The most popular OTC anti-malarial drug is still Artecom, used by 60% (12/20) of those who had used OTC medication in the past four years. Other drugs that had been used included: Primaquine (N=5), Nivaquine (N=1), Coartem (N=2), Artefan (Artemether/ Lumefantrine; N=1), and Quinine sulphate (N=1). Two person did not remember the name of the drug they had used.

4.7.4 Medication intake

Persons who had taken malaria medication were asked how many pills they had left when they stopped taking medication. In line with findings from earlier studies, we find that persons who had obtained medication through medical prescription were significantly more likely to complete the cure than persons who had bought malaria medicines OTC without testing (Figure 22; χ^2 , $p < 0.05$).

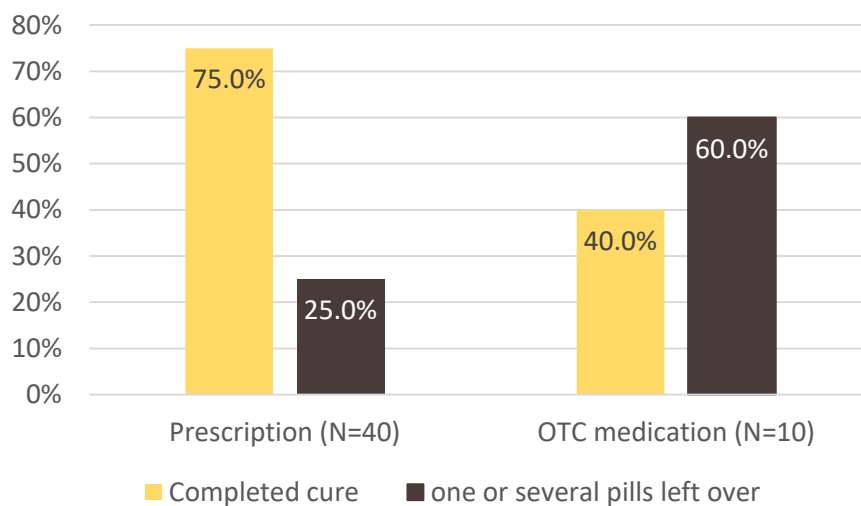


Figure 23. Share of person completing malaria medication, by whether the person had bought OTC medication without testing.

4.8 Malaria and mobility

Figure 23 shows the country where people were when they first experienced malaria symptoms, and the country where they believe they were infected. The graph highlights the public health implications of migratory movements of both gold mining populations and Indigenous populations in the interior of Suriname. If every person who had been ill with malaria had been infected in the same country as where they first felt symptoms, all bars in the graph would have been just one colour. That many bars have multiple colours indicates that several persons were infected in one country, and next travelled to another country where they got ill.

Among the 21 Indigenous inhabitants of Tepu who had experienced malaria in the past four years, two had fallen ill (i.e. feeling the symptoms) in Brazil. One of these two persons was a 45-year old man, who had experienced malaria in 2022. He believed that he had also been infected in Brazil. The other person, a 38-year old woman, suspected that he had been infected in Suriname, but only experienced the symptoms when she had arrived in Brazil (2020). The remaining 19 persons had experienced malaria in Suriname and also believed they had been infected here (Figure 23).

