

# Rapid Health Situation Assessment Report

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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

May 2020





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# Abbreviations

<b>AGC</b>	Artisinal Gold Council
<b>ASGM</b>	Artisanal and Small-scale Gold Mining
<b>ASM</b>	Artisanal and Small-scale Miner
<b>CHPS</b>	Community-Based Health Planning and Services
<b>CSO</b>	Civil Society Organization
<b>DHIMS</b>	District Health Information Management System
<b>DMTDP</b>	District Medium Term Development Plan
<b>EPA</b>	Environmental Protection Agency
<b>ERC</b>	Ethics Review Committee
<b>FGD</b>	Focus Group Discussion
<b>GEF</b>	Global Environment Facility
<b>GHS-ERC</b>	Ghana Health Service Ethical Review Committee
<b>GNASSM</b>	Ghana National Association of Small Scale Miners
<b>HFA</b>	Health Facility Assessment
<b>HQ</b>	Hazard Quotient
<b>HSA</b>	Health Situation Assessment
<b>KI</b>	Key Informant
<b>KII</b>	Key Informant Interview
<b>MESTI</b>	Ministry of Environment, Science, Technology and Innovation
<b>MoH</b>	Ministry of Health
<b>NAP</b>	National Action Plan
<b>NHIS</b>	National Health Insurance Scheme
<b>OPD</b>	Outpatient Department
<b>PPE</b>	Personal Protective Equipment
<b>RTA</b>	Road Traffic Accident
<b>SARA</b>	Service Availability and Readiness Assessment
<b>STI</b>	Sexually Transmitted Infections
<b>Swiss TPH</b>	Swiss Tropical and Public Health Institute
<b>TB</b>	Tuberculosis
<b>UNIDO</b>	United Nations Industrial Organization
<b>WHO</b>	World Health Organization



# 1 Background



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# 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 labor-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 (3).

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 [STI]), 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 1,600 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. The 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 (HSA) was to generate initial evidence and information regarding priority health concerns of artisanal and small-scale gold miners (ASM) 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 HSA 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 ASM 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 Ghana, Mozambique and Nigeria 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 HSA is to identify miners' health seeking behavior; perceptions of risks associated with ASGM held by miners, their families, and community members, as well as to assess the relative readiness and capacity of local health systems to respond to ASGM-related health issues.

In this report, we present the results of the HSA conducted in Ghana.

## Political linkages and political involvement in Ghana

Ghana 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. Ghana is therefore obligated to develop a NAP which includes a public health strategy on the exposure to mercury of ASM 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 Ghana. 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

## BACKGROUND

respective health ministries) the health components of the NAP activities being implemented in each country.

UNIDO and the Ghana Government have designated the Ministry of Environment, Science, Technology and Innovation (MESTI) to be the main national coordinating and executing agency of this project. MESTI is the administrative authority on environmental protection and the designated national authority on the Minamata Convention on Mercury.

The Environmental Protection Agency (EPA), the institution responsible for the activities related to ASGM in Ghana, 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 Ministry of Health (MoH), is the executing agency for the health components of the project.

UNIDO is the GEF implementing agency 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 results of the objectives will further inform the awareness and health protection activities specifically tailored to local needs. ”

# 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 by artisanal and small-scale gold miners, their families and the broader communities is very context specific.

The HSAs are conducted/piloted in Ghana, Mozambique and Nigeria, which have the overall aim of informing the development of the public health component of the NAP by the relevant government agencies (e.g. health, environment, mining and other). For the Ghanaian context, the present assessment sought to describe the scope of ASGM-related public health problems, characterize miners' health seeking behaviors, 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 HSA 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 does 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 behavior 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:

