



Integrating SARS-CoV-2 Ag-RDTs testing in the health service provision of Malaria Service Deliverers (CHW) working among mobile migrant communities in remote gold mining settings in Suriname.

Impact study

Integrating SARS-CoV-2 Ag-RDTs testing in the health service provision of Malaria Service Deliverers (CHW) working among mobile migrant communities in remote gold mining settings in Suriname:
IMPACT STUDY.

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Abbreviations and foreign words

ABS	General Bureau of Statistics (<i>Algemeen Bureau voor de Statistiek</i>)
Ag-RDT	Antigen Rapid Diagnostic Testing
ASM	Artisanal and Small-scale Mining
ATV	All-Terrain Vehicle
BOG	Bureau for Public Health (<i>Bureau voor Openbare Gezondheidszorg</i>)
CHW	Community Health Worker
CBvS	Central Bank of Suriname (<i>Centrale Bank van Suriname</i>)
COVID-19	Coronavirus Disease 2019
<i>currutela</i>	Gold miners' village
FIND	Foundation for Innovative New Diagnostics (FIND)
<i>Garimpeiros/ garimpo</i>	Gold miner (Por.)/ Gold mining area
GDP	Gross Domestic Product
IDB	Inter-American Development Bank
KAP	Knowledge, Attitudes and Practices
MoH	Ministry of Health
MoH-MP	Ministry of health Malaria Program
MP	Malaria Program
MSD	Malaria Service Deliverer
OTC	Over-The-Counter (medicine)
PAHO	Pan American Health Organization
PCS	Psychiatric Centre Suriname (<i>Psychiatrisch Centrum Suriname</i>)
POC	Police Education Centre (<i>Politie Opleidings Centrum</i>)
PPE	Personal Protective Equipment
RDT	Rapid Diagnostic Test
RGD	Regional Health Service (<i>Regionale Gezondheidsdienst</i>)
SWOS	Foundation for the Advancement of Scientific Research in Suriname (<i>Stichting tot Bevordering van Wetenschappelijk Onderzoek in Suriname</i>)
TropClinic	Malaria clinic at Geyersvlijt with outpost at the Anamoestraat
USD	United States Dollars
WHO	World Health Organization

Summary

The Project: This report presents the social impact study for the Project “Integrating SARS-CoV-2 Ag-RDTs testing in the health service provision of Community Health Workers (CHWs) working among mobile migrant communities in remote gold mining settings in Suriname”, hereafter named “the Project”. The Project is executed by a consortium of the Suriname Ministry of Health Malaria Programme (MoH-MP), the Foundation for the advancement of Scientific Research in Suriname, and Social Solutions consultancy. The latter was responsible for this impact study. Financial support was provided by FIND-Diagnosis for all.

Study aims: The Project aims to enhance access to COVID-19 testing services for mobile migrant populations in Artisanal and Small-scale gold Mining (ASM) areas in the interior of Suriname. The aims of this impact study are to: (1) document changes in COVID-19 related knowledge, perceptions and behaviours between May and October 2022; (2) assess changes in access to COVID services in remote mining communities as a result of the implementation strategy, and (3) assess the experiences and perceptions of community health workers (CHW) about their COVID-19 services to the community.

The intervention: Sixteen CHWs from remote ASM communities in Suriname were trained to disseminate COVID-19 information and perform the COVID-19 nasal swab. Upon arrival at their living/working place in the interior, they informed the ASM community mostly through direct communication and Whatsapp-groups. Patients could either come to the location where the CHW was located, or call to ask the CHW to come to his or her location. Reactions were generally positive; inhabitants of gold mining areas were happy that COVID-19 services were provided at no cost and nearby. A main challenge was the tendency of gold miners and those working with and for them, to self-diagnose and self-medicate. Only when they have tried different medicines and still feel really ill, they will go see a health worker. Other challenges included the fact that some individuals had no trust in the qualifications of the CHWs as community members; that gold miners “do not listen” and “do whatever they want”, and that people believed the nasal swab to be painful.

Changes in knowledge, attitudes and practices: Numeric findings about knowledge, attitudes and practices related to COVID-19, reflecting the baseline situation and the post-intervention situation, are summarized in Table 1. Some of the differences between the two periods are likely related to the fact that at the moment, the pandemic lies dormant: there are very few COVID-19 cases, all restrictions have been lifted, and vaccination programs have come to a virtual standstill. Mostly though, the pre- and post-intervention figures are very similar.

Conclusions: The researchers conclude that establishing COVID-19 test locations in mobile migrant communities in the Suriname interior was doubtlessly important. It may not have had much impact on COVID-related knowledge, but it significantly raised the number COVID-19 tests among persons who otherwise would not have tested. It also helped to keep the target population aware of the continued presence of the pandemic and continued infection risk. There is room to further increase the impact of this program by making the CHW locations and services better known to the target population through area visits, banners and other forms of communication.



Table 1. COVID-19 indicators, comparing the baseline situation with the post-intervention situation

Indicator	Baseline (May 2022)	Post-intervention (October 2022)
Sample		
N	235	270
% Women	40% (94/235)	34.4% (93/270)
% Surinamese	20% (47/235)	15.9% (43/235)
Access to MoH-MP services		
% who have contact information for the CHW in their area	Not measured	16.3% (44/270)
% who report that it is possible to conduct a COVID-19 test in their gold mining area/community	Not measured	28.5% (77/270)
% who know that there is a CHW in their mining area where one can conduct a COVID-19 test	Not measured	18.1% (49/270)
Knowledge		
% able to name accurate COVID-19 transmission ways	90.2% (212/235)	90.7% (245/270)
% able to list one or more COVID-19 symptoms	96.2% (226/235)	92.2% (249/270)
Average number of correct answers out of four statements	3 (N=232)	2.9 (N=270)
% who agreed that COVID-19 is a very contagious disease	93.6% (220/235)	89.3% (241/270)
% who disagreed with the statement: Only people who are already weakened by illness or old age die of COVID-19	84.6% (198/234)	85.9% (232/270)
% who disagreed with the statement: COVID-19 is not dangerous, it is just like a flu	79.8% (186/233)	73% (197/270)
% who know that COVID-19 is NOT transmitted by bats	44.3% (104/235)	44.1% (119/270)
% who are able to name at least one effective measure to protect oneself against COVID-19 infection	96.2% (226/235)	93% (251/270)
Attitudes (perceptions)		
% of men believing to be at risk of COVID-19 infection	Not measured	50.3% (89/177)
% of women believing to be at risk of COVID-19 infection	Not measured	66.6% (62/93)
% reporting to be willing to take a COVID-19 test at that moment	86.4% (203/235)	73.0% (197/270)
Practices		
% reporting not adhering to any COVID-19 measures	3.4% (8/235)	56.3% (152/270)
% reporting to practice social distancing	27.7% (65/235)	0% (0/270)
% of men reporting at least one COVID-19 infection (regardless of test result)	22.7% (32/141)	25.4% (45/177)
% of women reporting at least one COVID-19 infection (regardless of test result)	41.4% (39/94)	44.1% (41/93)
% having been tested for COVID-19 at least once	48.5% (114/235)	67.8% (183/270)
% Surinamese who have been tested at least once	34.8% (16/46)	46.5%, 20/43
% foreign migrants who have been tested at least once	52.1% (98/188)	71.8%, 163/227
% of those tested, who named COVID-19 interventions of the MoH-MP as a reason to get tested	9.7% (11/113)	12% (22/183)
% of those who had been tested only once, who named COVID-19 interventions of the MoH-MP as their reason to get tested	15.9% (7/44)	15.3% (11/72)

% of those tested, whose most recent COVID-19 test was conducted by the MoH-MP team.	25.4% (29/113)	29% (53/183)
% of those who had COVID-19, who reported that they had quarantined the most recent time they had experienced COVID-19	68.6% (48/70)	72.1% (62/86)
% of Surinamese who received at least one vaccination dose	40.4% (19/47)	34.9% (15/43)
% of foreign migrants who received at least one vaccination dose	86.7% (163/188)	81.9% (186/227)

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Key statistics

Variable	Value
General	
Total Population Suriname, 2019 (Mid-year population)	598,000 (ABS 2021)
Land area	163,820 km ²
Economic (World Bank data, accessed 2022)	
GDP (current USD), 2020 (* billion USD)	USD 2.88 billion
Annual GDP growth, 2020	-15.9%
Per capita GDP (current USD), 2020	USD 4,916.6
Inflation, consumer prices (2021)	59.1%
Artisanal and small-scale gold mining (ASM)	
Estimated number of ASM, incl. service sector in the interior	~20 thousand (Heemskerk et al., 2021)
Share of women in ASM population	~25%
Share of migrants in ASM population	~ ² / ₃ to ³ / ₄ of total ASM population
COVID-19 (Data from COVID-19 dashboard, by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU) accessed 13/09/2022¹)	
Confirmed COVID-19 cases, 03 Jan 2020- 08 Nov 2022	81,228
COVID-19 deaths, 03 Jan 2020- 08 Nov 2022	1,392
Total number of vaccine doses	554.588
Vaccination, share of target population	55.6%
Weekly number of cases (November 2-8)	0
28-day number of cases (by November 9, 2022)	97
Health care provision in the Suriname interior	
Number of Medical Mission Primary Health Care clinics in the Interior.	51
Area covered and number of persons serviced by Medical Mission PHC clinics	> 130.000 km ² 54,000 persons
Number of Community Health Workers of the MoH-MP, Nov 2022	21, incl. 18 women
Number of CHW who executed SARS-CoV-2 Ag-RDTs testing in the gold mining communities	16

¹ URL: <https://www.arcgis.com/apps/dashboards/bda7594740fd40299423467b48e9ecf6>

1 Introduction

1.1 Background

This report presents the impact study for the project: *Integrating SARS-CoV-2 Ag-RDTs testing in the health service provision of Community Health Workers (CHWs) working among mobile migrant communities in remote gold mining settings in Suriname*, hereafter referred to as the “Project”. This Project is executed by the Suriname Ministry of Health Malaria Program (MoH-MP) and the Foundation for the advancement of Scientific Research in Suriname (SWOS). Financial support is provided by *FIND-Diagnosis for all*, through its program for “Community-based applications of SARS-CoV-2 Ag-RDTs for timely and effective public health response”.

The Project targets the mobile migrant population in Artisanal and Small-scale gold Mining (ASM) communities. An estimated 20,000 people work in the ASM sector in the remote interior of Suriname (Heemskerk et al., 2021). These people are either gold miners or deliverers of auxiliary services to miners. The ASM population is dominated by men; women constitute about one fifth of the population in different ASM areas, and are mainly active in the ASM service economy. Foreign migrants from Brazil make up the largest share of those who work and live in ASM areas. Others are mostly Surinamese Maroons, smaller numbers of other Surinamese, and migrants from other countries (e.g. Dominican Republic, Cuba, Guyana, China). Regardless of their origin, we consider all of those working in ASM areas mobile migrant populations because they typically have no fixed place to live, often moving away from an area when gold deposits are exhausted or when prospects in another location are better.

ASM populations live in mining camps and mining settlements, named *curutelas*, which vary in size, stability, and relative isolation. Here they arrange their lives largely out of view of the Suriname government, and to a large extent disconnected from government services such as running water and electricity. Access to health care is jeopardized by the remoteness of the ASM communities, the absence of formal health services, and the high costs in time and money to travel to a health post. In this context, inhabitants of ASM areas largely rely on home remedies, over-the-counter (OTC) medication, and amateur medical interventions when falling ill or experiencing an accident.

In the context of COVID-19, mobile migrant populations in ASM areas form a particular at-risk group. They move frequently, hardly use protective measures, have a high propensity to self-diagnose and medicate, have limited access to accurate information, and have poor access to health services. The goal of the Project is to ameliorate COVID-19 services for this vulnerable group by training a network of Community Health Workers (CHWs) from the remote gold mining communities in COVID-19 testing and diagnosis.

As part of the national malaria elimination effort, the MoH-MT established a network of CHWs in the various remote mining sites. These CHWs provide malaria diagnosis and treatment within their communities under supervision of the Malaria Program. In the context of the FIND Project, the CHWs were trained to perform COVID-19 outreach and testing with SARS-CoV-2 Ag-RDTs.

From 28 March to 01 April, 2022, a group of 21 CHWs followed a training where they learned about COVID-19 and were trained in properly and safely conducting the COVID-19 Rapid Antigen Test (SARS-CoV-2 Ag-RDTs). The CHWs are individuals who live and work in the ASM areas and have expressed interest in providing health services to their communities. They typically do not have a medical background and often very little formal education in general. The MoH-MP was already working with this group of CHWs for the

provision of malaria diagnosis and treatment to their peers under supervision of the Malaria Program. The delivery of COVID-19-related health services was a new task for the CHWs. These services included, among others, informing their communities about COVID-19, promotion of protective measures, identification of suspect cases, making COVID-19 test services available, and supporting positive cases.