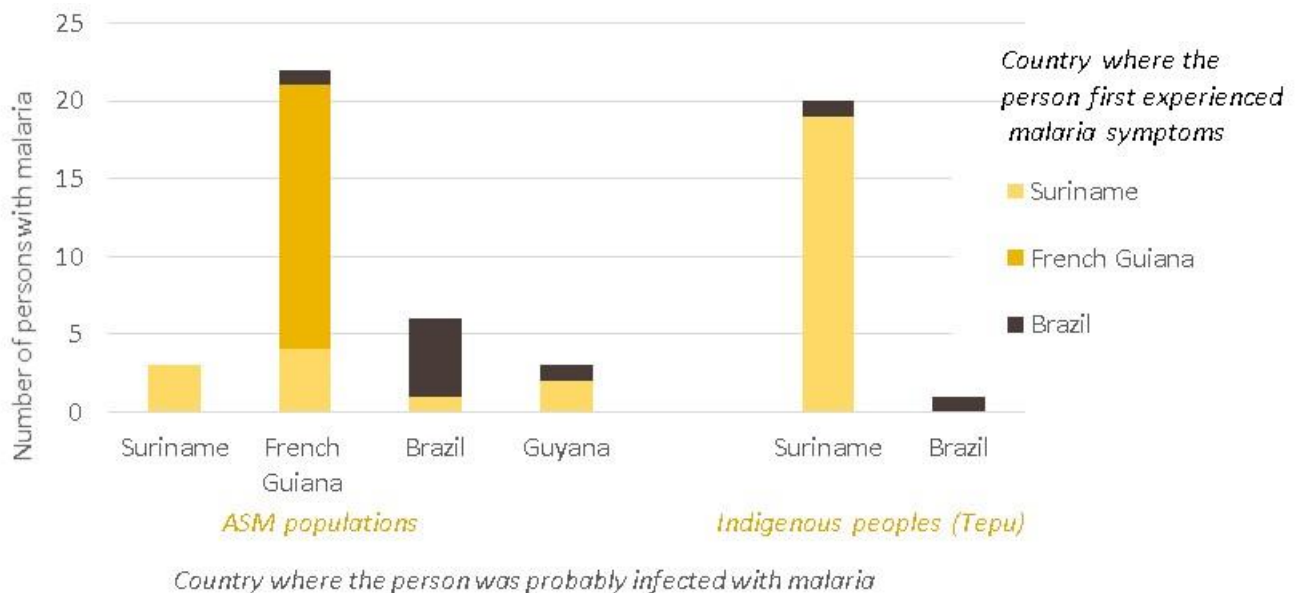


Figure 24. People who have experienced malaria in the years 2019-2023, with the country where they probably were infected and the country where they were when they first felt symptoms – the last time they had malaria.

Among the ASM populations, mobility is higher and the stories get more complex (Figure 23). Three individuals believed that they had been infected with malaria in Suriname. All three also were in Suriname when he first experienced symptoms. Of the 10 persons fell ill with malaria in Suriname (i.e. first indication that they were sick), seven (70%) suspected that had been infected abroad: one in Brazil, two in Guyana and four in French Guiana. Of the 22 persons who believed that they had been infected with malaria in French Guiana, four had moved on to Suriname and one was in Brazil when they experienced symptoms. Of the three persons who believed that they had been infected in Guyana, two had travelled to Suriname and one was in Brazil when they first felt symptoms.

4.9 Familiarity with malaria test locations

4.8.1 Knowledge of malaria test locations in the interior

Respondents were asked whether it was possible to conduct a malaria test near the village or *garimpo* where they were at the moment of the interview. Among Indigenous inhabitants of Tepu, all but two respondents (97.2%, 69/71) reported that it was possible to test somewhere nearby (Figure 24). The two remaining persons said they did not know for sure. All persons who knew a place (100%, 69/69) named the Medical Mission clinic in the village as a place to test for malaria. Also, when asked where they would go if they would like to test for malaria at that very moment, all respondents (100%, 71/71) reported that they would go to the MZ clinic. One Indigenous woman also reported that she might go to French Guiana.

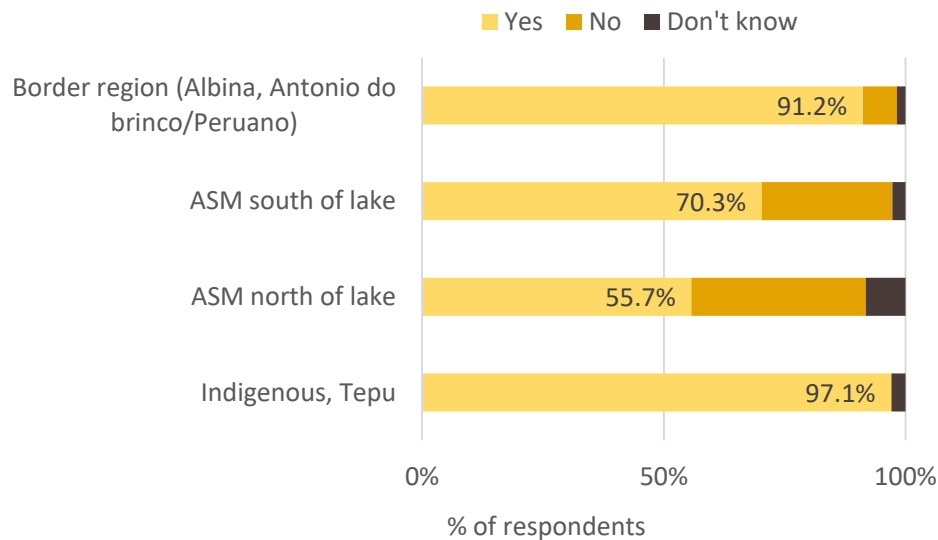


Figure 25. Is it possible to conduct a malaria test in this mining area/village or nearby (<1 hour travel)?

The gold mining areas in Brokopondo north of the lake (Nieuw Koffiekamp and Bewojo) are situated relatively close to the traditional Nieuw koffiekamp and Klaaskreek. Many gold miners in the mentioned mining areas originate from these nearby villages. Nieuw Koffiekamp and Klaaskreek both have an MZ clinic, where villagers can go for free. People from outside the village pay a small fee. Just over half (55.7%, 34/61) of interviewees in this mining region reported that it was possible to test for malaria nearby (Figure 24). Others said that it was not possible (36.1%, 22/61), or that they did not know if it was possible (8.2%, 5/61). Those who said that it was possible to test nearby, all (N=34) named one of the MZ health posts as a nearby place to test for malaria. When asked where they would go if they would feel malaria symptoms, a small majority of respondents in this region named MZ (54.1%, 33/61). Other places where they would go to test for malaria included somewhere in Paramaribo (ask there), BOG, a family doctor, or the hospital (Figure 25).