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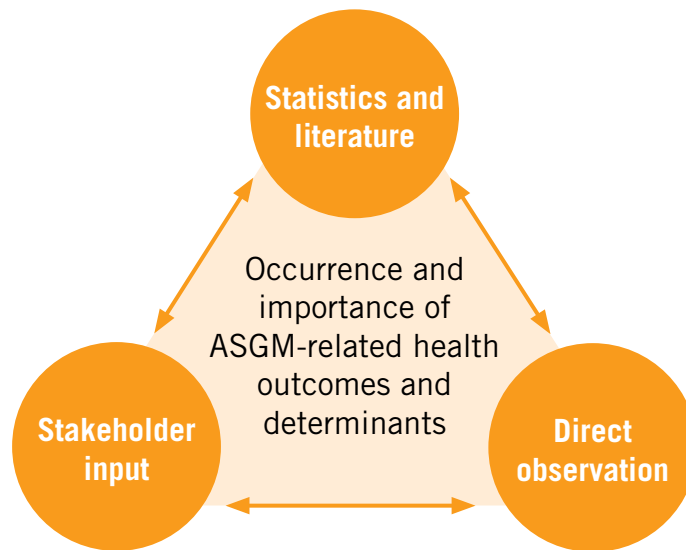
# Methodology

## Study design

This observational study applied a cross-sectional design using a mixed-method approach. To examine the interface between ASM 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 HSA (10).

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



## Study sites

In Ghana, two sites with a long history of ASGM activities were selected for this rapid HSA. The first site in Birim-North District is located in the Eastern

Region about three hours from the national capital, Accra. The second site was in Tarkwa-Nsuaem Municipality in the Western Region (see Table 1).

**Table 1:** Selected ASGM sites

Region/District	District capital	Regional capital	Industrial mines
Eastern Region/ Birim-North District	New Abirem	Koforidua	Newmont Akyem
Western Region/ Tarkwa-Nsuaem Municipality	Tarkwa	Sekondi-Takoradi	Gold Fields Tarkwa, AngloGold Ashanti Iduapriem

# Study population and sample size

In each ASGM site, key informant interviews (KIIs), focus group discussions (FGDs) and HFAs were conducted. For the FGDs four mining communities (Nyafoaman, Noyem, Amenam and Nwinso) were

visited in Birim-North District and two (Kanianko and Kedadwen) in Tarkwa-Nsuaem Municipality. 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
<ul style="list-style-type: none"> <li>■ Local government officials</li> <li>■ Local health authorities</li> <li>■ Local environmental (health) authorities</li> <li>■ Health care providers at peripheral health facilities in ASGM areas</li> <li>■ Community leaders</li> <li>■ ASGM community leaders</li> <li>■ Civil society organizations working on ASGM-related issues</li> </ul>	<ul style="list-style-type: none"> <li>■ Artisanal and small-scale gold miners</li> <li>■ Family members of miners</li> <li>■ Community members in surrounding communities of ASGM sites (excluding leaders)</li> <li>■ Potentially other relevant community groups that were identified at the local level (e.g. community health workers)</li> </ul>	<ul style="list-style-type: none"> <li>■ Nearest public, primary health care facilities serving ASGM communities</li> <li>■ Referral hospital for the primary health care facilities</li> </ul>

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

Participants for the FGDs were recruited by the investigators with the help primarily of local partners in the ASGM sites in the associated communities (executive members of ASGM associations) and district assembly representatives. The local partners were instructed to guarantee a random selection

of participants in terms of occupation (e.g. digging ore, washing ore, working with mercury, etc.) with different demographic characteristics (i.e. age and sex). If necessary, the investigators intervened to ensure proper allocation of participants to their respective group. FGDs comprised 8-10 participants, allowing for a participative discussion lasting between 45-90 minutes. Both gender-specific and mixed-gender FGDs were conducted. After reviewing the responses of the initial FGDs additional groups with specific demographic characteristics (e.g. elderly women or female miners) were recruited.

Ghana's health delivery system is a three-tier system, divided into national, regional and district-level. On the district-level, the system further distinguishes

between Community-Based Health Planning and Services (CHPS) zone (CHPS compounds), sub-district (health centres, clinics) and district (district hospitals). In this study, the public, primary health care facilities (CHPS compounds and health centres/ community clinics) serving the ASGM community in each site were visited. Additionally, the first-level referral health facility for the primary health care facilities was visited in order to include the facility where potentially more complicated cases would

be handled (thus constituting an important link in the referral system for ASGM). The respondents were invited to a KII. At the same time, a HFA was conducted to assess the capacity of the facilities to respond to ASGM-related health issues.

