Rapid Health Situation Assessment Report

Nigeria

Piloting a New WHO Framework to Support the Development of Public Health Strategies on Artisanal and Small-scale Gold Mining in the Context of the Minamata Convention on Mercury

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Abbreviations

ASGM	Artisanal and Small-Scale Gold Mining
CHEW	Community Health Extension Worker
ERC	Ethics Review Committee
FGD	Focus Group Discussion
FMENv	Federal Ministry of Environment
FMoH	Federal Ministry of Health
GEF	Global Environment Facility
HFA	Health Facility Assessment
HIV	Human Immunodeficiency Virus
HSB	Health Seeking Behaviour
IAH	Initiative for Advancement of Humanity
KI	Key Informant
KII	Key Informant Interview
LGA	Local Government Area
MARPS	Most At Risk Populations
MSF	Médecins Sans Frontières
MMSD	Ministry of Mines and Steel Development
NADEL	Center for Development and Cooperation
NAP	National Action Plan
NCD	Non-Communicable Disease
NGO	Non-Governmental Organization
NSG	National Steering Group
PPE	Personal Protective Equipment
RDT	Rapid Diagnostic Test
SARA	Service Availability and Readiness Assessment
STD	Sexually Transmitted Disease
SMP	Social Mobilization Plan
Swiss TPH	Swiss Tropical and Public Health Institute
TB	Tuberculosis
UN	United Nations
UNIDO	United Nations Industrial Organization
WHO	World Health Organization

1 Background

In this section:

Background

Artisanal and small-scale gold mining and health

Artisanal and small-scale gold mining (ASGM) is, broadly speaking, the exploitation of smaller gold deposits by individuals, small groups or small cooperatives *(1)*. ASGM often is labour-intensive work using no or limited mechanization and may have low recovery rates. The sector is often characterized by low levels of capital, productivity, occupational safety, and limited access to land and trading markets. ASGM is practiced in over 70 countries worldwide. An estimated 10-15 million people are involved in ASGM, including 4-5 million women and 1 million children, whereas a further 80-100 million people's livelihoods are affected by ASGM *(2, 3)*. ASGM is an important activity in many developing countries as it provides a primary and additional source of income, particularly in rural regions where economic alternatives to agriculture are limited. The ASGM sector is estimated to contribute about 25% of the global gold production *(2)*.

ASGM-related health hazards can be categorized into chemical (e.g. mercury, cyanide, arsenic, lead), biological (e.g. water- and waste-related diseases, sexually transmitted infections), biomechanical (e.g. traumas, overexertion), physical (e.g. noise, low oxygen levels) and psychosocial (e.g. drug abuse, stress, fatigue) hazards *(4)*.

Many countries are taking active steps to reduce and where possible eliminate the use of mercury in the ASGM process. However, due to its low cost, easy use and widespread availability, mercury amalgamation remains the preferred method employed in ASGM to extract gold. Consequently, mercury is used in ASGM in more than 70 countries and represents the largest global demand sector for mercury, with approximately 1600 tons per year used. ASGM is also estimated to be the largest source of anthropogenic mercury emissions to the environment *(5, 6)*.

The Minamata Convention

The Minamata Convention on Mercury, adopted in 2013, is an international environmental treaty designed to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds *(7)*. The Convention was named after the Japanese city Minamata, which suffered a devastating incident of mercury poisoning. In paragraph 3 (a) of article 7, the Minamata Convention on Mercury obligates each Party that has more than insignificant ASGM in its territory to develop and implement a national action plan (NAP) in accordance with annex C to the Convention *(7)*. Item (h) of annex C indicates that such NAPs must include a public health strategy on the exposure of artisanal and small-scale miners and their communities.

Such public health strategies must include inter alia, the gathering of health data, training for health care workers, and awareness raising through health facilities. The World Health Organization (WHO) is developing guidance for health ministries to support the development of public health strategies on ASGM. However, the WHO guidance may also aid in the development of other NAP content required under annex C, especially item (i) which requires strategies to prevent the exposure of vulnerable populations, particularly children and women of child-bearing age, especially pregnant women, to mercury used in ASGM; and item (j) which requires strategies for providing information to artisanal and small-scale miners and affected communities.

This WHO initiative has been established in response to World Health Assembly Resolution 67.11, which recognizes the role of health ministries in supporting the implementation of the Convention and calls upon WHO to provide technical support in this regard. WHO has thus developed a framework comprising a suite of tools to support the development of public health strategies on ASGM. WHO set out to pilot the use of the framework and related tools in three African countries that (i) have extensive ASGM activities and (ii) are in the process of developing a NAP, namely Ghana, Mozambique and Nigeria.

Study rationale

The present study aimed at piloting the WHO guidance (in particular the study protocol and associated tools) for an assessment of public health challenges in an ASGM context. The specific objective of the health situation assessment was to generate initial evidence and information regarding priority health concerns of ASGM miners and their communities, and to provide an initial understanding about available health systems capacities to respond to those health concerns. This information informs the selection of priorities and interventions to be reflected in the public health strategy of the NAP.

The health situation assessment was intended as a preliminary study, and was not expected to provide an in-depth epidemiological overview of the health impacts of ASGM. The methods, and tools developed to support it, were thus geared towards obtaining a preliminary and if possible representative picture of the health challenges of ASGM miners and their communities and the health facilities' capacities to address and respond to their particular health needs.

Lessons learned and insights from the pilot experiences in Nigeria and two other countries (Ghana and Mozambique) will be used to enhance the protocol, as well as present a set of tailored recommendations for each country which then can be used to inform the development of their public health strategies as part of the NAP. The objective of the health situation assessment is to identify ASGM miners' health seeking behaviour, miner and family members' perceptions of risks associated with ASGM, as well as to assess the relative readiness and capacity of local health systems to respond to ASGM-related health issues.

Here, we present the findings of the health situation assessment performed in two ASGM sites in Nigeria.

Political linkages and political involvement in Nigeria

Nigeria signed the Minamata Convention in 2013 *(8)*. The country has also formally notified the Minamata Convention Secretariat that there is more than insignificant ASGM in its territory. Nigeria is therefore obligated to develop a NAP which includes a public health strategy on the exposure to mercury of ASGM miners and their communities.

Under the Convention, such NAPs must be formally endorsed by the respective government and submitted to the Convention Secretariat no later than three years after entry into force of the Convention or three years after the notification to the Secretariat, whichever is later. The Minamata Convention on Mercury was entered into force on 16 August 2017.

NAP activities are formally underway in Nigeria. This process is being supported by the United Nations Industrial Organization (UNIDO) with funding from the Global Environment Facility (GEF). At the request of UNIDO, WHO has agreed

to co-execute (with the respective health ministries) the health components of the NAP activities being implemented in each country.

UNIDO and the Nigerian Government have designated the Federal Ministry of Environment (FMEnv) to be the main national coordinating and executing agency of this project. FMENv is the administrative authority on environmental protection and the designated national authority on Minamata Convention on mercury.

The Ministry of Mines and Steel Development (MMSD), the institution responsible for the activities related to ASGM in Nigeria, was responsible for the activities related to the development of the national ASGM assessment and baseline.

WHO, working in close coordination and collaboration with the Federal Ministry of Health (FMoH), is the executing agency for the health components of the project.

UNIDO is the GEF IA for the project. The UNIDO project manager will provide technical advice, as well as coordinate and monitor the project activities. All work plans, responsibilities, timelines, and budgets should be reviewed and approved by the UNIDO project manager to ensure fast, safe, and accurate execution of the project.

2 Aim and objectives

The health situation assessment is conducted/ piloted in the three countries with the overall aim of informing the development, by relevant government agencies (i.e. health and other), of the public health component of the NAP

Aim and objectives

ASGM sites and communities are diverse and often characterized as relatively remote with poor access to safe drinking water, adequate sanitation and health care *(4)*. While areas hosting ASGM are generally covered by the peripheral health system, accessibility, acceptability and affordability of health care in artisanal and small-scale gold miners, their families and the broader communities is very context specific.

The health situation assessment is conducted/piloted in the three countries with the overall aim of informing the development, by relevant government agencies (i.e. health and other), of the public health component of the NAP. In this context, the present assessment sought to describe the scope of ASGM-related public health problems, characterize ASGM miners' health seeking behaviours, miners' and family members' perceptions of health risks associated with ASGM, and to assess the capacity of the local health systems to cope with the challenges imposed by ASGM.

The specific lines of inquiry (and supporting hypotheses) of the health situation assessment were:

1. To describe the health issues as reported by artisanal and small-scale gold miners and by health care providers living and working in ASGM areas.
   Hypothesis 1: There are differences between priority health concerns reported by artisanal and small-scale gold miners and the local (general) population as reported by health care providers and as reflected in local health statistics (where possible).

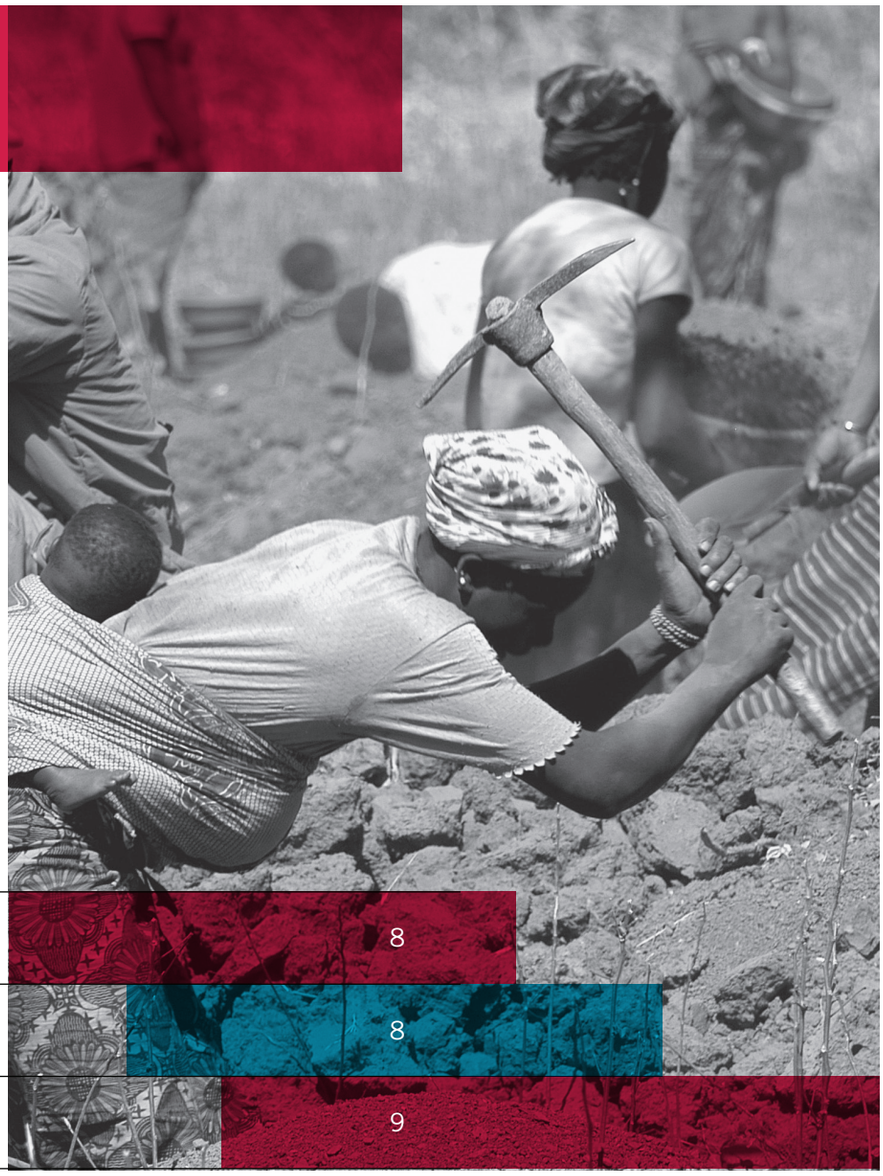
2. To describe health risk perceptions in artisanal and small-scale gold miners.
   Hypothesis 2: Artisanal and small-scale gold miners' understanding and perceptions of the dangers of ASGM activities do not compel them to adopt safer or more environmentally friendly practices and/or pursue another activity.

3. To describe the access to health care, health care-seeking behaviour patterns and challenges related with it.
   Hypothesis 3: Artisanal and small-scale gold miners, their families and the broader communities face challenges in accessing health care.

4. To describe the capacity and readiness of the health system and qualification of health care providers to address health problems specific to artisanal and small-scale gold miners, their families and the broader communities.
   Hypothesis 4: The health care system, in particular at the local level (i.e. near to ASGM communities) is insufficiently capacitated to address health problems specific to artisanal and small-scale gold miners. Regional and local differences in capacity might also exist.

The results of the above objectives will further inform the awareness and health protection activities specifically tailored to local needs. It will inform the type of advocacy needed at different levels, the design and content of awareness-raising materials, the nature of potential outreach activities to be implemented and the involvement and responsibilities of different stakeholders.

3 Methodology



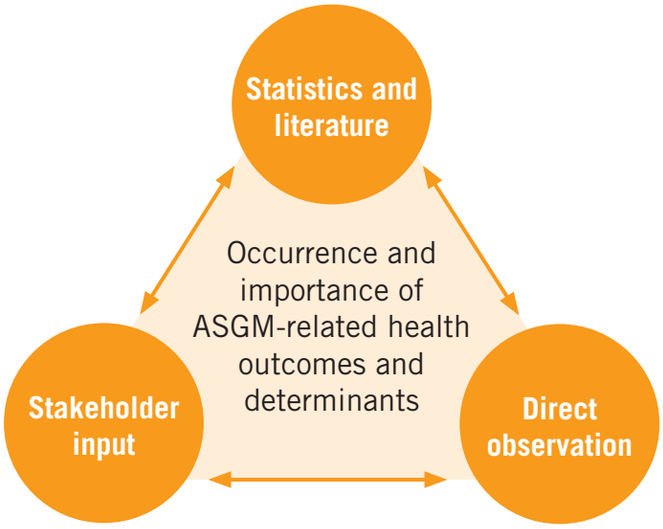
In this section:

Methodology

Study design

This observational study applied a cross-sectional design using a mixed-method approach. To examine the interface between ASGM miners and the health system, a combination of qualitative data from interviews and discussion rounds, quantitative data from the health sector (i.e. health statistics and Health Facility Assessments (HFAs)) as well as direct observations (see Figure 1) were assembled *(9)*. Such a methodological triangulation, combining multiple forms of evidence and perspectives, is an important means to enhance the validity of a recommendation and thus considered to be a robust methodology for use in the health situation assessment *(10)*.

Figure 1: Methodological triangulation (adapted from Winkler et al. 2011)



Study sites

In Nigeria, two active ASGM sites were selected in Niger and Osun states, respectively. These two sites were selected in line with the national ASGM baseline assessment studies being conducted in the country under the auspices of the MMSD in collaboration with the FMEnv and ratified by the National Steering Group (NSG) for the execution of the NAP. These sites were selected because they show ongoing mining activities at the current stage. It is noted that other states, such as Zamfara, also show substantial ASGM activities in their territories. In the selected sites, NGOs, community-based associations or civil society organizations were present. Prior to this assessment, the ASGM communities in the selected sites were not well described. The final selection of sites is listed in Table 1.

Table 1: Sites investigated in the country

State	Local Government Area	Administrative post (state capital)	Mines	Obs.:
Niger	Shiroro	Minna	Galadimakogo, Kpmakpma	Site 1
Osun	Atakunmosa West	Oshogbo	Ilekki, Ibodi	Site 2

Study population and sample size

In each ASGM area, key informant interviews (KIIs), focus group discussions (FGDs) and HFAs were conducted. The participant groups for the different data collection methods are shown in Table 2 below.

Table 2: Target participant groups and target health facilities

Key informant interviews	Focus group discussions	Health facility assessments
■ Local government officials ■ Local health authorities ■ Local environmental (health) authorities ■ Health care providers at peripheral health facilities in ASGM areas ■ Community leaders ■ ASGM community leaders ■ Civil society organizations working on ASGM-related issues	■ Artisanal and small-scale gold miners ■ Family members of miners ■ Community members in surrounding communities of ASGM sites (excluding leaders)	■ Nearest public, primary health care facilities serving ASGM communities ■ Referral hospital for the primary health care facilities

Participants of KII were identified among the participant groups and primarily targeted the highest authority in each group, i.e. District Medical Officer, District Environmental Health Officer, community leader, ASGM community leader (or their superiors) or health facility manager. Other relevant key informants were identified by the chain sampling method.

Participants for FGDs were recruited by the interviewer and the local partner on the ASGM sites and in the associated communities in arrangement with the local community and/or ASGM community leaders and the community health worker. Only individuals that have been in the area for two mining seasons or more were eligible to participate in FDGs in order to guarantee that participants have had a certain exposure time to the local circumstances. Care was taken to guarantee a random selection of participants in terms of type of work done (e.g. digging ore, washing ore, working with mercury, etc.), the conditions (e.g. seasonal vs. annual workers, dayshift vs. nightshift) or demographic characteristics (e.g. age). This was achieved through random walks in the ASGM site. FGDs comprised 5-10 participants, allowing for a participative discussion lasting between 45 and 90 minutes. Both gender-specific and mixed-gender FGDs were conducted.

The public, primary health care facilities (health post and/or health centre) serving the ASGM community in each site were visited and subjected to a HFA. In addition, the first-level referral health

facility for the primary health care facility was visited in order to include the facilities where potentially more complicated cases would be handled (thus constituting an important link in the referral system for ASGM).

Written consent was obtained from all participants of KIIs and FGDs. Individuals less than 18 years of age were not included.

Community mobilization and sensitization activities

In the selected ASGM sites, community sensitization activities were conducted prior to the site visits. A social mobilization plan (SMP) was developed in advance with support of the Federal Ministry of Health. The SMP described the process of: (i) informing the community about the piloting project and involving community leaders and others; (ii) explaining to the study population the necessity of doing the survey and its unfolding (duration and period of investigation, participant selection process and survey tools); (iii) creating a space for continuous exchange to engage with different community groups; and also described the (iv) roles and responsibilities of different local stakeholders, e.g. community-based organizations and civil society organizations as entry points for a participatory approach to engage with the community; (v) how data were to be gathered and used, safeguarding full confidentiality; and (vi) strategies for disseminating the findings of the project.

In order to carry out community mobilization and sensitization activities, the project team worked closely with civil society organizations as an entry point for a participatory approach. In a first step, the project team explored and identified at national, regional and sub-regional level NGOs, associations or civil society organizations that were authentically representative of the study population in the selected study sites. The organizations included Geo-Mob Social Response Centre, CERPMIST Environmental Academy, and Initiative for Advancement of Humanity.