The gold mining areas south of the hydropower lake –Morro de Macaco & Montanha de Robson and Gran Kreek - are at quite some distance from regular health posts. These places are served by Malaria Service

Deliverers (MSD) from the MoH-MP. In this region, 70.3% (52/74) of survey respondents reported that it was possible to conduct a malaria test nearby, and 27% (20/74) believed that it was not possible (Figure 24). Among those who reported that it is possible to test for malaria nearby, 96.2% (50/52) referred to the MSD. Two persons named MZ. When asked here they would go if they would feel malaria symptoms, the majority of respondents in this region named the MSD (70.3%, 52/74). Other places where ASM populations south of the lake would go to test for malaria included Paramaribo, MZ (in the nearby Maroon village), Bode (people from the MoH-MP sometimes stay there), or a regular hospital.

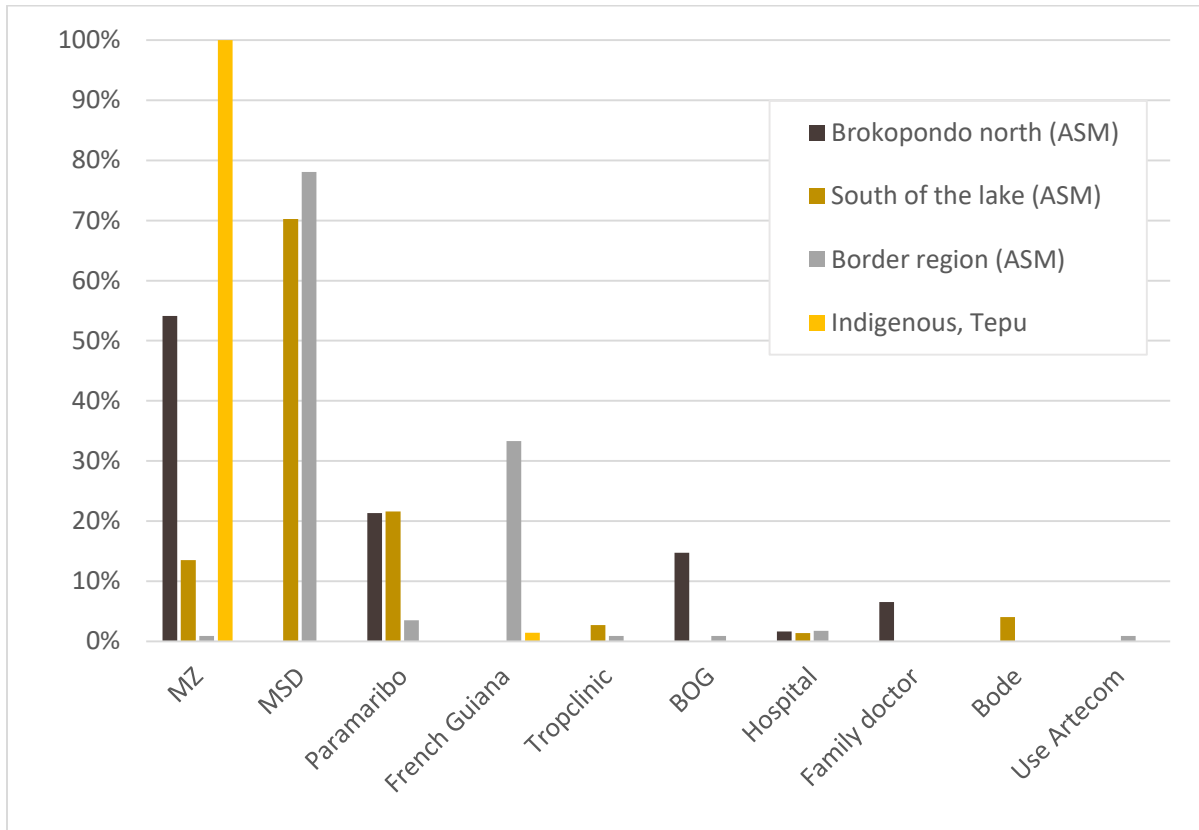


Figure 26. Places where members of the different sub-populations would go to test for malaria if they were to feel ill at the time of the survey. Numbers presented in Annex 2.

Albina and Antonio do Brinco/Ronaldo are transit areas for mining populations, where many of those working in French Guiana come to rest and buy supplies. The MoH-MP has trained local persons in these areas as MSD. In Albina, the MSD works from a container that has been equipped as health post at the waterfront. In Antonio do Brinco/Peruano, the MSD owns and operates a clothing shop and makes herself available for malaria testing if people ask for it. In Albina, 81.6% (40/49) of respondents knew it was possible to test nearby, and all of them named the MSD as the place to go (100% of those who reported that they knew a place). Also, 79.6% of respondents reported that they would go test with the MSD if they would feel malaria symptoms at that moment. Others mostly listed French Guiana as the place where they would go (18.4%, 9/49). In Antonio do Brinco/Peruano, almost everyone knew that there was a nearby place to test for malaria (98.5%, 64/65). Also these persons mostly referred to the MSD (78.1%,

50/64) and French Guiana (45.3%, 29/64) as a places to go test for malaria nearby. In this border region, 78.1% (89/114) of the interviewees reported that they would test with an MSD if they would feel ill at that moment, and 33.3% (38/114) named French Guiana as a place where they would go.