1.2 Impact study goals and objectives

1.2.1 General goal

In its national response to the COVID-19 pandemic, the Ministry of Health (MoH) in Suriname aims to reach all people in the country. Yet for logistic and financial reasons, public COVID-19 services (outreach, diagnosis and immunization) concentrated in the populated coastal area and the traditional interior communities, with minimum services extended in the mining communities. The project responded to this gap by training people from these communities to raise COVID-19 awareness and provide COVID-19 diagnostics with rapid tests.

The general goal of this impact study is to analyse to what extent the Project intervention has improved access to COVID-19 services among mobile migrant populations in ASM communities, and how this has subsequently affected COVID-19 test behaviour. In addition, we analyse changes in knowledge of, attitudes towards, and behaviour in response to the COVID-19 pandemic in the remote mining communities where the CHWs are active.

1.2.1 Objectives

The specific objectives of this impact study are to

- 1) Assess changes in COVID-19 knowledge, perceptions and behaviours in the target population as a result of Project-related outreach activities.
- 2) Analyse how the Project has affected access to COVID-19 diagnostics with rapid tests for mobile migrant populations in gold mining communities in the Suriname interior.
- 3) Identify strengths and weaknesses of the Program, and suggest modifications to enhance efficiency and effectiveness of public health services delivery to the difficult to reach populations in the remote Suriname interior.
- 4) Document Project-related experiences of CHWs, as well as their suggestions for improvement.

2 Study design and methodology

2.1 Study design

This impact study primarily relies on primary data collection. It combines a quantitative survey in selected ASM areas, and structured interviews with CHWs who have been providing COVID-19 tests and information in ASM communities.

In March/April 2022, a baseline survey was performed to measure knowledge, perceptions and behaviours in relation to COVID-19 prior to the intervention. In October/November 2022, the research team returned to the same ASM areas for the impact survey. In order to measure change, the impact survey asked largely the same questions. A number of redundant questions were removed, and a few clarifying questions were added for the impact survey.

In addition, we interviewed CHWs who had been trained and subsequently participated in the COVID-19 program both during the baseline phase and after the Project intervention.

2.2 Quantitative survey

2.2.1 Study locations

The quantitative survey was executed in two ASM regions (Figure 1):

- Southeast of the hydropower lake, where the largest gold miners' village was Curutela de Claudia/Sarakreek, and
- West of the hydropower lake, where the largest concentration of gold miners and mining service providers can be found in Vila Brasil

Each one of these regions consists of various mining sites and gold miners' villages. The locations in Figure 2 indicate the local names given by gold miners to these places.

The initial reasons to select these two regions were that:

1. There are one or more MSDs active in these areas,
2. The gold miners and mining service providers in these areas work in Suriname (i.e. they do not primarily work in French Guiana).

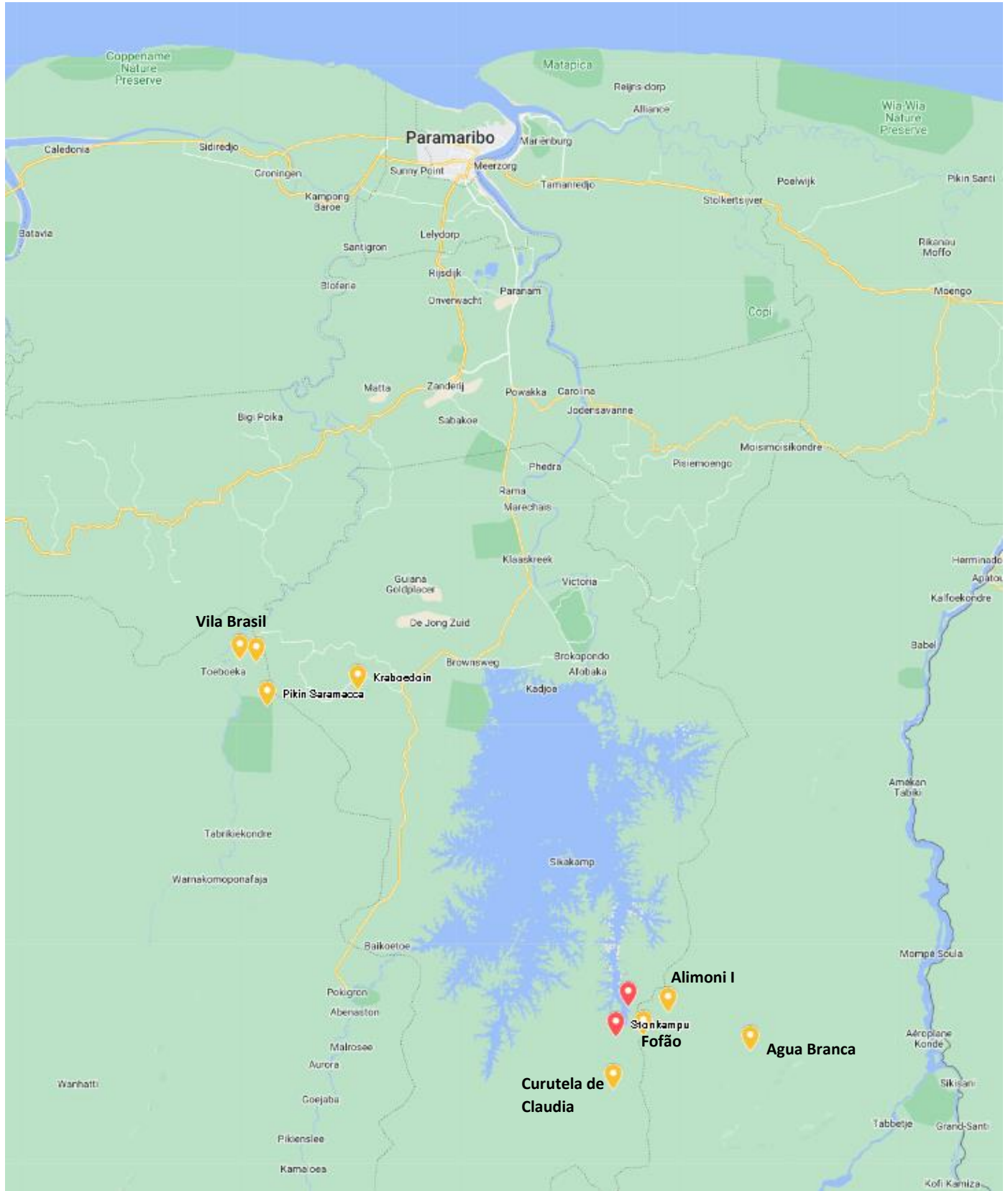


Figure 1. Survey locations. Yellow markers indicate survey locations, the red markers are boat landings.

2.2.2 Sampling method

Random sampling of the mining population is difficult. Gold miners are not registered and populations change in response to gold discoveries or other economic or political trends. Moreover, because of the isolation of many ASM areas and high travel expenses, it was not possible to visit all areas. Respondents were interviewed in mine sites across the selected research areas (Table 2). This way, the survey captured the diversity of experiences in an extensive area.

Table 2. Number of respondents per location, by sex (N=270)

Region	Mining area/ <i>garimpo</i>	Men, N (%)	Women, N (%)	Total, N (% Of total)
South-East of the hydropower lake	Curutela de Claudia	25 (57.6%)	34 (42.4%)	59 (21.9%)
	Alimoni 1	5 (62.5%)	3 (37.5%)	8 (3%)
	Fofão	28 (70%)	12 (30%)	40 (14.8%)
	Agua Branca	15 (44.1%)	19 (55.9%)	34 (12.6%)
West of the hydropower lake	Krabudoin	11 (73.3%)	4 (26.7)	15 (5.6%)
	Vila Brasil	79 (73.1%)	29 (26.9%)	108 (40%)
	Pikin Saramacca	5 (83.3%)	1 (16.7%)	6 (2.2%)
TOTAL		177 (65.6%)	93 (34.4%)	270 (100%)

In each mining site, the researchers adopted a stratified purposive sampling approach; targeting every person who fit the selection criteria within specific target groups. These selection criteria were;

- The person must be at least 18 years of age
- The person must have worked in a Suriname ASM area for at least six months.

For statistical reasons, the researchers aimed to interview approximately:

- 50% migrants, 50% Surinamese
- 30% women
- 50% gold miners, 50% persons delivering services to the miners, such as sale of food, fuel etc.

The main purpose of this division was to ensure that the sample would include a large enough number of persons of each different subpopulation to ensure that comparison between groups would be possible. This strategy meant that women were slightly over-sampled; the literature suggests that women constitute about 20% of the ASM population, while we aimed for at least 30% women.

The final sample included members of all these sub-groups, but the researchers did not manage to survey the target share of Suriname gold miners and mining service providers, because there were not many of them in the study areas. Relatively more Suriname gold miners and mining service providers are working in Brokopondo district north of the lake. However, the MoH-MP does not have CHWs in this area because these areas have better access to regular health services provided by the Medical Mission-Primary Health Care (*Medische Zending*, MZ) in the villages.

2.2.3 Sample characteristics

A total of 270 individuals participated in the survey, among whom 34.4% women. Women were, on average, 39.2 years of age (Range 19-65). The mean age of men was 40.6 years (range 19 - 73).

The ASM population, as well as our sample, is dominated by Brazilians (71.9%, 194/270). One out of every eight respondents was Surinamese (15.9%, 43/270). Almost all these Surinamese were males. Other nationalities in the sample included Dominicans (4.1 %, 11/270), Chinese (3.7%, 10/270), Cubans (2.2 %, 6/270), Venezuelans (1.5%, 4/270), one Haitian (0.4%), and one person from Vietnam (0.4%). Most Dominicans and Cubans were women (Table 3).

In terms of nationality there were two main differences between the baseline study and the impact study. In the first place, Haitians, Venezuelans and Vietnamese had not been encountered during the baseline study. During the impact study, there were only six individuals of these nationalities (together), and their presence in the sample did not alter the results. Secondly, in the baseline study sample, Chinese were underrepresented because a language barrier made it difficult to conduct qualitatively acceptable surveys with Chinese individuals. For the impact study, a fieldworker who is fluent in Chinese was recruited, and she conducted 10 interviews with Chinese inhabitants of ASM areas. It was important to include these Chinese nationals because in recent years, we have observed increasing numbers of Chinese working in the ASM areas and because of the language barrier they are often excluded from studies. In order to allow for comparison with the baseline study, we explicitly mention nationality where this is relevant in the results.

Table 3. Number of respondents by nationality and sex

	Female (N=93)	Male (N=177)	Total(% of total)
Brazilian	68 (35%)	125 (65%)	194 (71.9%)
Suriname	5 (11.6%)	38 (88.6%)	43 (15.9%)
Dominican	9 (81.6%)	2 (18.2%)	11 (4.1%)
Chinese	4 (40%)	6 (60%)	10 (3.7%)
Cuban	4 (66.7%)	2 (33.3%)	6 (2.2%)
Venezuelan	3 (75%)	1 (25%)	4 (1.5%)
Haitian	-	1 (100%)	1 (0.4%)
Vietnam	-	1 (100%)	1 (0.4%)
TOTAL	93 (34.4%)	177 (65.6%)	270 (100%)

Interviewees performed a wide variety of professions in the ASM areas. Under the term “gold miner” we included mine workers (those doing the manual labour in the pit), the operation owner and the excavator operator. Together, they function as a team responsible for getting the gold out of the ground. These gold miners represented 46.3% of the total sample (Figure 2).

The remaining 53.7% of respondents were persons who did not directly mine for gold. They delivered a wide variety of services to gold miners in terms of logistics, entertainment, or other life necessities. Services related to the logistic chain are provided by transport providers (ATV, car, boat), mechanics, ATV works shops, and workers in maintenance, sawing and welding. Entertainment is provided in bars and brothels, and other life necessities are taken care of by the various shops, traveling merchants, and clergy, among others (Figure 2).