Geo-Mob is an NGO working on Water and Sanitation and Health Promotion, especially as they concern communities with extractive industries. The joint community mobilizers' team was led by senior personnel of Geo-Mob. Geo-Mob has experienced grassroots-oriented health professionals serving as social mobilizers. The organization has worked extensively with local communities conducting public health surveillance and monitoring across Nigeria. They also have grassroots-oriented mobilizers who speak the local language of the ASGM population in the Niger State. Geo-Mob worked closely with the local community groups, traditional rulers' council, other civil society coalitions in Niger State, and the Federal Capital Territory, Abuja, to ensure effective stakeholder involvement and social mobilization towards the survey.

In the same vein, the involvement and social mobilization of NGOs, professional associations, and religious bodies in the Osun State were strengthened by the participation of the NGO, Initiative for Advancement of Humanity (IAH). IAH is a civil society organization dedicated to paralegal and public health intervention services. Their goal is to assist vulnerable populations through the law as an instrument of social engineering, providing 50% improvement on access to health care services, education and human rights of women, youth and the "Most At Risk Populations (MARPS)". IAH has experienced programme staff in managing stakeholders and implementing public health intervention programmes in Osun State.

In a second step, the project team engaged with identified civil society organizations to collect valuable information on how to conduct the study in a way in which potential harms can be reduced, and on how to approach the communities.

In a third step, civil society organizations engaged in a participatory approach with the communities to explain the study's objectives and the risks and benefits associated with it. It was particularly important to learn about community members' fears of potential harm that the implementation of the study may have caused. Due to their familiarity and legitimate engagement with the communities,

these civil society organizations were responsible for providing adequate information to the community regarding the survey activities, clarifying any fears or doubts the community may have had about the subject and risks of being involved. They also established effective channels of communication and encouraged community participation and involvement in the study.

In a fourth step, civil society organizations worked closely with community leaders and with the leaders of miners' associations. Community leaders were sensitized, explaining the whole process of the survey and the need for active engagement of the community and the target group.

Data collection and tools

Document review

A review of available peer-reviewed literature produced on ASGM was carried out. The literature review informed the refinement of semi-structured questionnaires for conducting KII and FGD at the local level.

Key informant interviews

The interviews followed a semi-structured questionnaire specific to the different types of key informants consulted. The KII-questionnaires used are shown in the annex.

Focus group discussions

The discussions followed a semi-structured questionnaire tailored to the different types of participant groups targeted. The generic FGD-questionnaires are shown in the annex.

The same topics as for the KII were covered under the FGD using an open-ended questioning route. The discussions were left open after a question was posed, encouraging active and spontaneous participation. The questionnaires were translated and administered in local languages. Whilst the researcher was steering the FGD, the local partner supported the translations.

Health facility assessment

At the level of health facilities, a HFA was conducted to assess the capacities and the readiness of the health system to provide health services. This covered human resources, availability and functionality of equipment and diagnostics, and availability of medicines.

For this purpose, an adapted and abbreviated version of the WHO Service Availability and Readiness Assessment (SARA) tool was employed. Additional questions have been included on the basis of the WHO's technical paper on "Environmental and occupational health hazards in ASGM" to determine readiness to deal with common environmental and occupational health problems associated with ASGM, e.g. capacity to deal with poisonings *(4)*. The HFA tool is shown in Table 19.

Direct observations

Direct observations were another important means of data collection during the field work activities. While a comprehensive assessment of work processes, exposure pathways and other aspects of the ASGM site was beyond the scope of this research, a rapid observational assessment was conducted. For this purpose, an observational "site walk-through" tool was used to describe ASGM working processes and conditions, access to drinking water and sanitation, use of personal protection measures, means of transportation, public health outreach activities at ASGM sites and other important characteristics of the site. The tool is included in the annex.

Data management

Data recording

Data from KIIs and FGDs were directly recorded in the questionnaire in the field either through (i) paper-based hand-written recording of answers or (ii) entering of answers and keywords directly into a computer. In case of hand notes, answers were subsequently entered into a computer. KIIs and FGDs were not recorded on tape or transcribed.

Data protection and confidentiality

Computers were password protected and data stored on the server at Swiss TPH (encrypted with Secure Sockets Layer, to which only the study investigators had access). No individual data were given out to third parties. Names were obtained for the informed written consent and not to be associated with any of the data collected, including photographs. Names and signatures were shared or used. No names are mentioned or appear in any documentation and dissemination of the research findings or photographs.

Data ownership and sharing

Data are the basis for all sound public health actions and the benefits of data sharing are widely recognized, including scientific and public health benefits. Whenever possible, WHO wishes to promote the sharing of health data, including but not restricted to surveillance and epidemiological data. In this connection, and without prejudice to information sharing pursuant to the International Health Regulations and other legally binding instruments (e.g. the WHO Nomenclature Regulations 1967), by providing data to WHO, the Federal Ministry of Health of Nigeria signed an agreement that it:

- Had confirmed that all data to be supplied to WHO hereunder have been collected in accordance with applicable national laws, including data protection laws aimed at protecting the confidentiality of identifiable persons;
- Had agreed that WHO shall be entitled, subject always to measures to ensure the ethical and secure use of the data, and subject always to an appropriate acknowledgement of Nigeria:
  - to publish the data, stripped of any personal identifiers (such data without personal identifiers being hereinafter referred to as "the Data") and make the data available to any interested party on request (to the extent they have not, or not yet, been published by WHO) on terms that allow non-commercial, not-for-profit use of the data for public health purposes (provided always that publication of the Data shall remain under the control of WHO);
  - to use, compile, aggregate, evaluate and analyse the data and publish and disseminate the results thereof in conjunction with WHO's work and in accordance with the Organization's policies and practices.

Swiss TPH hands over all data to WHO at the end of the study.

Ethical considerations

Ethical conduct of study

The study was carried out in accordance to the present study protocol and with principles enunciated in the CIOMS International Guidelines for Health-Related Research Involving Humans, together with the Declaration of Helsinki, as well as all national legal and regulatory requirements *(11)*.

Participants were informed in detail about the planned research, as well as risks and benefits of participation, and informed consent of all study participants was obtained in writing (see the annex). The information described the basic principles that guarantee the rights of participants in human research: voluntary participation, confidentiality and identity protection; benefits and risks; the amounts, methods and timing of compensation; and the mechanism of communication of the results. The consent was administered by the study team before the application of the questionnaires. Participants had the opportunity to raise questions, which were answered by the study team. Participants had the right to withdraw from the study at any moment without any consequences, in which case the already obtained information was deleted.

Ethical approval was sought across the Ethics Review Committee (ERC) of WHO for the master study protocol. The study procedures and ethical considerations presented in the master protocol were followed in all three study countries. Thereafter, country-specific protocols were developed and ethical approval sought with the National Health Research Ethics Committee of Nigeria (NHREC/01/012007).

4 Literature review

> **Apart from children under five, pregnant women, older children, mining workers and breastfeeding infants were also at a major risk of lead poisoning**

Literature review

The search terms "artisanal gold mining AND Nigeria" were entered into three databases; the Web of Science, PubMed and CINAHL. From this search a total of nine publications concerning artisanal mining, health and Nigeria could be identified.

The publications can be grouped into two topics. The major part examined the massive lead poisoning outbreak in northern Nigeria, caused by ASGM. Two other papers investigated the different trace and heavy metals and their potential health risks in the environment of Nigerian artisanal mining sites.

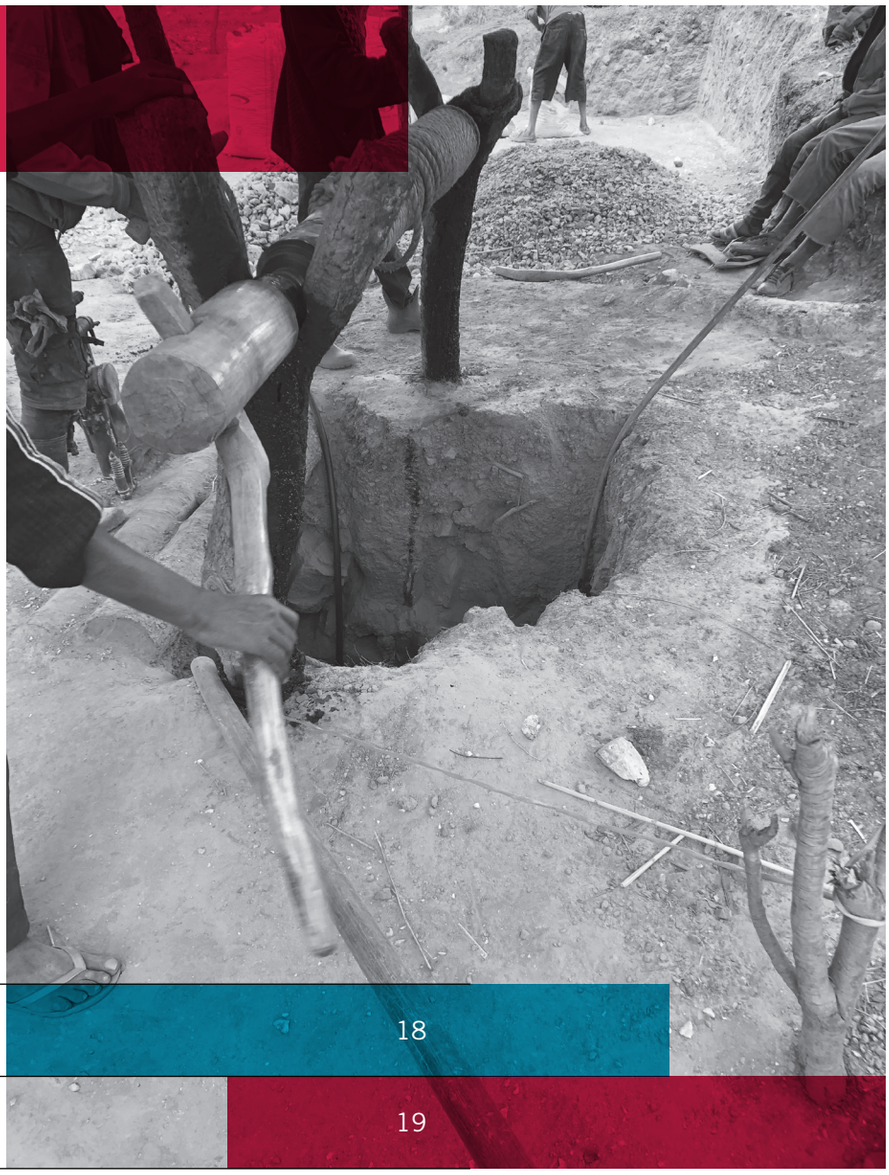
As a result of rising gold prices and difficult access to fertilizers, many farmers in northern Nigeria started to extract gold in artisanal mining sites. Due to the high amounts of lead in the ores, a lead poisoning epidemic swept across northern Nigeria in 2010. Most affected were children under five, of which more than 400 died during the epidemic *(12, 13)*. Médecins Sans Frontières (MSF) and Terra Graphics then started the first population wide intervention on lead poisoning, which continued for four years *(14)*. A total of 2349 lead-poisoned children under five were subjected to chelation therapy, 27,000 m^3 of lead-contaminated soil and mining waste was removed, and replaced with clean soil and different educational and technical support programs were started in the villages to promote safe mining practices and educate people about the chelation therapy *(12-14)*. During the four years of the program, mean lead levels in the blood in children under five decreased from 149 µg/dL to 15 µg/dL and the mortality could be reduced from 40% to 2.5% *(13, 14)*. Occupational Knowledge International additionally assessed together with MSF the effectiveness of a wet spray misting method during the ore processing to reduce the miners' exposure to lead and silica dust. The intervention proved to reduce lead and silica concentration in air samples by 95% ($t = –9.38$, $df = 22$, $p = < 0.0001$) and 80% ($t = 4.12$, $df = 17$, $p = 0.00064$), respectively *(15)*. Different transmission routes of lead poisoning were assessed during the epidemic. Accidental soil ingestion from hand to mouth and respiratory tract infestation by dust were identified as two of the main transmission routes *(16)*. Also, lead ingestion with food, mainly contaminated cereals and legumes, was found to contribute to 11%-34% of the children's blood lead levels *(14)*. Risk factors for lead poisoning induced mortality in children under five were decreasing age of the children, their mothers' professional activities in the ore processing, having the community well as a primary water source and high lead levels in the soil. Apart from children under five, pregnant women, older children, mining workers and breastfeeding infants were also at a major risk of lead poisoning *(16)*.

MSF discovered several ethical issues during their population wide intervention: Despite community education programs of MSF, not all parents agreed to continue chelation therapy of their children until an acceptable level of lead has been reached in the child's blood *(13)*. Mostly fathers made these decisions, despite the fact that mothers were much more knowledgeable about the health issues and status of the children *(12)*. Further, unsafe mining activities have reappeared two years after the remediation of the lead-contaminated topsoil layer *(13)*. Ironically, children on chelation therapy are more susceptible to lead absorption. Therefore, the continued unsafe mining practices endangered children on treatment even more *(12)*. These issues address questions like patient/parent autonomy versus responsibility to treat, and the possibility to stop the intervention in villages with a low acceptance versus withdrawing treatment options from individuals who would still like to continue *(13)*.

One of the studies investigating trace and heavy metals close to artisanal mining sites found high levels of Al, Fe, Mn, Cr, Ni, Pb and Cd in surface and ground water samples. Pb, Cr and Cd could also be found in fish. Concentrations high enough for non-carcinogenic side effects were identified for Al, Fe, Mn and Pb, whereas concentrations high enough for carcinogenic side effects were identified for Cr and Cd. Additionally, Ni and Pb concentrations in the water were found to be high enough to pose a cancer risk for infants and children *(17)*.

The second study concluded that most of the metals were bound to the soil matrix. However, Sn and Pb showed high levels of mobility. Dermal contact was the highest exposure to carcinogenic metals. The levels of Al, Co and As were higher than acceptable limits for children and posed a high risk of non-cancer adverse effects to health *(18)*.

5 Field study findings



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Field study findings

Study population

A total of 21 KIIs, 14 FGDs and 6 HFAs were conducted (Table 3) in the two ASGM sites in Niger and Osun states of Nigeria.

Table 3: Sample sizes

	State		Total
	Niger	Osun	
Key informant interviews			
Gov. officials (regional or federal)	3	–	3
Environmental authorities	1	1	2
Health care providers	4	2	6
Traditional leaders	3	2	5
ASGM community leaders	2	1	3
Civil society organizations	1	1	2
Total KIIs	**14**	**7**	**21**
Focus group discussions			
Miners	4	3	7
ASGM community members (non-miners)	3	3	6
Mixed miners and non-miners	-	1	1
Total FGDs	**7**	**7**	**14**
Health facility assessments	**4**	**2**	**6**

Lessons learnt with regards to the sampling:

- Flexibility is needed in the acceptance of KIs as some individuals need to be interviewed due to cultural norms and as a sign of paying respect.
- Interesting KIs might be outside the pre-defined KI categories.
- The "health authority" from the first level, i.e. local government area or district, should be selected for a KII.
- For FGDs, two sub-categories are ideally defined: miners and non-miners. It was challenging to identify non-mining family members.
- Five to 10 days are required for one person to do all the required KIIs, FDGs and HFAs in one site. The tasks can be divided between skilled and trained investigators.
- The mobilization in Nigeria was done in two ASGM sites in both states, instead of one site per state as determined in the study protocol. This influenced the work load for data analysis and reporting.

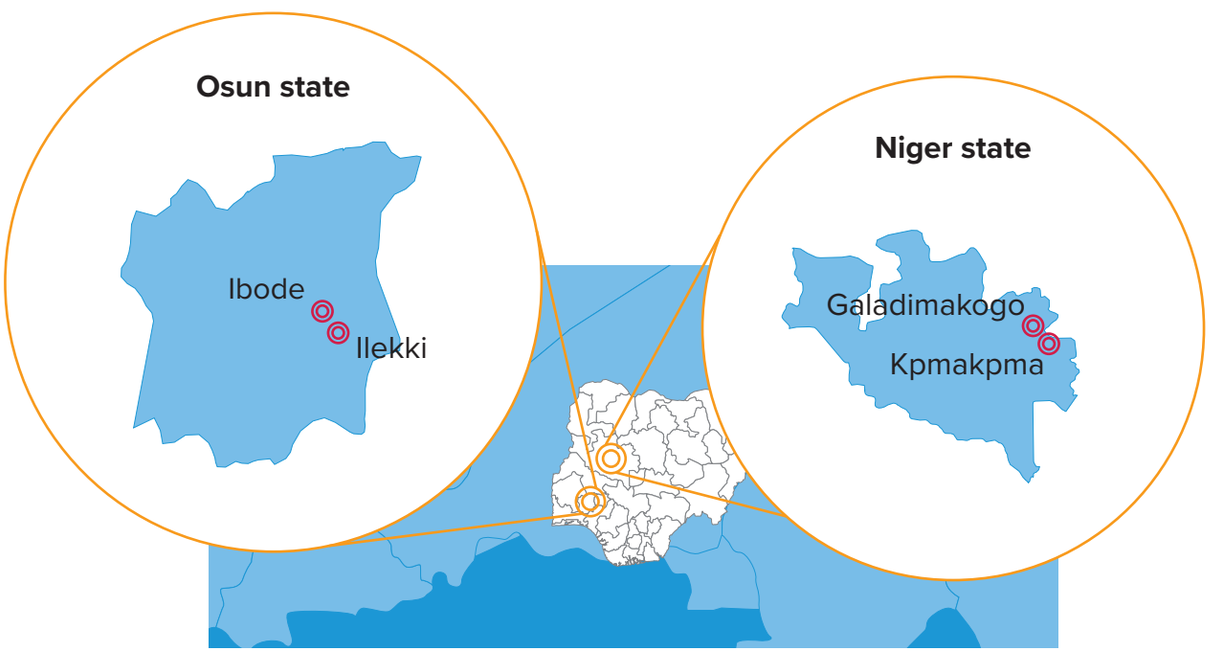
Community profiling

ASGM sites

In Niger state, Galadimakogo and Kpmakpma in Shiroro LGA were visited. In Osun state, Ibodi and Ilekki sites in Atakunmosa West LGA were visited.

A map of the sites is shown in Figure 2. The four communities are described in more details in the following sections. Table 4 describes the key features of each ASGM site.

Figure 2: ASGM study sites



Galadimakogo
In 1984, the community of Galadimakogo was resettled to this location due to the Shiroro dam construction. Previous to resettlement they were fishermen and farmers with no experiences in mining. ASGM has been practiced in this community since ~34 years, hence, three years after they have been resettled to this location. When relocating, parents would tell their children not to get involved in mining, because it is evil.

The community has about 3000 households and the economy is dominated by ASGM. There are full-time and part-time miners as well as non-miners. According to estimates of the village leaders, the large majority of people are directly involved in ASGM. Besides farming, small businesses and cattle rearing are economic activities.