4.8.2 Knowledge and use of the Tropclinic

The MoH-MP operates a health centre that is specialized in malaria in Paramaribo city, the Tropclinic. In addition to malaria testing and treatment, the Tropclinic also provides COVID-19 testing, HIV testing, and identification of leishmaniasis and leprosy. In addition, ITNs are distributed to persons traveling to malaria-risk areas at no costs. In order to optimally serve the ASM populations, Tropclinic staff are fluent in Dutch, Sranantongo and Portuguese.



The survey results suggest that the Tropclinic is relatively best known among foreign migrant ASM populations. About one quarter of this group, 25.7% (47/183) was familiar with the trop clinic, and one person (0.5%, 1/183) had heard about it but did not know for sure where it was. Twenty-three persons had visited the Tropclinic in 2021-22 (12.6%, 23/183). About half of them (N=11) persons had visited the Tropclinic once in this period, and others had visited the Tropclinic 2, 3, 4 or even 5 times in these two years. Among those who had visited the Tropclinic, the most mentioned reason to go was malaria testing (56.5%, 13/23). Others went to get a COVID-19 test (N=4), to receive a free ITN (N=2), to perform an HIV test (N=2), to get condoms (N=1), or they went to accompany someone else (N=7). One Brazilian woman reported that she had visited the Tropclinic more than 10 times in the past two years, for malaria and HIV testing.

Among Surinamese ASM populations, only 6.1% (4/66) reported that they knew about the Tropclinic, and one other person had heard about it but did not know where it was (1.5%, 1/66). None of the Surinamese persons had visited the Tropclinic in the past two years (2021-2022).

In the Indigenous village of Tepu, only two persons reported that they were familiar with the Tropclinic (“malaria clinic”) in Paramaribo (2.8%, 2/71) and another four persons conveyed that they had heard about it but did not know where it was (5.6%, 4/71). All remaining persons had never heard of the Tropclinic or the description of this clinic (91.5%, 65/71). None of the Indigenous persons from Tepu had ever visited the Tropclinic.

4.10 Malakit

The Malakit program is a public health research-action project implemented through a collaboration of Suriname, French Guiana and Brazil. The program’s core activity the distribution of kits for self-diagnosis and self-treatment against Plasmodium infections in cross-border areas (Figure 26). The Malakit packages are distributed among ASM populations in either Brazil or Suriname, who are planning to cross the border into French Guiana to work in ASM. The person who receives a Malakit is trained by health mediators; in

Suriname the MSD. Through this approach, the three countries aim to increase the use of appropriate and complete malaria treatment (approved ACT + single-dose of primaquine), after a malaria diagnosis with a rapid diagnostic test (RDT). The secondary objectives are to reduce malaria prevalence among gold miners in French Guiana, and to improve their knowledge about malaria and its prevention.

Because the Malakit was specifically developed for gold mining populations in French Guiana, who have reduced access to malaria test and treatment services in the places where they work, it is no surprise that the Malakit was best known in this sub-population. Among ASM populations who were working in French Guiana, almost half had heard about the Malakit (49.7%, 91/183). Fifty persons of this sub-population (27.3%, 50/183) had received at least one Malakit pouch. Among those who had received at least one Malakit, the mean number of Malakits received was 1.8 (range 1-5)

Among ASM populations working in Suriname, two persons had heard about the Malakit (3%) and no-one had ever received or used it. Among the Indigenous peoples of Tepu, only one person had heard about the Malakit, and no-one had ever received one.

The people who had received a Malakit were asked if they had used the kit. Just over half of the persons in this group had used the Malakit to test themselves for malaria (52%, 26/50). Another 14% of those who had received a Malakit, had used it to test someone else. The remaining persons had not (yet) used to Malakit. Some reported they had given it to someone who had needed it. All 33 persons who had used the Malakit reported everything had been clear and that they had experienced no problems when using the Malakit either for themselves or for someone else. In the contrary, people were excessively positive about the Malakit

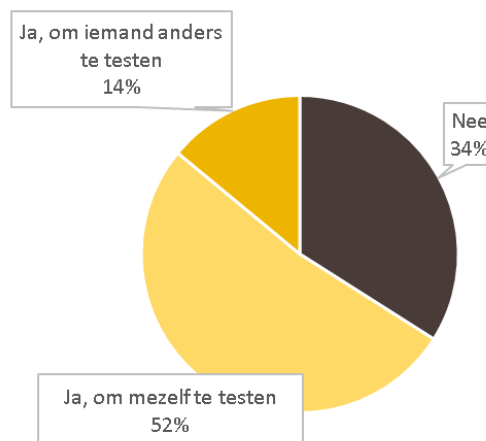


Figure 27. Share of persons who used the Malakit among those who received one (N=50)

