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In a life full of risks, COVID-19 makes little difference. Responses to COVID-19 among mobile migrants in gold mining areas in Suriname and French Guiana

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ABSTRACT

Worldwide, the socioeconomic impacts of COVID-19 disproportionally affect vulnerable groups in society. This paper assesses responses to, and impacts of, the pandemic among mobile migrant populations who work in Artisanal and Small-scale Gold Mining (ASGM) in Suriname and French Guiana. These populations are characterized by poverty, informal or illegal status, and limited access to health care and information. Field research in Suriname (November 2020–January 2021) and French Guiana (January, May, June 2021) included qualitative interviews, informal conversations and observations, and a quantitative survey with 361 men and women in ASGM communities.

Contrary to reports from the ASGM sector elsewhere, interviewed inhabitants of ASGM areas in Suriname and French Guiana showed little concern about COVID-19. Respondents reported feeling safer in the forest where they work than in the urban areas or in their home country. Trust in home remedies and over-the-counter pharmaceuticals further reduced anxiety about the pandemic. Three-quarters of survey respondents reported that the COVID-19 pandemic had not affected their work or income at all.

The researchers conclude that in these remote Amazon communities, responses to COVID-19 mirror attitudes and behavior vis-à-vis malaria and other health risks: self-medicate, ignore, and pray. Living on the margins of society mitigates the socioeconomic impacts of COVID-19, as containment measures are not applied to these socially invisible populations. Whereas the urban poor are severely hit by the pandemic, this hidden population benefits from high gold prices, an outdoors lifestyle, and traditional resourcefulness in dealing with a life full of risks.

1. Introduction

As soon as the first wave of Coronavirus disease 2019 (COVID-19) spread across the globe, it became clear that the most vulnerable groups in society are not only disproportionately at risk of COVID-19 infection and morbidity (Whitehead et al., 2021), but also relatively more likely to suffer from the socioeconomic consequences of the pandemic (Nicola et al., 2020; Conceição et al., 2020)). Data from international development aid organizations suggest that COVID-19's socioeconomic impacts magnify pre-pandemic vulnerabilities and inequalities (OECD, 2021; Josephson et al., 2020). These dynamics play out on both global and local scales. Globally, income losses from containment measures place a relatively higher burden on lower- and middle-income countries than on high-income countries (OECD, 2021; Conceição et al., 2020). Within countries and regions, the poor, migrants, socially vulnerable households, and informal workers are the first to lose jobs, have the least reserves to draw on, and are not covered by social safety nets that could cushion the severest impacts (OECD, 2021; Martin et al., 2020; Nicola et al., 2020).

This paper assesses perceptions of COVID-19, protective strategies,

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and impacts of the pandemic on men and women working in the Artisanal and Small-scale Gold Mining (ASGM) sector in Suriname and French Guiana, South America. ASGM has been defined in many different ways (Seccatore et al., 2014), but typically refers to a form of gold mining that relies on elementary mining and processing practices relying on a workforce that does not have an academic mining education. Legal arrangements, working technologies, and forms of labor organization are highly diverse, ranging from individuals handling a gold pan to mechanized operations with hydraulic equipment, mills, and excavators (Libassi, 2020; Seccatore et al., 2014). In the study region, ASGM is almost exclusively performed as a mechanized and informal activity, with the workers operating largely out of sight of the national governments.

The ASGM population in Suriname and French Guiana consists largely of migrant gold miners from Brazil, known as *garimpeiros* (de Theije and Heemskerk, 2009). In French Guiana, more than 95 percent of those working in ASGM are undocumented *garimpeiros* (Le Tourneau, 2020). In Suriname, the ASGM population is more heterogeneous, including tribal people from the interior, a small number of urban residents of various ethnic backgrounds, and a handful of migrants from the Dominican Republic, Cuba, Guyana, Venezuela, and China (Heemskerk and Duijves, 2012). About two-thirds of this workforce, however, comes from Brazil. An unknown portion of migrant gold miners have legal residency in Suriname, but none have a formal permit to extract gold.

We refer to those involved in the ASGM sector in the interior of Suriname and French Guiana as mobile migrant populations (see also Hiwat et al., 2018). This term reflects their origin from different places outside of the mining communities, and the fact that they frequently move around, either following rumors of large gold discoveries or running from authorities. Despite heterogeneity in terms of nationality, ethnic background, gender and age, inhabitants of ASGM areas also have a lot in common: they tend to come from poor rural families, have a low level of formal education, and have limited access to resources, information and proper health care facilities (Douine et al., 2018a; Heemskerk and Duijves, 2016; Le Tourneau, 2020). The ASGM sector is an attractive and essential livelihood strategy for these marginalized groups because of its low entry requirements in terms of educational degree, specialized skills, and money.

Studies elsewhere have documented that apart from having poor access to adequate health services, ASGM communities have been economically affected by COVID-19 measures. Hilson et al. (2021) describe some of these impacts in a study on ASGM-dependent communities in Sub-Saharan Africa. In this region, livelihoods of ASGM miners have been harmed by a falling local gold price; closing borders; closed schools that force women miners to stay at home or take children to the mines; a rise in local commodity prices; reduced access to food markets; and travel restrictions. Academic research and journalistic investigations in many different African, Latin American and Asian countries similarly report significant income losses in ASGM communities as a result of the pandemic (Calvimontes et al., 2020; Hilson et al., 2021; Muthuri et al., 2021). Among others, COVID-related containment measures disrupted local supply chains and gold trade, which, in some regions, caused elevated prices for produce while at the same time lowering local prices for gold (Hilson et al., 2021; Hilson and McQuilken, 2014; Persaud et al., 2017). Threats to food security in ASGM communities have been documented in, among others, Kenya (Muthuri et al., 2021) and Liberia (Hilson et al., 2021).

Our study in Suriname and French Guiana, on the northern tip of South America, sketches a different picture. In these communities, ASGM has helped miners and their families to cushion economic shock and minimize the livelihood impacts of the COVID-19 pandemic, exactly *because* they are hard to reach and socially invisible. In this paper we describe the responses of migrant and mobile populations in Suriname and French Guiana ASGM communities to the pandemic, and the socioeconomic impacts that COVID-19 has had on this unique occupational group in the Amazon region.