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

Prior to the selection of the ASGM sites, community sensitization activities were conducted. The Swiss Tropical and Public Health Institute (Swiss TPH) together with WHO and support from the MoH developed a plan to spearhead this activity. This plan was to: (i) inform the community about the piloting project and involve community leaders and others; (ii) explain 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) create a space for continuous exchange to engage with different community groups through interviews and focus group discussions with their consent; (iv) describe roles and responsibilities of different local stakeholders, e.g. community-based organizations and civil society organizations (CSO) as entry point for a participatory approach to engage with the community; (v) convey how data will be gathered and used, safeguarding full confidentiality; and (vi) present strategies for disseminating the findings of the project.

The project team worked closely with the association of miners, the Ghana National Association of Small Scale Miners (GNASSM), and Friends of the

Nation, a CSO working in mining communities, as entry point to ensure a participatory approach. Due to the familiarity of these two associations/ groups and previous legitimate engagement with the communities, their members at the local level were known and readily accepted. They assisted the study team to liaise with community leaders in various communities to ensure effective stakeholder involvement. They 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. Community leaders were sensitized, explaining the whole process of the survey and the need for the active engagement of the community and the target groups.

The district assemblies were involved to a smaller extent in helping the team liaise with community leaders. This limitation of official involvement was due to the ban by government on illegal mining which had generated some level of mistrust between the mining communities and the assemblies.

# 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 which are described in the following sections. The search terms “*artisanal gold mining AND Ghana*” were entered into three databases: Web of Science, PubMed and CINAHL. All articles related to artisanal mining and health in Ghana were included in the review.

## Key informant interviews

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

The total number of KII (in the range of 9-15 per ASGM site) was determined at the time of the study when the investigator felt that all questions asked in the survey tools had been answered with sufficient depth representing all population groups of interests.

## 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. Care was taken to ensure that all FGD participants could express their thoughts and opinions.

Where possible the questionnaires were translated and administered in the local languages. If the interviewer was not fluent in the local language a local partner facilitated the administration of the FGD. Whilst the interviewer was steering the discussion, the local partner supported the translations.

The total number of FGDs (in the range of 5-11 per ASGM site) was determined at the time of the study when the investigators felt that all questions asked in the survey tools had been answered with sufficient depth representing all population groups of interests.

## Health facility assessment

At the level of health facilities (in the range of 4-5 per ASGM site), a HFA was conducted to assess the capacities and the readiness of the health system to provide health services. This covered for example human resource capacities, protocols in place, availability and functionality of equipment and diagnostics, availability of medicines and infection control measures in place.

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 (4). These included the capacity to deal with poisonings, in particular mercury and cyanide poisoning, availability of basic occupational health services, and capacity to deal with trauma including burns. Basic laboratory capacity and/or referral protocols for dealing with ASGM-related health issues are available. The HFA tool is included in the annex.

## 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 electronically. In case of hand notes, answers were subsequently entered into the digital tools. KIIs and FGDs were neither recorded on tape nor 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 associated with any of the data collected, including photographs. No names and signatures were shared or used. All information in any documentation and dissemination of the research findings or photographs were rendered anonymous.

## 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, an agreement was signed, stating 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;
- 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 Ghana:
  - 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.

As per contractual agreement between WHO and UNIDO “All intellectual property rights related to the activities will belong to the recipient agency. The contributing agency and, if applicable, the relevant program Government will enjoy a perpetual, royalty-free, non-exclusive and non-transferable license.” Hence, UNIDO is not the executing agency for the research and does not own the data.

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 with the present study protocol as approved by the Ethics Review Committee of the Ghana Health Service and with principles enunciated in the Council for International Organizations of Medical Sciences (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 form 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 will be followed in all three study countries. Thereafter, country-specific protocols were developed and ethical approval sought with the Ethics Review Committee of the Ghana Health Service (GHS-ERC) as stated above (GHS-ERC Number: 015/04/19).