Those who had heard about the Malakit were asked if they knew where they could get one. Almost a quarter of persons in this group did not know where to get one (24.7%, 22/89). The largest share of respondents from this group mentioned the MoH-MP or the MSDs as a place to get the Malakit (24.7%, 22/89). Three persons mentioned that the Malakit can be bought in the French Guiana mining areas (3.4% of those who had heard about Malakit, 3/89). One person reported that the price was about 3 grams of gold (~USD 150). Another person reported that he had received one for free from someone in the French Guiana *garimpo*. Two persons mentioned that one can get the Malakit in a hospital in French Guiana. One of them had been admitted to the hospital of Cayenne with Malaria, and had received a Malakit there. The other person named the hospital in Maripasoula. In Albina, several persons complained that they could not get the Malakit anymore at the MSD post. They expressed the hope that the Malakit would become available once more to take it to their work location in French Guiana.



Figure 28. Malakit pouches with diagnostic tests and malaria medication

4.11 Perceptions of Intimate Partner violence

In order to obtain a general idea about perceptions of intimate partner violence, the survey asked respondents whether they believed that a man/woman was justified to beat or hit his/her partner under specified circumstances. The question was posed as such (copied from MICS):

“Sometimes a man can be irritated by something his wife or female partner does. Do you believe that a man has the right to beat or hit his female partner if she ...”, followed by three possible incidents. These incidents were: (a) go out without telling him, (b) quarrel with him, and (c) refuse to have sex with him. Next, the same question was posed but with the gender roles reversed. We asked: is a woman justified to beat or hit her male partner under these same circumstances. The share of persons who answered affirmatively, i.e. who believed that a man/woman was justified to beat or hit his/her partner under specific circumstances is portrayed in figures 28 and 29. The answers are compared by sex and sub-population.

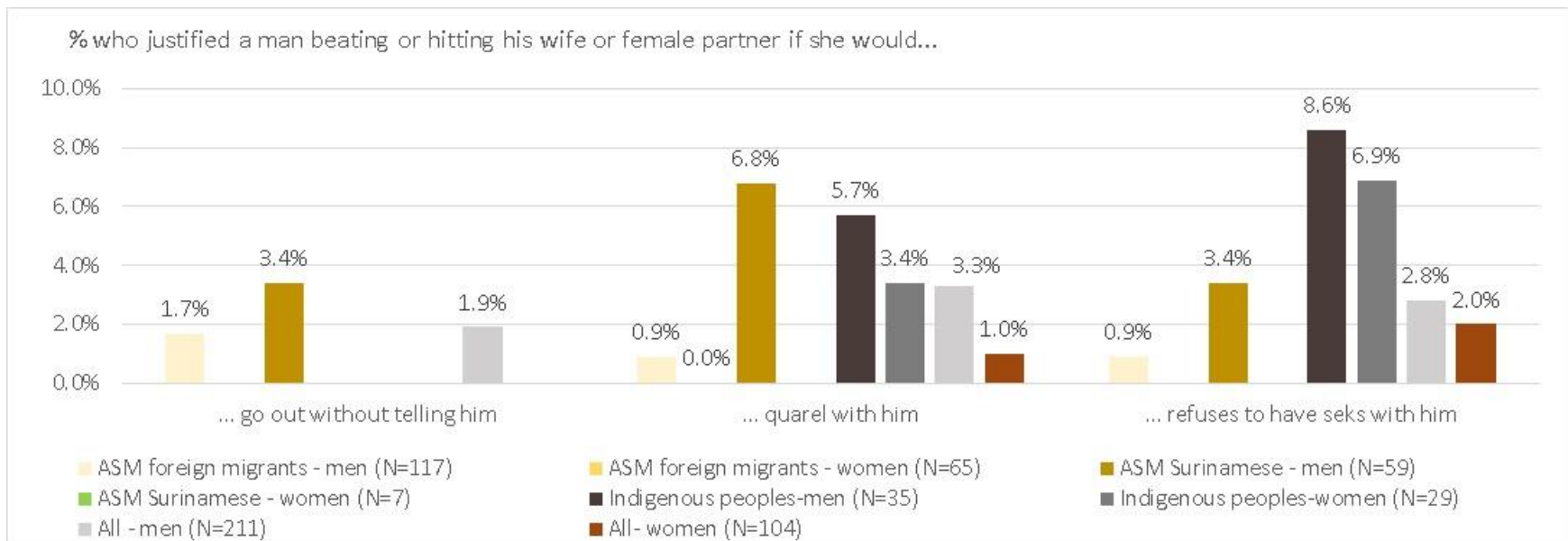


Figure 29. Number of men and women who believe that a man has a right to beat or hit his female partner under certain circumstances