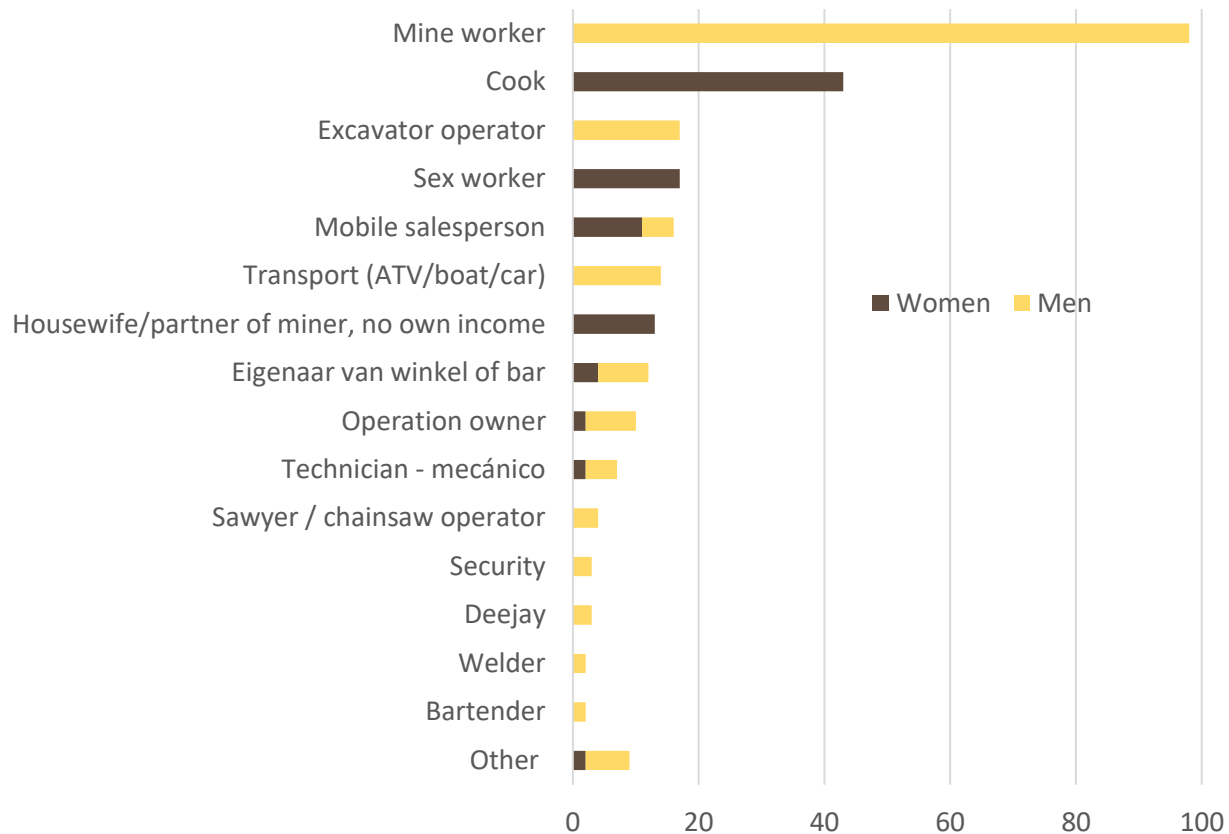


Figure 2. professions in the ASM areas, by sex (N=270)

Occupations in the ASM areas are defined by gender (Figure 2). Mine workers, and people performing technical jobs, were almost exclusively men. One exception was a female technician in the Agua Branca area. On the other hand, all sex workers and cooks were women. In addition, there were women in the mining areas who had come along with a male partner, but did not themselves earn an income. This gender division of labour is typical for Suriname ASM areas (Heemskerk et al., 2021).

Many respondents reported working in gold mining for quite a long time already; men more so than women (Figure 3). About half of men had been working in gold mining areas for more than 10 years. Women were more likely than men to be recent arrivals; 36.6% of women had started to work in the ASM areas less than two years ago, versus 28.2% of men. Women from the Dominican Republic, Cuba and Venezuela were relatively more likely than Brazilian and Surinamese women to be recent arrivals to the gold mining business; 62.5% of female migrants from these countries had started working in ASM since 2020 (10/16), and only one had more than 10 years of experience in the ASM sector. Meanwhile among Brazilian women 29.4% had started work in the ASM sector since 2020, and almost half (47%) had worked in ASM for more than 10 years.

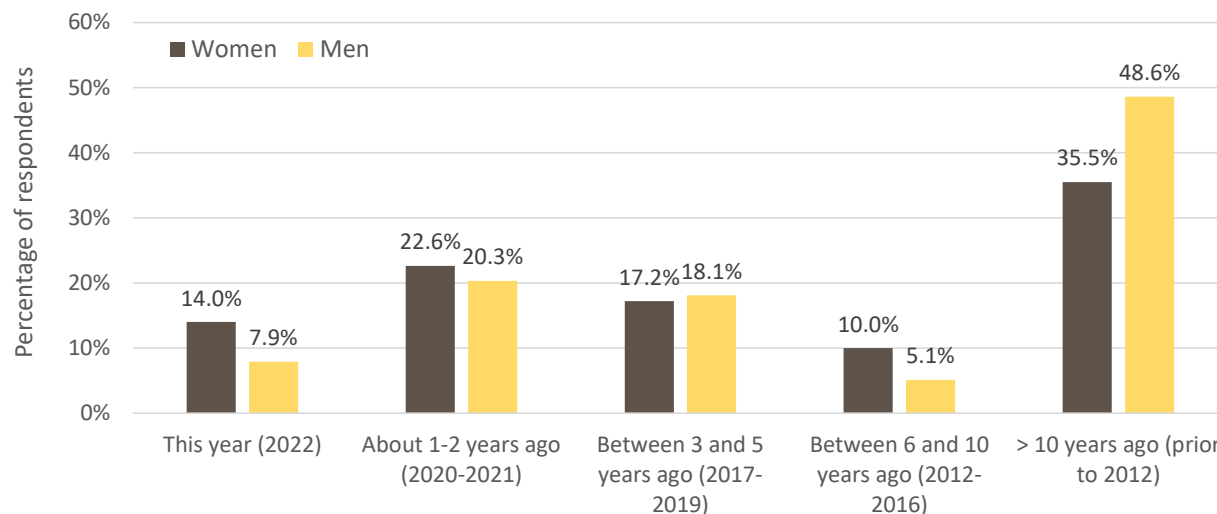


Figure 3. Number of years experience working in the ASM sector, by sex.

2.3 Structured Interviews with Community Health Workers

The MoH-MP trained 21 CHWs in the various interior locations in various aspects related to COVID-19, including:

- Knowledge of disease characteristics, symptoms, transmission ways and prevention;
- Performance of the COVID-19 Rapid Antigen Test, including the use of related Personal Protective Equipment (PPE) and all related matters; and
- Skills to safely work with the community on measures to reduce COVID-19 transmission

Of these 21 persons, five did not start the COVID-19 work. Of the remaining 16 CHWs, 12 persons were interviewed, either by phone or in person. They were asked about their work experience, reactions of their peers, results, challenges, the guidance they had received from the MoH-MP, and suggestions for improvement of COVID-19 service provision.

Two of the interviewed CHWs were men; the remaining 10 were women. Their work areas included the area south and south-east of the hydropower lake (Tjilipasi, Sarakreek, Grankreek), the area west of the hydropower lake (Krabudoin, Vila Brazil, Pikin Saramacca), the border region between Suriname and French Guiana (Nassau, Apoema/Mama Ndyuka, Peruano/Ronaldo, Albina, Yaw pasi).

2.4 Limitations and challenges

As we did not take a random sample, we cannot extrapolate results to the ASM population at large. Nevertheless, given our extensive experience in ASM areas, we are convinced that the sample was representative of the target population, and that the results provide an accurate representation of the perception, knowledge and attitudes of gold miners and mining service providers in Suriname.

Respondents may unintentionally or intentionally distort information. Among others, memories are not exact records of events, and the way that people “remember” events or behaviour may differ from what actually happened. Moreover, interviewees may want to hide certain sensitive information, or provide desirable answers. We minimized this source of bias by working with experienced surveyors. Their many years of work experience with the target population, allowed surveyors to recognize “unusual” answers and use different ways of verification in case of doubt.



3 Access to COVID-19 services

3.1 The CHWs: work organisation and logistics

The CHWs who participated in the COVID-19 program received test materials and protective gear at their location. Most also received a saturation device, and some a blood pressure device. They had been trained in the use of all of these instruments. To the six CHWs who had not received a blood pressure meter, it was not clear why not. They lamented the lack of this instrument because measurement of blood pressure is much asked in the gold mining areas.

Patients could either come to the location where the CHW is located, or call to ask the CHW to come to his or her location. If the CHW, transportation was provided in different ways. Some CHWs had their own transportation, usually an All-Terrain Vehicle (ATV), and were compensated for its use. Others solicited boat or ATV transportation at the moment it was needed.

Most CHWs work from their homes and/or work locations. When a patient arrives, they fabricate a simple test set-up with a table and chairs. One CHW is a traveling vendor, servicing Krabudoin and Vila Brasil, and takes her test materials with her. When there is demand in some location, she finds a place to perform the tests. The CHW in Albina is located in a small container clinic at Papatam, a temporary rest area from where many foreign migrant gold miners cross the border into French Guiana. This container, however, lacks a sink and running water, as well as electricity. Given these paucities, the Albina cabin is not an optimal location for COVID-19 testing; one cannot wash one's hands after patient consultation and the cabin gets too hot to comfortably sit inside.

During the COVID-19 intervention period (April-November 2022), the MoH-MP provided professional support to the CHWs in different ways. Each CHW has a supervisor, who can be called in case of questions. In some instances the supervisor visited the CHW to assist him or her during COVID-19 test activities, in other cases there was only distant support. In the case that a patient was severely ill, a medical doctor could be consulted.

3.2 Familiarity with the CHWs

Survey respondents were asked whether they knew where to find a CHW in their working area. In asking this question, the field workers specifically asked about CHWs who test and treat malaria, as this service has been provided for about a decade now. Almost two-thirds of respondents reported that they did not know where to find a CHW in their work area (63.7%, 172/270). Another 9.3% believed there was someone but did not know who or where to find the person. Others knew the person but did not know how to reach him/her (7%). Only 16.3% of respondents knew the person and knew how to get in touch with the CHW.

There were considerable differences between areas in terms of how well known the local CHWs were. In the mining areas west of the lake (Vila Brazil, Pikin Saramacca, Krabudoin), few people were aware of the CHW services. In this region, two-thirds of interviewees reported that they had no idea about the possible presence of a CHW, even though CHWs have been active in each one of these areas for many years. Another 10.9% of persons believed that there might be someone, but they did not know who or where to reach the person. Hence more than three quarters of inhabitants of the Western ASM areas are poorly aware of the health services provided by CHWs near them. Twelve percent of interviewees knew the CHW and how to reach him or her. In Vila Brazil, several persons referred to the people from Tropclinic who travel to the area every couple of months to provide health services.



Also in Agua Branca, very few persons were aware of the CHW services. Only one person responded that she knew a CHW in the area and where to find the person (2.9%, 1/34), while 91.2% of interviewees in this area had no idea about where to find a CHW nearby (31/34).

In the Curutela de Claudia, by contrast, 37.3% of interviewees knew who the CHW was and how to reach this person (22/59). Another 15.2% knew the CHW, but had no contact information. Being aware that there is a CHW and knowing the person's name will facilitate seeking care when needed. Data on familiarity with the CHWs for different gold mining areas are summarized in Figure 4.