Both women and men mine; however, women almost exclusively do alluvial mining. Most miners mine on an all-year basis and it represents their only means of income. Among male miners that participated in the FGDs, less than half reported to directly work with mercury themselves. Miners are mostly locals, having lived in the community for more than five years. Most FGD participants had primary education or less.

The practice of cyanidation of tailings started in the 1-2 years before the present study visit. It is practiced by in-migrants from other countries such as Mali or Burkina Faso but not yet by locals.

A minority of the population is not directly involved in ASGM. They have small businesses (e.g. selling foods, cloths, handicrafts, spare mechanical parts, restaurants, tailoring, etc.), farm (e.g. yam, sugarcane, rice, corn, soya beans, groundnut) or are cattle rearers. According to elderly community members, who are still farming, young people are no longer considering practicing farming. Most people nowadays buy food at the local markets instead of producing themselves.

Figure 3: Mining pit in Galadimakogo ASGM site

Kpmakpma
This village has about 500 households, consisting of 25 clans with about 25-30 households each. Less than half of the households are believed to be involved in mining. Other than mining, people are involved in farming and other small businesses. According to KIs, there is still a sufficient part of the population involved in farming. The young generation has interest in farming and there is no fear that there is not going to be enough farming. In addition, there is also enough farmland available. If farm land is occupied by mining, there is farmland available elsewhere.

Mining started in Kpmakpma about 10 years ago. Most miners are locals from the villages. After ~2 years of initial mining, foreigners were attracted to mine in this site. Both women and men mine; however, women do alluvial mining only. While men mine all year round, women mine especially in the dry season.

In the site, miners dig but they only take sand, not rocks, because there are no means to crush the rocks. Mercury amalgamation is practiced. Mercury burning is done at the mining site, not in the village. The dealer comes to the site to buy the gold.

There is no mining association or organization present; however, there are a few sponsors. Sponsors fund the entire mining operation in advance. This entitles them to gold extracted by the miner. Women mine without a sponsor. Conflicts are always resolved within the community in a community assembly under the leadership of the village chief. After initial land conflicts, the community assembly decided that miners always have to consult the land owner before mining and pay him some petty compensation for it. This system is viewed as working very well and has avoided conflicts between land owner and miner.

Figure 4: Kpmakpma ASGM site

Ibodi
This village has about 400 households, whereas a third of all households is believed to be involved in mining. The miners are almost all in-migrants and not native to the community. Miners usually come from other states (mainly northern Nigeria) and have been in this area for less than five years. Miners' households are often a mix of persons from different places usually living in overcrowded conditions and in a temporary shelter.

The site is an expansive alluvial mining site with pits scattered over a large area. The processing is done in the stream within the mining site. Mining is purely alluvial and no mercury is used during the process. Tailings are realized directly into the stream. The environmental degradation of the land is obvious and there is no plan to reclaim the land after activities stop. Most miners are seasonal workers and are working for an association or a sponsor.

Figure 5: Ibodi ASGM site

Ilekki
The site is an expansive alluvial mining site with about 200 6-meter-deep pits scattered all over the site. Digging and washing are done on the site and tailings are directly released into the stream. No mercury is used in the gold recovery process. The environmental degradation of the land is obvious and there is no plan to reclaim the land after activities stop.

Miners are predominantly not from the local communities but come from other Nigerian states or from other countries. None of the miners in FGDs reported residing in the community for more than five years. Most miners work on a seasonal basis and farming remains their main source of income. They have an association to which they all belong, but most are working independently while some work for a sponsor.

Figure 6: Alluvial mining in Ilekki

Women and child miners

Women and children worked on ASGM sites in Niger state. In Osun state, only children were seen working, while women were engaged in trading activities and not observed to mine.

Women report that they only do alluvial mining. They take either top soil or left-over stone from the pits which they will then wash and pan in the streams. They do not use any machinery or chemicals. After sufficient washing, the gold and sand mixture is kept in a container which will be burnt in the household to dry; thereafter, gold is separated from sand by sieving. Reportedly, they gain 0.2-0.5 g of gold in one week.

Children are involved in mining in, for example, the pits, milling or washing (Figure 7).

Figure 7: Children working at milling machine

Vulnerable and marginalized groups

Elderly people, both men and women, were considered a vulnerable group by most KIs. They were perceived as vulnerable because they cannot mine and earn money for health care, but need to rely on their children. They also might prefer traditional medicine and seek modern health care only if traditional medicine did not provide healing.

Non-locals (or in-migrants) were seen as marginalized. An example mentioned was that if a non-local gets trapped in a collapsing pit, he could be left behind whereas for a local, the family would come and try to save him. Non-locals might also not seek health care because they do not have any help or family support locally. As miners often do not have money, no one could support them financially in getting health care. In Osun state, miners in general were considered a neglected group. This is believed to be linked to the predominant in-migrant status of these miners. However, health care providers reported, there is no reluctance in accepting non-local patients at the health facilities.

Children under the age of five years and young people (*"because they are most involved in mining"*) were also considered as vulnerable groups by some KIs.

Table 4: Key observational features of the selected ASGM sites

State	Niger		Osun	
ASGM site name	**Galadimakogo**	**Kpmakpma**	**Ibodi**	**Ilekki**
Approximate size/surface	200m x 500m	300m x 500m	300m x 500m	800m x 1,200m
Years of ASGM activity	~34 years (~1987)	10 years	>55 years	~20 years
Types of gold mining	Hard rock, alluvial	Rock sand, alluvial	Alluvial, sand	Alluvial, sand
Nature of gold mining	Rudimentary, open cast with pits	Rudimentary, open cast with pits	Rudimentary	Rudimentary
Seasonal nature	Annual, with reduced activity in the rainy season	Annual and seasonal	Annual	Annual
Organizational structure	Partially organized with mining associations and sponsors	Not organized, a minority work for a sponsor	Most miners work for an association or a sponsor	Most miners belong to an association but work independently, a minority work for a sponsor
ASGM worker demographics	Men: 300+	Men: 300	Men: 700	Men: 800
	Women: ~200	Women: 250	Women: 0	Women: 0
	Children: ~150	Children: 100	Children: 0	Children: 60
Information on migration patterns	Few foreigners	Some in-migrants from neighbouring countries	All miners are in-migrants from northern Nigeria	All miners are in-migrants from northern Nigeria
Activities observed	■ Pit mining (digging) ■ Crushing ■ Milling ■ Carrying loads ■ Open mercury burning ■ Washing	■ Pit mining (digging) ■ Excavation ■ Carrying loads ■ Open mercury burning ■ Washing	■ Pit mining (digging) ■ Carrying loads ■ Sluicing ■ Washing	■ Pit mining (digging) ■ Excavation ■ Carrying loads ■ Sluicing ■ Washing
Physical hazards observed	■ Dust ■ Underground mining ■ Confined spaces ■ Exposure to sunlight ■ Slipping and falling inside the pit	■ Drilling ■ Crushing ■ Ore processing ■ Confined spaces ■ Dust ■ Exposure to sunlight ■ Falling into pits	■ Dust ■ Confined spaces ■ Falling into pits	■ Dust ■ Exposure to sunlight ■ Confined spaces ■ Falling into pits

State	Niger		Osun	
ASGM site name	**Galadimakogo**	**Kpmakpma**	**Ibodi**	**Ilekki**
Mechanical hazards observed	■ Heavy lifting ■ Work using non-mechanized tools ■ Use of inappropriate equipment ■ Awkward postures	■ Heavy lifting ■ Work using non-mechanized tools ■ Use of inappropriate equipment ■ Awkward postures	■ Heavy lifting ■ Work using non-mechanized tools ■ Use of inappropriate equipment ■ Awkward postures	■ Heavy lifting ■ Work using non-mechanized tools ■ Use of inappropriate equipment ■ Awkward postures
Chemical hazards observed	■ Mercury	■ Mercury	None	None
Biological hazards observed	■ Vectors ■ Stagnant waters ■ Rats, snakes	■ Vectors ■ Stagnant waters	■ Vectors ■ Stagnant waters	■ Vectors ■ Stagnant waters
Psychosocial hazards observed	■ Unsafe working conditions ■ Poor living and working conditions	■ Unsafe working conditions ■ Poor living and working conditions ■ Cramped living conditions	■ Unsafe working conditions ■ Poor living and working conditions ■ Cramped living conditions	■ Unsafe working conditions ■ Poor living and working conditions ■ Cramped living conditions
Protective measures observed	None	None	None	None
Date of site visit	15.03.2019	18.03.2019	26.03.2019	26.03.2019

Lessons learnt with regards to the observational tool:

- The observational tool was useful in getting a fast overview of the site. The more options that are displayed (e.g. for vectors), the better because it is easier to fill in.
- The observational tool was usually filled in with the support of the ASGM leader or a worker who could provide accurate information on the site.

Environmental and socio-economic impacts of ASGM activities

Environmental impacts

Awareness of environmental impacts of ASGM was considerably more wide-ranging in KIIs than in FGD participants. Table 5 summarizes the environmental impacts perceived by KIs, structured into leading themes and specific issues mentioned therein.

Table 5: Environmental impacts according to key informants

Leading themes	Specific issues
Environmental degradation	■ No environmental control of mining activities ■ Degradation of the land due to mining activities ■ Abandonment of land after activity ■ No reclamation of the land after termination of activity ■ Erosion of land ■ Land becomes infertile, left with no nutrients ■ Land becomes only arable again after ~5 years ■ Destruction of farm land ■ Collapsing terrain ■ Streams are eroded, increasing in size because of mining within streams ■ Land excavations increase chances of earthquakes and other natural disasters
Use of mercury	■ The use of chemicals is dangerous to animals, humans and environment ■ No precautions are taken to dispose of mercury safely
Contamination of soil	■ Contamination of soil through chemicals ■ Chemicals make soil “soft” and crops will not grow anymore
Contamination of water	■ Contamination of water through chemicals (heavy metals) ■ Water to wash gold is further used for irrigation ■ Pit holes are filled with water and people use as drinking water ■ Humans and animals drink contaminated water ■ Stress on water sources because of water depletion ■ Open defecation leading to faecally contaminated waters that are also used for drinking
Contamination of air	■ Contamination of air through burning of mercury amalgam ■ Open defecation also led to intense air pollution

Table 6 summarizes the environmental impacts perceived by FGD participants, structured into leading themes and specific issues mentioned therein.

Table 6: Environmental impacts according to focus group participants

Leading themes	Specific issues
Environmental degradation	■ Land erosion ■ Stream expansions due to mining in the stream
Water-related issues	■ Stream water is polluted with sand and chemicals ● Water has a weird smell ● Cattle drink this water, which harms them and finally the humans through eating their meat ■ Less drinking water available

Socio-economic impacts

Table 7 summarizes the leading themes and specific socio-economic impacts raised by KIs. The economic opportunities were mentioned as the positive consequence of ASGM, including secondary impacts such as increased purchasing and investment power and secondary markets and businesses.

Negative impacts focused on (i) low school enrolment; (ii) changes in livelihood; (iii) conflicts around land; (iv) lack of institutionaliation of mining activities; (v) social issues such as crime, drugs, alcoholism, prostitution; (vi) in-migration; (vii) inequalities; (viii) disruption of social cohesion; and (ix) living conditions.

Miners are generally believed to live a risky, unhealthy lifestyle. Accompanying activities such as drug and alcohol consumption and prostitution are unhealthy behaviours that miners adopt.

The fact that women work in mining has also been perceived as empowerment for women. While without mining they have no access to gaining an income, this activity gives them money for themselves and some independence.

It is generally believed by most KIs that it is beneficial if the mining activities are organized, i.e. the mining is undertaken by an “organization” or “association”. These organizations are expected to get into an exchange with the land owners before mining activities start, agreements are made, and they also invest in some community development.

Table 7: Socio-economic impacts according to key informants

Leading themes	Specific issues
Economic impacts	■ Income opportunity ■ Employment opportunity ■ Creation of secondary markets ■ Creation of purchasing power: cars, televisions, motorbikes, land ■ Creation of investment power: in other secondary businesses, including farming ■ Strengthens capability of a man to be able to marry ■ Land sales have increased
Livelihoods	■ Increase of food prices: due to less local farming activities and in-migrants ■ Increase of living costs ■ Shifting of livelihood activities from farming to mining ■ Farming activities are abandoned or neglected ■ Seasonal mining/farming can reduce impact of food price inflation ■ If mining yield is low, miners can revert to stealing farm yield ■ Drowning of animals in flooded pits
Education and school enrolment	■ Low school enrolment (teacher estimation in Galadimakogo: 75% of children do not go to school but mine instead) ■ Interest in education is low with parents and children ■ Children prefer to mine whereby they earn some money instead of going to school; they are intrigued by seeing miners' wealth (phones, motorbikes, etc.) whilst non-miners remain poor ■ Parents encourage children to do mining ■ Children mining is child abuse and child labour ■ Village leaders' and teachers' associations do meetings with guardians of the children to sensitize them on the importance of schooling
Conflicts	■ Conflicts between land owners and miners ● Miners start mining without asking permission from land owners ● Miners start mining without having official mining permits ● Miners do not compensate farmers for using their land ● Miners do not restore the land after activity ■ Mining activities reduce available farm land ■ It seems that sometimes the strategy of miners is to make land unusable for farming overnight, with the intention to compel a lease agreement afterwards since the farm is already ravaged and no longer good enough for farming
Institutionalization (organization, skills)	■ Organization of mining activities is beneficial: ● reduces conflicts ● improves relationships between communities, land owners and miners ● pre-agreements before mining activity starts are beneficial and avoid future conflicts ■ ASGM is not an activity that is planned by the government (e.g. city planning) and therefore is often not organized, rather chaotic ■ Illegal activity: miners often have no permits, non-Nigerians have no residency permits ■ ASGM is not an official activity; therefore, it is not a skill that is taught/trained according to best standards and safety precautions ■ More training in ASGM is needed with regards to skills, productivity, safety ■ Institutionalization could increase productivity

Leading themes	Specific issues

Social issues, including crime, drugs, alcohol and prostitution	■ There is happiness because of gold discovery
	■ Increase in substance abuse:
	  ● A lot of miners consume drugs, are addicted to drugs
	  ● Drugs are believed to give them more strength
	  ● Drugs such as Indian hemp, smoking herbs
	■ Increase in alcohol consumption
	■ Increase in insecurity and crime:
	  ● Fights in communities
	  ● Aggressions against women, including rape
	  ● Thieves, bandits, killings, robbery, petty stealing
	■ Increase of prostitution: females from other areas in-migrate and local women engage in transactional sex
	■ In sites where miners are in-migrants, they are very mobile and can disappear quickly after having committed a crime

Non-locals, in-migrants	■ Influx of in-migrants is promoted by mining activity ■ Host community is poorly prepared to host many in-migrants ■ Separation of workflows between locals and foreign groups, which avoids language misunderstandings ■ Cyanidation is not yet done by Nigerians; foreigners practice it, e.g. from Mali and Burkina Faso ■ In-migration leads to overpopulation ■ The population growth has outpaced the development
Inequalities	■ Farmers are not compensated for mining on their land ■ Communities have limited financial benefits from mining activities ■ Miners are better off ■ Miners, companies, associations and sponsors benefit from ASGM, not the community as a whole
Social cohesion	■ Mining disrupts the community cohesion ■ There is a lack of trust among community members ■ Nomadic nature of miners hampers building of community sense
Living conditions	■ Vibration causes houses to crack ■ Overcrowding ■ Living outdoors

Socio-economic impacts described by the FGD participants circled around the same leading themes as described by the KIs (Table 8).

Table 8: Socio-economic impacts according to focus group participants

Leading themes	Specific issues
Economic impacts	■ ASGM has brought wealth: ● People can buy houses ● Women can buy dresses ● Youth can buy motorcycles ● Men can marry ■ Were able to buy fertilizers and farming equipment to help them increase their harvest ■ Secondary businesses sell more products because miners have money
Livelihoods	■ They have no wish in continuing mining but there is no alternative ■ They have no farming experience ■ They buy food ■ They need changes to their lifestyles so that they do not have to do mining anymore ■ Food prices are fluctuating at normal scales but no inflation because of mining
Conflicts	***Miners' perspective:*** ■ There are frequent conflicts with farmers on land use ■ Sponsors help them get a small compensation for land owners ***Non-miners' perspective:*** ■ Illegal miners enter farms without permission ■ Farmland is destroyed ■ Land dispute can go to the police and further the court; however, often it is handled locally through the chief and his advisors ■ Miners can steal food or tools from farmers
Education	■ Less children want to go to school
Crime, drugs, alcohol and prostitution	■ Stealing of pits, tools/equipment, food ■ Smoking of Indian hemp ■ Consumption of "good luck" tablets ■ Miners buy stuff on credit and sometimes run away without paying back ■ Kidnapping in neighbouring communities
Non-locals, in-migrants	■ Stealing of pits, food, tools, etc., is believed to be committed more frequently by non-locals than locals

Health-related issues in the ASGM context

General health situation

Table 9 summarizes the health issues mentioned by KIs for different population groups.

Sexually transmitted diseases (STDs) do not seem to be a major (known) public health challenge as of yet. In Galadimakogo, two months before the current study, an HIV counselling and testing campaign was held in the village where apparently the majority was found to be HIV-negative.

Table 9: Health issues according to key informants

Population group	Common health issues
All ages	■ Malaria ■ Fevers ■ Diarrheal diseases, typhoid fever ■ Schistosomiasis ■ Yellow fever ■ Vomiting ■ Body pains ■ Pneumonia ■ Road traffic accidents ■ Headaches ■ Malnutrition ■ Skin rashes ■ Appendicitis
Children	■ Stomach pains ■ Headaches ■ Convulsions ■ Coughing ■ Fevers ■ Malaria ■ Diarrheal diseases

Frequent health issues as reported by participants from the FDGs varied among the different population groups (Table 10).

Table 10: Health issues according to focus group participants

Population group	Common health issues
Children	■ Malaria ■ Fever ■ Convulsions ■ Vomiting ■ Conjunctivitis ■ Oral health
Women	■ Abdominal pain
Elders	■ General body pain, back pain ■ Fatigue ■ Reduced eye sight ■ Typhoid fever ■ Ulcers (stomach) ■ Hot legs ■ Reduced sensitivity of skin
Non-miners	■ Ulcers (stomach, chest) ■ Typhoid fever ■ Malaria ■ Back pain, join pain, knee pain ■ Hypertension ■ Appendicitis ■ Hernia
Farmers	■ Farm materials cuts, herbicides mismanagement. They use it before it rains and it washes away. And people drink. ■ Ingestion of insecticide and organophosphates leading to poisonings

Awareness of ASGM activities

KIs whose work somehow involves mining (i.e. officials from the ministries, civil society organizations) were well aware of the mining activities ongoing in Niger and Osun states and other states in Nigeria.