# 4 Literature review



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# Literature review

The initial search resulted in a total of 175 papers in Web of Science, PubMed and CINAHL. After screening the titles and removing duplicates, 40 publications concerning artisanal mining, health and Ghana could be identified. Of these 27 remained after abstract and full text screening.

The available literature can be grouped into studies assessing the health risks related to mercury and other heavy metals, injuries during ASGM activities, other health risks related to ASGM and nutrition in ASGM communities.

## Exposure to mercury and related health risks

The studies investigating mercury levels in urine of Ghanaian miners found levels varying from 5.2 to 43.8 µg/L, whereas the highest concentration was measured in those that are involved in the amalgam burning process (12–15). Non-miners from the same communities had a urinary mercury concentration of 1.2 µg/L and people in non-mining communities had even lower mercury levels (14, 15). However, Basu et al. argue that the mercury levels in urine of non-miners living in mining communities are still rather high and call for protection of community health from the mining activities (14). Another study found that 20% of residents in a mining community had abnormally high urine mercury levels (16).

Mercury contamination in human hair was found to vary between 0.97 and 6.59 µg/g depending on seasonality and reaching unhealthy levels (12, 14, 17, 18). Apparently, the mercury levels seem to be higher in the dry season compared to the rainy season. This finding might be associated to the higher availability of fish during the dry season (18).

A study investigating blood mercury levels discovered that 58% of the investigated artisanal miners exceeded the blood mercury level of the occupational threshold of 5 µg/L (19).

When asked, the miners identified the burning process after amalgamation, mercury contamination of water due to spillage and rain as the main reasons for mercury contamination. Indeed,

the anthropogenic mercury pollution seemed to increase in streams during the past years (20). Also, ingestion of mercury via the oral route due to bad hand hygiene was reported (21).

These findings together indicate that miners and community members in ASGM sites in Ghana are both directly exposed during the mining processes but also indirectly through environmental contamination and subsequent ingestion of mercury compounds in water and fish.

The mercury induced health outcomes identified by the miners are skin irritation, respiratory problems, muscular tremors, numbness of extremities and atrophy, vomiting, gastro-intestinal problems, and death (21). Researchers found that the concentrations of blood mercury, coupled with creatinine and urinary proteins, are negatively associated with the estimated glomerular filtration rate (22). Similarly, the thyroid hormone levels of the hormones T3 and T4 are negatively associated to blood mercury levels (19). However, no statistically significant relationship between hypertension and mercury level could be found (17).

The miners' knowledge about the negative health effects of mercury differ greatly. A cross-sectional survey found that 89% of the 588 interviewed miners had low to very low knowledge about health effects of mercury. Oddly, miners currently working and miners with primary or secondary education

were less aware of the health risks of mercury than their unemployed or uneducated counterparts. The authors assumed that the latter had been working for a longer time in ASGM and therefore had more experience. Female miners seemed to know less about the effects of mercury (OR = 0.32,  $p < 0.05$ ) whereas miners who have suffered previous

occupational health problems were almost 5 times more likely to have this knowledge compared to healthy miners (OR = 4.86,  $p < 0.0001$ ) (23). Using humorous songs to educate miners about the safe handling of mercury and its possible adverse effects is recommended by Veiga and Marshall (24).

## Exposure to other heavy metals and related health risks

While looking at the concentration of other heavy metals, arsenic, chromium, copper, manganese, aluminum, nickel, selenium and zinc exceeded the normal urine concentrations in miners (25). In stream water, arsenic, aluminum, manganese, chromium and nickel were identified in levels higher than the WHO recommendations for drinking water. During the dry season this water was used by 70% of the community as drinking water (26). Mine-pit water containing high levels of aluminum and arsenic located in the same community was used in bathhouses and for pito (local beer) brewing (26).