Comparing our data with those from other mining regions in the Global South helps understand the diffuse experiences in ASGM communities and reveals the diverse ways in which poor rural communities are affected by, and respond to, COVID-19. This is important for two main reasons. In the first place, understanding health perceptions and beliefs among hidden and hard to reach populations is essential for the development of inclusive, evidence-based public health decision-making and related prevention messaging. Secondly, identification of the factors that help ASGM communities in Suriname and French Guiana sustain themselves during the global health and economic crisis can guide development interventions aimed at mitigating the economic impacts of COVID-19 in the global South.

2. Background

Suriname and French Guiana are part of the larger Amazon region. They are situated on the northern tip of the South American continent, north of Brazil. Suriname is an independent country since 1975, while neighboring French Guiana is an overseas territorial collectivity of France. Together, Suriname and French Guiana count less than a million inhabitants; about 600,000 in Suriname and some 300,000 in French Guiana. This population is concentrated along the coastline. The vast interior of Suriname and French Guiana is covered with dense, tropical rainforest, with Indigenous and tribal communities along the meandering rivers, and dispersed gold mining settlements known as *currutelas*. In French Guiana, there is also a handful of small urban centers in the forested interior.

Gold mining is one of the most important economic activities in the Amazon region (Cremers and deTheije, 2013; de Theije et al., 2014). An estimated 30,000–35,000 persons may be working directly in the ASGM sector in Suriname and French Guiana combined, with the largest share working in Suriname (Douine et al., 2020; Seccatore et al., 2014).

In addition to mine operators and workers, whose primary occupation is extracting gold, the gold mining population consists of people providing auxiliary services in ASGM areas. They may work in the supply chain (e.g. sellers of fuel, food), and as cooks, bar and restaurant owners, transport providers, sex workers, mechanics and in a wide variety of other roles. Between one-third and a quarter of the ASGM population in Suriname and French Guiana are women, who mostly work in the ASGM service economy.

National policies, including health policies, vis-à-vis ASGM communities differ dramatically in Suriname and French Guiana. The French law imposes strict environmental, health and economic regulations on the formal small-scale gold mining sector. In addition, the 2007 establishment of the *Parc National Amazonien*, which covers 41 percent of the territory of French Guiana, and the existence of several other types of protected areas, has limited the area in which mining is permitted. Today, apart from half a dozen medium to big mining operations, only a few dozen legal small-scale gold mining operations are active, while some 7000–10,000 garimpeiros clandestinely mine for gold in French Guiana. France carries out a strongly repressive regime against these migrant ASGM miners, who hide their operations in the dense tropical rainforest (Douine et al., 2018a; Le Tourneau, 2021). When caught, equipment and personal possessions are destroyed (Le Tourneau, 2020; de Theije and Luning, 2016). Because garimpeiros are not supposed to be present in French Guiana, the French government does not offer or facilitate the provision of health or other public services in illegal ASGM communities.

The Suriname government, by contrast, has adopted a laissez-faire attitude towards ASGM. Even though not legally allowed, gold miners can practically work where and how they want, as long as they do not create too much nuisance for large-scale mining firms, national mining rights title owners, and rural communities (Heemskerk et al., 2015). National government law enforcement and services are virtually absent from Suriname ASGM areas. Thus in both countries, for contrasting reasons, ASGM communities are socially invisible, meaning that they are

separated from, and systematically neglected by, the national government and majority of the public (Nunes, 2020).

The life of an Amazon gold miner is generally not a healthy life. It is characterized by long, arduous working hours in the burning sun; poor diets; unsafe drinking water; untreated sores; parasitic diseases and infections; exposure to chemicals; and, in some cases, excessive use of alcohol and drugs (Douine et al., 2018a; Le Tourneau, 2020). Work and transportation accidents are frequent and in the absence of personal protective gear such as helmets or safety boots, it is not uncommon to see gold miners with wounds, cuts and scars. For many years, malaria was the main health risk in both Suriname and French Guiana ASGM areas (Douine et al., 2018b; Hiwat et al., 2018). Today, Suriname has virtually eliminated malaria in large parts of the interior, but in French Guiana ASGM areas malaria continues to be a main cause of morbidity (Douine et al., 2018b; Heemskerk and Duijves, 2016; Nacher et al., 2013). The forested interior also is an area where other parasitic diseases thrive, including leishmaniasis and a variety of intestinal infections (Ramdas, 2012). Furthermore, specifically women experience unmet sexual and reproductive health needs (Heemskerk and Duijves, 2012).

Remoteness, coupled with a high-risk lifestyle and a lack of government health services in ASGM areas, creates health inequities between urban areas and traditional forest communities on the one hand, and ASGM communities on the other hand. In line with its repressive policy vis-à-vis ASGM, France does not extend health or other public services to ASGM communities – which, according to French authorities, should not be there in the first place (Le Tourneau, 2020). Yet, notwithstanding France's formal position, ASGM miners receive treatment in French Guiana hospitals and health centers the same way French citizens do. Countless *garimpeiros* have been treated in Cayenne or Saint Laurent hospitals for life-threatening malaria, snake bites, cardiac problems, broken bones and knife or firearms injuries. However, access to care remains a challenge as reaching a health post, seeing a doctor, and returning to the work site, can take days. This means lost income and a chance that one's job will be gone upon return. Moreover, travel to and from the ASGM areas is expensive. The roads and waterways are difficult to navigate, and transportation prices incorporate the risk of getting caught by French law enforcement, which will result in the destruction of possessions (Le Tourneau, 2020; de Theije and Luning, 2016).