KIs from the health sector were aware of the mining activities to a varied degree. Health care providers within the ASGM communities were well aware of the mining activities and, in some instances, have already visited the mining sites. Health care providers at state levels were only partly aware of mining activities in the state. In addition, they were not all aware of mercury use in ASGM. Exposure to ASGM in general was low for health care providers at state level, i.e. in referral hospitals.

Awareness of mercury use

The understanding on mercury exposure pathways and consequences on human health and environment differed greatly between KIs. Within governmental institutions at national and regional levels, there was high awareness of mercury use and its harmfulness.

At state and local levels, not all KIs were aware that mercury is used in ASGM. In Niger state, mercury is used under the name of “chemicals”, not by its name. The awareness that mercury is harmful for human health or the environment was even lower. Some KIs have heard about mercury use and effects only during the sensitization activities of this study. In Osun state, the ASGM sites visited did not use mercury and hence, its use and potential health effects were unknown to KIs.

Most KIs thought that ASGM communities are generally ignorant on the implications of mercury, whereby "ignorant" implies both "not knowing" and "not caring".

Awareness of ASGM health issues

Among key informants
From the KIs' perspective, miners are often unaware of the health effects of ASGM, including mercury use. And even in case they are aware, it is neglected in favour of the economic opportunity. KIs believe that miners are "ignorant" of the health risks related to ASGM. This "ignorance" includes both the awareness of health risks and the willingness to protect oneself from risks even if aware. The ignorance of the miners also extends to the health of other community members who they put in danger due to their activities. In addition, the adherence to safe mining rules (e.g. how to build the pit) is believed to be low.

As described above, local KIs also were not always aware of the harmfulness of mercury to health. Some local KIs have learned that mercury and cyanide are harmful only during the course of this study and they believe that their communities are not aware.

Among non-mining community members
Similar to KIs, the non-miners living in the ASGM communities visited perceive mining as a risky occupation and believe that the majority of miners are too careless about their health. This because they consider mining a hazardous occupation, but also due to the limited hygienic conditions they live and work in. However, they recognize that there are strong individual differences on awareness and precautions taken to protect one's health. In particular, sponsors and dealers are able to take care of themselves since they possess more money.

Among sponsors
Sponsors interviewed in KIIs or FGDs were unaware of the harmfulness of mercury use. The awareness of other occupational hazards was higher.

Among miners
Most miners during FGDs perceived their work as risky, especially so in Niger state. Mining was considered less risky in Osun state, as it was mostly alluvial mining and risks were limited to accidents in or around pits.

Among health care providers
Awareness of health risks in miners among health care providers was high for biomechanical risks (e.g. fractures, uncomfortable postures, injuries), biological (e.g. unsafe sanitation, unsafe sexual behaviours), moderate for physical risks (e.g. heat, low oxygen levels) and low for chemical risks from mercury or cyanide.

Furthermore, health care providers expressed certain risks such as "contact with miners can cause meningitis".

Health risks and effects of ASGM

A myriad of health risks and effects of ASGM as described by KIs (Table 11).

Table 11: Health risks and effects of ASGM according to key informants

Leading themes	Specific issues
Occupational hazards	■ Falling in pits by humans (including children) and animals ■ Collapsing pits ■ Land slides ■ Inhalation of dust (leading to pneumonia, silicosis) ■ Accidents and injuries ■ Carbon monoxide intoxication from water pump machine in pit ■ Excessive work and exhaustion ■ Extreme heat and cold ■ Vibration ■ Falling stones

Leading themes	Specific issues
Environmental health hazards	■ Dirty environment ■ No safe drinking water ■ Open defecation ■ Faecal-oral infections ■ Smoke from burning waste and refuse in ASGM communities causes respiratory problems and allergies
Vector-related hazards, animals	■ Malaria ■ Mining is creating stagnant waterbodies that become breeding sites for mosquitoes ■ Spread of Lassa fever
Chemical hazards	■ Mercury exposure: inhalation and direct contact ■ Cyanide exposure ■ Lead exposure
Social and livelihood hazards	■ Not enough food ■ Killings for economic gain ■ Kidnappings for economic gain
Community exposures	■ Same instruments used to mine and process food ■ Tailings are used for building houses ■ Children eat from hand to mouth while soil is contaminated with mercury ■ Drinking water is polluted with heavy metals ■ People are bothered about the noise from milling machines
Health effects	■ Symptoms of swollen legs when they stand in the waters/ponds up until the knees (pedal oedema) ■ Swollen face ■ Eyeball changes ■ Carbon monoxide poisonings ■ Injuries: puncture injury in legs, cuts in feet, rocks falling on heads ■ Drug abuse: leading to overdosing, accidents ■ Sexually transmitted infections ■ Headaches ■ Dizziness ■ Body pains ■ Stiffness ■ Stomach pains ■ Malaria ■ Mental disorders ■ Pneumonia ■ Fingernails falling off ■ Diarrheal diseases: typhoid fever, dysentery, cholera

Health risks and health effects described by FGD participants are shown in Table 12. Miners in FGDs mentioned fears such as being arrested for illegal activities, being attacked by herders or being affected by bad spirits. These fears and concerns were not raised by KIs but "living in fear" evidently poses a significant stress on miners.

There was also a difference between miners from Niger and Osun states. More types and a different pattern of health risks were reported in Niger state, more often linked to occupational and chemical hazards. In Osun state, most frequent health risks were related to environmental and vector-related hazards.

Table 12: Health risks and effects according to focus group participants

Occupational hazards	■ Traumatic falls potentially leading to death ■ Falling into pits ■ Carbon monoxide intoxication ■ Low oxygen levels in pits
Environmental health hazards	■ Drinking dirty (unsafe) water ■ Drinking water from mining pits
Vector-related hazards, animals	■ Snake bites, scorpion bites ■ Exposure to mosquito bites and malaria ■ Schistosomiasis because of working in water
Chemical hazards	■ Uncertainty about harmfulness of chemicals; however, some suspect that it is harmful, thus: ● They work outside of the village ● They burn some equipment after use
Social and livelihood hazards	■ Prostitution ■ Drugs (Indian hemp, Tramadol, Codeine) used to suppress fear of pits and other risks ■ Insufficient food: lack of food, lack of money to buy food, preoccupation with mining instead of farming and preparing food ■ Eating of animals that are contaminated with chemicals
Fears	■ Attacks from herders who see the environmental degradation as a distortion of grazing land ■ Fear of arrest from government as their activities are classified as illegal ■ Fear of evil, bad spirits: a place with gold is prohibited to work at and inhabited by the bad spirits ■ Mental health disorders from bad spirits ■ Security concerns
Health effects	■ Joint pains, muscle pains, neck pains, back pains, general body pain ■ Lacerations ■ Headaches ■ Stomach pains, stomach ulcers ■ Traumas: head injuries from stones crumbling into pits, puncture wounds ■ Colds ■ Malaria ■ Diarrheal diseases: typhoid fever, dysentery ■ Cough ■ STIs ■ Swollen legs ■ Extensive shivering (~1 hour) with cough, running nose and headache ■ Fingernails painful, falling off ■ Stiffness in fingers, hardening of palms ■ Postural deformity ■ Eye problems (losing sight, itching, dust in eyes) ■ Dizziness ■ Skin rashes ■ Meningitis caused by contact with miners
Gender differences (health effects in women)	■ Small injuries on hands and feet from alluvial mining ■ Postural hypertension ■ Itching in intimate body parts ■ Vaginal lesions ■ Irregular menstruations (e.g. twice a month) ■ Urinary tract health issues (e.g. painful urination) ■ Vaginal discharge (black and white)

Use of protective measures

All KIs reported that the use of personal protective equipment (PPE) is very low or not existent. Very few miners use gloves, steel boots or masks. KIs also noted a lack of willingness to adhere to safety precautions and procurement of PPE.

Miners reported that they mostly work without wearing any PPE. Miners mostly work barefoot or with sandals (flip flops), few with basic sneakers and only one FGD participant reported to wear safety boots. Even though hands get stiff and skin diseases are frequent, gloves were not used.

Some miners admit that PPE would be good, but they concede that it will be inconvenient to work with PPE. For example, the heat would not allow them to wear protective clothing.

Miners would also refuse to use PPE if it is "offered" to them by the sponsor because the cost of the PPE will ultimately be deducted from their earnings. In such cases, they prefer to have the money for themselves. Similarly, some miners reported that they do not have enough money to buy PPE.

Furthermore, miners (male and female) considered it would be impossible to protect themselves from snake or scorpion bites.

Non-miners also consider mining a risky profession and are therefore not mining themselves. They observe that miners mostly do not protect themselves by using PPE and they suspect it may be due to their desire to maximize their profit and not spend income on PPE.

Health seeking behaviour

Health seeking behaviour (HSB) as perceived by KIs is described in Table 13. In Niger state, it was believed that most people, including miners, go to the health facility first to seek medical care. However, traditional medicine was used by part of the population and for certain health issues. In Osun state, traditional medicine was believed to be preferred over modern medicine and seeking health care at a health facility. HSB can vary greatly between different locations as it has a multitude of determining factors (e.g. individual, cultural and institutional). Overall, access to health care was considered limited mainly due to distance. There was no clear consensus among KIs on whether miners can or cannot afford health services.

Table 13: Health seeking behaviour of miners according to key informants

Leading themes	Specific issues

Modern medicine *versus* traditional medicine or self-medication	***Niger state***
	■ Majority use the health facilities
	■ Traditional medicine is also practiced, to a lesser extent::
	  ● Traditional healers
	  ● Supernatural beliefs
	  ● Belief in god for protection and healing
	■ Miners come to hospital health facility because they recover faster with modern medicine than traditional medicine and can go back to work faster
	Osun state
	■ Miners trust more in herbal medicine due to belief system, ignorance and culture

Access to health care	■ Ability to access health care is limited, in terms of geographical access ■ Willingness to access health care is limited ■ Preference to access a facility that is close by, has staff and more medical equipment and drugs. In Galadimakogo, this is the case for private facilities as compared to the public facility. ■ ASGM sites can be difficult to access as there is a lack of roads
Affordability and willingness to pay for health care	■ Money allows miners to afford health services and buy drugs ■ In turn it is not ideal if they must spend the little money they have on health care ■ Affordability is a problem, also for miners ■ Sponsors mostly do not pay for health care for miners ■ There are no free drugs except anti-malarials

Leading themes	Specific issues
Non-locals, in-migrants	■ Non-locals are less likely to access health care: ● No family or other social network to support them ● No sponsor support ■ Health facility does not discriminate against non-locals ■ In case of accidents, locals can be saved by family, whereas non-locals can be left behind ■ In-migrants in remote ASGM communities do not know where a health facility is

Table 14 shows issues around HSB for participants of FGDs. There are important local differences between ASGM sites, depending on availability of health care services.

Table 14: Health seeking behaviour of miners according to focus group participants

Leading themes	Specific issues
Modern medicine *versus* traditional medicine or self-medication	■ Medical care is sought from public and private providers and traditional medicine practitioners; preference varies in each site ■ Don't go to facility for minor injuries but take paracetamol or other self-treatment, but go to facility for serious, life-threatening issues ■ In other instances, they provide first aid on the site, e.g. stop bleeding with a cloth or mobilizing a fracture, and then take the person to the health facility ■ Some don't go to facilities but rather go buy drugs directly ■ Herbal remedies are used sometimes ■ Snuff is used for strength and better eyesight
Access to health care	■ Major barrier is distance to health facility ■ Transport cost is a challenge if health facility is not within the community ■ In the absence of a nearby facility, help is sought from a traditional practitioner ■ Low confidence in the medical personnel is limiting access
Public *versus* private health care facilities	■ Public facility is cheaper ■ In public facility, they go and afterwards they go to chemist/pharmacy and buy medicine ■ In private facility they can negotiate the price of the drug which is available in the facility and they can pay later, e.g. after 3 days ■ For vaccinations, public services are used
Affordability and willingness to pay for health care	■ Affordability is a challenge, ranging from sometimes to always between participants ■ Preference to buy drugs directly instead of paying additionally for consultation at the facility ■ Lack of money prevents accessing the full range of services desired/needed
Pharmacies, vendors	■ When they buy drugs, they are healed and can go back to work ■ Chemists/pharmacists* are advising them on what to buy
Site differences	■ In Galadimakogo, there is one public and three private facilities. Most people prefer the private facilities, as they are closer, always staffed, always open, have drugs and there is a possibility to pay with a delay. ■ In Kpmakpma, there is one public facility. Two CHEWs work at the facility on shifts. All cases beyond their capacity get referred to a general hospital. ■ In Ibodi, there is a strong preference for traditional medicine as the health facility access is very limited; many miners do not even know where the closest health facility is located. There were, however, facility data to show that some miners use the health facility.

* Chemist/pharmacist refers to the shop owner, but is often not a qualified pharmacist.

Health promotion activities

According to most KIs, no awareness or health promotion activities have been done in the ASGM communities visited. The exception is awareness and intervention campaigns by the Government and MSF in response to the lead poisoning outbreak two years preceding the study. This included awareness creation via television and radio.

According to health care providers, there has never been any awareness on ASGM health issues, neither for themselves professionally nor for the communities. There is willingness from the side of the health care provider to have more information on ASGM health issues in order to enable them to afterwards raise awareness themselves.

According to the community members, health promotion activities have happened in the past for general health issues, for example, on vaccination, use of bednets, water and sanitation, environmental cleanliness, or HIV testing campaign. These were brought to them through community outreach activities, radio announcements or health care providers. The exposure to health promotion activities varied between the ASGM sites visited.

In Niger state, no site has received a health promotion activity related to ASGM health issues in particular.

In Osun state, one focus group (male leaders) mentioned that they received health promotion on safer mining. Similarly, there is one billboard that advertised safer mining targeted towards leaders of mining communities. There were also radio announcements on safer mining by the government.

Health system capacities and readiness

Capacities and readiness according to users

KIs perceived generally low capacities and readiness of the local health system to respond to ASGM-related issues, including mercury poisoning. Readiness to lead poisoning was reported high in Niger state because health care providers were trained therein in response to a previous lead poisoning outbreak. The insufficient training of health care providers with regards to major injuries and metal poisoning, the lack of appropriate infrastructure and lack of diagnostic and treatment capacities were perceived as limitations in readiness.

Table 15: Capacities and readiness according to key informants

Leading themes	Specific issues
(Training of) health care providers	■ There are no algorithms for identification and response to heavy metal poisoning ■ Index of suspicion is low and diagnosis is typically focused on infectious diseases ■ Most health care providers are not trained to recognize the symptoms of heavy metal poisoning ■ Health care provider may or may not recognize, be able to test and report for heavy metal poisoning
Health care services	■ Services are offered to the extent possible in the local health facilities ■ Health care providers and facilities are ready to receive any miner that needs them, but they are limited in responding to needs ■ They may not be able to respond to trauma cases that need surgical intervention, e.g. serious head injury ■ Miners seem to not get a diagnosis from the health care providers for the swollen leg symptoms ■ Health care providers generally refer fractures to traditional bone healers according to local norms ■ Capacities vary between facilities, e.g. in Galadimakogo, private facilities are perceived as more ready to response to ASGM health needs
Equipment, diagnostics and treatment	■ Health facilities are not well equipped: ● No mercury poisoning testing ● No cyanide poisoning testing ● No mercury chelator ● No cyanide antidotes ● Insufficient drugs, frequent stock outs ● Few inpatient beds ■ First aid is offered at the health facilities ■ Capacities to test and treat lead poisoning is higher
Reporting of (unknown) conditions	■ Reporting of (unknown) conditions by health care provider is a challenge; however, if such conditions are reported to higher levels, the health system can respond
Infrastructure	■ Infrastructure is insufficient, e.g. where a small health facility is serving a community that has grown due to ASGM activities
Availability of staff	■ Health care providers are not always (24/7) available, but this varies between facilities ■ Availability of health care providers is higher in private facilities (in Galadimakogo) ■ Health care providers do not always live in the ASGM community but can be called in case of emergencies
Experiences from lead poisoning outbreak	■ Local health care facilities were not able to detect the lead poisoning but MSF detected it ■ Once the cases were reported, the health system was able to respond to it ■ The health system is ready to recognize lead poisoning where health care providers have been sensitized during the outbreak

Participants of FGDs are generally satisfied with the services provided at the local health facilities. They are particularly satisfied with the health care providers. However, they recognize the health care providers' limitations in terms of diagnostic and treatment capacities. In particular, the availability of medical staff, in terms of qualification (e.g. medical doctor) and presence around the clock, was considered a barrier to readiness.

Table 16: Capacities and readiness according to focus group participants

Leading themes	Specific issues
Satisfaction	■ Both men and women are generally satisfied with the services they receive at the local health facilities, especially with regards to the health care providers' attitudes ■ Since they don't have money to buy the medicine, they can't blame the health care providers for not healing them
Health care services	■ Bone fractures cannot be handled in the facilities and therefore they go to traditional bone healers ■ Small surgery such as stitching cuts can be done in some facilities; for larger procedures, they need to go to a referral hospital
(Training of) health care providers	■ It is a limitation that there are no medical doctors at the health facilities ■ Availability of staff (24/7) is not always guaranteed
Equipment, diagnostics and treatment	■ Lack of equipment is a challenge in general ■ Many diagnostic tests are not available ■ Availability of drugs is a challenge in the health facilities and they often have to buy drugs at the chemist
Women's concerns	■ Home deliveries are very common ● No midwives at the health facility ● Assistance by "old women" ● They go to the health facility in case of complications ■ They receive rash treatment cream for vaginal itching; however, the itching comes back after a short while

Capacities and readiness according to providers

The perceptions of capacities and readiness of users' needs comparison to perceptions from health care providers. As shown in Table 17, most health care providers stated that they are only trained and equipped to respond to primary health care issues. Importantly, facilities at local level were all peripheral primary health care facilities and the most qualified staff was always community health extension workers (CHEWs) (see Table 19).

Table 17: Capacities and readiness according to providers at local level

Leading themes	Specific issues
Training of health care workers	■ No health care provider in the facilities visited has received any training on mining-related issues ■ Health care providers report "learning by doing"
Reporting	■ In one health facility in Galadimakogo, the health care provider asks about the professional background of a patient which is, however, only partly recorded in the register ■ Other facilities didn't report on patient background
Health care services	■ Bone fractures are usually immobilized in the primary health care facilities and afterwards either referred to a referral hospital or, according to local customs, people visit a bone healer ■ Often, miners directly seek health at another (bigger) facility especially since they return from work after the local public health facility has already closed (after 4 pm)
Equipment, diagnostics and treatment	■ Providers generally stated that they are ready to respond to primary health care issues although health care facilities face infrastructural and equipment challenges ■ One health care provider is confident that the facility and staff are ready to respond to injuries and mercury intoxications ■ Most health care providers consider themselves and the facilities not ready to respond to ASGM health needs beyond primary care

Table 18: Capacities and readiness according to providers at state level (Niger state)

Leading themes	Specific issues
Training of health care workers	■ There is specialist emergency and orthopaedic staff ■ No staff is trained specifically for mercury or cyanide intoxications
Health care services	■ Burns are cared for with first aid and immediately sent to another referral hospital in town (15 mins drive, IBB Specialist Hospital)
Equipment, diagnostics and treatment	■ Reaching a diagnosis for mercury poisoning can be difficult as there are often language difficulties ■ They do differential diagnosis, ask for history and run lab tests to the extent possible. Treat in case of a positive result. They do not have a way to conduct mercury specific test.