In terms of cancer risk and chronic health risk due to contact with heavy metals found in water and sediments, mercury (hazard quotient [HQ]: 4.60), lead (HQ: 1.45) and arsenic (HQ: 1.98) all showed they pose a chronic health risk. Arsenic concentrations are additionally a cancer risk if the water is orally ingested as the cancer risk of  $3.1 \times 10^{-3}$  is above the guidance values of the United States EPA ( $1 \times 10^{-4} - 1 \times 10^{-6}$ ) (27).

## Injuries in ASGM

A total of 70% of artisanal gold miners (N = 120) have never used personal protective equipment (PPE) for their work (28). Injuries and their prevention are therefore an important topic to address. Injury rates in ASGM workers were identified to generally vary between 5.0 and 5.9 injuries per 100 person years, whereas miners working in licensed mines are in the lower spectrum (29, 30). Interestingly, when focusing on smaller subsamples, women are much more prone to injuries compared to men (6.1 compared to

4.2 injuries per 100 person years) (29). This might be a result of different working conditions (31). When inquiring the details of the injuries, over half of the injuries were lacerations and most of the injuries happened during excavation (58.7%) and crushing (23.1%) (29). A retrospective cross-sectional survey, looking at hospital records and media, found fractures and contusions to be the most frequent injuries occurring to artisanal gold miners. Reasons for the injuries were mostly collapsing pits and falls (32).

## Other mining associated health risks

Other chemical and physical health risks were also identified in and around ASGM sites in Ghana. Self-reported health was assessed in Ghanaian mining communities in connection to bad smells from the mines and dust in their air. People who thought that odor can influence their health status reported more poor health outcomes than people who did not believe in odor affecting their health (OR = 1.77,  $p < 0.01$ ). People seeing dust “less frequently” still reported poorer health outcomes than people never seeing dust (OR = 1.93,  $p < 0.05$ ) (33). Another study investigated the radiation of radon and radionuclides in an ASG mine (34). In both cases the radiation was considerably smaller than the limits for radiation hazard (34).

While investigating the pulmonary function of artisanal gold miners, their forced expiratory volume and the ratio of forced expiratory volume to forced vital capacity were impacted (14). Additionally, breathlessness and severe breathlessness were identified (14). However, another study on pulmonary function could not find any difference between ASGM communities and non-mining communities (35). In this study, both communities

had poor lung functions due to the exposure to indoor air pollution in connection with the burning of biomass fuels for cooking (35).

Miners from two illegal mining sites rated collapsing pits, sediments or shafts, underground heat, slipping and falling, cuts, dynamite rock blasts, smoke from grinding machines, bodily pains, coughing, eye problems and fights among gang members as some of the most apparent mining-related health risks (21).

Mining-related mental health risks are so far not yet well investigated in Ghana but in a study by Basu et al. (2015) substance abuse was reported as becoming a bigger problem.

A health and demographic survey was conducted in an ASGM community (36). The results show that compared to other Ghanaian communities, the ASGM community possesses more items of wealth (radio, mobile phones), but at the same time lacks basic infrastructure, like access to clean water and sanitation. Good quality antenatal care is not available in the community (36).