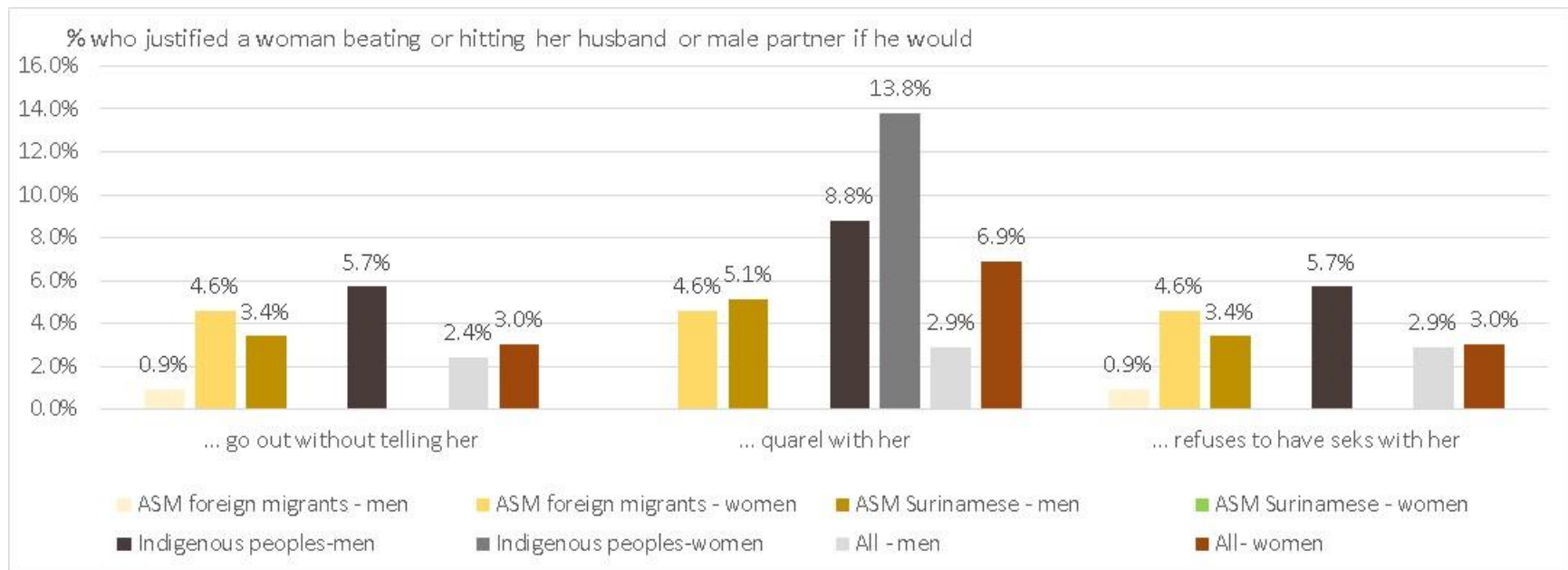


Figure 30. Number of men and women who believe that a woman has a right to beat a male partner under certain circumstances

The data suggests some differences between the different sub-groups in the extent to which people believe that beating or hitting a partner is justified under certain circumstances. However, the sample sizes of some of the subgroups are very small and the percentages are low; the figures can therefore not be extrapolated to the populations at large. Also, the questions about Gender based Violence did not fit very well in a survey about malaria, and some people felt uncomfortable with the question and/or refused to answer the question.

The outcomes of these questions can be summed up as follows:

- Women in the ASM sector, both Surinamese and foreign migrants, indicated that a man was not justified to hit or beat his wife under any circumstances.
- On the other hand, 4.6% of foreign migrant women indicated that a woman was justified to hit a male partner in *all* circumstances: if he would go out without telling her, quarrel with her, or refuse to have sex.
- None of the women justified a man beating his female partner if she would go out without telling him.
- On average, a woman beating her male partner was more often accepted than the reverse; a man beating his female partner, especially among women.
- Among Indigenous peoples, violence between partners was, on average, more often justified than among other groups.
- Surinamese men were more likely than men from the other sub-groups to justify wife-beating in all three mentioned conditions.
- Indigenous men were more likely than men from the other sub-populations to justify a woman beating her male partner, in all three mentioned conditions.
- Male foreign migrants were less likely than Suriname people to justify violence between partners, regardless of the condition or who hit who.

5 Discussion and conclusion

5.1 Discussion

Interior populations, both Indigenous peoples and gold mining populations, Surinamese and foreign migrants, men and women, and young and old, all deal with a variety of health problems. The most commonly experienced health condition in all groups was back pain, probably related to heavy physical work and carrying heavy loads. Also quite a few persons reported liver and kidney pains, though it is uncertain whether these were correctly diagnosed. Foreign migrant women appeared conscious about timely checks for cervical cancer. Suriname women, both Indigenous women and women working in the ASM areas (mostly Maroon), were less likely to go for check-ups, and could benefit from more awareness.

In response to their various ailments, people in all sub-groups take a variety of medication. We only analysed the use of antibiotics, but informal conversations suggest that people also frequently use liver and kidney medication, as well as a range of painkillers. Antibiotics intake is high, especially among women and among Indigenous peoples. Three-quarters of Indigenous persons reported that they had taken antibiotics in the year prior to the interview, typically prescribed by MZ. Informal conversations suggest that especially ASM populations do not follow a regimen but just take a couple of antibiotic pills when they have pain or feel bad. The combination of high antibiotics consumption rates and high OTC acquisition raises concerns about developing antibiotic resistance, and should be monitored by the Ministry of Health. Generally, foreign migrants are much more likely than Surinamese (Indigenous or ASM) to not see a doctor and use OTC medication when they feel ill. This trend is apparent for both antibiotics and malaria medication.