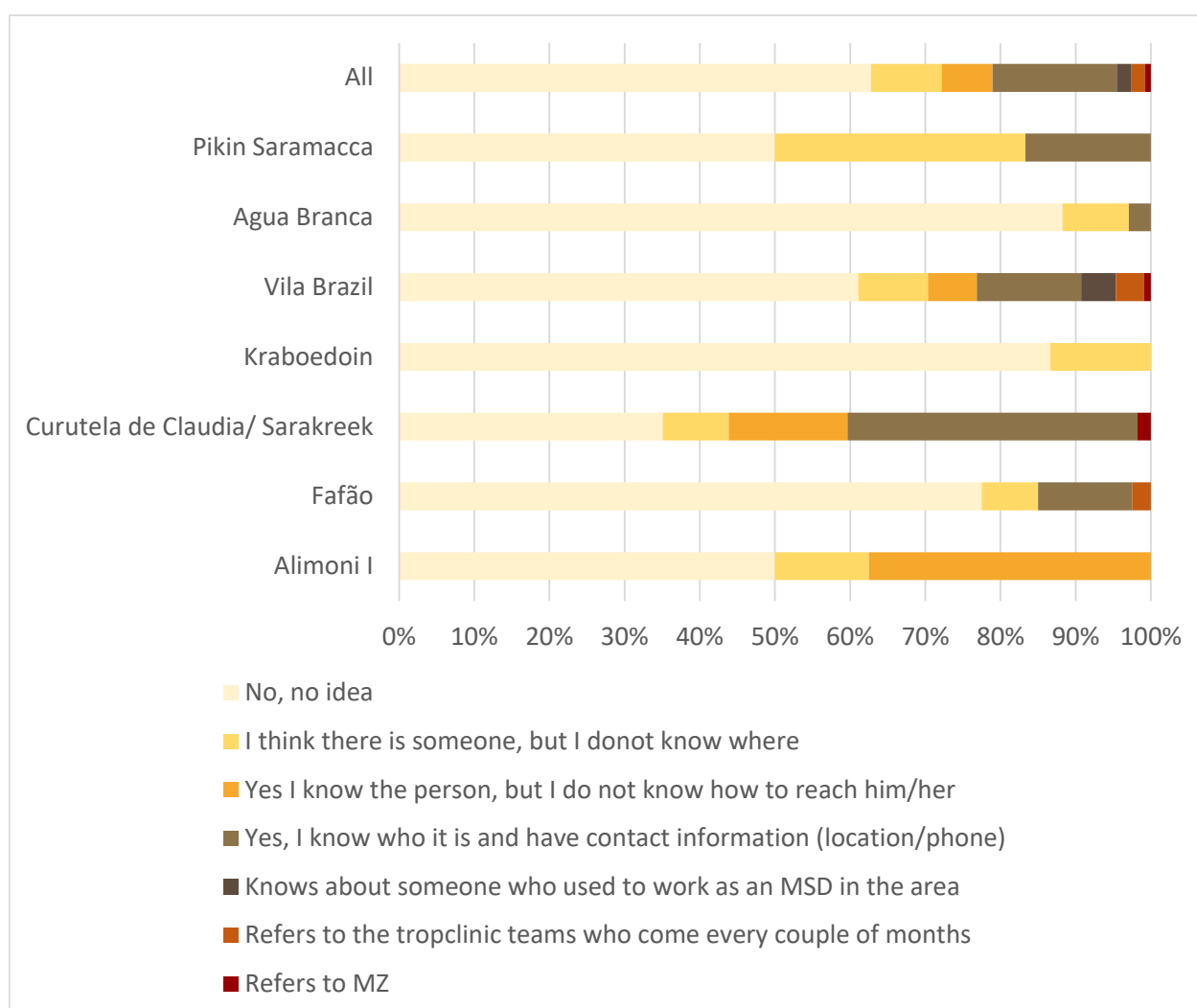


Figure 4. Familiarity with the CHWs in different gold mining areas

In asking about the CHWs who test for malaria, five individuals referred to the field missions from the MoH-MP, which visit these areas every couple of months. Two Surinamese named the MZ health posts as a place to find CHWs.

The limited level of familiarity with the CHWs in particularly the areas east of the lake (Krabudoin, Vila Brasil) cannot easily be explained. It possibly played a role that the CHW who used to work at Vila Brasil

left, and that people do not yet know about her replacement. The other CHW serving this area is coming and going, and does not stay at a fixed spot. The results suggest that more pro-active engagement with the target group and informing them about the presence and work of the CHWs could improve access to health services in these areas. Different CHWs suggested that posters, a flag or a banner would have helped to mark their home or shop as a COVID-19 test location.

3.3 Reception of the COVID-19 test facilities

After the trained CHWs returned to their work locations, they started informing the people in their work area about the COVID-19 services – though some more pro-actively than others. CHWs had different ways to make their new services known. Most CHWs started with informing the persons in their surroundings that, in addition to malaria testing, they now also provided COVID-19 testing. In some cases they also talked to several key persons in surrounding mining communities. In case that someone came to test for malaria, it was common to inform the person about the COVID-19 test service, and offer him/her a test. In some areas Whats-app groups are used for sharing news. These were very effective in spreading the word about the option for COVID-19 testing. One person reported that she made a poster and pinned it to the door, informing passer-by's about the services she provided. The couple working as CHWs in Grankreek reported that many weekends, they travel to surrounding mining areas for the malaria work. They used those occasions to talk about COVID-19 as well, and inform people about their services.

Reactions to the COVID-19 services were overall positive:

The people were very happy because we are at quite a distance from the city. Most people were positive. You will always have some who are not interested, we know that. ... They walk away or are busy with their phone (CHW, Grankreek).

They were happy because Maripasoula [hospital in FG] is at a distance from here. They were happy that I could give them the information and that there was an option to test (CHE, Yaw Pasi).

People were enthusiast because at that time we did not yet have self-tests here, and there was a period that many people had flu symptoms. They became afraid and were searching for a place to test, otherwise they would have to go to the city and it is very expensive. They reacted positive because it was free and could be done right there (CHW, Sarakreek).

Occasionally negative reactions were encountered, but they were rare:

Some people get angry. They say: I am not going to test. I try to calm them down, ease them. And explain calmly why it is good (CHW, Tjilipasi).

Some were not interested, they said they did not need to know whether they had COVID-19 or not (CHW, Grankreek).

Such negative reactions were uncommon though, and generally the CHWs reported that the population in ASM areas was happy and grateful that they were able to perform COVID-19 services in the *garimpo*, nearby and at no cost.

3.4 Knowledge of COVID-19 services provided by Community health Workers

In addition to asking in more general terms about the presence of a CHW in their living area, gold miners and mining service providers also were asked whether it was possible to test for COVID-19 in their *garimpo* (mining area) or *curutela* (gold miners' village). The majority of interviewees reported that it was not possible to test for COVID-19 in their work area (59.6%, 161/270). In addition, 11.9% did not know whether it was possible (32/270). Just over a quarter of respondents reported that it was possible to test for COVID-19 nearby (28.5%, 77/270).

When asked to name the place where one can perform a COVID-19 test, most referred to the CHW in the area (59.8%, 49/82). Others named the staff from the Tropclinic who regularly visit the gold mining areas (26.3%, 21/82), and/or said they could perform a self-test (8.5%, 7/82). In addition, three persons reported that they had heard about COVID-19 services in the ASM area but could not relate where to go (3.7%, 3/82), one person had experienced that "people" had come to test but they did not know who they were, and a man in Agua Branca reported that one could get tested in the local drugstore (Figure 5).

The data suggest that access to public health services such as testing for malaria and COVID-19 could be improved by more assertive advertising and/or promoting the presence of the CHWs in the ASM areas, including the person's contact information. In this context, the CHWs recommended working with banners or posters to mark their test location.

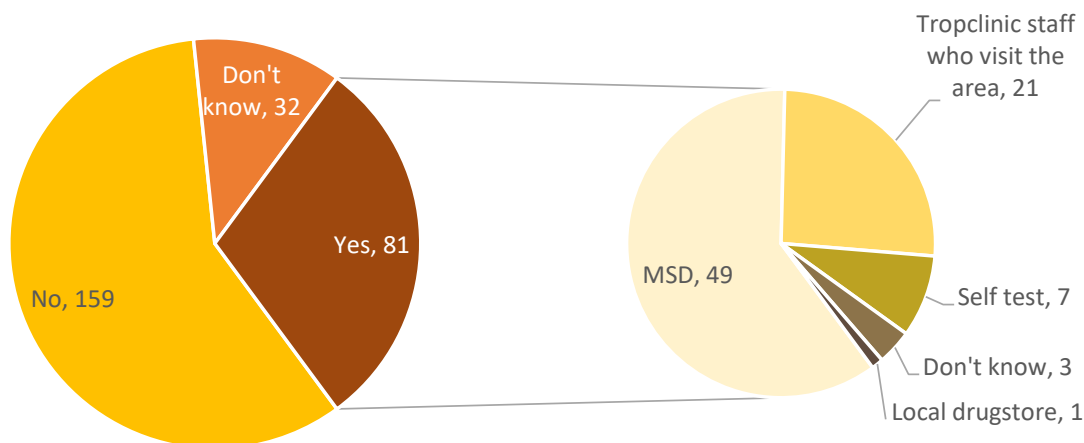


Figure 5. Is it possible to perform a COVID-19 test in your area, and if so where?

3.5 Challenges encountered by CHWs in working with the gold mining population

The CHWs encountered several challenges in offering COVID-19 services to the gold mining population. The main challenge is related to the way that inhabitants of ASM areas approach and attack health issues in general, haphazardly taking medication based on their own diagnoses (see also Le Tourneau, 2020; Heemskerk et al., 2022). The target population consumes an alarming amount and variety of medicines, including antibiotics and pain killers, when they believe to have problems with their back, kidneys, liver, or other body parts; when they have rashes or infections; and when they believe they suffer from malaria or other infectious diseases. Seeing a health worker is simply not a first response to illness in this group. A CHW explains:

They do not test, they self-medicate. The garimpeiro is difficult. When he feels bad, he will first buy medication at the Chinese store, and take that. For example, he takes medication for back ache, and then, when it does not improve, he will take something to cure kidney pains, and so on and so forth, until there is nothing left. Only when nothing helps and he feels really bad, he will go to the doctor (CHW, Ronaldo)

Other CHWs confirmed this reading, and added gold miners and others living in the mining areas have little interest in listening to health advice.

Sometimes it is useless to be working with gold miners on issues concerning their health. They always believe they know better than you do, and they call themselves "Dr. Pião" (~Dr. Digging into the ground) (CHW, Grankreek)

The way the gold miners live together; no mask, no distance, no isolation. Gold miners are not concerned about their health, they see everything as "normal" (CHW, Grankreek)

The gold miners do not listen, they do whatever they want even though you explain everything to them (CHW, Ampoema).

Another challenge, reported by two CHWs, is that some inhabitants of gold mining areas do not trust them, the CHWs, because they are not full medical doctors, but rather people from the community.

You hear people say: "this one does not know anything and then she comes play nurse here" or "from nothing she suddenly became something". Some people walked away during information sessions (CHW, Grankreek).

Some, when they are poorly educated, can be aggressive. Some do not believe in our work. They have less trust in us because they already know us (CHW, Ronaldo).

Despite these challenges, most of the CHWs are highly motivated to serve their communities, and to continue doing so in the years to come.

4 Knowledge

4.1 Knowledge of COVID-19 transmission ways

Knowledge of the causes of COVID-19 was generally good. In response to the open-ended question “Can you tell me what is the cause of COVID-19, how it is transmitted?” more than 90% of respondents correctly named one or more transmission ways (Figure 6). The best known way in which COVID-19 is transmitted is if an infected person coughs or sneezes near you. The second most mentioned cause mentioned transmission way was through the air, related to respiration of an infected person (Figure 6). Under the label “other”, people mentioned: kissing (N=2), saliva (2), not being vaccinated (3), not washing/disinfecting hands (2), and going into a crowd (2). Similar answers had been provided in the baseline study (Figure 4). One notable difference is that during the baseline study, one-third of respondents (35.3%) had reported that touching an infected person or forms of bodily contact could be a cause of transmission. During the impact study, this was hardly mentioned (1.1%). We cannot explain this difference.

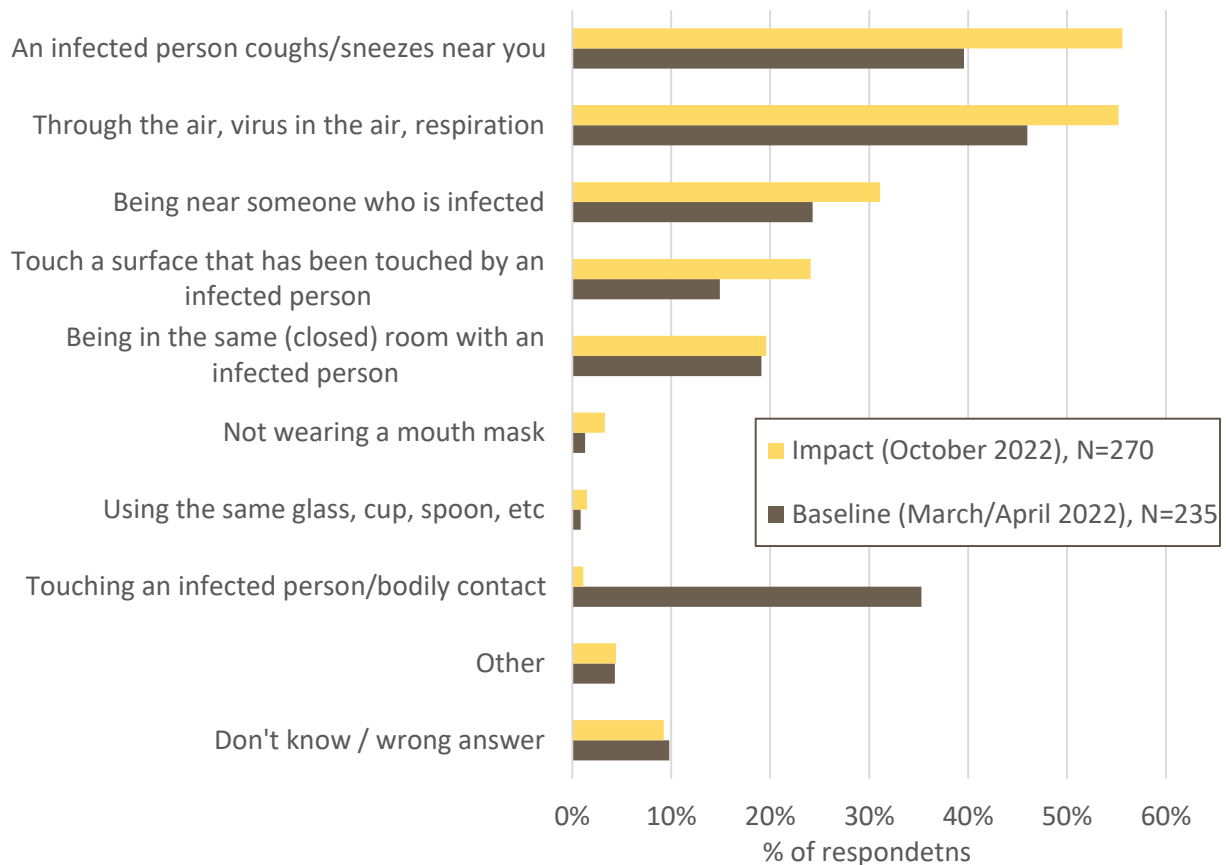


Figure 6. COVID-19 transmission ways named by respondents in the baseline (N=235) and impact (N=270) studies

During the baseline study, one out of every ten persons (9.8%) did not know how COVID-19 was transmitted (23/235). For the impact study, this was about the same: 9.3% of respondents (25/270). Among them, 21 persons reported that they did not know, three persons gave erroneous answers (blowing cigarette smoke on someone, mosquito, through the eyes), and one Suriname man was convinced that he could not get COVID-19 because he was drinking forest medicine.