In the Suriname interior, there are health clinics in Indigenous and tribal communities but garimpeiros usually do not visit those, mostly because of the language barrier and their preference for the more modern French health clinics (Heemskerk and Duijves, 2012). There are no fixed health posts in the ASGM areas. Nevertheless, the Suriname Ministry of Health Malaria Program provides malaria services in virtually all ASGM areas as part of its malaria elimination strategy. These services include malaria awareness campaigns, distribution of free insecticide-treated mosquito nets, and free malaria test and treatment services (Eer et al., 2018; Hiwat et al., 2018). The Malaria Program specifically targets mobile migrant gold mining populations, regardless of their legal status in the country. For other health issues, people working in the ASGM sector visit a health center in Paramaribo, in their respective home countries, or in French Guiana, depending on the health issue and preference. In a 2012 health access study in Suriname ASGM communities, one-third of respondents reported that they would travel to French Guiana in case of a minor illness and close to half would seek medical help in French Guiana if they were to fall seriously ill (Heemskerk and Duijves, 2012). Even though France strongly discourages the presence of migrant gold miners, those who manage to reach a clinic or hospital are treated by French health workers, and free of charge.

Even though gold miners can move around more freely in Suriname, travel to a health post can still be expensive and time consuming, creating a barrier to accessing public health services. Malaria research shows that distance to health services, and the related costs in time and money, is the single most important motivator for gold mining populations to not test for malaria when they feel symptoms, and subsequently use over-the-counter medication instead of prescription drugs (Heemskerk and Duijves, 2016).

3. Methodology

The study used a mixed method design, combining and triangulating data from a quantitative survey with qualitative information obtained from in-depth interviews, observations, and informal conversations.

Between November 2020 and January 2021, a Suriname research team conducted a quantitative survey with 361 inhabitants of ASGM areas, among whom about half were working in French Guiana (46.8%) and the other half (53.2%) in Suriname (Table 1). Because the ASGM population is unregistered, partly working clandestinely, and mobile, collecting a random sample was not possible. In order to ensure participation across important inequity dimensions, the researchers took a stratified purposive sample. Stratification criteria included gender (about one-third women), nationality (including different minority nationalities), and profession (about half gold miners, half service providers). Given prior research experience in the area and the combination of methods, the researchers are confident that this sampling method generated a good representation of perceptions and behavior in the target group.

For geopolitical reasons it was not possible for the Suriname survey team to physically conduct the quantitative survey in French ASGM areas. Therefore, surveys with respondents who were working in French Guiana were collected in Suriname mining service centers on the border with French Guiana. In these locations, those clandestinely working in French Guiana congregate to rest, buy supplies, visit family, see a doctor, and wait for a suitable moment to cross the river (Le Tourneau, 2020). Study locations in Suriname included: Papatam/Albina, Ronaldo/Antonio do Brinco (Fig. 1, region 4), and the area south of the Brokopondo lake (Alimoni I and II, Bode, Agua Branca, Baika creek; Fig. 2, region 3). In addition, one-quarter of all surveys (N = 83) was conducted in the "Little Belem" neighborhood in Paramaribo city, in and around the bars, shops, and hotels that are frequented by migrant gold miners when they are in town.

The survey covered demographics and the general health situation in ASGM areas, and included questions about knowledge, perceptions and behaviors vis-à-vis COVID-19. Surveys were conducted in the language that the interviewee felt most comfortable with. The survey team consisted of experienced interviewers who were all fluent in Portuguese and Sranantongo (Suriname national Creole language), plus one or more of the following additional languages: English, Chinese, Dutch, and Maroon languages. Prior to each survey, oral consent was obtained from the interviewee, after which the survey was conducted using a paper form to record the answers.

In addition to the survey, data were collected through informal conversations with people involved in ASGM, both in the ASGM areas

Table 1
Sample characteristics.

	Suriname	French Guiana	Total
Total N	192 (53.5%)	169 (46.8%)	361 (100%)
Gender			
Women	64 (33.3%)	41 (24.3%)	105 (29.1%)
Men	128 (66.7%)	128 (75.7%)	256 (70.9%)
Profession			
Gold miners	83 (43.2%)	82 (48.5%)	165 (45.7%)
Mining service providers	109 (56.8%)	87 (51.5%)	196 (54.3%)
Age group			
18–24	12 (6.3%)	18 (10.8%)	30 (8.4%)
25–45	92 (48.2%)	96 (57.5%)	188 (52.5%)
>45	87 (45.5%)	53 (31.7%)	140 (39.1%)
Nationality			
Brazilian	122 (63.5%)	154 (91.1%)	276 (76.5%)
Surinamese	37 (19.3%)	1 (0.6%)	38 (10.5%)
Other migrants	33 (17.2%)	14 (8.3%)	47 (13.0%)