Knowledge about the cause, symptoms and best way to prevent malaria differs between the different surveyed sub-populations. Generally, the chance of having correct knowledge increases with: (a) higher age, (2) having experienced malaria in the past 4 years, and (3) being foreign (i.e. non-Surinamese). In the total population, 80.3% knew that the mosquito is the only cause of malaria; 94.4% could name one or more malaria symptoms; and 75.6% named the bed net as a way to protect oneself against malaria. While these figures are quite high, misperceptions continue to exist. About one third of all respondents, for example, believed that bats can transmit malaria. There also is a strong belief that forest medicine or home remedies can effectively protect one against malaria. In Tepu, a MDA intervention to curb the spread of malaria was not properly understood by some of the villagers. Several respondents from this Indigenous village reported that MZ had given them medication to prevent getting malaria, or that they could not get malaria because they were taking the MZ medication. A village information session about the MDA may take away such misperceptions.

Generally, Surinamese ASM populations were less informed about malaria than the other sub-populations in this study. Only two-thirds of the Surinamese working in gold mining knew that the mosquito is the only cause of malaria. Malaria has been gone for many years from the areas where Surinamese gold miners are most active (e.g. Brokopondo north), and hence malaria is not part of their daily life concerns. Especially young people proved poorly informed: they had never experienced malaria and to them, malaria was something from the past. Yet not only youngsters do not worry

anymore about malaria. More than one quarter of all respondents believed that Suriname is malaria-free, and half of respondents did not feel at risk of malaria infection. Recent malaria outbreaks in the southern Indigenous villages show, however, that malaria can easily spread again in villages and areas that have been malaria-free for several years. Therefore it is important that the malaria campaign targets not only the gold mining areas but also the traditional villages, and especially the young people in these villages.

ITN distribution is a proven way to reduce malaria transmission rates, and one of the pillars of the malaria elimination strategy of the MoH-MP. ITN distribution has focussed on high-risk areas, and this was reflected in the rates of ITN possession and use among different sub-populations. Tepe's indigenous peoples were the bed net champions of this study: 100% possessed an ITN, and everyone had slept under an ITN in the night prior to the interview. The recent malaria outbreaks in the village may have motivated people to use the bed nets consistently. Among gold mining populations, bed net coverage and use were lower, especially among Surinamese in the gold mining sector. In this group, 4.5% possessed an ITN and only one person had slept with an ITN in the previous night. Among foreign migrants, especially those working in French Guiana, ITN coverage was higher, in part because much of the ITN distribution has focussed on this group. Nevertheless, also among gold mining populations working in French Guiana, only 9.4% had slept with an ITN the previous night. The main mentioned reason to not sleep with a bed net was that the person did not have one. Some of those working in French Guiana reported that they had received an ITN before, but left it for their colleagues when they left the mining area. Others had lost their ITN when it was destroyed by the gendarme. Distributing bed nets at one side of the border, and burning them at the other side, is not an efficient use of public health resources.

Like malaria knowledge and bed net use, malaria test and treatment behaviour differed among the different sub-populations in the study. Whereas the Indigenous Peoples of Tepe had all but one tested when they felt malaria symptoms, one quarter (26.5%) of persons working in the gold sector had not tested for malaria the last time they believed they had malaria. The Indigenous individuals who had tested positive received malaria medication from a health professional in Suriname or Brazil. Subsequently, all but two persons completed the malaria regimen. Among gold mining populations, 29.4% used OTC medication, and 42.2% of those who had suspected malaria did not complete their medication. As we found in earlier studies, garimpeiros often take a couple of anti-malaria pills when they feel malaria symptoms, and when they feel better, they save the remaining pills for the next time they feel ill.

Data on the country of (probable) malaria infection by the county of feeling symptoms draw attention to the public health implications of migratory movements of both gold mining populations and Indigenous populations in the interior of Suriname. Part of the gold mining populations, especially those in Suriname, are quite settled and have been living and working in the same place for many years. Others, however, travel regularly between Brazil, Guyana, French Guiana and Suriname. As a result, they may be infected with malaria in one country, but fall ill elsewhere, and in the meantime are a vector for malaria transmission. By this means, also developments like the expulsion of thousands of gold miners from the Brazilian state of Roraima, may directly affect the spread of malaria in Suriname. Similarly, Suriname's Trio indigenous peoples travel back and forth between different Suriname trio villages and Missão Tiriyo (native name: Tawainen), at the border with Suriname in the

state of Para, Brazil. In this context, it could be useful to seek collaboration with the local health post in Missão Tiriyo, the French Indigenous communities along the Lawa River, and other places where Suriname Indigenous people travel.