Lessons learnt with regards to the health facility assessments:

- It was challenging to identify a person at the level of the referral facility that (a) has enough time to participate and (b) would be the ideal respondent for all questions since the referral hospital is organised into specialized departments.
- The hospital medical chief of the referral hospital was designating a staff as respondent.
- It was challenging to obtain health statistics of the health facilities visited due to factors such as unavailability of the data at the time of the visit or health workers' unavailability to share statistics without formal approval of the relevant hierarchical level.

Health facility assessments

The HFA covering human resources, services, infrastructures, medical equipment, diagnostic capacities and drug availability at local level in the ASGM sites is shown in Table 19.

None of the four facilities visited (three in Niger and one in Osun state) had either a qualified medical doctor, nurse or midwife. Instead, human resources present were CHEWs who are trained to render services sometimes outside their area of expertise.

Services offered cover primary health care, including maternity. Inpatient services were offered in three out of four facilities. None of the facilities had a functional ambulance or equivalent. Importantly, none of the facilities had running water, which was a significant limitation for the proper and hygienic operation of the facility. None of the facilities had a laboratory, limiting the diagnostic abilities of the facilities.

Despite potential risk of high STD and HIV rates as seen in many ASGM contexts, HIV testing using rapid diagnostic tests (RDTs) was only offered in two of the facilities and care and treatment was offered in none. Tuberculosis (TB), non-communicable diseases (NCDs) and any serious traumas (electric shocks, injuries to the nervous system, fractures) were not cared for in any of the facilities; intensive care units or surgery wards did not exist.

Three out of four facilities reported that they do not handle chemical intoxications other than from pesticides. Chelators (DMPS, DMSA) for mercury intoxication or antidotes for cyanide intoxication were not available.

Health facilities did not routinely record the professional background of their patients (see also 5.5.2); hence, data on the proportion of miners among the overall number of patients were not available.

Anything that was beyond the scope of the health care provider and facility is referred to the respective referral hospitals. This includes mercury intoxications, which, according to health care providers, they have rarely encountered.

In summary, the health facilities at local level show limited readiness to recognize, diagnose and care for typical ASGM-related health risks and health issues such as traumas, chemical intoxication or STDs.

Table 19: Health facility assessment at local level

Health facility	BHC Galadima-kogo	Nyachesa Clinic and Maternity Home	BHC Kpmakpma	BHC Ibodi
A. Basic information				
State	Niger	Niger	Niger	Osun
Local Government Area	Shiroro	Shiroro	Shiroro	Atakunmosa West
ASGM site	Galadimakogo	Galadimakogo	Kpmakpma	Ibodi
Type of facility	Public	Private	Public	Public
Health facility level	Primary (basic) health care facility	N/A (private, primary health care)	Primary (basic) health care facility	Primary (basic) health care facility
Interview date	15.03.2019	17.03.2019	17.03.2019	27.03.2019
Duration of existence of health facility (in years)	Unknown	Unknown	15 years	Unknown
Catchment population of the health facility	2000	Unknown	4296	1982
B. Human resources availability: How many of the following human resources are available in your facility?				
Community health extension worker (CHEW)	3	1	2	4
Laboratory technician	0	1	0	0

Health facility	BHC Galadima-kogo	Nyachesa Clinic and Maternity Home	BHC Kpmakpma	BHC Ibodi
Other	Leprosy attendant (government employee, full-time)	2 student interns from Zaria School of Health Technology		
C. Which health services are offered in your facility?				
Outpatient services	Yes	Yes	Yes	Yes
Inpatient services	No, not routinely. Can make exceptions depending on conditions. There is another public health facility in the community that can receive inpatients.	Yes, 5 beds	Only for short-term observations, 4 beds	Yes, 3 beds
24-hour emergency services	Yes, however, was closed at time of visit and needed to be called.	Yes	No	Yes
Ambulance services (functioning 24/7)	No	No	No	No
Blood transfusion	No	No	No	No
Primary health care services	Yes	Yes	Yes	Yes
Neonatal resuscitation with bag and mask	No	No	Yes	Yes
Immunization services	Yes	No	Yes	Yes
HIV testing and counselling	Yes	No	No	Yes
Family planning services	Yes	Yes	Yes	Yes
Pharmacy	No	Yes	No	Yes
Intensive care	No	No	No	No
General surgery	No	No	No	No
Emergency trauma/ surgical care	Simple sutures	Simple sutures	Simple sutures	No
Radiology	No	No	No	No
Diagnosis, treatment and treatment supervision of TB	No	No	No	No
Diagnosis or management of non-communicable diseases, such as diabetes, cardiovascular disease, or chronic respiratory disease	They diagnose clinically but have to refer in case of suspicion	No	No	No

Health facility	BHC Galadima-kogo	Nyachesa Clinic and Maternity Home	BHC Kpmakpma	BHC Ibodi
Diagnosis of mercury exposure in whole blood or urine	No	No	No	No
Basic occupational health services	No	No	No	No
Trauma: Services in case of falls from height and explosion	Dislocations, factures: mobilizing and referral to Kutta (general hospital; 45 minutes). They stitch, mobilize a fracture.	Yes	Yes	Yes
Screening of neurological disorders	No	No	No	No
Screening of pneumoconiosis (interstitial lung diseases) through chest radiography or CT	No	No	No	No
Trauma: Electric shock	No	No	No	No
Trauma: Limb, bone fracture	No	Yes	No	No
Trauma: Brain injury	No	No	No	No
Trauma: Spinal injury	No	No	No	No
Trauma: Wounds caused by cutting, hitting and sticking	Yes, simple sutures	Yes, simple sutures	Yes, simple sutures	Yes
Trauma: Burns	Yes, minor	No	Yes, minor	Yes, minor
Chemical poisoning	Yes, only herbicides	Yes	No	No
D. Service usage				
Number of inpatient beds	0	4	4	3 (an additional 8 are non-functional)
Total number of inpatients (last year)	0	678 admissions (March – November 2018)	0	No data
What is the estimated percentage of ASM among total inpatients?	Less than 10%	No data	No data	No data
Total number of outpatients (last year)	N/A	1,190 (March – November 2018)	810	1,372
What is the percentage of ASM among total patients?	No data	No data	No data	No data

Health facility	BHC Galadima-kogo	Nyachesa Clinic and Maternity Home	BHC Kpmakpma	BHC Ibodi
Number of emergency calls for accidents (monthly average)	2-3 accidents per month, among people using transports (motorcycles, not miners)	No data	6	No data
Of which, accidents among ASM	No data	No data	No data	No data
E. Infrastructure				
Does this facility have a cellular phone or a private cellular phone that is supported by the facility?	Private only	Private only	Private only	Private only
Is there regular/reliable running water?	No	No	No	No
What is the source of electricity?	Yes, but frequent power cuts	Yes, national grid	Yes, national grid	Generator
Functioning refrigerator	Yes, for vaccines and icepacks	No	No	Yes
Does this facility have a functional ambulance or other vehicle for ambulance services?	No	No	No	No
Is fuel available for its functionality?	N/A	No	No	No
Functioning computer	No	No	No	No
Internet	No	No	No	No
F. Which medical equipment is available and functional in your health facility?				
Scale for adults	No	No	Yes	Yes
Digital blood pressure apparatus	Non-functional	Yes	No	No
Glucometer	No	No	No	Yes
Pulse oximeter	No	No	No	No
Oxygen concentrator	No	No	No	No
Oxygen cylinders	No	No	No	No
Oxygen delivery apparatus (functional)	No	No	No	No
Intravenous infusion kit/ IV sets	Yes	Yes	Yes	No
Anaesthesia equipment	No	No	No, but they use local anaesthetic agent for suturing	No

Health facility	BHC Galadima-kogo	Nyachesa Clinic and Maternity Home	BHC Kpmakpma	BHC Ibodi
Sterile gloves	Yes	No	Yes	Yes
Artificial breathing machine	No	No	No	No
Headrest	No	Yes	No	No
Aspirator (electric, pedal)	No	No	Yes	No
Pressure cooker for sterilization	No	No	No	No
G. Drug availability: Which drugs are available in your facility?				
ART (Zidovudine, Nevirapine, Efavirenz)	No	No	No	No
TB drugs (first-line)	No	No	No	No
TB drugs (second-line)	No	No	No	No
Oxytocin/Misoprostol	Yes	Yes	Yes	No
Penicillin/Ampicillin/ Benzadine	No	Yes	No	No
Erythromycin	No	Yes	No	No
Doxycycline	No	Yes	No	No
Antipyretics (anti-fever)	Yes	Yes	Yes	No
Diazepam/valium	Yes	Yes	No	No
Injectable magnesium sulphate or other anticonvulsant	No	No	No	No
Adrenaline injection	Yes	No	No	No
Anti-histamines	No	Yes	Yes	No
Thiazides	No	Yes	No	No
Salbutamol, Beclomethasone inhaler	No	No	No	No
Cefriaxone injection 1g (antibiotic injection)	No	Yes	No	No
Ciprofloxacin 500mg cap/ tab	No	Yes	No	No
Ko-trimoxazole suspension	No	Yes	Yes	No
Amoxicilin 500mg	Yes	Yes	No	No
Penicillin injection	No	Yes	No	No
Gentamycin injection	Yes	Yes	Yes	No
Diclofenac 50/75mg (Voltaren)	No	Yes	No	No

Health facility	BHC Galadima-kogo	Nyachesa Clinic and Maternity Home	BHC Kpmakpma	BHC Ibodi
Paracetamol	Yes	Yes	Yes	No
Sodium chloride injectable solution (NaCl)	No	No	No	No
Betamethasone/ Dexamethoasone injection	No	No	No	No
Chelators for mercury (DMPS, DMSA)	No	No	No	No
Antidotes for cyanide	No	No	No	No
H. Diagnostic availability				
Blood glucose level	No	No	No	Yes
Urine protein level	No	No	No	No
Urine ketone dipstick tests	No	No	No	No
Liver function tests	No	No	No	No
Renal function tests	No	No	No	No
Test for chemical poisoning	No	No	No	No
Blood chemistry analyser	No	No	No	No
Centrifuge	No	No	No	No
Haemoglobin testing	No	No	No	No
Full blood count and differential testing	No	No	No	No
ABO blood grouping testing	No	Yes	No	No
TB testing (microscopy or GeneXpert)	No	No	No	No
Gram stains	No	No	No	No
Light microscopy	No	No	No	No
Electrocardiogram (ECG)	No	No	No	No
I. Care and referral systems in place				
What is the procedure in a suspected case of mercury poisoning?	Referral. Diagnosis of mercury poisoning not possible but based on anamnesis, there can be a suspicion followed by a referral to Minna General Hospital.	Never seen a case, but all cases above their scope are referred to Shalom Nursing and Maternity Clinic.	It is above their scope. Would be referred to General Hospital Minna.	Referral to General Hospital, a copy of the referral form is kept in an exercise book in the facility.

Health facility	BHC Galadima-kogo	Nyachesa Clinic and Maternity Home	BHC Kpmakpma	BHC Ibodi
What is the (referral) procedure in case of burns?	Beyond first degree burns, referral	Fill out a referral form and give to relatives who arrange their own transport to the hospital.	Fill out a referral form and give to relatives who arrange their own transport to the hospital.	Referral to General Hospital, a copy of the referral form is kept in an exercise book in the facility.
What is the (referral) procedure in case of trauma (e.g. compound fracture, severe injury, etc.)?	Severe cases are referred	Fill out a referral form and give to relatives who arrange their own transport to the hospital.	Fill out a referral form and give to relatives who arrange their own transport to the hospital.	Referral to General Hospital, a copy of the referral form is kept in an exercise book in the facility.
Proximity of referral hospital (in hours by motorized transport)	~45 mins by motorbike (Kuta general hospital), ~1.5 h by car to Minna, IBB Specialist Hospital general hospital	35 mins	30 mins	20-30 mins
Transportation possibility to referral hospital offered by your facility	No	No	No	No
Cost of referral in local currency (both ways):	N3000-5000 (sometimes free)	N700	N700-3000 (entire car hire)	N2500

Health system priority needs

Among all health issues discussed, KIs and FGD participants were asked about perceived health system priority needs.

Table 20: Health system priority needs according to key informants

Leading themes	Specific issues
Awareness	■ Need to increase the awareness of the health issues related to ASGM ■ Need to raise awareness also on indirect exposures of mercury, e.g. through fish ■ Awareness is perceived as a first step for people to take precautions ■ Awareness should be created adapted to local context in local language ■ Intensify health education on risks of informal mining
(Training of) health care workers	■ Ministry of Health needs to conduct regular trainings of health care providers in ASGM states to recognize mercury poisoning ■ Disease Surveillance and Notification Officers need to be trained and encouraged to report symptoms of heavy metal poisoning
Infrastructure	■ Ministry of Health has a responsibility to build health infrastructure close to the ASGM sites ■ Access roads to ASGM sites will increase miners' (and communities') access to health care ■ Larger infrastructure is needed for the patient volume
Equipment, diagnostics and treatment	■ Need of sufficient drugs ■ Need for additional equipment, e.g. forceps, stitching material
Non-mining related	■ Combat open defecation ■ Effective waste management strategies ■ Provision of decent housing

The main priority need as noted by FGD participants was the availability of health care providers, including medical doctors, nurses and midwives (Table 21). In addition, availability of diagnostics and treatment, health education in communities and better access to health care for remote communities were perceived priority needs.

Besides the health system issues, participants of FGDs mentioned disease-related priorities such as having a midwife in the community, expanding immunization activities to adults, providing family planning opportunities or doing something about their eye problems.

Table 21: Health system priority needs according to focus group participants

Leading themes	Specific issues
(Training of) health care workers	■ Provide adequate and permanent health care personnel in the facilities, i.e. medical doctors, nurses, midwives
Equipment, diagnostics and treatment	■ Ensure sufficient medical supply for diagnosis and treatment ■ Free drugs at all times ■ Improve medical equipment
Awareness	■ Provide health education in communities
Infrastructure	■ Provide health infrastructures in villages that do not have health facilities yet and are remote
Non-mining related	■ Provision of safe drinking water ■ Provision of safe sanitation

Institutional and stakeholder aspects

Mining associations, sponsors

The organization of the ASGM activities varied among sites (see Table 4). KIs and FGD participants generally perceive associations as positive. A site that is organized by an association is less chaotic and less prone to conflicts. Community relations between the native population and incoming miners are better managed with an association. Associations also have the means to provide mining equipment.

In addition, most but not all associations are also involved in community development initiatives. For example, they sponsor the renovation of a school or the building of a health facility. Nevertheless, it is believed that associations and miners overall benefit more from ASGM than the general population.

A sponsor is typically a man who is paying a few persons that mine for him. The sponsor collects the final product and is responsible for selling it on the market. Sponsors did not report making any investments in community development.

There is a gender gap with regards to mining associations or sponsors as women (only practicing alluvial mining) never reported belonging to a mining association or having a sponsor.

Government

KIs and FGD participants reported that there are few government activities with regards to ASGM activities and related issues such as health. In all sites, there has never been a grassroots intervention such as this current study. It is believed that the government could do more for the ASGM communities. The enforcement of certain regulations, e.g. banning gold processing activities from the household or banning of minors working in ASGM, is considered insufficient at times.

However, it is recognized that the government/ Ministry of Federal Health has intervened successfully in the case of the lead poisoning crisis.

Inter-sectoral and inter-organizational collaboration

According to some KIs, there is inter-sectoral and inter-organizational collaborations, whilst for others, this collaboration is very limited and not visible in their daily activities. Similarly, some KIs feel that inter-sectoral and inter-organizational collaborations are indispensable to achieve positive changes in the ASGM sector, while others believe that every organization works towards its own goals.

It is recognized that actors are able to come together quickly and collaborate efficiently in cases of disasters as seen during the lead poisoning event.

The Minamata Convention and the associated development of the NAP has brought a new dynamic for inter-sectoral and inter-organizational collaborations. In fact, the Minamata Convention – overseen by the project steering committee – kicked off the inter-ministerial collaboration, including ministries of health, environment, water resources, agriculture, information, government agencies like Customs and Immigration, as well as the local government authorities. Furthermore, organizations such as WHO, UNIDO, MMSD, as well as academic institutions or NGOs are participating in the NAP process.

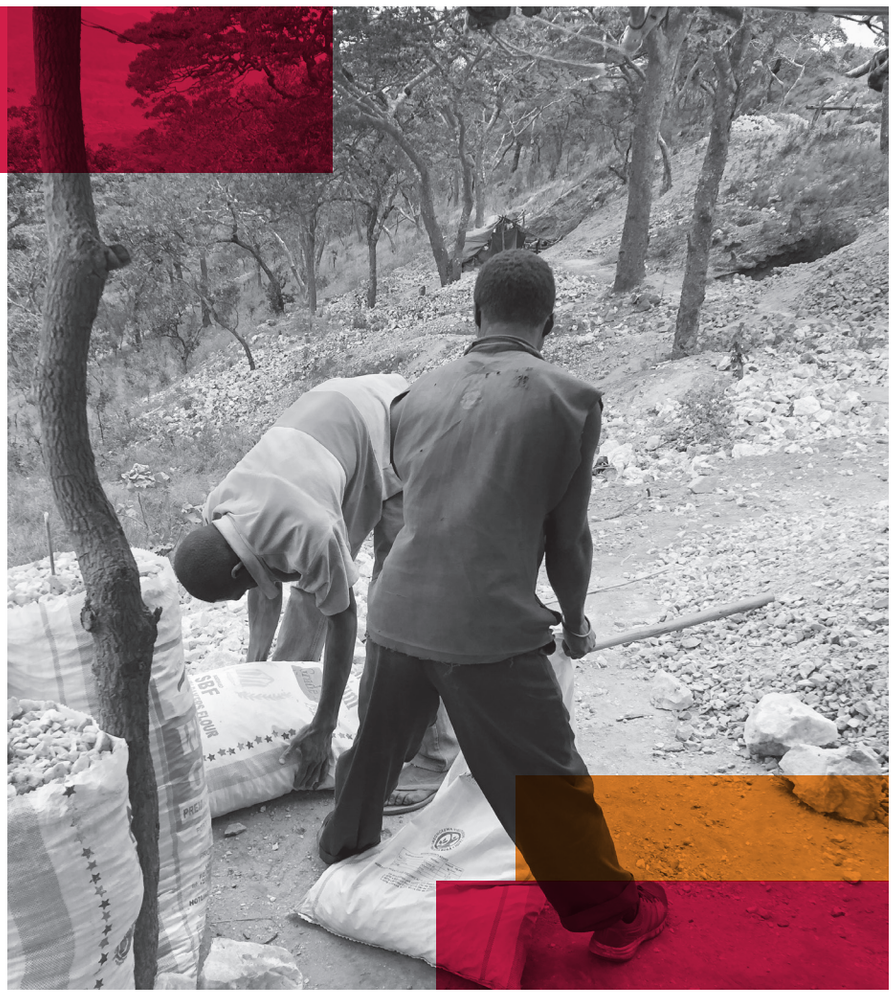
Community initiatives

KIs and FGD participants were asked what the ASGM communities could do themselves to improve their situation, especially their health situation. Propositions made are listed in Table 22 below. Apart from issues listed in the table, non-miners also mentioned that miners could save up income and use that money to invest in a less risky business to generate their income.