4.2 Knowledge of COVID-19 symptoms

Most respondents were able to list one or more COVID-19 symptoms (92.2%, 249/270). Twenty-one persons (7.8%) could not name any symptoms; twice as much as during the baseline study six months ago (3.8%). We do not know why knowledge of symptoms has decreased. It may be related to the fact that in the months prior to the survey, there was virtually no media attention for COVID-19.

The top three most mentioned symptoms of COVID-19 were headache (named by 52.2% of respondents, 141/270), fever (51.9%, 140/270), and body pains/pain in joints (41.1%, 111/270) (Table 4). These symptoms also were the three most mentioned symptoms during the baseline survey. One difference was that headache moved from the third most mentioned symptom to the first place. It is possible that the relatively recent incidents of the Omnicron COVID-19 variant, which was characterized by heavy headaches, played a role.

Table 4. Known COVID-19 symptoms

Symptoms	N (N=270)	%
Headache	141	52.2%
Fever	140	51.9%
body pains/pain in joints	111	41.1%
Loss of taste/smell	105	38.9%
Difficulty breathing	88	32.6%
Coughing	74	27.4%
Flu-like symptoms	53	19.5%
Sour throat	52	19.3%
Tiredness	41	15.2%
Throwing up/nauseous	11	4.1%
Diarrhea	7	2.6%
No appetite	6	2.2%
Other (Feeling cold/hot, shivers,)	16	5.9%
Don't know	21	7.8%

4.3 Knowledge of selected COVID-19 facts

We presented five statements to measure knowledge and opinions about specific COVID-19 facts (Figure 7). Respondents were asked whether these statements were true or false; or whether they agreed or disagreed with them.

The largest share of respondents agreed with the statement: “COVID-19 is a very contagious disease” (89.3%, 241/270) (Figure 6). Consistent with this response, three-quarters of respondents disagreed with the statement that “COVID-19 is not dangerous, it is just like a flu” (73%, 197/270). Also in line with this

perception, the large majority of respondents disagreed with the statement: “Only people who are already weakened by illness or old age die of COVID-19” (85.9%, 232/270).

Even though the population in ASM areas is still aware that COVID-19 is a dangerous disease that can also affect healthy persons, the data suggest that a share of the target group has become less convinced of the severity of COVID-19. The share of respondents who agreed that COVID-19 is a very contagious disease was slightly higher during the baseline survey (93.6%), just like the share of persons who disagreed that COVID-19 was just like a flu (79.8%).

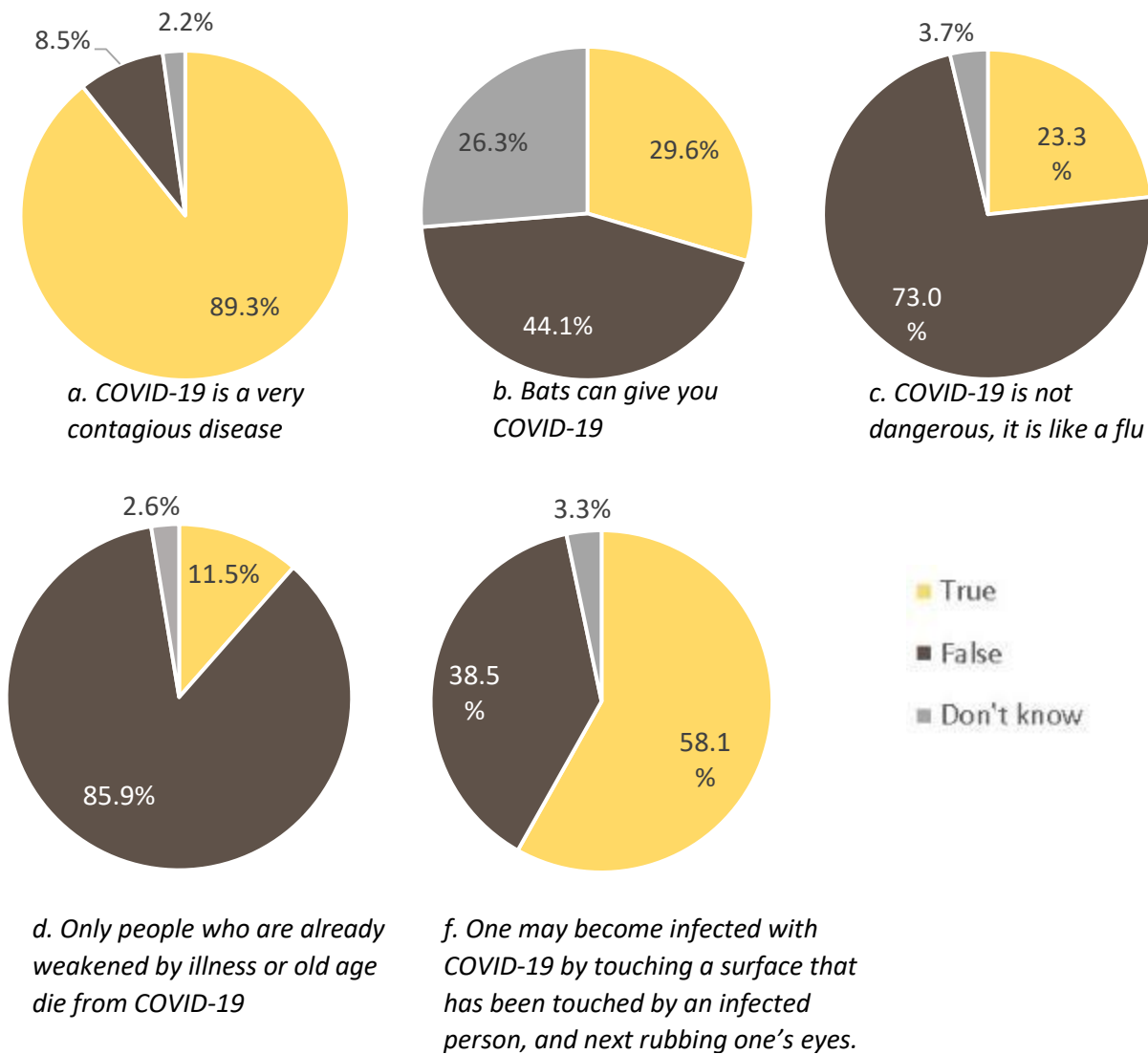


Figure 7. Are the following statements a through f true or false?

The largest difference between the baseline study (March/April '22) and the present impact study (Oct/Nov '22) was observed in reference to the statement “You may become infected with COVID-19 by touching a surface that has been touched by an infected person, and next rubbing your eyes.” During the baseline study, 80.4% of respondents agreed with this statement, versus 58.1% of persons who participated in the impact study. This change in perception is in line with growing scientific consensus that COVID-19 rarely spreads through surfaces (Lewis, 2021).

We noted differences in COVID-19 related knowledge and perceptions between Surinamese inhabitants of ASM areas and foreign migrants. Surinamese respondents (N=43) were relatively more likely than migrants (N=227) to answer “don’t know” to any statement. Foreign migrants were more likely than Surinamese to consider COVID-19 “just like a flu” (resp. 25.1% vs. 14% agreed; χ^2 , $p<0.005$). On the other hand, Surinamese were more likely than foreign migrants to agree that “Only people already weakened by illness or old age die of COVID-19” (resp. 23.3% and 9.3%; χ^2 , $p<0.001$).

Many respondents were hesitant about the role of bats in causing COVID-19. Thirty percent of respondents believed that bats do transmit COVID-19; 44.1% believed that the statement was false, and 26.3% said they did not know. These figures did not differ much between the baseline study and the impact study. There was a small difference between Surinamese and migrants in reactions to this statement, with foreign migrants being relatively better informed. In comparison with foreign migrants, Surinamese were more likely to say that they did not know (resp. 24.7% and 34.9%). Meanwhile foreign migrants were relatively more likely to consider the statement false (resp. 45.4% vs 37.2%).

In order to quantify knowledge, we counted the number of correct answers per person. Table 5 lists each statement, listing what answer was considered the correct answer. We omitted the statement about contaminated surfaces, because this statement may be theoretically right, but in practice the risk is negligible.

On average, respondents answered 2.9 out of 4 questions correctly, ranging from no single correct answer (8 persons) to four correct answers (N=76, 28.1% of respondents). It was most common for respondents to answer three out of four statements correctly (N=127, 47% of respondents) (Figure 8). There was no significant difference between women and men, or between Surinamese and foreign migrants, in terms of the number of correct answers.

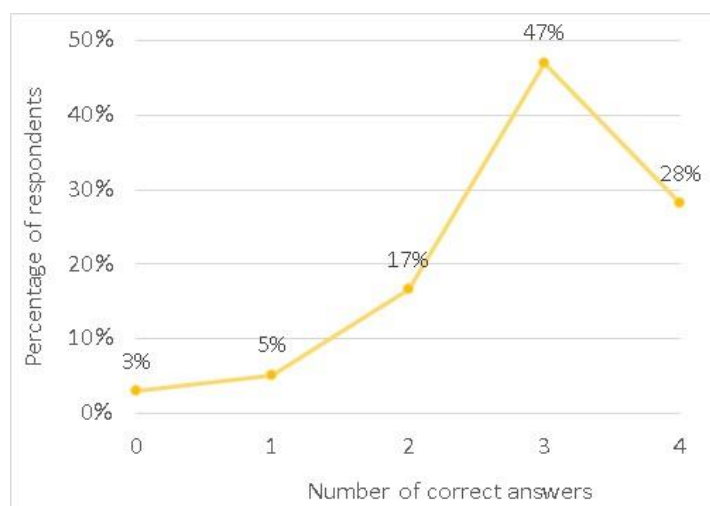


Figure 8. Number of correct answers to true-false statements

Table 5. Knowledge of specific COVID-19 facts: number and percentage of respondents reporting true or false in response to four COVID-19 related statements.

Statement	Correct answer	N	Number (%) of correct answers
a. COVID-19 is a very contagious disease	True	270	241 (89.3%)
b. Bats can give you COVID-19	False	270	119 (44.1%)
c. COVID-19 is not dangerous, it is just like the flu	False	270	197 (73.0%)
d. Only people who are already weakened by illness or old age die of COVID-19	False	270	232 (85.9%)

4.4 Knowledge of ways to reduce exposure to COVID-19

Respondents were asked what measures one can take to protect oneself against COVID-19. Consistent with the baseline study, the four best known measures were wearing a face mask (mentioned by 63.7% of respondents, 172/270), social distancing (53%, 143/270), regularly disinfect hands with alcohol or another disinfectant (51.1%, 138/270), and regularly wash hands with water and soap (35.6%, 96/270) (Figure 9). These MOHANA (Mouth mask, hands washing, distancing) measures were promoted most fervently by the Suriname MoH in its COVID-19 awareness communication. There were no significant differences between Surinamese and migrant respondents in terms of this top four most mentioned measures to reduce the chances of COVID-19 transmission.

Figure 9 displays the listed answers that were provided, distinguishing Surinamese versus foreign migrants. Vaccination was named by 14.8% of respondents, though more often by migrants than by Surinamese. Surinamese were relatively more like to express belief in home remedies and staying out of busy places as ways to reduce COVID-19 infection risk. Nine persons reported that one cannot do anything to protect oneself against COVID-19, and five persons indicated that they did not know any protective measures. Other answers that were only named once included: sleep with mosquito net, play sports regularly, be careful, education, pharmaceuticals, be careful touching door knobs and railings, not embrace people, disinfect groceries after purchase, it is in de hands of God, not share drinking glass, and personal hygiene.