Migratory movements of both ASM populations and Indigenous Peoples present a challenge to Suriname's goal of malaria elimination. They also make it necessary that both policy makers and health professionals in the different countries collaborate and inform one another about malaria outbreaks, infection rates, and source investigation outcomes. The Malakit is one example of such collaborative efforts between different national governments. Among the 34 persons in the ASM populations who had experienced malaria in the past four years, nine (26.5%) had used the Malakit to test and treat themselves; almost the same number as those who had used OTC medication. None of the users had experienced any problems with the Malakit and in informal conversations, they lauded the contribution that the Malakit has made to reducing malaria in French Guiana.

One of the malaria elimination strategies of the MoH-MP is to enhance the chances that people who feel malaria symptoms, can find a place nearby to test for malaria. The Malaria Service Deliverers (MSD) fulfil this role in the gold mining areas and the resting places from where gold miners travel to French Guiana. In the places where the MSDs are active (border region, south of the lake), about three quarters of persons reported that they would go test with the MSD if they would feel malaria symptoms. For Indigenous peoples and, to a lesser extend people working in the gold sector in Brokopondo, the MZ clinic was the first choice. The Tropclinic was poorly known.

5.2 Conclusions

The study outcomes provide directions for interventions in Suriname's road to malaria elimination. First, the data support the importance of the current malaria awareness campaign and call for an intensified focus on young people in the interior, also in places that have been malaria free for some time. The recent joint training for MSDs and MZ staff about behaviour change communication, among others, was an exciting way to share knowledge and involve the local MZ clinics more closely in malaria work. Relevant malaria awareness messages include: (a) There still is malaria in Suriname, (b) The mosquito is the ONLY cause of malaria, and (c) Use a bed net to protect yourself. In addition it is important to enhance knowledge about other public health issues, including: (a) excessive and wrong use of antibiotics can cause antibiotic resistance, (b) the chance of dying from cervical cancer can be significantly reduced by performing check-ups.

Second, as in earlier studies, our results emphasize the need for continued collaboration with Brazil, Guyana and French Guyana. In this context, it is important that the Malakit remains available to gold miners working in French Guiana; it is a popular alternative for OTC medication. Cross-border collaboration should also include regular communication about malaria trends and health interventions between places where cross-border indigenous groups live. The willingness of the surveyed Indigenous Peoples to sleep with a bed net, test when feeling symptoms, and complete malaria treatment, will facilitate the elimination of malaria from their villages.

Annexes

Annex 1: Malaria symptoms mentioned by different sub-populations

	Gold mining populations- Surinamese (N=66)		Gold mining populations- foreign migrants (N=183)		Indigenous Peoples (N=71)	
	N	%	N	%	N	%
Fever	39	59.1%	155	84.7%	66	93.0%
Headache	22	33.3%	138	75.4%	62	87.3%
Body pains	26	39.4%	103	56.3%	27	38.0%
Cold shivers / Feeling cold / Feeling hot-cold	19	28.8%	81	44.3%	11	15.5%
Pain in muscles and joints	11	16.7%	37	26.8%	31	43.7%
No appetite	21	31.8%	35	19.1%	16	22.5%
Throwing up	6	9.1%	38	20.8%	18	25.4%
Tired/Weakness	12	18.2%	19	10.4%	16	22.5%
Diarrhea	3	4.5%	7	3.8%	-	
Flu-like symptoms	3	4.5%	4	2.2%	1	1.4%
Back pain	-		2	2.4%	3	4.2%
Pain in the eyes	1	1.5%	4	2.2%	-	
Nausea	-			0.0%	4	5.6%
Pain in/inflammation of liver	-		4	2.2%	-	
Kidney infection, pain in kidneys	-		4	2.2%	-	
If you also have HIV, the colour of the skin will change	-		2	1.1%	-	
Bitter /sour taste in the mouth	1	1.5%	1	0.5%	-	
Dizziness	-		2	1.1%	-	
Yellow eyes, yellow skin	1	1.5%	1	0.5%	-	
Numb hands	-		-		1	1.4%
Pain in the eyes	-		-		1	1.4%
Throat pain	-		-		1	1.4%
No taste	1	1.5%	-		-	
Get skinny	1	1.5%	-		-	
Wounds in the mouth	-		1	0.5%	-	
Hemorrhages	-		1	0.5%	-	
Hallucinations	-		1	0.5%	-	
Don't know	14	21.2%	2	1.1%	2	2.8%

Annex 2: Numbers with Figure 23

Region	MZ	MSD	Paramaribo	French Guiana	Tropclinic	BOG	Hospital	Family doctor	Bode	Use Artecom
Brokopondo north (ASM)	54.1%	-	21.3%	0.0%	-	14.8%	1.6%	6.6%	-	-
South of the lake (ASM)	13.5%	70.3%	21.6%	0.0%	2.7%	-	1.4%	-	4.1%	-
Border region (ASM)	0.9%	78.1%	3.5%	33.3%	0.9%	0.9%	1.8%	-	-	0.9%
Indigenous, Tepu	100.0%	-	-	1.4%	-	-	-	-	-	-