Table 22: Proposed community initiatives

Leading themes	Specific issues
Awareness raising	■ Miners could recognize the risks of their profession ■ Recognize the importance of health ■ Report incidences or unusual health events to authorities
Personal protective equipment	■ Obtain education on PPE ■ Invest in PPE ■ Use PPE
Safer techniques	■ Train themselves and acquire skills for safer mining techniques ■ Procurement of modern mining equipment that is safer
Common financial investments	■ Save money to build a health facility, equip it with staff ■ Pool money to buy drugs together ■ Create a community-based health insurance pool to fund their health care
Institutional opportunities	■ Form cooperations ■ Belong to a mining association
Social cohesion	■ Meet together and organize themselves ■ Meet together and inform each other on health issues and importance of self-care ■ Meet together and solve problems in the community ■ Invest in non-monetary community developments that will benefit the overall community, including health

6 Conclusions



> **Overall, risks were often recognized by miners but risks were almost always secondary to the economic gain (often equalled to survival since mining is believed to be the only economic and occupational opportunity).**

Conclusions

In this study, two ASGM sites in each of Niger and Osun states were visited in March 2019 for a rapid health situation assessment. The ASGM communities were diverse in their population composition from sites with mostly locals – where women and children are also working in mining – to sites with mostly non-locals. A myriad of environmental (e.g. environmental degradation, contamination of soil, water and air) and social challenges (e.g. low school enrolment, conflicts, lack of institutionalization of mining activities, in-migration, inequalities, disruption of social cohesion, poor living conditions, crime, drugs and prostitution) were described by participants of KIIs and FGDs.

Hypothesis 1: There are differences between priority health concerns reported by artisanal and small-scale gold miners and the local (general) population as reported by health care providers and as reflected in local health statistics (where possible).

- The health issues reported by artisanal and small-scale gold miners and by health care providers living and working in ASGM areas were largely concordant. However, miners and community members described a wider array of different symptoms as compared to health care providers, which might be explained by the fact that: (i) miners/community members do not go to the health facility for all health issues; (ii) the description of health issues might differ between community members and medical personnel; and (iii) the health care providers have limited capacities to recognize and diagnose all health symptoms correctly. However, there is a marked difference between health issues reported by miners as compared to other ASGM community members that do not mine. Miners more often reported issues linked to their occupational risks whilst community members more often described health issues characteristic for rural settings in sub-Saharan Africa.

Hypothesis 2: Artisanal and small-scale gold miners' understanding and perceptions of the dangers of ASGM activities do not compel them to adopt safer or more environmentally friendly practices and/or pursue another activity.

- Health risk perceptions in artisanal and small-scale gold miners identified occupational hazards (e.g. falls, carbon monoxide intoxication, accidents), environmental health hazards (e.g. unsafe sanitation, unsafe drinking water), vector-related hazards (e.g. animal bites, malaria), chemical hazards (e.g. uncertainty about effects from chemicals) and social and livelihood hazards (e.g. drugs, insufficient food). Moreover, miners mentioned fears such as being arrested for illegal activities, being attacked by herders or being affected by bad spirits. These fears and concerns were not raised by KIs but "living in fear" evidently poses a significant stress on miners. There was also a difference between miners from Niger and Osun states. A different pattern of health risks were reported in Niger state, more often linked to occupational and chemical hazards. In Osun state, most frequent health risks were related to environmental and vector-related hazards. Overall, risks were often recognized by miners but risks were almost always secondary to the economic gain (often equalled to survival since mining is believed to be the only economic and occupational opportunity). Consequently, PPE use was very low, with main reasons stated being inconvenience and affordability.

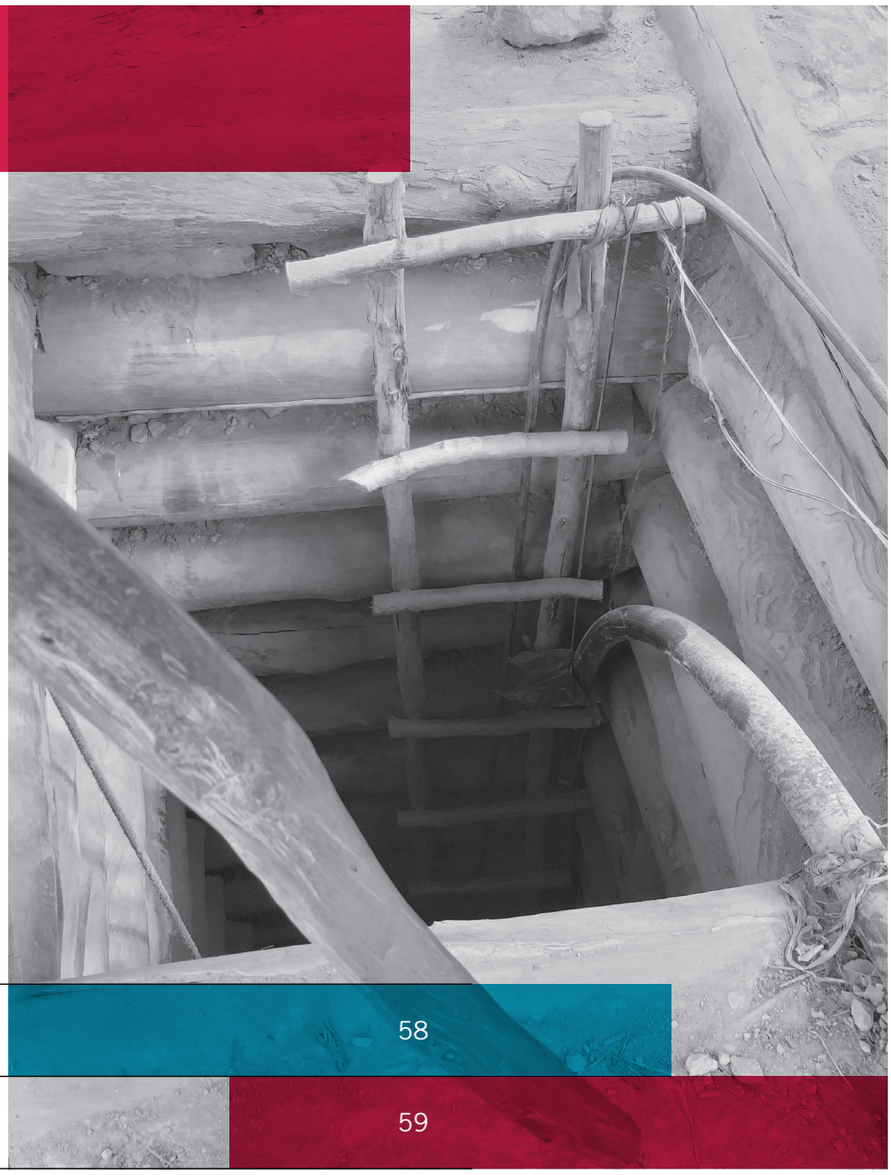
Hypothesis 3: Artisanal and small-scale gold miners, their families and the broader communities face challenges in accessing health care.

- Geographical access to health care varied between sites based on mere distance to the nearest health facility. In bigger locations, such as Galadimakogo, three health facilities (two public and one private) were serving the local population, whereas there was no facility in Illekki. Generally, the visited sites were covered by the peripheral, rural health system with limited medical staff (only CHEWs in all facilities visited), limited medical equipment, diagnostics and treatments and no ambulance services. Apart from these structural challenges, factors at individual level, including health seeking behaviour or affordability, influence access to health care. Non-local miners were considered disadvantaged in accessing health care for several reasons: (i) they do not have a social network that could potentially support them in accessing and paying for health care, (ii) general reluctance to access the health system in an unfamiliar environment, and (iii) potential language barriers that might exist with the health care provider.
- In Niger state, it was believed that most people, including miners, go to the health facility first to seek medical care. However, traditional medicine was used by part of the population and for certain health issues. In Osun state, traditional medicine was believed to be preferred over modern medicine and seeking health care at a health facility. HSB can vary strongly between different locations as it has a multitude of determining factors (e.g. individual, cultural and institutional). Overall, access to health care was considered limited mainly due to distance, including affordability for transport. In the presence of drug stores (also called chemists or pharmacies), there is a strong tendency to skip the health care provider and directly buy drugs and self-treat. For bone fractures, traditional bone healers are preferred over the local health facilities. Health facilities with limited capacities to manage bone fractures also refer patients to the traditional bone healers. Overall, HSB is lacking behind on what is considered "appropriate" HSB by WHO for structural and individual reasons.

Hypothesis 4: The health care system, in particular at the local level (i.e. near to ASGM communities) is insufficiently capacitated to address health problems specific to artisanal and small-scale gold miners. Regional and local differences in capacity might also exist.

- According to the HFA, the capacity and readiness of the health system to address health problems specific to artisanal and small-scale gold miners, their families and the broader communities is very limited in terms of staff with sufficient training, offered services, diagnostic abilities, treatment options and referral (including emergency) infrastructure. Community members were generally satisfied with the health care providers even though recognizing the health care providers' limitations in terms of diagnostic and treatment capacities. In particular, the availability of medical staff, in terms of qualification (e.g. medical doctor) and presence around the clock, was considered a barrier to readiness. In the view of most KIs, the local health system has low capacities and readiness to respond to ASGM-related issues, including mercury poisoning. The insufficient training of health care providers with regards to major injuries and metal poisoning, the lack of appropriate infrastructure and lack of diagnostic and treatment capacities were perceived as limitations in readiness. Most health care providers recognized that they are only trained and equipped to respond to primary health care issues, limiting them to respond to ASGM-related health issues such as severe injuries, STDs or chemical intoxications. Health structures at regional level are better trained and equipped for biomechanical health risks but were equally limited in responding to chemically induced health issues.

7 Recommendations



In this section:

Recommendations

A number of recommendations are formulated below at different levels of intervention, i.e. individual, community and institutional level.

This comprehensive but non-exhaustive list of recommendations can guide the selection of public health interventions within the NAP in Nigeria.

Recommendations at individual level

- Practice of alternative activities such as farming and fishing, especially during the rainy season, can represent an alternative income source, promote self-subsistence and avoid risks related to mining during the rainy season (e.g. collapsing pits, slippery terrain).
- The use of individual PPE is recommended to protect from injuries:
  - Solid shoes: Solid shoes (sneakers or more solid with profile) can protect from falls due to slipping and injuries due to rough ground and falling rocks as well as protect to some extent against animal bites (snakes, scorpions).
  - Hats, helmets: Headgear can protect from sun, diminish the impact of hits and minimize the risk of injuries due to falling rocks.
  - Protective glasses: Eye protection for rock breaking activities.
  - Gloves: Hand gloves when handling rocks and metal.
  - Masks: Protection from inhalation of dust and mercury fume.
- Adaptation of safer mining approaches to minimize risks:
  - Building of safer underground shafts through reinforcement of pits with (wooden) scaffolding or similar.
  - Ensuring oxygen supply in underground shafts.
  - Use of retorts when burning mercury amalgam.
  - Safe disposal of mercury and cyanide tailings.
- Environmental management and hygiene:
  - Avoid pollution of the environment through spilling mercury-contaminated water and tailings into rivers used by communities for drinking, irrigation and other activities. Instead, these could be discharged at a designated area only to minimize introduction into the environment and accumulation in the food chain.
  - Reclamation of land after use such as filling pits to avoid falls of humans and animals or stagnant water bodies that promote mosquito breeding.
  - Avoid open defecation at mining sites and environment. Practice defecation in designated sanitary latrines.
- Understand the importance and value of personal health:
  - Adapting a safer and healthier lifestyle (including safer mining behaviours, personal hygiene, avoidance of substance abuse, practicing safe sex, etc.) will avoid potential future health care costs.
  - Understanding that personal health has a value and a price. Minimal income savings will allow coverage of health care and avoid economic shocks.
  - Maintain high sense of security consciousness to avoid conflicts with host communities and avoid attacks from gold thieves and armed herders.

Importantly, individuals will face challenges to adapt safer mining measures if they find financial efforts (even if minimal) are inconvenient or more time-consuming than the existing standard. Therefore, miners do need support in adapting safer and healthier behaviours through awareness raising, training and facilitation (e.g. bringing the PPE closer to them).

Recommendations at community level

- Separate all mining activities, including amalgam burning activities, from the community residential areas.
- Organize mining activities along traditional structures and use existing, traditional mechanisms for land use management and conflict management.
- Organize mining activities through mining associations proven functional and beneficial by other ASGM communities.
- Balance farming and mining activities in communities to ensure self-subsistence and balanced demand and supply of agricultural products.
- Create secondary markets that also promote safer mining such as locally sold PPE.
- Engage in stakeholder exchanges with representatives from other sectors such as education, farming and fisheries, health and civil society. Cross-sector collaborations could help to tackle low school enrolment, low farming activity or health seeking behaviour, and can increase advocacy for social and health issues within ASGM communities.
- Promote community cohesion in the face of potential substantial in-migrant population.

Similar to individuals, communities will face challenges in implementing certain recommendations. Institutional frameworks will be determinants in the success in implementing community-based recommendations.

Recommendations at institutional level

- Expand on existing and well-functional local, traditional mechanisms on land use management and conflict management.
- Organize mining activities through mining associations by scaling existing association models in the country that have proven functional and beneficial by affected stakeholders, especially affected ASGM communities.
- Increase accountability of mining associations with regards to:
  - Health promotion activities, including use of PPE, safer mining techniques and health insurance schemes
  - Environmental hazard management
  - Provision of first aid for work-related accidents
  - Community engagement with regards to land use and conflict management
  - Corporate social responsibility activities that return a proportion of the financial gain back to the community, also benefiting the non-mining community members.
- Raise awareness on ASGM-related health issues at individual, community and institutional levels (including government, politicians and decision-makers, health sector, civil society sector and mining associations) through previously found effective means (e.g. radio, billboards, associations, NGOs, innovative technologies).
- Support individuals and communities in:
  - Using PPE
  - Adapting safer mining techniques, including seasonal mining
  - Diversifying economic opportunities in ASGM: farming, secondary markets.
- Facilitate and enhance stakeholder exchanges between sectors (mining, environment, health, welfare, education, agriculture, justice, etc.), civil society and ASGM communities. This will help facilitate tackling environmental, social, livelihood (including land use planning and conflict) and health issues related to ASGM.
- Create community-based health insurance schemes in collaboration with community leaders and mining associations.

- Provide all health facilities in ASGM areas, including referral facilities, with the training manual for health professionals entitled "Health Issues in Artisanal and Small-Scale Gold Mining" developed by the Artisanal Gold Council (AGC), UNIDO and GEF.
- Enhance investments in training of medical staff on ASGM-related health issues, provision of medical equipment, infrastructure, diagnostic and treatment capacities in local health facilities, and ensure effective referral systems to secondary and tertiary health structures.
- Promote appropriate HSB in ASGM communities where appropriate services are offered, including timely health seeking, avoidance of traditional medicine and self-treatment.
- Increase health promotion activities for health issues particular to ASGM communities such as substance abuse, STIs, water and sanitation, and occupational health, including on mercury and cyanide use.
- Legalising ASGM activities would help to:
  - Increase security in ASGM sites which are currently not covered by the executive legislative system (e.g. police). Increased security can reduce kidnapping and robberies in ASGM and increase miners' security.
  - Properly plan and execute ASGM activities to minimize conflicts and risks (environmental, social, health).
  - Facilitate the creation of secondary markets (e.g. mining equipment, PPE).
  - Decrease mental stress to miners due to fear from the legislative system, insecurity, conflicts and the notion of bad spirits related to ASGM.
  - Recognize ASGM communities officially as a group with specific health risks as a first step to addressing those risks appropriately.

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Annexes

Informed Consent – Key Informant

Informed consent: Assessment of public health challenges in artisanal and small-scale gold mining communities and the local health system's readiness to respond in Nigeria

My name is *[name]* and I am a Local Researcher from the Swiss Tropical and Public Health Institute (Swiss TPH). You are invited to participate in a study on health issues and behaviours in your community. The study is done in collaboration between the *[local partner]*, the World Health Organization (WHO) and the Swiss TPH.

The goal of the study is to assess the health situation of artisanal small-scale gold (ASGM) miners, their families and other community members and to find out about individuals' actions when they think to have a health problem or to be ill. We are also assessing the preparedness and capacities of the local health facilities and of their staff to respond to health needs of the ASGM communities. As a result of this study, recommendations for the Federal Ministry of Health are developed to improve the current health situation of ASGM communities.

The study activities include: (i) interviews with professionals working with the ASGM, health or environmental sectors, authorities, or individuals that are well-informed about the local communities; (ii) discussions with artisanal and small-scale gold miners, family members and other ASGM community members; and (iii) visits to the local health facilities to obtain information and to assess the facility and its staffs' capacities to work on ASGM-related health issues. You are invited to participate in an interview *[and a HFA]*. The interview will take about 30-45 minutes *[with HFA: 60-120 minutes]*.

Voluntary participation
Your participation in this study is entirely voluntary. You can freely decide whether or not to participate and you are free to stop the interview at any time without further obligations. If you decide to stop directly after the start of the interview, you will not lose any benefits and data collected will be kept confidential.

Risks
There are no physical risks linked with the present study. The current study has received all necessary approvals. You are not exposed to any harm or disadvantages. Importantly, the current study is a research study and all information you are sharing with us is kept strictly confidential and is only used for research objectives. The overall objective of the study is to understand the health challenges of ASGM miners and their communities and how the health system can best work together with the study community to address and respond to their health needs. The research team can however not foresee with certitude or control which actions the government will take as a follow-up of this study. To address some of these risks from the beginning of the project, the project team will work together with identified civil society organizations to collect valuable information on how to approach the communities and how to conduct the study in a way in which potential harms can be reduced.