We considered the following answers as correct ways to prevent COVID-19 transmissions:

- ✓ Wear a face mask
- ✓ Regularly disinfect hands with alcohol or disinfectant
- ✓ Social distancing
- ✓ Regularly wash hands with soap and water
- ✓ Vaccination
- ✓ Not go to busy places/in crowds
- ✓ Stay away from infected persons/persons with symptoms
- ✓ Clean everything/disinfect surfaces
- ✓ Stay at home/isolate oneself

All other answers, such as using home remedies or Vitamin C, were not considered correct answers, because there is no scientific evidence that they are effective in limiting COVID-19 transmission. Knowledge of these protective measures was reasonable, though 7% of respondents could not name any protective measure. This was an increase from the baseline situation, when only 3.8% of surveyed

inhabitants of ASM areas were unable to name at least one effective way to reduce the chances of becoming infected with COVID-19.

Table 6. Measures to protect oneself against COVID-19 transmission mentioned by Surinamese and foreign migrant respondents

What can one do to prevent becoming infected with COVID-19?	Surinamese (N=43)		Migrants (N=227)		All (N=270)	
	N	% of Surinamese	N	% of Migrants	N	% of total
Wear a face mask	24	55.8%	148	65.2%	172	63.7%
Social distancing	26	60.5%	117	51.5%	143	53.0%
Regularly disinfect hands with alcohol or disinfectant	21	48.8%	117	51.5%	138	51.1%
Regularly wash hands with soap and water	14	32.6%	82	36.1%	96	35.6%
Vaccination	2	4.7%	38	16.7%	40	14.8%
Use home remedies	4	9.3%	19	8.4%	23	8.5%
Other (only named once)	1	2.3%	9	4.0%	10	3.7%
Not go to busy places/in crowds	8	18.6%	2	0.9%	10	3.7%
You cannot do anything/you cannot protect yourself	4	9.3%	5	2.2%	9	3.3%
Don't know	2	4.7%	3	1.3%	5	1.9%
Stay in the forest, do not go to town	2	4.7%	3	1.3%	5	1.9%
wear gloves	2	4.7%	2	0.9%	4	1.5%
Take vitamine C	0	0.0%	4	1.8%	4	1.5%
Stay away from infected persons/persons with symptoms	1	2.3%	3	1.3%	4	1.5%
Live healthy	1	2.3%	1	0.4%	2	0.7%

Surinamese were relatively more likely than foreign migrants to be unable to name a method against COVID-19 transmission (14%, 6/43 vs 5.7%, 13/227). Yet furthermore there was not much difference between these groups with regard to the correct number of responses they mentioned (Figure 10).

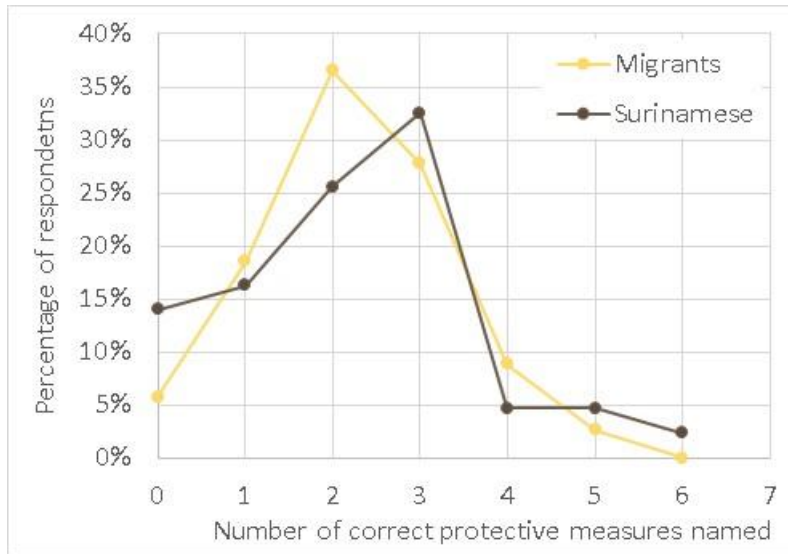


Figure 9. Number of correct protective measures mentioned

5 Attitudes

5.1 Perception of COVID-19 infection risk

Inhabitants of gold mining areas were asked whether they believed that they were at risk of COVID-19 infection. More than half of respondents answered affirmatively (55.9%, 151/270). Forty-one percent of respondents believed that they ran no risk (anymore) to become infected, and 3% of respondent reported that they did not know. There was no difference in risk perception between Surinamese and foreign migrants in general. Chinese respondents were relatively more likely than others to feel at risk of COVID-19 infection (90%, 9/10) while, on the other hand, the majority of interviewed Venezuelans believed that they were not at risk (75%, 3/4). The numbers of these specific subgroups were too small to determine the statistical significance of these differences. As compared to men, women were significantly more likely to believe that they were at a risk of becoming infected with COVID-19 (51.7%, 89/172 vs 68.9%, 62/90, χ^2 $p < 0.01$, excluding answer Don't know) (Figure 11).

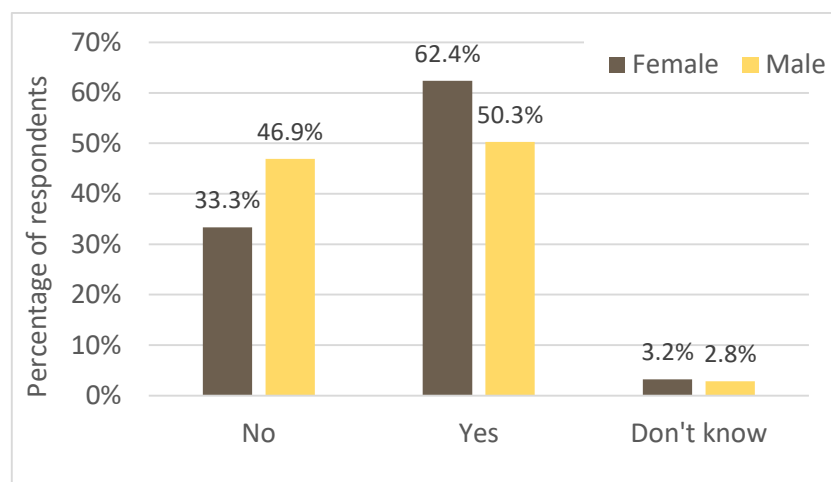


Figure 10. Perception of being at risk for COVID-19 infection

The main reason for believing to be at risk was simply that there still is COVID-19, followed by the observation that “Anyone can get it”. These and other reasons for believing to run a risk of becoming infected with COVID-19 are listed in Table 6.

Inhabitants of the gold mining areas who believed that they were not at risk motivated their answer mostly by stating that there is no COVID-19 (anymore) in the mining areas, or that the pandemic has passed altogether (Table 7). A Brazilian cook emphasized that she had never heard of someone in the gold mining areas contracting COVID-19. Others believed that there was no COVID-19 in the gold mining areas because they did not see anyone with symptoms.

Other reasons for believing not to be at risk of becoming infected with COVID-19 were mentioned less often. Several individuals associated the risk of contracting COVID-19 with their general health and a healthy lifestyle. Their justifications included:

- I do not drink liquor and I do not smoke
- I do not easily get ill, I am healthy
- I am a strong black man

- I am a strong, healthy man
- I never had it, even during the pandemic, so I do not think I can still get it.

Yet others believed they did not risk COVID-19 infection because they did not travel to Paramaribo, and outsiders did not come to them.

Table 6. Reasons to believe to be at risk of getting COVID-19

Why do you believe you are at risk of becoming infected with COVID-19? (N=148)	N	%
There still is COVID-19	105	70.9%
Anyone can get it	50	33.8%
People who are infected do not go in isolation	4	2.7%
I do not protect myself	3	2.0%
There are many people arriving from outside	2	1.4%
You do not know who has it/people can be asymptomatic	2	1.4%
Because of my profession I am in close contact with people (sex worker, bar tender)	2	1.4%
Other (it is dangerous, it is contagious, I have not been vaccinated, you can never be sure, I already got it so I might get it again, the virus mutates so we will have to deal with it)	6	4.1%

Table 7 Reasons for believing not to be at risk of getting COVID-19

Why do you believe you are not at risk? (N=111)	N	%
There is (almost) no COVID-19 anymore in the gold mining areas	52	46.8%
There is (almost) no COVID-19 anymore	27	24.3%
I have been vaccinated	15	13.5%
I am strong/healthy/not easily ill	7	6.3%
I feel good/have no symptoms	3	2.7%
I am careful	3	2.7%
I do not go to the city/Paramaribo	3	2.7%
I use home remedies	3	2.7%
I pray/trust in God	2	1.8%
I had COVID-19 before	2	1.8%
Camp is isolated, they do not have much contact with outsiders	2	1.8%
Other (Here one lives in nature; I have no time to think about COVID; we live in an open space; it is warm here, no contact with people who have symptoms, It just became a regular flu)	6	5.4%

5.2 Test willingness

We asked: “If a health worker would ask you to conduct a COVID-19 test now, would you be willing to take one?” Three-quarters of interviewees responded affirmatively (73.0%, 197/270). As compared to the baseline survey, when 86.4% of respondents had been willing to test, test willingness seems to have decreased. It is likely that the low number of recent COVID-19 infections affects test willingness. There was no significant difference between women and men, or between Surinamese and foreign migrants, in terms of their willingness to test.

The grand majority of those who were not willing to test motivated their decision saying that they did not feel any symptoms, so they did not see the use of a test (85.9%, 61/71). Another four persons conveyed that the found the test painful (5.6%, 4/71). All other reasons to refrain from testing were all mentioned by just one person. They included:

- There is no COVID-19 anymore
- One can conduct a self-test if needed
- The person had COVID-19 nine months ago, and feels good now.
- The person does not like it.
- The person was recently tested.
- You hear strange things, like people who were not infected and suddenly got infected
- A stick in the nose is dangerous.

6 Practices

6.1 Protecting oneself against COVID-19

Survey participants were asked what measures they still were taking against COVID-19. One of the women, a Surinamese, conveyed that she still took COVID-19 seriously. She accounted that she wiped everything she bought with alcohol. After leaving the house, she would bathe as soon as she returned home. And upon receiving money she would let it soak in water for a while. She, however, was an exception. The majority of respondents reported that they were not doing anything anymore (56.3%, 152/270; Table 8). There was no significant difference between women and men, or between Surinamese and foreign migrants, in current adherence to COVID-19 measures. A likely explanation is that in Suriname, all COVID-19 restrictions have been lifted. One rarely sees someone with a mouth mask, and a COVID-19 test or vaccination are no longer required to enter the country.

Comparing data from the impact study with those from the baseline study just half a year ago, we notice various differences. In the first place the share of persons stating that they do not adhere to any COVID-19 protective measures increased from 3.4% to 56.3% (Table 8). Vice versa, fewer individuals reported taking precautions against COVID-19. While the top five most used measures is more or less the same during both time periods, during the baseline study many more persons adhered to these measures.

Rubbing hands with alcohol or a disinfectant was most frequently cited as something that people still adhered to (21.5%, 58/270), with no difference between Surinamese and foreign migrants. In many gold mining camps, we noticed bottles of hand sanitizer on the table for everyone to use. Staying at a distance from persons with symptoms was the second most common way to reduce the chances of COVID-19 infection during the impact study. During the baseline study this measure was not mentioned, probably because people were keeping at a distance from everyone, not just those displaying symptoms. Indeed, during the baseline study a quarter of persons reported that they adhered to social distancing (general) (27.7%), while no-one reported this anymore half a year later. During the impact study period, eight persons reported taking vitamin C. This was not mentioned during the baseline study.

Those who still occasionally wore a face mask specified that they only wore it when going to town, going to busy places (market, store), or when being near persons with flu symptoms. In practice, no-one was observed wearing a face-mask. A Chinese shop owner reported that he did not wear a facemask because customers would think that he is infected with COVID-19, and subsequently they would not come to buy things. Another Chinese shop owner indicated that he had still plastic wrapped around the counter of his shop to protect his wife and himself when they were working.

Table 8. Measures taken by respondents to protect themselves against COVID-19, comparing the baseline data (N=235) with data from the impact study (N=270).