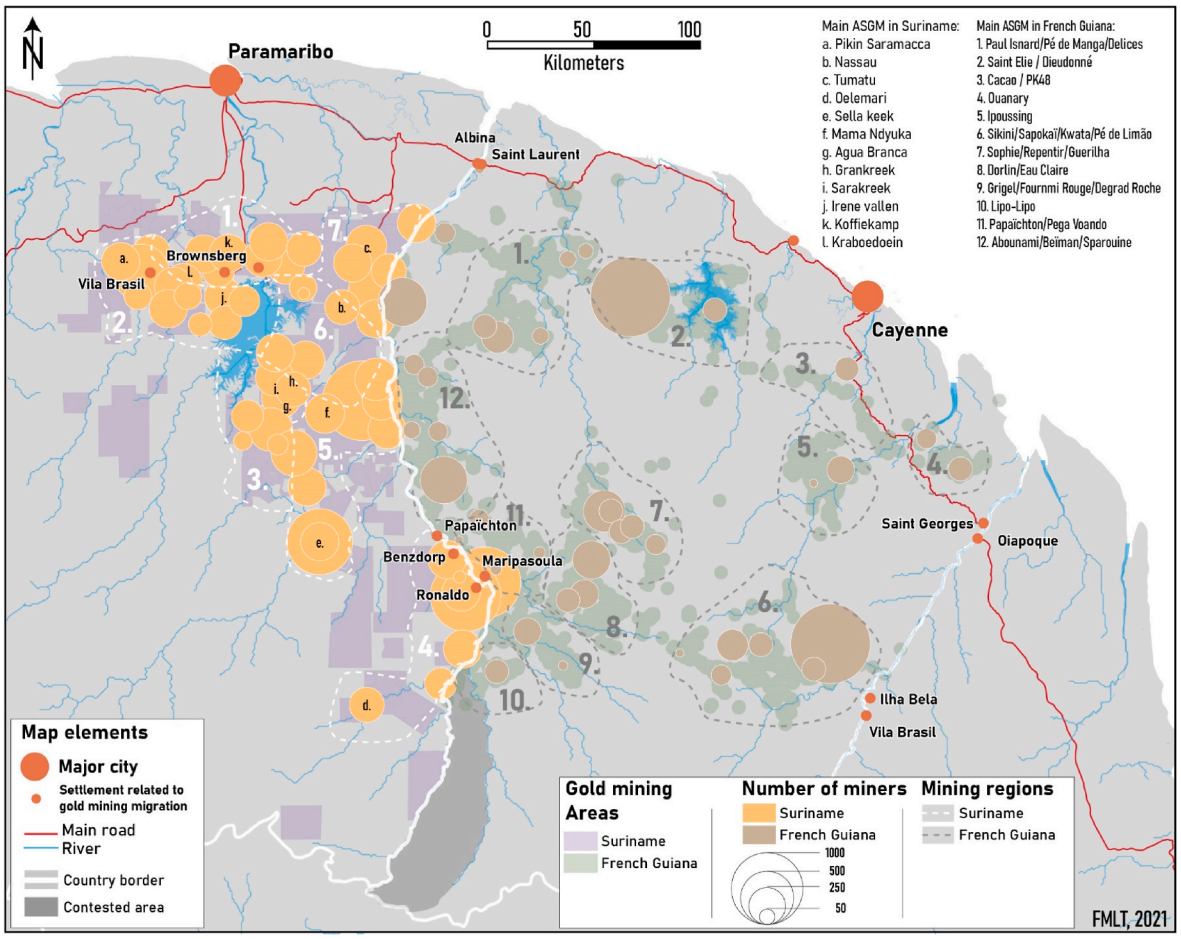

Fig. 1. Main artisanal and small-scale gold mining areas in Suriname and French Guiana with approximate population figures. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

and in the capital city of Paramaribo. These informal conversations and observations were crucial for obtaining a better understanding of COVID-19 related perceptions and behaviors. Qualitative data were also recorded in writing.

In French Guiana, one researcher visited ASGM settlements scattered in different and distant regions: Sophie, Repentir and Dagobert (upper Mana River) in Jan 2021, and the Inipi river, Pé de Limão, upper Inini, and Atouka in May and June 2021. During these visits, qualitative in-depth interviews were conducted with about 50 garimpeiros, in Portuguese. Also here, informal and non-structured conversations with garimpeiros were essential for deepening understanding of how this population views and deals with COVID-19. Data was recorded in writing.

The quantitative survey data were entered into a database and analyzed using statistical software (IBM SPSS, Version 22). Qualitative interview information was organized, explored and coded, looking for similarities or differences, and subsequently identifying recurring themes, opinions and beliefs.

4. Ethics approval

Ethics approval for fieldwork in Suriname was received from the Ministry of Health in Suriname (# AG3467; November 16, 2020). Approval for the work in French Guiana was obtained from the Center National de la Recherche Scientifique (CNRS). In both countries, team members followed national COVID-19 measures, including wearing face masks, using disinfectant hand gel, and distancing. Confidentiality of the study subjects was protected and individual data were not shared.

5. Survey results

Twenty-nine percent of survey respondents were women. In mining teams they were cooks (31.3%), spouses of miners (6.7%) and sometimes mine owners (2.9%). Women – in the ASGM service sector worked as sex workers (27.6%), *marreteiras* (traveling saleswomen; 18.1%), brothel owners (3.8%), shop owners (2.9%), and a variety of other professions. Men were mostly laborers in the mines (52.7%), but also transport providers (12.9%), equipment owners (7.4%) and active in more than twenty other professions. The average age was 42.2 for men (range 16–70) and 40.6 (Range 22 to 68) for women.

When asked about their main health concerns, COVID-19 (26.9% of respondents) was mentioned most frequently (N_{total} = 360), with women being twice as likely as men to name COVID-19 (43.3% vs 20.3%). Other health concerns included malaria (24.4%), leishmaniasis (23.3%), and accidents (20.3%). Gender affects health risk perceptions. Compared to women, men more often mentioned work accidents as a source of concern (5.8%, N_{women} = 104 vs 26.2%, N_{men} = 256). Men also were twice as likely as women to report that they were not concerned about any health issue (resp. 18.0% vs. 9.6%). On the other hand, one-third of women (32.7%, N_{total} = 104) expressed concern about sexual and reproductive health issues, versus 9.8% of men (N_{total} = 256).

When asked "*Do you know how someone can get infected with COVID-19?*" the grand majority of respondents (88.4%) were able to name one or more ways of contracting COVID-19. Generally, respondents were aware that COVID-19 is an infectious disease that is contracted from an infected person, either by having physical contact or by being close to the person without protection – though two persons named the

mosquito, and one person named the bat as transmission vectors. Other rare answers included that smoking or disbelief in God caused COVID-19 infection. COVID-19 symptoms were well known. Symptoms that were mentioned by at least one-third of respondents included fever (55.1%), headache (47.1%), shortage of breath (42.7%), flu-like symptoms (39.9%) and body aches (37.4%) (N_{total} = 361). Less frequently mentioned were sore throat, coughing, loss of taste and/or smell, tiredness, and a wide variety of other ailments.

Almost half of survey respondents reported doing nothing to protect themselves against COVID-19 (45%, N_{total} = 360). One-fifth of survey respondents conveyed that they wore a face mask in proximity of other persons, but they typically did not wear a face mask or have one with them during the interview (21.1%). Other reported protective measures were: wearing a face mask when leaving the camp (9.2%); regularly disinfecting hands (29.2%); staying at a safe distance from people in the camp (9.7%) or coming from outside (8.6%); and regularly washing hands with water and soap (2.8%). During fieldwork and health care missions in different ASGM areas in Suriname and French Guiana, however, social distancing and other protective measures were rarely observed, suggesting a lapse between health knowledge and practices.

Respondents referred to a variety of personal rules for when to wear a face mask and when not to. For example, they reported only wearing a face mask when talking with "outsiders" such as people coming from Paramaribo, or when traveling away from the gold mines. Some sex workers said they wore a mask during work, others required the client to wear a face mask, and yet others mentioned that they did not use face masks during work at all. One woman explained that she used a face mask with clients at night, but that the heat made it unbearable in daytime.