Benefits
Your participation in this research will contribute to finding solutions on how to improve the health and health care situation of ASGM communities. In Nigeria, the study findings will be used to inform a wider political process. This political process is planned to support the government in taking steps to ensure the health and well-being of ASGM miners and their communities.

Remuneration for participation
Participation in this study does not involve any costs for you. You will not receive a salary for participating in this study, but you will receive a compensation in the form of a lunch meal if the interview takes place during the lunch break *[value of lunch: ___]*, and a cash payment to compensate for your transport costs *[value of lunch: ___]*. Even if you decide to no longer participate in this study, you will receive a partial compensation, based on your contribution.

Data management and confidentiality
The confidentiality of your data is important to the study team. You will be asked for your name and signature in order to ensure that you have understood all the information on the study and that the risks and benefits of your participation are clear. Your name will be noted on this form only. Your name and signature will not be shared or used any further. All data will be kept strictly private and will be stored on a secure server at the Swiss TPH, which is only accessible to the study team.

Community feedback
The study team holds the responsibility to share the results with you. They will be shared with the support of the Federal Ministry of Health and civil society organizations in community meetings or local events where the study took place. Educational and communication materials will be developed and made available to openly discuss the ASGM survey results.

Contact person: If you have any questions regarding this study, you may contact: *[enter contact]*

Certificate of Consent:
I have read and understood the Informed Consent form and I consent voluntarily to be a participant in this study by signing this form.

Place and date:	Place and date:
_____	_____
Participant full name:	Interviewer full name:
_____	_____
Participant signature of thumb print:	Interviewer signature:
_____	_____

Informed Consent – Focus Group Participants

Informed consent: Assessment of public health challenges in artisanal and small-scale gold mining communities and the local health system's readiness to respond in Nigeria

My name is *[name]* and I am a Local Researcher from the Swiss Tropical and Public Health Institute (Swiss TPH). You are invited to participate in a study on health issues and behaviours in your community. The study is done in collaboration between the *[local partner]*, the World Health Organization (WHO) and the Swiss TPH.

The goal of the study is to assess the health situation of artisanal small-scale gold (ASGM) miners, their families and other community members and to find out about individuals' actions when they think to have a health problem or to be ill. We are also assessing the preparedness and capacities of the local health facilities and of their staff to respond to health needs of the ASGM communities. As a result of this study, recommendations for the Federal Ministry of Health are developed to improve the current health situation of ASGM communities.

The study activities include: (i) interviews with professionals working with the ASGM, health or environmental sectors, authorities, or individuals that are well-informed about the local communities; (ii) discussions with artisanal and small-scale gold miners, family members and other ASGM community members; and (iii) visits to the local health facilities to obtain information and to assess the facility and its staffs' capacities to work on ASGM-related health issues. You are invited to participate in an interview *[and a HFA]*. The interview will take about 30-45 minutes *[with HFA: 60-120 minutes]*.

Voluntary participation
Your participation in this study is entirely voluntary. You can freely decide whether or not to participate and you are free to stop the interview at any time without further obligations. If you decide to stop directly after the start of the interview, you will not lose any benefits and data collected will be kept confidential.

Risks
There are no physical risks linked with the present study. The current study has received all necessary approvals. You are not exposed to any harm or disadvantages. Importantly, the current study is a research study and all information you are sharing with us is kept strictly confidential and is only used for research objectives. The overall objective of the study is to understand the health challenges of ASGM miners and their communities and how the health system can best work together with the study community to address and respond to their health needs. The research team can however not foresee with certitude or control which actions the government will take as a follow-up of this study. To address some of these risks from the beginning of the project, the project team will work together with identified civil society organizations to collect valuable information on how to approach the communities and how to conduct the study in a way in which potential harms can be reduced.

Benefits
Your participation in this research will contribute to finding solutions on how to improve the health and health care situation of ASGM communities. In Nigeria, the study findings will be used to inform a wider political process. This political process is planned to support the government in taking steps to ensure the health and well-being of ASGM miners and their communities.

Remuneration for participation
Participation in this study does not involve any costs for you. You will not receive a salary for participating in this study, but you will receive a compensation in the form of a lunch meal if the interview takes place during the lunch break *[value of lunch: ___]*, and a cash payment to compensate for your transport costs *[value of transport: ___]*. Even if you decide to no longer participate in this study, you will receive a partial compensation, based on your contribution.

Data management and confidentiality
The confidentiality of your data is important to the study team. You will be asked for your name and signature in order to ensure that you have understood all the information on the study and that the risks and benefits of your participation are clear. Your name will be noted on this form only. Your name and signature will not be shared or used any further. All data will be kept strictly private and will be stored on a secure server at the Swiss TPH, which is only accessible to the study team.

Community feedback
The study team holds the responsibility to share the results with you. They will be shared with the support of the Federal Ministry of Health and civil society organizations in community meetings or local events where the study took place. Educational and communication materials will be developed and made available to openly discuss the ASGM survey results.

Contact person: If you have any questions regarding this study, you may contact: *[enter contact]*

Certificate of Consent:
I have read and understood the Informed Consent form and I consent voluntarily to be a participant in this study by signing this form.

No.	Name of participant	Place and date	Signature or thumb print
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KII Questionnaire – Government official

A. KII information	
A1	Date of the KII:
A2	Place of the KII:
A3	Type of KII:
A4	Interviewee function/position:
A5	Start time:
A6	Interviewer name:
B. Basic information	
B1	How long have you been working in this function/position?
B2	Do you know since when ASGM is practiced in this country/district/region?
B3	What are the ASGM activities in this country/district/region you are aware of? (e.g. locations, type of mining)
C. Awareness	
C1	What are the environmental implications that ASGM had on local communities?
C2	What are the social implications that ASGM had on your local communities?
C3	What are the economic implications that ASGM had on your local communities?
C4	What are the health implications that ASGM had on your local communities?
D. Health system capacities and readiness	
D1	In your opinion, is the health system at its current state capable and ready to respond to ASGM-related health issues?
D2	In your opinion, do you feel that health care providers working in the local health facility/-ies are familiar and sufficiently trained to respond to ASGM-related health issues?
	If not, why not?
	If not, what should be done to improve the situation?
D3	In your opinion, do you think local health facilities are sufficiently equipped to respond to ASGM health issues?
	Probe for: Chelators for mercury, antidotes for or cyanide, surgery, ambulance, etc.?
D4	Where would you see the most urgent needs to improve the health systems capacities and readiness to respond to ASGM-related health issues?
	Who is responsible for taking steps for improvement?
D5	What could the artisanal and small-scale gold miners and community members do themselves to improve the situation related to ASGM-health issues?
E. Political level	
E1	In terms of health issues related to ASGM, what has been done in the past, what is currently being done and what is planned to be done in the future on the national- or sub-national level to address ASGM-related health issues?
	What is done in your district/region in particular?

E2	In your opinion, which sectors have to work together in order to address ASGM-related health issues?
	Is this inter-sectoral collaboration happening at the current stage?
	If yes, how and who are the players?
	If not, why not?
E3	Do you think ASGM and associated issues, including mercury use, are addressed with sufficient collaboration among public, private and civil society bodies?
	And among relevant ministries (e.g. ministry of mining, economy, environment, health, social welfare, etc.)?
F. End of the interview	
F1	Do you have any questions you want to ask me?
F2	Thank you for your participation.
F3	End time of the interview:
G. Observations by the interviewer	
G1	Other observations/notes from the interviewer:

KII Questionnaire – Health authority official

A. KII information	
A1	Date of the KII:
A2	Type of KII:
A3	Location of interview:
A4	Interviewee exact position/function:
A5	Start time:
A6	Interviewer name:
B. Basic information	
B1	How long have you been working in this district/region?
B2	Do you know since when ASGM is practiced in this district/region?
B3	What are the ASGM activities in this district/region you are aware of?
C. Awareness	
C1	What are the environmental implications that ASGM had on local communities?
C2	What are the social implications that ASGM had on your local communities?
C3	What are the economic implications that ASGM had on your local communities?
C4	What are the health implications that ASGM had on local communities?
	Also due to environmental, social and economic changes due to ASGM activities?
	Including health risks! Probe for mercury and cyanide exposure if not mentioned spontaneously.

C5	In your opinion, what are the biggest health risks for the general population (community)?
C6	In your opinion, which are the neglected, marginalized or stigmatized groups in the community and especially in terms of health and access to health care?
	Probe for artisanal and small-scale gold miners if not mentioned.
C7	In your opinion, do artisanal and small-scale gold miners always seek medical care or treatment when it would be indicated?
	If not, why not? What are the factors that determine whether they seek medical care or treatment or not?
	If not, what else do they do?
D. Health system capacities and readiness	
D1	In your opinion, is the health system at its current state capable and ready to respond to ASGM-related health issues?
D2	In your opinion, do you feel that health care providers working in the local health facility/-ies are familiar and sufficiently trained to respond to ASGM-related health issues?
	If not, why not?
	If not, what should be done to improve the situation?
D3	In your opinion, do you think local health facilities are sufficiently equipped to respond to ASGM health issues?
	Probe for: chelators for mercury, antidotes for cyanide, surgery, ambulance, etc.?
D4	Where would you see the most urgent needs to improve the health systems capacities and readiness to respond to ASGM-related health issues?
	Who is responsible for taking steps for improvement?
	What political commitment is needed from which body?
D5	What could the artisanal and small-scale gold miners and community members do themselves to improve the situation related to ASGM-health issues?
D6	In terms of health issues related to ASGM, what has been done in the past, what is currently being done and what is planned to be done in the future on the national- or sub-national level to address ASGM-related health issues?
	What is done in your district/region in particular?
D7	In your opinion, which sectors have to work together in order to address ASGM-related health issues?
	Is this inter-sectoral collaboration happening at the current stage?
	If yes, how and who are the players?
	If not, why not?
E. End of the interview	
E1	Do you have any questions you want to ask me?
E2	Thank you for your participation.
E3	End time of the interview:
F. Observations by the interviewer	
F1	Other observations/notes from the interviewer:

KII Questionnaire – Environmental (health) authority official

A. KII information	
A1	Date of the KII:
A2	Type of KII:
A3	Location and name of facility:
A4	Interviewee exact position/function:
A5	Start time:
A6	Interviewer name:
B. Basic information	
B1	How long have you been working in this district/region?
B2	Do you know since when ASGM is practiced in this district/region?
B3	What are the ASGM activities in this district/region you are aware of?
C. Environmental issues	
C1	What are the environmental implications that ASGM has on local communities?
C2	In this setting, what is the nature of the different environmental pollution pathways that are caused by ASGM (i.e. source-pathway-polluted environment)?
	Probe for mercury and cyanide exposure if not mentioned spontaneously.
C3	In this setting, what are the different direct and indirect ways of exposures to different community groups, i.e. artisanal and small-scale gold miners and other community members and children?
C4	Do you feel that local communities understand the concept of environmental pollution of mercury used in ASGM?
D. Socio-economic issues	
D1	What are the social implications that ASGM had on your local communities?
D2	What are the economic implications that ASGM had on your local communities?
E. Health issues	
E1	What are the health implications that ASGM had on local communities?
	Also due to environmental, social and economic changes due to ASGM activities?
	Including health risks! Probe for mercury and cyanide exposure if not mentioned spontaneously.
E2	In your opinion, what are the biggest health risks for the general population (community)?
E3	In your opinion, which are the neglected, marginalized or stigmatized groups in the community and especially in terms of health and access to health care?
	Probe for artisanal and small-scale gold miners if not mentioned.
E4	In your opinion, do artisanal and small-scale gold miners always seek medical care or treatment when it would be indicated?
	If not, why not? What are the factors that determine whether they seek medical care or treatment or not?
	If not, what else do they do?

E5	Do you feel that artisanal and small-scale gold miners understand the health consequences caused by environmental pollution of mercury used in ASGM?
	If not, why not?
E6	Do you feel that local communities understand the health consequences caused by environmental pollution of mercury used in ASGM?
	If not, why not?
E7	Do you feel that local health care providers understand the health consequences caused by environmental pollution of mercury used in ASGM?
	If not, why not?
E8	Where would you see an urgent need for action to address artisanal and small-scale gold miners health and the health of the broader community?
F. Public system capacities and readiness	
F1	In your opinion, is the health system at its current state capable and ready to respond to ASGM-related health issues?
F2	What could the artisanal and small-scale gold miners and community members do themselves to improve the situation related to ASGM-health issues?
F3	In terms of health issues related to ASGM, what has been done in the past, what is currently being done and what is planned to be done in the future on the national- or sub-national level to address ASGM-related health issues?
	What is done in your district/region in particular?
F4	In your opinion, which sectors have to work together in order to address ASGM-related health issues?
	Is this inter-sectoral collaboration happening at the current stage?
	If yes, how and who are the players?
	If not, why not?
F5	In the [Ministry of Environment], which environmental health issues (related to ASGM) are specifically addressed and how?
G. End of the interview	
G1	Do you have any questions you want to ask me?
G2	Thank you for your participation.
G3	End time of the interview:
H. Observations by the interviewer	
H1	Other observations/notes from the interviewer:

KII Questionnaire – Health care provider at local level

A. KII information	
A1	Date of the KII:
A2	Type of KII:
A3	Location and name of facility:
A4	Start time:
A5	Interviewer name:
B. Basic information	
B1	How long have you been working in this community/facility?
B2	Do you know since when ASGM is practiced in this community?
B3	What are the ASGM activities in this district you are aware of?
B4	In your health facility, do you ask, report or record the occupational backgrounds or accident history of your patients? In other words, would you know whether a patient is a miner or not?
	If yes, do you record it anywhere?
C. General health issues	
C1	What are the most common diseases or conditions in the communities of the district/region?
	In children?
	In women?
	In adults?
C2	What are the most common accidents and injuries in the communities of the district/region?
C3	In your opinion, which are the neglected, marginalized or stigmatized groups in the community and especially in terms of health and access to health care?
	Probe for artisanal and small-scale gold miners if not mentioned
D. Awareness of socio-ecnomic issues related to ASGM	
D1	What are the environmental implications that ASGM had on local communities?
D2	What are the social implications that ASGM had on your local communities?
D3	What are the economic implications that ASGM had on your local communities?
E. Awareness of health issues related to ASGM	
E1	What are the health implications that ASGM had on local communities?
	Also due to environmental, social and economic changes due to ASGM activities?
	Including health risks! Probe for mercury and cyanide exposure if not mentioned spontaneously.
E2	In your opinion, what are the biggest health risks for the general population (community)?
E3	In your opinion, what are the health risks for artisanal and small-scale gold miners in particular?

E4	In your opinion, do artisanal and small-scale gold miners always seek medical care or treatment when it would be indicated?
	If not, why not? What are the factors that determine whether they seek medical care or treatment or not?
	If not, what else do they do?
E5	According to your knowledge, do you know if artisanal and small-scale gold miners protect themselves against these health risks?
	If yes, how do they protect themselves?
	If not, why don't they protect themselves?
F. Health promotion information	
F1	Who is providing the health prevention information:
	for the general population (community)?
	For the ASGM communities in particular?
F2	Where is the health promotion information given? (e.g. media, at the facility, peers, leaders, etc.)
F3	In what form is the health promotion information given? (e.g. radio, mass campaigns Leaflets, brochures?)
F4	On which topics is the health promotion information given?
G. Health system and institutional support	
G1	Where would you see an urgent need for action to address artisanal and small-scale gold miners health and the health of the broader community?
G2	What could the artisanal and small-scale gold miners and community members do themselves to improve the situation related to ASGM-health issues?
H. Health facility assessment: capacities and readiness	
H1	Do you feel that you or others working at this health facility are familiar and sufficiently trained to respond to ASGM-related health issues?
H2	Do you think your facility is sufficiently equipped to respond to ASGM-related health issues?
H3	*Continue with separate HFA tool.*
I. End of the interview & HFA	
I1	Do you have any questions you want to ask me?
I2	Thank you for your participation.
I3	End time of the interview:
J. Observations by the interviewer	
J1	Other observations/notes from the interviewer:

KII Questionnaire – Health care provider at regional level

A. KII information	
A1	Date of the KII:
A2	Type of KII:
A3	Location and name of facility:
A4	Function/position of the KI:
A5	Start time:
A6	Interviewer name:
B. Basic information	
B1	How long have you been working in this facility?
B3	What are the ASGM activities in this district/region you are aware of?
B4	In your health facility, do you ask, report or record the occupational backgrounds or accident history of your patients? In other words, would you know whether a patient is a miner or not?
	If yes, do you record it anywhere?
	If yes, is this information transmitted to the next higher reporting level? (e.g. in a monthly report)
B5	Have you personally ever consulted a patient that was a miner?
	If yes, what was his/her health issue(s)?
	If many, what were the most common health issue(s)?
C. General health issues	
C1	What are the most common diseases or conditions in the communities of the district/region [all ages]?
C2	What are the most common accidents and injuries in the communities of the district/region?
C3	In your opinion, which are the neglected, marginalized or stigmatized groups in the community and especially in terms of health and access to health care?
D. Awareness of health issues related to ASGM	
D1	In your opinion, what are the health risks and health issues of artisanal and small-scale gold miners in particular?
D2	*If not mentioned earlier:*
	Are you aware that mercury is used in ASGM?
D3	Are you aware of the human health implications (short- and long-term effects) of mercury? What are they?
D3	According to your knowledge, do you know if artisanal and small-scale gold miners protect themselves against these health risks?
	If yes, how do they protect themselves?
	If not, why don't they protect themselves?
D4	Can you think of any barriers/obstacles that miners have to seek medical care?
D5	What could the artisanal and small-scale gold miners and community members do themselves to improve the situation related to ASGM-health issues?

E. Health facility assessment: capacities and readiness	
E1	Do you feel that you or others working at this health facility are familiar and sufficiently trained to respond to ASGM-related health issues?
E2	Do you think your facility is sufficiently equipped to respond to ASGM-related health issues?
E3	*Continue with separate HFA tool.*
F. End of the interview & HFA	
F1	Do you have any questions you want to ask me?
F2	Thank you for your participation.
F3	End time of the interview:
G. Observations by the interviewer	
G1	Other observations/notes from the interviewer:

KII Questionnaire – Traditional Community Leader

A. KII information	
A1	Date of the KII:
A2	Type of KII:
A3	Community / village / area / site:
A4	Interviewee code:
A5	Additional information on the function/position of the interviewee:
A6	Start time:
A7	Interviewer name:
B. Basic information	
B1	Since when do you live in this community / village / area / site?
B2	Do you know since when ASGM is practiced in this community / village / area / site?
B3	What are the environmental implications that ASGM had on your community?
B4	What are the social implications that ASGM had on your community?
B5	What are the economic implications that ASGM had on your community?
B6	For how many (out of how many) households in your community is ASGM the primary source of income?
	How many households in total?
	How many in ASGM?