What are you (still) doing to prevent becoming infected with COVID-19?	Impact study (October 2022)		Baseline (March/April 2022)	
	N	%	N	%
Nothing	130	56.3%	8	3.4%
I rub my hands regularly with alcohol/disinfectant	58	21.5%	113	48.1%
I wear a face mask when I perceive a risk (e.g. go to town, be in crowds)	30	11.1%	196	83.4%
I stay away from people with symptoms	30	11.1%	0	0%
I am vaccinated	22	8.1%	83	35.3%
I do not go to busy places	18	6.7%	15	6.4%
U use home remedies	14	5.2%	14	6%
I stay in the forest/ I travel as little as possible to Paramaribo	13	4.8%	23	9.8%
Use Vitamine C	8	3.0%	0	0%
I use pharmaceuticals	4	1.5%	2	0.9%
Pray/Trust in God	2	0.7%	4	1.7%
Personal hygiene/bathing	2	0.7%	1	0.4%
Washing hands with water and soap	2	0.7%	3	1.3%
Live healthy	2	0.7%	5	2.1%
Stay home	1	0.4%	7	3.0%
Social distancing, general	0	0.0%	65	27.7%
Other	4	1.48%	3	1.3%

6.2 Experience with COVID-19 infection

Respondents were asked whether they had ever been infected with COVID-19. Two-thirds of respondents reported that they had never contracted COVID-19 (65.6%, 177/270), the same figure as during the baseline study. Another 2.6% were not certain, but believed that they had not contracted COVID-19. Twenty-nine percent of respondents were convinced that they had had COVID-19 (28.5%, 77/270) and another 3.3% were not certain but believed they did (9/270)

Women were more likely than men to report that they (possibly) had been infected with COVID-19 (Figure 12). This finding is in line with our figures from the baseline study.

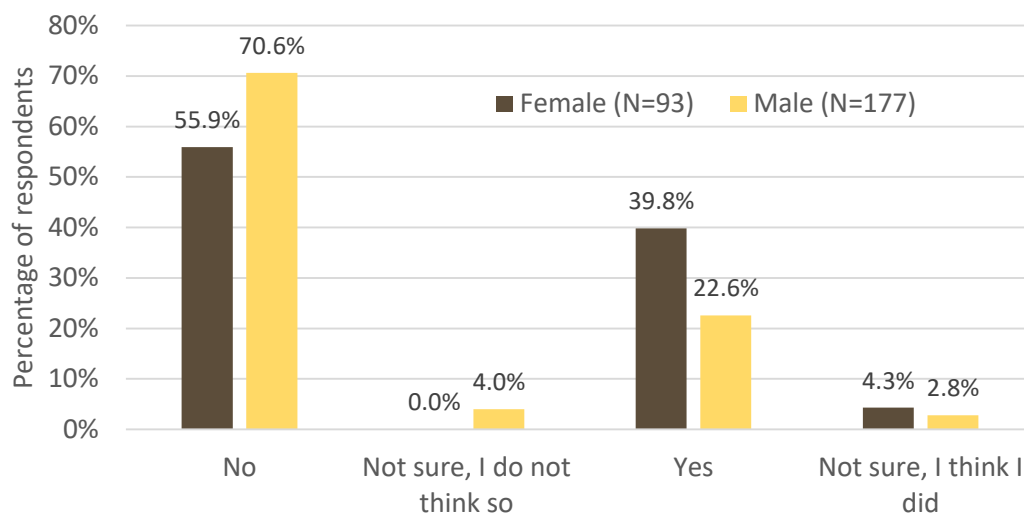


Figure 11. Did you ever contract COVID-19? Responses differentiated by gender.

Among those who had had COVID-19 or believed they might have had it, 81.4% (70/86) reported that they had only had it once. Eleven individuals had possibly been infected with COVID-19 twice (12.8%), and three persons reported three COVID-19 experiences. One Brazilian woman and one Brazilian man reported respectively four and five illness incidents.

Two-thirds of those who reported that they had possibly contracted COVID-19 at least once (i.e. they said “yes” or “I think I did” when asked if they ever had COVID-19), had confirmed this with a test the most recent time that they had COVID-19 (67.8%, 59/87). There was no significant difference between women and men, or between people of different nationalities in this regard.

6.3 COVID-19 test behaviour

5.3.1 Test behaviour reported by the gold mining population

Two-thirds of respondents had been tested for COVID-19 at least once, much more than during the baseline survey (67.8%, 183/270, versus 48.5%). This included individuals who had tested obligatory prior to international travel. Most of these people had been tested once (38.9%, 72/185) or twice (34.6%, 64/185). Seven individuals reported that they had tested 10 or more times. Among those who had tested for COVID-19 at least once, the mean number of tests was 2.3 (range 1-15), with a median of 2 tests. These figures were comparable to those for the baseline study.

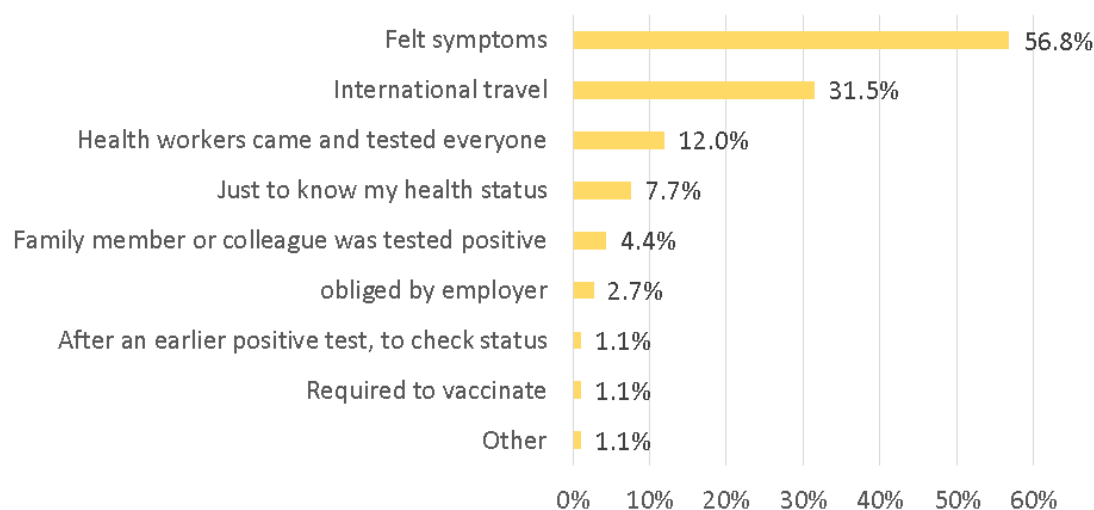
As compared to Surinamese inhabitants of ASM areas, foreign migrants were relatively more likely to have been tested (resp. 46.5%, 20/43 versus 71.8%, 163/227; χ^2 , $p < 0.005$). Also, women were relatively more likely to have been tested than men (resp. 78.5%, 73/93 versus 62.1%, 110/177; χ^2 , $p < 0.005$).

The most important reason to test for COVID-19 was that the person had felt symptoms (56.8% of respondents, 104/183). As compared to men (50.9%, 56/110), women (65.8%, 48/73) were more likely to have tested because of feeling symptoms. Another important reason was international travel (31.7%, 58/183), with little difference between women and men. The outreach activities of the MoH-MP had a significant impact on test behaviour; for 12% of respondents, this had been a reason to get tested. Among those who had only tested once, 15.3% indicated that the reason to get tested was because of the visit of

the MoH-MP team to the gold mining area (11/72). It is very likely that these people would not have tested without the MoH-MP visit.

Other reasons to test were of lesser importance. Figure 13 displays the various reasons to get tested.

Figure 12. Reasons to test (N=183)



Respondents who had tested for COVID-19 at least once (N=183) were asked where they had taken their most recent COVID-19 test. Almost one-third of respondents (31.7%, 58/183) had tested most recently abroad, mostly in Brazil (27.3%), and smaller numbers in French Guiana, Guyana, and China (Figure 14). Those who had tested abroad most often had done so as part of travel restrictions that were enforced at the time. It is likely that the tests in French Guiana (N=5) were associated with a visit to a clinic or hospital in French Guiana, where many foreign migrant go for medical emergencies and regular check-ups.

Twenty-nine percent of persons had performed their most recent test through one of the services provided by the MoH-MP: the Tropclinic, a CHW in the mining areas, or one of the COVID-19 field missions to the remote mining areas (29%, 53/183). This finding suggests that the MoH-MP services make a significant difference in providing access to COVID-19 test services.

“Other” places to get tested included the Bureau of public Health, the Medical Mission interior clinics, the Suriname international airport, the Dutch embassy, and a medical practitioner who had visited the person’s home.

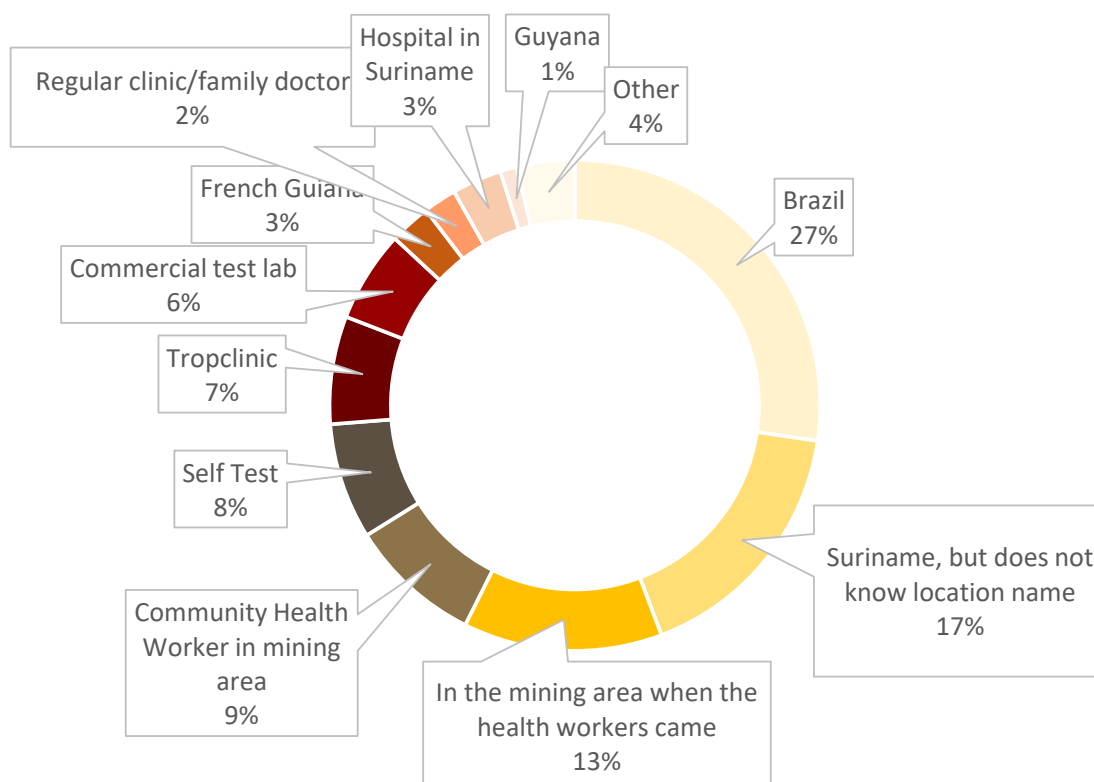


Figure 13. Location where the person performed the most recent test, only those who had tested at least once (N=182)

5.3.2 Community Health Workers experiences with COVID-19 testing

Virtually all CHWs experienced that the target population was initially hesitant to test or even averse to testing. Especially during All Case Detection (ACD)², when the purpose is to test as many persons as possible from a target region, the CHWs encountered quite some refusals. But also in instances where a positive case had been encountered, others in the same camp or home sometimes refused testing.

The local people, especially Albina and surroundings, probably it is a taboo for them. They are afraid or they do not want to do it (CHW, Albina).

The CHW in Albina conveyed that she tested two persons in a house of eight inhabitants positive, but none of the others wanted to test, no matter how much she tried to persuade them. Her colleague from Tjilipasi confirms:

Sometimes you have to beg them, but they do not want to do it, and you cannot force them. Even if you explain it to them: it is important, it is for your health. For example some are diabetic or have hypertension, than it can go wrong! It is better to prevent it. But they do not listen (CHW, Tjilipasi)

An important reason for not wanting to test was that people believed the tests to be painful.

² A public health mission to a specific area, with the aim to test all persons in that area on malaria, COVID-19 or another disease.

Not everyone wanted to participate in the ACD, even though they had symptoms. In the beginning people were really afraid because they had tested in the city, where it was very painful, and some had had nose bleeds. They were placing the stick too deep (CHW, Sarakreek).

Some were afraid to test, they did not want the stick in their nose. But my wife tried to convince them. She told them that now it is not like in the beginning when everything was new. In the past they really stuck the little stick far inside [your nose], but we do not do that anymore (CHW, Ampoema).

The CHWs spoke a lot with the people in their areas to try convince them to test. With some perseverance they were able to convince persons to test, who initially had not been willing to do so.