One-third of respondents used self-medication to protect themselves against COVID-19 and boost their immune system (34.6%, N_{total} = 361). Women were significantly more likely than men to use over-the-counter pharmaceuticals, vitamins, and herbal/home medicines to protect themselves against COVID-19 (44.8%, N_{total} = 105 vs. 30.5%, N_{total} = 256). Four men reported drinking alcohol (typically cachaça) to disinfect everything inside, sometimes in combination with medicinal tea.

With regard to pharmaceuticals, respondents referred to ivermectin, azitromicine, antibiotics (e.g. amoxiline) and regular pain killers and fever relievers such as paracetamol, aspirin and Dipyrone. Popular vitamins were vitamin C, B-complex, or multi-vitamins. Home remedies involved teas with a combination of the following ingredients: bitter tree bark or leaves (e.g. *Peumus boldus*), lime, lemon grass, garlic, onion and ginger. Less frequently mentioned ingredients for medicinal teas included honey, saffron, extract from the cotton plant (*Gossypium* sp), chicory (*Cichorium* sp), black pepper, and orange peel.

One-third of survey respondents believed that they were not at risk of contracting COVID-19 (33.3%, N_{total} = 361). This idea was fed by the perception that there is no COVID-19 in ASGM areas. Other reasons for feeling "safe" from COVID-19 were that the person did not move around a lot, did not go in crowds, and generally protected him- or herself. Thirteen persons erroneously believed that they could not get infected with COVID-19 because they had been infected before. As compared to foreign migrants, Surinamese inhabitants of ASGM areas relatively more often believed that they were not at risk for COVID-19.

Women were more likely than men to believe that they ran a risk to become infected with COVID-19 (77.1%, N_{total} = 105 vs 57.0%, N_{total} = 259) (Fig. 2). Main reasons for believing to be at risk for infection were exposure to people from outside, or simply that anyone can get it. A Brazilian woman (age 68) commented: "Well, I stay here, but other people go somewhere else and there they may become infected. And

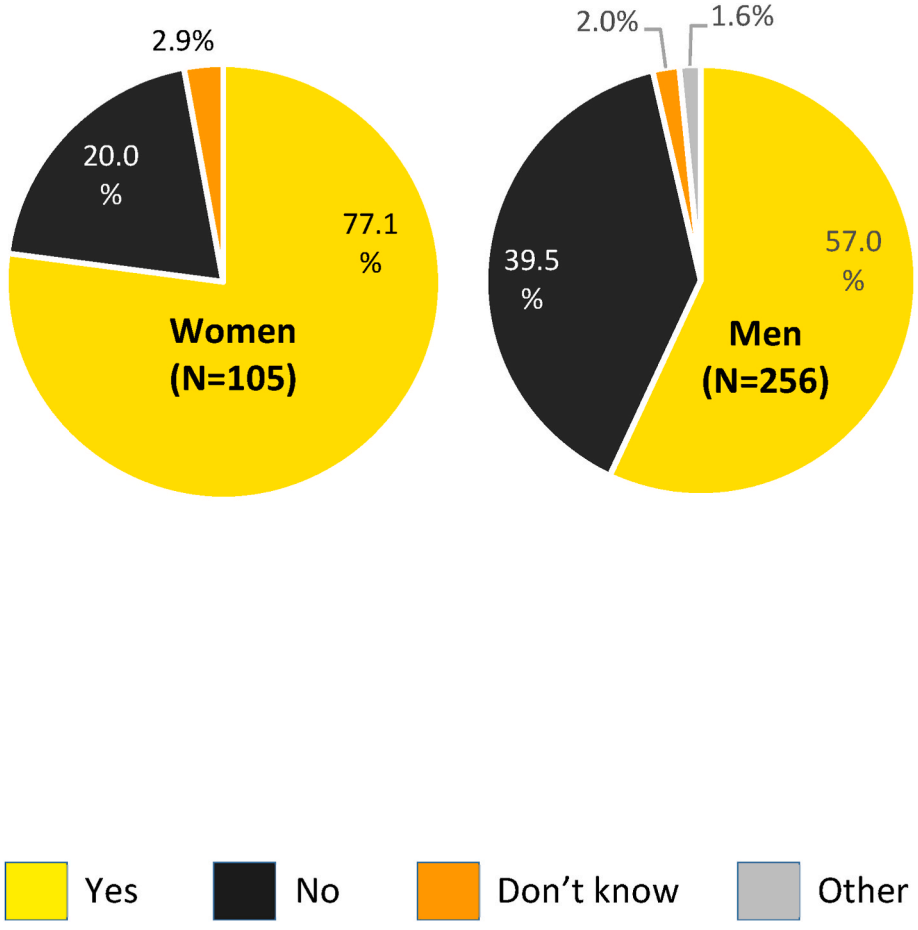

Fig. 2. Do you believe you are at risk of contracting COVID-19? (% of population).

next they bring it here."

The majority of respondents reported that the COVID-19 pandemic had *not* affected their work or income (71.3%, $N_{total} = 359$); two-thirds of women and one-quarter of men (66.4%, $N_{womenl} = 104$ vs 74.1%, $N_{men} = 255$). Reported impacts of the COVID-19 pandemic included temporarily work closure (10.3%); difficulties with travel within Suriname (8.1%) or across the border with French Guiana (5.3%); price increases (8.1). The latter trend was mostly due to the soaring Suriname inflation rates in 2020, which coincided with, but were not caused by, the pandemic.

The main way in which COVID-19 affected people's income earning opportunities was by hampering mobility and the circulation of people within ASGM areas, and to and from ASGM areas. The pandemic motivated people to stay for longer periods of time in the forest, where they felt safe from COVID-19 and avoided the risk of being stuck in Paramaribo during a lockdown. Transport providers were directly affected by the reduction in movement:

> *COVID caused a lot of income loss, because many persons [in the mining areas] do not travel to Paramaribo to buy supplies, and that is what we count on.* (Suriname boatman, male, age 22)

To bypass the closed borders, relatively more Brazilian gold miners took the risky route in small vessels across the sea to Suriname. We were informed about one incident where one such boat capsized and people drowned.