C. Health system issues and health seeking behavior	
C1	In your opinion, what are currently the most common health problems in your community?
	All ages
	Men vs. women
	Children vs. young adults vs. older adults
	Artisanal and small-scale gold miners
C2	In case of these health problems, do the community members seek medical care or treatment?
	If not, why not?
	If yes, where? Why did you go there?
C3	Do the community members face obstacles/barriers to get health care services for these health problems?
	If yes, what kind of obstacles and why?
C4	If they go to the health facility, are they getting the health care services that they need for these health problems?
	If not, why not?
C5	What are the most common accidents and injuries in your community?
C6	In your opinion, what are currently the biggest health risks to ASGM community members which live in ASGM areas but are not directly involved in mining activities?
	Possible answers:
	Malaria
	Living conditions
	Mental disorders
	Substance abuse
	Dust
	Noise
	Malnutrition
	Vibration
	Heat and humidity
	Fatigue
	Sexually transmitted diseases
	None
	Getting ill due to contact with chemicals
	Biomechanical problems
	Other, specify:

C7	In your opinion, what are the biggest risks for the artisanal and small-scale gold miner's health while they are working?
	Possible answers:
	Falling into a hole Getting buried underground
	Getting malaria Exhaustion
	Dust Noise
	Malnutrition Vibration
	Heat and humidity Radiation
	Low oxygen levels Fatigue
	Explosives None
	Getting ill due to contact with chemicals
	Other, specify:
C8	In your opinion, which are the neglected, marginalized or stigmatized groups in the community and especially in terms of health and access to health care?
C9	What could the artisanal and small-scale gold miners and community members do themselves to improve the situation related to ASGM-health issues?
D. End of the interview	
D1	Do you have any questions you want to ask me?
D2	Thank you for your participation.
D3	End time of the interview:
E. Observations by the interviewer	
E1	Other observations/notes from the interviewer:

KII Questionnaire – ASGM community leader

A. KII information	
A1	Date of the KII:
A2	Type of KII:
A3	Community / village / area / site:
A4	Interviewee code:
A5	Additional information on the function/position of the interviewee:
	How many people work for him?
	Where does he sell?
	Does he buy mercury? Where?

A6	Start time:
A7	Interviewer name:
B. Basic information	
B1	Since when do you live/work in this community / village / area / site?
B2	Do you know since when ASGM is practiced in this community / village / area / site?
B3	What were the environmental implications that ASGM had on your community?
B4	What were the social implications that ASGM had on your community?
B5	What were the economic implications that ASGM had on your community?
C. Health system issues and health seeking behavior	
C1	In your opinion, what are currently the most common health problems in your community?
	All ages
	Men vs. women
	Children vs. young adults vs. older adults
	Artisanal and small-scale gold miners
C2	In case of these health problems, do the community members seek medical care or treatment?
	If not, why not?
	If yes, where? Why did you go there?
C3	Do the community members face obstacles/barriers to get health care services for these health problems?
	If yes, what kind of obstacles and why?
C4	If they go to the health facility, are they getting the health care services that they need for these health problems?
	If not, why not?
C5	What are the most common accidents and injuries in your community?
C6	In your opinion, what are the biggest risks for the artisanal and small-scale gold miner's health while they are working?
	Possible answers:
	Falling into a hole Getting buried underground
	Getting malaria Exhaustion
	Dust Noise
	Malnutrition Vibration
	Heat and humidity Radiation
	Low oxygen levels Fatigue
	Explosives None
	Getting ill due to contact with chemicals
	Other, specify:

C7	In your opinion, what is currently the biggest health risk to community members not directly involved in mining which live in ASGM areas but are not directly involved in mining activities?
	Possible answers:
	Malaria
	Living conditions
	Mental disorders
	Substance abuse
	Dust
	Noise
	Malnutrition
	Vibration
	Heat and humidity
	Fatigue
	Sexually transmitted diseases
	None
	Getting ill due to contact with chemicals
	Biomechanical problems
	Other, specify:
C8	In your opinion, which are the neglected, marginalized or stigmatized groups in the community and especially in terms of health and access to health care?
C9	What could the artisanal and small-scale gold miners and community members do themselves to improve the situation related to ASGM-health issues?
D. End of the interview	
D1	Do you have any questions you want to ask me?
D2	Thank you for your participation.
D3	End time of the interview:
E. Observations by the interviewer	
E1	Other observations/notes from the interviewer:

KII Questionnaire – Civil society organization representative

A. KII information	
A1	Location and date of the KII:
A2	Type of KII:
A3	Interviewee code:
A4	Interviewee position/function:
A5	Start time:
A6	Interviewer name:
B. Basic information	
B1	How long have you been working in this district/region?
B2	Since when is your organization active in this district/region?
B3	Do you know since when ASGM is practiced in this district/region?
B4	What are the ASGM activities in this district/region you are aware of?
C. Awareness	
C1	What are the environmental implications that ASGM had on local communities?
C2	What are the social implications that ASGM had on your local communities?
C3	What are the economic implications that ASGM had on your local communities?
C4	What are the health implications that ASGM had on your local communities?
	Probe for mercury and cyanide exposure if not mentioned spontaneously.
C5	In your opinion, what are the biggest health risks for the general population (community)?
	Probe for mercury and cyanide exposure if not mentioned spontaneously.
	Is mercury exposure also a problem for those not directly using it?
C6	In your opinion, which are the neglected, marginalized or stigmatized groups in the community?
	Especially in terms of health and access to health care?
	Probe for artisanal and small-scale gold miners if not mentioned.
D. Health system capacities	
D1	In your opinion, is the health system at its current state capable and ready to respond to ASGM-related health issues?
D2	What could the artisanal and small-scale gold miners and community members do themselves to improve the situation related to ASGM-health issues?
D3	In your opinion, which sectors / organizations / bodies have to work together in order to address ASGM-related health issues?
	Is this inter-sectoral collaboration happening at the current stage?
	If yes, how and who are the players?
	If not, why not?

E. Organisational activities?	
E1	In terms of health issues related to ASGM, what is/has your organisation (been) doing in the past, what is currently being done and what is planned to be done in the future?
	What, topics, frequency, partners, target groups, impact, etc.
E2	Have or are you specifically addressing the use of mercury?
F. End of the interview	
F1	Do you have any questions you want to ask me?
F2	Thank you for your participation.
F3	End time of the interview:
G. Observations by the interviewer	
G1	Other observations/notes from the interviewer:

FGD semi-structured questionnaire – Artisanal and small-scale gold miners

A. FGD information	
A1	Date of the FGD:
A2	Type of FGD:
A3	Number of participants (m:f):
A4	Age range of participants:
A5	Additional information on the participants (if any):
A6	Name of community:
A7	Start time:
A8	Interviewer name:
B. General health issues and health seeking behavior	
B1	In your opinion, what are currently your main health problems?
	This covers all health problems (related to mining or not)! Probe depending on answers you get. E.g. if they only mention mining-related health issues, probe for general, non-mining related issues once they finished for the mining-related ones. And the other way around.
B2	In case of these health problems, do you seek medical care or treatment?
	If not, why not?
	If yes, where? Why did you go there?
B3	What do you do in the event of an accident or injury?
	Which factors determine that behavior?

B4	Have you and your family ever faced obstacles/barriers to get health care services for these health problems?
	If yes, what kind of obstacles and why?
B5	What is your level of financial effort to get health care at the health facility, i.e. transport cost, services, treatment?
B6	If you go to the health facility, are you confident that you can get health care services that you need for these health problems?
	If not, why not?
C. Health risks, perceptions and behaviors in the ASGM working process	
C1	In your opinion, what is currently the biggest risk to your health while you're working?
	Possible answers:
	Falling into a hole underground Getting buried
	Getting malaria Exhaustion
	Rock chippings Noise
	Malnutrition Vibration
	Heat and humidity Radiation
	Low oxygen levels Fatigue
	Explosives None
	Getting ill due to contact with chemicals
	Inhaling vapors
	Contaminated waste materials
	Dust
	Other, specify:
C2	When you work, do you do anything to protect yourself from those risks?
	If yes, how do you protect yourself? Why do you protect yourself?
	Possible answers:
	Respirator Gloves
	Boots Long sleeves
	Protective glasses Mask (simple)
	Other, specify:
	If no, why not?
D. Health promotion activities	
D1	Was there ever any health promotion given to you in this community?
	On any kind of health topic?
	On ASGM health issues?
D2	Where do you get health promotion information? (e.g. media, health sector, peers, leaders, etc.)
D3	In what form to you get health promotion information? (e.g. radio, mass campaigns Leaflets, brochures? (by whom), etc.)
D4	Who or what is providing the health prevention information? (e.g. NGOs, health care providers, private sector, government)

D5	Was the health promotion information given to you useful?
	If not, what would be useful?
D6	How can the health sector better address your health needs?
E. Social, demographic and economic information	
Ask the following questions by hand raising if answer applies!	
E1	Are you born in this region /district?
	Total of participants born in this region/district:
	Where are others from?
E2	*Total of participants that are not [country nationals]?*
	Where are they from?
E3	Have you been living here for more than 5 years?
	Total of participants that have been living here for more than 5 years:
E4	Are you here with your family?
	Total of participants that are here with their families:
E5	Have you completed primary school?
	Total of participants that have completed primary school:
E6	Are you working in ASGM the whole year?
	Total of participants that are working in ASGM the whole year:
E7	Are you working in ASGM on a seasonal basis?
	Total of participants that are working in ASGM on a seasonal basis:
E8	Is ASGM your primary source of income?
	Total of participants for whom ASGM is the primary source of income:
E9	Do you have an employer or are you part of an ASGM association?
E10	Do you have a sponsor?
E11	What are your principal activities while working in ASGM?
	Hunting
	Sampling
	Crushing, milling:
	Washing (incl. alluvial mining):
	Chemical use:
	Smelting, burning (mercury):
	Selling:
	Cyanidation:
	Mercury trading (buying):

F. End of the FGD	
F1	Do you have any questions you want to ask us?
F2	Thank you for your attention and participation.
F3	End time of the FDG:
G. Observations by the interviewers	
G1	Other observations/notes from the interviewer:
G2	Other observations/notes from the community health worker:

FGD semi-structured questionnaire – Family members of artisanal and small-scale gold miners

A. FGD information	
A1	Date of the FGD:
A2	Type of FGD:
A3	Number of participants (m:f):
A4	Age range of participants:
A5	Additional information on the group members (if any):
A6	Name of community:
A7	Start time:
A8	Interviewer name:
B. Social, demographic and economic information	
Ask the following questions by hand raising if answer applies!	
B1	Were you born in this region /district?
	Total of participants born in this region/district:
B2	*Total of participants that are not [country nationals]?*
B3	Have you been living here for more than 5 years?
	Total of participants that have been living here for more than 5 years:
B4	Are you here with your family?
	Total of participants that are here with their families:
B5	Do you have any children here?
	Total of participants that have children here:

B6	Have you completed primary school?
	Total of participants that have completed primary school:
B7	Is ASGM your primary souce of income in the household?
	Total of participants for whom ASGM is the primary source of income:
C. General health issues and health seeking behavior	
C1	In your opinion, what are currently your main health problems?
	This covers all health problems (related to mining or not)! Probe depending on answers you get. E.g. if they only mention mining-related health issues, probe for general, non-mining related issues once they finished for the mining-related ones. And the other way around. Try to separate in the written answer if possible.
C2	In case of these health problems, do you seek medical care or treatment?
	If not, why not?
	If yes, where? Why did you go there?
C3	Have you and your family ever faced obstacles/barriers to get health care services for these health problems?
	If yes, what kind of obstacles and why?
C4	What is your level of financial effort to get health care at the health facility, i.e. transport cost, services, treatment?
C5	If you go to the health facility, are you confident that you can get health care services that you need for these health problems?
	If not, why not?
C6	Are accidents and injuries common in your community?
	If yes, what are the most common accidents?
C7	What do you do in the event of an accident or injury?
	Which factors determine that behavior?
D. Health risks, perceptions and behaviors in the ASGM working process	
D1	In your opinion, do you think you are exposed to any health risks particularly caused the ASGM activities that are on-going in your community?
	If yes, which particular health risks?
	If yes, how do you protect yourself from these health risks?
	Do probe for mercury and cyanide if not mentioned spontanously.
D2	Do miners do risky work?
	Do they protect themselves?
	If not, why do you think they don't protect themselves?
D3	What could miners do themselves, to protect themselves?
E. Health promotion activities	
E1	Where do you get health promotion information? (e.g. media, health sector, peers, leaders, etc.)
	On any kind of health topic?
	On ASGM health issues?
E2	In what form to you get health promotion information? (e.g. radio, mass campaigns Leaflets, brochures? (by whom), etc.)

E3	Who or what is providing the health prevention information? (e.g. NGOs, health care providers, private sector, government)
E4	Was the health promotion information given to you useful?
	If not, what would be useful?
F. End of the FGD	
F1	How can the health sector better address your health needs?
F2	Do you have any questions you want to ask us?
F3	Thank you for your attention and participation.
F4	End time of the FDG:
G. Observations by the interviewers	
G1	Other observations/notes from the interviewer:
G2	Other observations/notes from the community health worker:

FGD semi-structured questionnaire – ASGM community members (non-mining)

A. FGD information	
A1	Date of the FGD:
A2	Type of FGD:
A3	Number of participants (m:f):
A4	Age range of participants:
A5	Additional information on the participants (if any):
A6	Name of community:
A7	Start time:
A8	Interviewer name:
B. Social, demographic and economic information	
Ask the following questions by hand raising if answer applies!	
B1	Were you born in this region /district?
	Total of participants born in this region/district:
B2	*Total of participants that are not [country nationals]?*
B3	Have you been living here for more than 5 years?
	Total of participants that have been living here for more than 5 years:

B4	Are you here with your family?
	Total of participants that are here with their families:
B5	Do you have any children here?
	Total of participants that have children here:
B6	Have you completed primary school?
	Total of participants that have completed primary school:
C. General health issues and health seeking behavior	
C1	In your opinion, what are currently your main health problems?
	This covers all health problems (related to mining or not)! Probe depending on answers you get.
	If they do not mention mining-related issues, ask them about the riss miners might have to their knowledge.
C2	In case of these health problems, do you seek medical care or treatment?
	If not, why not?
	If yes, where? Why did you go there?
C3	Have you and your family ever faced obstacles/barriers to get health care services for these health problems?
	If yes, what kind of obstacles and why?
C4	What is your level of financial effort to get health care at the health facility, i.e. transport cost, services, treatment?
C5	If you go to the health facility, are you confident that you can get health care services that you need for these health problems?
	If not, why not?
C6	Are accidents and injuries common in your community?
	If yes, what are the most common accidents?
C7	What do you do in the event of an accident or injury?
	Which factors determine that behavior?
D. Health risks, perceptions and behaviors in the ASGM working process	
D1	In your opinion, do you think you are exposed to any health risks particularly caused the ASGM activities that are on-going in your community?
	If yes, which particular health risks?
	If yes, how do you protect yourself from these health risks?
	Do probe for mercury and cyanide if not mentioned spontanously.
D2	Do miners do risky work?
	Do they protect themselves?
	If not, why do you think they don't protect themselves?
D3	What could miners do themselves, to protect themselves?
E. Health promotion activities	
E1	Where do you get health promotion information? (e.g. media, health sector, peers, leaders, etc.)
E2	In what form to you get health promotion information? (e.g. radio, mass campaigns Leaflets, brochures? (by whom), etc.)

E3	Who or what is providing the health prevention information? (e.g. NGOs, health care providers, private sector, government)
E4	On which topics did you ever get health promotion information in your community?
	Did you ever receive health promotion information on ASGM-related health issues?
E5	Was the health promotion information given to you useful?
	If not, what would be useful?
F. End of the FGD	
F1	How can the health sector better address your health needs?
F2	Do you have any questions you want to ask us?
F3	Thank you for your attention and participation.
F4	End time of the FDG:
G. Observations by the interviewers	
G1	Other observations/notes from the interviewer:
G2	Other observations/notes from the community health worker:

Health facility assessment questionnaire

See Table 19.

Observational tool – ASGM site

Date of ASGM site visit	
Name, location of ASGM site	
Approx. pop. size of ASGM site	
Coordinates	
Types of gold mining	☐ Hard rock ☐ Alluvial (river sediments) ☐ Other, specify:
Nature and scale of gold mining (e.g. if rudimentary, or if use some equipment in specific points in the process)	
Seasonal nature of gold mining activities	☐ Annual, all-year round ☐ Seasonal: _____ ☐ Other, specify:

Organizational structures of the ASGM site	☐ None ☐ Organized, specify: ☐ Do not know Community (land owner) involvement:
Demographics of workers (add approximations if possible)	☐ Males ☐ Females ☐ Children
Information on migration patterns (if any) ■ Extent of in-migration ■ Origin of migrants ■ Seasonality of migration, if applicable	
Where are the different work processes done? *Sketch out the area or narrative. Importantly, where is the amalgam smelting done? On ASGM site, in community, etc.?* *Where are the tailings released? Is there a nearby river?*	
Types of activities observed	☐ Extraction ☐ Tunnelling ☐ Drilling ☐ Dredging ☐ Crushing ☐ Milling ☐ Sluices ☐ Centrifugation ☐ Vibrating tables ☐ Gravity concentration ☐ Whole ore amalgamation ☐ Concentrate amalgamation ☐ Open mercury burning ☐ Protected mercury burning (e.g. use of retorts) ☐ Refining ☐ Carrying loads ☐ Sifting ☐ Excavation ☐ Shanking
Physical hazards observed	☐ Noisy tools ☐ Blasting ☐ Drilling ☐ Crushing ☐ Ore processing ☐ Underground mining ☐ Confined spaces ☐ Contact with explosives ☐ Contact with live wires ☐ Air pollution (petrol burning) ☐ Contact with faulty electronic equipment ☐ Dust ☐ Vibration ☐ Waste burning ☐ Exposure to sunlight (UV) ☐ Other, specify:
Mechanical hazards observed	☐ Heavy lifting ☐ Awkward postures ☐ Work using non-mechanised tools ☐ Repetitive work ☐ Use of inappropriate equipment ☐ Use of heavy equipment ☐ Explosions ☐ Other, specify:
Chemical hazards observed	☐ Elemental mercury ☐ Cyanide ☐ Pesticides ☐ Carbon monoxide ☐ Other, specify:

Biological hazards observed	☐ Vectors ☐ Stagnant waters ☐ Other, specify:
Psychosocial hazards observed	☐ Unsafe working conditions ☐ Cramped living conditions ☐ Poor living and working conditions ☐ Other, specify:
Protective measures in use observed *Which?*	☐ Use of PPEs ☐ Helmets ☐ Gloves ☐ Other: ☐ Boots
Additional information	


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