I explained them that I do not stick the little stick very far inside, and they also could watch when I was testing someone else. It helped, because afterwards they would come (CHW, Yaw Pasi).

One CHW reported that some individuals believed that since they had been vaccinated, they would not get COVID-19 anymore, and therefore they would not need to test.

[We told them] that it was important, and that you can get COVID-19, even though you are vaccinated (CHW Gran Kreek)

All CHWs reported that they spent quite some effort in explaining people that it is important to know one's status, both to take better care of oneself and to protect others.

Every person who comes for a malaria test, I propose: let's also perform a COVID-19 test. Some agree, but others not. You try to convince them, but if they refuse you cannot force them. But I do try to persuade them. I explained: you do not need to be ill but if you test you know if you are infected, so you can protect others. That way I could get some to test (CHW, Albina).

I told them ... why it is important to test. If the test is positive and you feel really bad, we can make contact with the doctor in the city, and if necessary the ambulance will wait for you at Afobaka. That was very effective (CHW, Saracreek).

She tells the story of a 27-yr old woman with asthma who was suffering from shortage of breath and had to be sent to Paramaribo. The ambulance was waiting for her at Afobaka.

6.4 Quarantine behaviour

5.4.1 Self-reported quarantine behaviour

Seventy-two percent of those who had experienced COVID-19 at least once reported that they had quarantined the most recent time they had experienced COVID-19 (72.1%, 62/86). A primary reason to not go into quarantine was that the person needed to work in order to eat and maintain him/herself (10 persons). A similarly important reason to not go into isolation was that it is not possible, or that there are no places in the gold mining areas to quarantine (10 persons). Other reasons were mentioned less frequently and included that the person was careful or made sure to stay at a distance from others. One Suriname woman conveyed that she simply stayed at home in the village with her children; a Brazilian shop owner reported that he was in Paramaribo and just stayed home; and a Brazilian woman did not go into isolation because she was not sure that she actually had COVID-19.

5.4.2 Community Health Worker experience with quarantine

The self-reported quarantine behaviour of inhabitants of ASM areas stands in sharp contrast to the comments of CHWs who service the population. Without exception, all CHWs reported that gold mining populations did not quarantine upon being tested positively, unless they are really ill. Their comments are telling:

In the forest no-one quarantines. Maybe if someone is really ill, they stay in their hammock. You will not get Brazilians in the mining camps and villages to quarantine (CHW, Curutela de Claudia/Sarakreek)

No [they do not quarantine], every person has his own way of thinking. They say they will all get it some time anyway, because it is just a flu (CHW, Grankreek)

During the pandemic, many people got ill at Ronaldo. But only two persons quarantined, and the remaining 54 [who tested positive] did not. There were at least five positives in the hospital, all had been infected by one person; they had stayed together at the Chinese hotel. They do not want to [quarantine] (CHW, Ronaldo).

Some of the CHWs tried to talk to patients to convince them to take protective measures. A few persons behaved more responsibly after talking with them, but most people simply ignored the measures.

Gold miners do whatever they want. When they have been tested positive they get a mouth mask and all information. But still, as soon as they step into the boat, they remove the mouth mask and just sit among all other people in the boat. When they arrive in the mines, they tell no-one that they have been tested positive. After a week you get a couple of persons from that area where the person was tested positive. They live how they want. (CHW, Ampoema).

It is very difficult to convince people to quarantine; they won't do it. If people were positive but asymptomatic, they would just go to work. And sit with others. I explained them that they should at least keep at a distance and wear a mouth mask, as to not infect others. That did not always help (CHW Sarakreek/Li-Pau-San).

You tell them, you need to quarantine for some days, we do not have medication.... They just do not listen, they go to the cabaret (CHW, Tjilipasi).

Only one CHW, at Yaw Pasi, on the border with French Guiana, reported that the four persons who she had tested had gone in quarantine. Two of them were from the gold miners' village where she stayed, and they provided space for one of the others. The fourth person was in a very bad state and had to be referred to a hospital in Maripasoula (FG)

6.5 Vaccination behaviour

5.5.1 Vaccination status

Three quarters of respondents (74.4%, 201/270) reported that they had received at least one dose of a COVID-19 vaccine, about the same share as during the baseline study (77.4, Figure 14). There was no significant difference between women and men in terms of their vaccination status. Nationality did play a role. The data suggest that foreign migrants were significantly more likely than Surinamese to be

vaccinated: 34.9% of Surinamese (15/43) versus 81.9% of migrants (186/227) had received at least one dose of a COVID-19 vaccine (χ^2 , $p < 0.001$).

Zooming in to the different nationalities we observe large differences in vaccination willingness, though the subgroups are too small to draw statistically valid conclusions. On the high end, all ten Chinese respondents had vaccinated, as well as 84.5% (164/194) of Brazilians and three quarters of Venezuelans (75%, 3/4). On the low end, only a third of Surinamese (34.9%) and less than half of Dominicans (45.5%, 5/11) had vaccinated.

Among those who had vaccinated, most individuals (65.2%, 131/201) had taken two vaccination doses. Smaller proportions of the population had taken just one vaccination dose (14.4%, 29/201), three doses (14.4%, 29/201) or 4 doses (6%, 12/201; Figure 15).

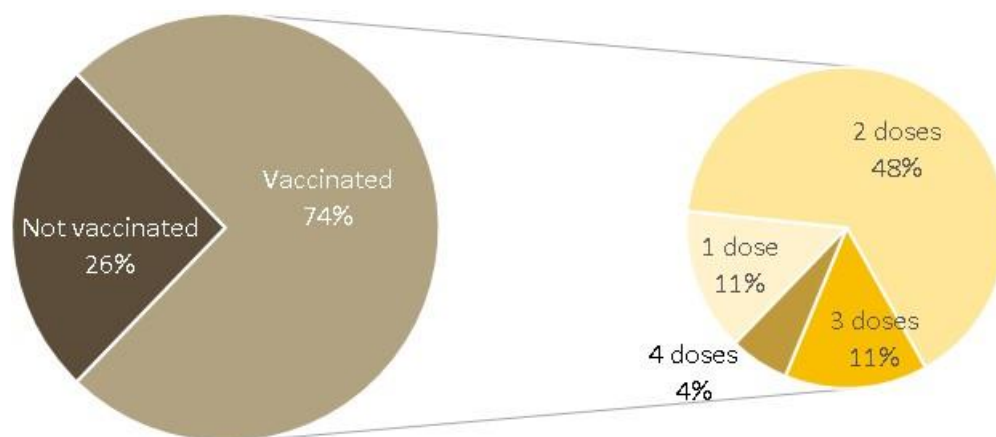


Figure 14. Number of respondents who vaccinated, with the number of vaccination doses, N=270

5.5.2 Preferred vaccination location

Respondents were asked where they would go if they would want to take a(nother) COVID-19 vaccination dose. One-fifth of them reported that they did not want to be vaccinated (anymore) (22%, 60/270). For those who did name a place or describe where they would go, many answered that they would either just ask around (22% 60/270) or travel to Paramaribo, and ask someone there (often a cab driver) to bring them to a location. Among actual places, best known were the hospital and the Bureau for Public Health (BOG). Sixteen persons reported that they would rely on the services of the MoH-Mp: the Tropclinic, the health missions that come to the mining areas, or a CHW (5.9%, 16/270). Table 9 lists the locations that were named as places to become vaccinated.

Table 9. Places where people would go to get vaccinated

Location / description	N	%
I do not want to be vaccinated again	60	22%
Would travel to Paramaribo and ask someone there to bring me	71	26%
Would ask around/inform where I can go	60	22%
Hospital	28	10%
Bureau for Public Health (BOG)	13	5%
On the mining areas when they come here	8	3%
Tropclinic	6	2%
Brazil	6	2%
Zorghotel	5	2%
General practitioner/public clinic	5	2%
Medical mission	2	1%
POC	2	1%
CHW in Vila Brazil	2	1%
Other (PCS, Sana Budaya, a school where she had been before)	3	1%

7 Conclusions

In March/April of 2022, the MoH-MP trained CHWs in the delivery of COVID-19 services to remote gold mining communities in the Suriname interior, which have poor access to regular health services. The CHWs were trained in providing COVID-19 information and conducting the nasal swab to detect positive cases. The participating CHWs experienced that in general, participants of gold mining areas were happy that this service came to their communities, especially since it was free and nearby.

The CHWs encountered several challenges in conducting their COVID-19 outreach work. A serious impediment is that typically, gold mining populations in Suriname are quite nonchalant when it comes to their health. They are prone to self-diagnose and self-medicate, and will only go test or seek medical help when they feel very ill. This lax attitude towards public health issues resulted in an observed lack of adherence to COVID-19 measures, including quarantining when positive, even at the height of the pandemic. Two CHWs had experienced that some individuals from the target population doubted their medical skills because the CHWs are from the community, like themselves, and not certified medical doctors. This perception was not expressed during interviews with the inhabitants of ASM areas.

This impact study assessed changes in knowledge, attitudes and practices with regard to COVID-19 in the target population as a result of the Project intervention. In this context, it is relevant to note that during the intervention time, the number of COVID-19 cases had declined steeply and all national restrictions had been lifted. Due to these changes, the target population was (even) less worried about COVID-19, which likely affected interest in COVID-19 services and test willingness.

The survey results suggest that the target population is well informed about COVID-19. Differences in COVID-19 related knowledge between the baseline situation (April 2022) and the post-intervention situation (October 2022) are minimal. As compared to six months ago, respondents now (October) were better able to name COVID-19 transmission ways, though the misperception that bats can transmit COVID-19 is persistent. Knowledge of symptoms and ways to protect oneself against COVID-19 infection remained almost the same. Consistent with the baseline study, the four best known measures to protect oneself were wearing a face mask, social distancing, regularly disinfect hands, and regularly washing hands with water and soap. Even though the most respondents were still aware that COVID-19 is a dangerous disease that can also affect healthy persons, the data suggest that an increased share of the target group is doubting the present severity of COVID-19.

Indeed, with the pandemic tailing off and illness events becoming, in many cases, relatively benign, COVID-19 is no longer perceived as a severe health problem. About forty percent of respondents believed that they were not at risk of getting COVID-19. They motivated this by saying that the pandemic was over, or that there was no COVID-19 in the mining areas. These ideas were likely strengthened by the fact that more than two thirds of the target population believed that they had never had COVID-19. In addition, widespread vaccination, especially among the migrant population, fuels the perception that COVID-19 is no longer something to be concerned about. The lack of concern about COVID-19 was reflected in the lack of adherence to protective measures. More than half of respondents reported that they were not doing anything anymore to limit their chances of becoming infected with COVID-19.

In October 2022 (post-intervention), two-thirds of respondents had been tested for COVID-19 at least once, much more than during the baseline survey. The majority of these tests had been executed because the person had felt symptoms or, in a third of cases, because of international travel. The perception that



the pandemic is (almost) over and that COVID-19 is now just like a regular flu, probably lessened the willingness to test. When explicitly asked if they would be willing to get tested for COVID-19 by a health worker, three-quarters of interviewees responded affirmatively. In practice, however, CHWs experienced that when they offered testing services, inhabitants of the gold mining areas were not very eager to comply, even when displaying symptoms. A main reason for not wanting to test was that the nasal swab was thought to be painful. In addition, in some cases CHWs were confronted with a general lack of interest. With a lot of explaining and patience, CHWs managed to subdue fears and convince many of those who initially refused to get tested.

While the health perceptions and attitudes of the target population are difficult to change, the MoH-MP can take measures to enhance effectiveness and reach of the COVID-19 and other health services provided by CHWs. A much-needed action is to increase visibility of the CHWs in the different ASM areas. Almost two-thirds of respondents reported that they did not know where to find a CHW in their work area, and over 70% of respondents reported that there was no possibility for COVID-19 testing in their area or did not know whether such a service was provided.

Improving access to the CHWs, for example through signs or banners, app groups, and visits in the area, can significantly enhance positive health outcomes. The survey data suggest that for 12% of surveyed inhabitants of ASM areas, the reason to test for COVID-19 was that MoH-MP staff (CHWs and others) had come to the area to test everyone. Moreover, almost one-third of respondents had performed their most recent test through one of the services provided by the MoH-MP: the Tropclinic, a CHW in the mining areas, or one of the COVID-19 field missions to the remote mining areas. It is likely that these persons would not have tested without the MoH-MP COVID-19 intervention.

We conclude that establishing COVID-19 test locations in mobile migrant communities in the Suriname interior was doubtlessly important. It significantly raised the number COVID-19 tests among persons who otherwise would not have tested, either because of their attitude or deterred by the high costs of travel to the nearest health centres. It also helped to keep the largest share of the target population aware of the continued presence of the pandemic and continued infection risk. These results deliver a convincing argument to continue and expand CHW services in the remote gold mining areas of Suriname.

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