Reduced movement of gold miners also affected the financial position of other ASGM service providers:

> *There is less business. You have to be careful [with your money], decide what is or is not possible. You cannot stop working while there is still a room that needs to be paid and you need to take care of yourself.* (Brazilian sex worker, female, age 36)

Furthermore, less movement of people made it more difficult to find workers:

> *[…] you need an excavator operator or workers; you search but you do not find sufficient people. Many Brazilians left for Brazil, but still they have not returned* (Brazilian cook, female, age 44).

> *We* stopped for a while with work because we had to get people from the city to work.
>
> (Brazilian gold miner, male, age 51)

> I do not work with everyone, and when someone has left I have to either stop the operation or continue with fewer men. Because of COVID I do not just accept any person to join.
>
> (Brazilian equipment owner, male, age 50)

As borders closed and distribution networks limited operations, it also became more difficult to import goods that were needed to keep the business running:

> *Everything goes slowly. There are fewer flights. Some of the things you need to arrange you cannot get done, like buying parts for machinery.* (Suriname gold miner, male, age 48)

Such experiences, while difficult for those involved, were minority voices. The majority of inhabitants of ASGM areas ran their businesses as usual.

6. Discussion

Neither Suriname nor French Guiana keeps records of COVID-19 infections among mobile and migrant populations in ASGM areas, so there are no scientific data on the health toll that the pandemic has taken on this group. Informal conversations and accounts from mobile health workers suggest that those with COVID-19 symptoms typically do not get tested, even when services are readily available. In Suriname ASGM communities, Portuguese speaking health workers provided COVID-19 information, protective products, and tests through a collaboration between the Ministry of Health, the private sector, and the Pan American Health Organization (PAHO). Between May and September 2021, the program executed 17 COVID-19 missions. Gold miners and mining service providers were eager to learn more about COVID-19, but only 218 individuals were tested in ASGM communities totaling more than 5000 persons. Of these, 79 persons (36.2%) tested positive for COVID-19. Before the health mission, these COVID-positive persons had no intention to travel to a health post to take a COVID-19 test. Also during one field trip in French Guiana, free COVID-19 tests were offered. However, gold miners were unwilling to take them, feeling that the tests were painful and useless, as they did not feel themselves to be at risk or were not experiencing COVID-like symptoms. Health workers also observed that people with COVID-19 symptoms did not always isolate themselves from others. Instead, when feeling flu-like symptoms, there was a strong tendency to self-medicate and just continue work as usual.

Regardless of the true risk of COVID-19-related morbidity and mortality in the remote ASGM areas, many gold miners in Suriname and French Guiana are convinced that the pandemic is primarily happening outside of their work areas. Similar perceptions have been recorded in Brazilian ASGM areas (Calvimontes et al., 2020). Often-heard comments are that "people in the mining areas do not have it" or that "COVID is weaker in the forest, because the air here is healthier". Vice versa, those who believe that there is COVID-19 in the mining areas blame "people from everywhere" who arrive in the ASGM areas. These statements may have some validity, in that living arrangements in the ASGM areas are spacious, and people work largely outdoors or in structures with plenty of ventilation.

When falling gravely ill as a result of COVID-19 related symptoms, migrant mobile populations can find medical help in the urban areas. In Suriname, hospitalization must be paid out of pocket for those without health insurance, motivating many to seek medical care French Guiana. In French Guiana, migrant miners can receive treatment or hospitalization when they show up at a government health post, with no questions asked. Thus, in case of serious trouble, the French health system acts as an ultimate safety net. In both countries, the various vaccination locations welcome migrants, with or without documentation.

Self-medication is traditionally popular in this migrant mobile population, which has a strong trust in both home remedies and over-the-counter medicine to deal with health problems (Le Tourneau, 2020; do Nascimento et al., 2019). The tendency of gold mining populations in the study region to preventatively or curatively self-medicate has been documented for malaria (Douine et al., 2018b; Heemskerk and Duijves, 2016), sexual health problems (Heemskerk and Duijves, 2019), and leishmaniasis (Ramdas, 2012). Also in response to COVID-19, inhabitants of ASGM areas consume a variety of pharmaceuticals, both preventatively, for example one pill each week, or curatively when one suspects being infected. Even though there is no conclusive evidence about the efficacy of ivermectin and azitromicine in preventing or treating COVID-19 (Castañeda-Sabogal, 2021; Hinks et al., 2021), particularly Brazilian migrants were taking these medicines, encouraged by Brazilian social media. These veterinary remedies are popular in part because they are believed to be stronger than regular medicine. When people feel symptoms of (unconfirmed) COVID-19 and get better after self-treatment, this is interpreted as proof of the curative powers of ginger/lemon tea, bitter tree extracts, or pharmaceuticals.

In part, the propensity to self-medicate rather than to see a doctor is motivated by poor access to health services, which in turn is a function of the distance to health services and the costs in time and money to get there (Douine et al., 2018a; Heemskerk and Duijves, 2012; Ramdas, 2012). For another part, the aversion to visiting public health services is characteristic of the rather nonchalant attitude towards health risks. In response to the multitude of illnesses and risks in their work and natural

environment, gold mining populations use minimal personal protective equipment, take medication haphazardly, and rely on home remedies and treatment; only seeking professional medical assistance in the most severe cases (Douine, 2018a; Le Tourneau, 2020; Nascimento et al., 2019). Pijpers and Luning (2021) report a similar response to the COVID-19 pandemic among gold miners in Ghana. Confronted with "(deadly) accidents, equipment breakdown, political interventions, competition between rival mining operations and violent clashes between competing groups of miners", COVID-19 is merely perceived as "another interruption to lives and operations that are marked by constant interruptions of various kinds" (Pijpers and Luning, 2021: 14).

The response to COVID-19 shows parallels with how this migrant mobile population deals with malaria. Malaria studies in this region corroborate that gold mining populations are willing to visit official malaria test and treatment locations *if they are nearby*. However, if the nearest health post requires substantial travel, implying lost working days, high expenses and possible encounter with law enforcement (in French Guiana), people prefer self-diagnosis and treatment (Heemskerk and Duijves, 2016; Hiwat et al., 2018). Particularly in French Guiana, inhabitants of ASGM communities rely heavily on OTC medication to deal with (suspected) malaria (Douine et al., 2018b; Nacher et al., 2013). Shop owners, pharmacists and traveling vendors in the ASGM areas cater to this market by selling different malaria medicines, often of inferior quality, poorly stored, and with questionable 'medical' advice (Nacher et al., 2013). In Suriname ASGM areas, a network of community health workers ensures that there is always someone who can test for and treat malaria nearby (Eer et al., 2018; Hiwat et al., 2018). This strategy has significantly elevated the chances that those with suspected malaria take the test, receive and use government regulated medication, and complete their treatment (Heemskerk and Duijves, 2016).

As compared to men, women in ASGM areas had more health concerns in general, and were more likely to feel at risk of COVID-19 infection in particular. Gender differences in health consciousness were reported in previous malaria studies in the study population, with women being more likely to possess and use a bed net against malaria, take a malaria test when they feel symptoms, and complete their malaria cure (Heemskerk and Duijves, 2016). Gender dissimilarities in health perceptions and consciousness are not unique to gold mining populations or the study region, yet are important to keep in mind in the design of behavior change communication strategies.

As elsewhere in the Global South, the COVID-19 pandemic economically affected the ASGM sector in Suriname and French Guiana. Delays and standstills were more frequent and lasted longer when lockdowns obstructed the purchase of machinery parts, food and fuel. Restricted mobility complicated finding new workers and moving to a new work location when the old location was mined out. Also international supply chains were disrupted as Suriname formally closed its borders, and national authorities intensified control of the borders between Suriname, French Guiana and Brazil. Those who used to travel to Brazil frequently, for example to buy supplies for resale in ASGM areas, travelled less because of either the lockdowns or fear for the COVID-19 situation in Brazil.

For the majority of inhabitants of ASGM areas in Suriname and French Guiana, these measures were a nuisance but the economic impacts were relatively limited. Almost three-quarters of respondents reported that COVID-19 had not affected their work and income at all. One factor that helped the ASGM sector was the rise in the international price of gold, which was an indirect result of the pandemic. Gold has traditionally been used as a hedge against uncertainty in economic and financial markets, pushing gold prices upwards as worldwide COVID-19 cases increased (Yousef and Shehadeh, 2020). In 2020 the price of gold rose with 24.4 percent. On August 4, 2020, the London Bullion Market Association (LBMA) price of gold hit USD 2067 per troy ounce, or about 66 USD per gram of gold (World Gold Council, 2021). Since then, the price of gold has dropped somewhat, but has stayed steady above 54 USD/gram throughout 2021. In comparison, the average annual price of gold in the year 2000 was only 9 USD/gram nominal value, or 14 USD/gram Purchasing Power Parity (PPP); in 2010 the price had risen to 39 USD/gram (49 USD/gram PPP), and 45 USD/gram (48 USD/gram PPP) in 2019 (Fig. 3).

High gold prices not only benefitted the gold miners themselves, but also those providing auxiliary services because prices in ASGM areas in this region are paid in gold (de Theije and Luning, 2016). The mine owner pays his or her workers a percentage share of the earnings in gold, and pays the mechanic, the excavator operator, the cook, and all other work force either a percentage share or a fixed fee in gold. Expendable incomes, in turn, are used to purchase necessities, transportation, and entertainment, also in gold. Depending on the remoteness of the area, a boat ride could cost a couple of grams of gold, a soft drink may be purchased for a decigram of gold, and a short stay with a sex worker varies between one and 3 g of gold. In the ASGM areas, the value of gold does not affect the prices of products and services (in gold), as these prices do not rapidly respond to international gold price fluctuations. However, inhabitants of gold mining areas typically sell part of their gold for cash money, thus earning more as gold prices rise.

Comparative analysis suggests that differences in the economic impacts of COVID-19 on the ASGM sector are partly explained by differences in market access. Recent research articles report a dramatic widening of the gap between local and global commodity prices in gold and gemstone mining areas in different African, Asian, and Latin American countries (Hilson et al., 2020; Muthuri et al., 2021). As a result, miners received less money despite soaring international gold prices.

In Suriname and French Guiana, inhabitants of ASGM areas are less dependent on powerful middlemen. Part of the gold may be sold in the ASGM areas, to informal buyers or money transfer services, which work with a network of partners to deposit money in a bank account in Brazil or Suriname (de Theije and Luning, 2016). This happens relatively more often in French Guiana, where in addition to distance, the risk of running into law enforcement or criminals plays a role in motivating people to sell locally. Mostly, however, inhabitants of gold mining communities typically sell their gold to buying houses in Suriname's capital Paramaribo or in Brazil. Here they receive prices that are directly linked to international stock market prices. Not one person reported that the COVID-19 pandemic complicated or changed these transactions.

In Suriname, public COVID-19 containment measures heavily affected low income groups (Arteaga et al., 2021). Repetitive total lockdowns, curfews, closure of public transportation, a prohibition on contact professions (e.g. hair dressers), closure of the hospitality business, closure of daycare centers, and other COVID-19 measures severely hit informal workers, independent entrepreneurs, and vulnerable households (Arteaga et al., 2021). Informal communications and newspaper reporting suggest that these effects were disproportionally felt in the urban areas.

One reason for the relatively limited impact of COVID-19 measures in the rural interior is simply that in these remote places, they were (and are) not enforced. In some countries, government efforts to combat the spread of COVID-19 prevented miners and buyers from reaching mines (Muthuri et al., 2021). Undocumented gold miners working clandestinely in French Guiana ASGM areas, however, were hardly affected by lockdowns. Since dodging the police is their "business as usual", they did not feel the weight of measures aimed at restricting mobility taken in the territory. And as mining areas are not supposed to exist, authorities never tried to enforce lockdowns in them. In Suriname, government authorities have focused enforcement on urban zones rather than in the forest communities, leaving local inhabitants convinced that "the COVID rules do not apply here". Hence, while urban residents had to stay home, mining teams in the isolated forest areas worked on weekends and after curfew hours. As brothels in the urban areas closed for months in a row, the *cabarets* in mining areas continued to serve customers. When busses in Paramaribo were no longer allowed to transport passengers, informal quad-drivers, excavator operators and boatmen

Fig. 3. Development of international gold prices, 2016–2021. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)

continued to transport passengers to, from, and within ASGM communities.

As the urban lower- and middle-income classes saw their incomes dwindle, the ASGM sector was thriving on high prices of gold and relatively low prices of fuel (which is the main driver of production costs) in 2020. We contend that, in the interior regions of Suriname and French Guiana, gold mining populations continued to work not despite, but largely because of the informal nature of their work. Problems with food security as a result of COVID-19 measures, which have been reported in ASGM communities of different African countries (Hilson et al., 2021; Muthuri et al., 2021), were not mentioned even once by gold miners working in Suriname and French Guiana. Only one cook in French Guiana mentioned that, due to the travel restrictions, her camp adapted its diet to eating more bush meat and fish, to complement the rice, beans and salted meat that have to be smuggled in from outside.

The relative resilience of the ASGM sector in Suriname and French Guiana to COVID-19 containment measures can also, in part, be attributed to the resourcefulness of its participants, who are used to solving most of their daily life challenges without support from national governments (Heemskerk and Duijves, 2013; Le Tourneau, 2020). In much of the larger Amazon region, mobile and migrant ASGM populations arrange everyday needs such as access to drinking water, electricity, security, 'public' transportation, and work supplies, independently from national governments. When airline travel between Brazil and Suriname was suspended, relatively more Brazilians wishing to travel to Suriname resorted to informal boat travel across the Atlantic Ocean. The risk of being intercepted by the more frequent border patrols increased, but *garimpeiros* know that borders are porous and, if they were to be caught, Suriname border authorities can potentially be paid off. Indeed, border controls never deterred small-scale gold miners from traveling between these countries (Le Tourneau, 2020). Also in other countries, researchers have signaled the resourcefulness of ASGM populations as an asset that has helped maintain their businesses despite the lockdowns, border closures, and other governmental COVID-19 measures (Calvimontes et al., 2020; Hilson et al., 2021).

Not despite, but because of its existence on the margins of formal society, ASGM provided a large degree of resilience against the income shocks experienced in other sectors. A similar experience was reported for Ghana, where informality enabled miners to purchase ASGM inputs such as mercury from across the borders, while formal businesses were heavily affected by the official measures (Muthuri et al., 2021). Also in remote ASGM areas in Liberia (Hilson et al., 2021) and Mali (Muthuri et al., 2021), small-scale mining activities were able to persist under minimal state enforcement of COVID-19 measures.

In this context of disease-driven recession, Maconachie and Hilson's (2018) analysis on the impacts of ebola on rural livelihoods in Sierra Leone provides an interesting parallel. In 2014–16, the Sierra Leone government enforced lengthy periods of quarantine and blocked regional trade routes to prevent the spreading of ebola. These measures brought artisanal diamond mining to a virtual standstill. Rural populations subsequently turned to gold mining, which, in contrast to diamond mining, could be carried out in isolation, enabling the miners to avoid government authorities who were enforcing quarantining exercises. Gold mining provided relatively fast cash, "… helping many individuals cope with a shortage of financial capital assets, in the process building diggers' resilience during a period of chaos." (Maconachie and Hilson, 2018). This potential of ASGM as a rural livelihood diversification strategy and source of resilience against economic shock has been recognized by both academic researchers (Hilson and McQuilken, 2014) and development organizations (World Bank, 2013), and recently inspired the World Bank to develop an emergency response program for artisanal and small-scale mining communities impacted by COVID-19 (World Bank, 2022).

7. Conclusion

Inhabitants of remote ASGM communities in Suriname and French Guiana are exposed to large number of risks, especially concerning health. In this life full of risks and as of now, COVID-19 seems to make little difference for them. Most people interviewed in our study displayed little concern about COVID-19, perceiving it as just one other issue to deal with and of no more concern than malaria, snakes, or police force activity. Strong confidence in, and traditional reliance on, home remedies and OTC medication may have reinforced the relatively relaxed attitude towards COVID-19. This attitude was visible, among others, in the minimal use of basic measures such as wearing face masks and social distancing. The response towards COVID-19 seems not much different from the general attitude towards other health threats in these north-Amazon communities: work hard, self-medicate, and pray.

Understanding the health perceptions and beliefs of socially invisible groups like mobile migrant miners in the Amazon region is important in the context of formulating public health responses to the pandemic. Public health strategies aimed at elevating test willingness, for example, can benefit from targeted behavior change communication that takes into account common misperceptions, language and culture, local living and working conditions, and uses of home remedies.

Our data reveal that subgroups of the ASGM community experienced health insecurities and income loss as a consequence of the pandemic, with relatively more women reporting socioeconomic impacts as compared to men. Women tend to work in the mining service economy, which relies on moving around in and between urban centers and gold mining areas, activities that have become more difficult. Moreover, travel requires sitting together in a boat, plane or car, which increases infection risk. Sex workers are particularly vulnerable, as they need to move around every couple of weeks, and social distancing is impossible in their profession.

Yet while the pandemic caused national lockdowns, a curfew, closed borders and temporary closure of urban businesses, the largest share of ASGM population managed to live their working lives as usual. They are used to insecurities, as ASGM activities always provide volatile, intermittent and uncertain incomes. In Suriname and French Guiana, ASGM incomes have proven remarkably resilient in the face of worldwide economic recession. Where income earning options for the urban poor were severely restricted by COVID-19 containment measures, many women and men in ASGM communities saw their incomes rise. The sector was aided, no doubt, by soaring international gold prices, but also by continued market access, resourcefulness of the workers, the informal nature of the sector, and the relative absence of government enforcement of COVID-19 regulations – all of which are intrinsically linked in these remote forest regions.

Credit statement

Marieke Heemskerk: Design, Methodology, Data collection in Suriname, Formal analysis, Writing – original draft preparation. François-Michel Le Tourneau: Data collection in French Guiana, Visualization, Writing – review & editing, Reviewing. Helene Hiwat: Reviewing. Hedley Cairo: Data collection. Pierre Pratley: Conceptualization, Methodology, Writing- Review and Editing, Funding acquisition.

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