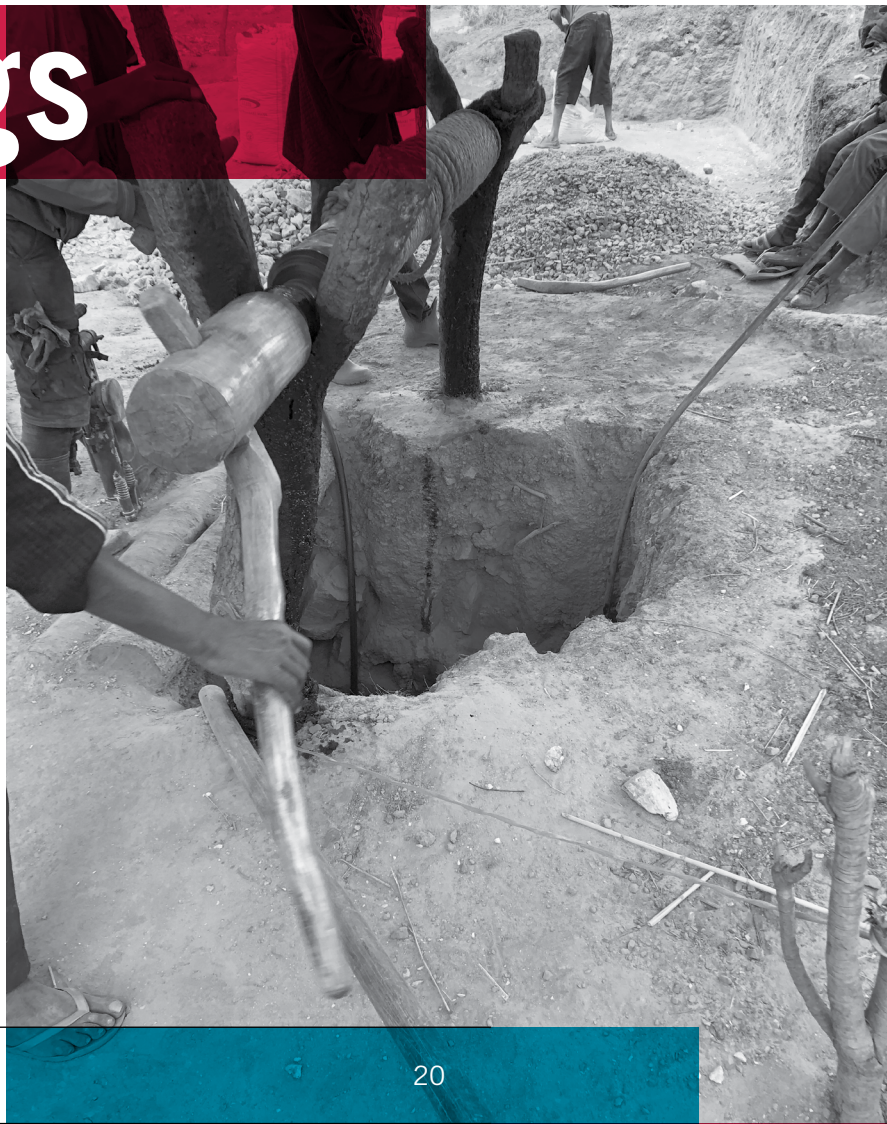
## Nutrition in ASGM sites

Food insecurity can arise in ASGM communities because farming land is degraded and the local farmers change their livelihoods to mining. Not only is food quantity a limiting factor, but also food quality. A heavy metal analysis conducted in two food fish species, the bigeye grunt and the Bagrid catfish, found elevated levels of arsenic and mercury in the fish (37). However, considering that a Ghanaian eats 0.0685 of fish per day, the health risks from the ingestion of heavy metals in

fish is negligible (37). Another study in northern Ghana found that the locally produced beer pito contained aluminum, chromium, manganese, nickel, zinc, arsenic and lead above WHO standards for drinking water (14). Also, diets can change in ASGM communities. In the health and demographic survey households reported to have a low fruit and vegetable consumption. However, nutritional deficiencies could not be identified (36).

# 5 Field study

## findings



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# Field study findings

## Study population

A total of 28 KIIs, 16 FGDs and 9 HFAs were conducted (Table 3) in the two ASGM sites in Birim-North District and Tarkwa-Nsuaem Municipality in Ghana.

**Table 3:** Sample sizes

	District		Total
	Birim-North	Tarkwa-Nsuaem	
<b>Key informant interviews</b>			
Government officials	1	1	2
Environmental authorities	1	1	2
Local health authorities	1	1	2
Health care providers at local level	3	5	8
Health care providers at regional level	1	0	1
Traditional leaders	2	2	4
ASGM community leaders	4	2	6
Civil society organizations	2	1	3
<b>Total KIIs</b>	<b>15</b>	<b>13</b>	<b>28</b>
<b>Focus group discussions</b>			
Miners	3	3	6
ASGM community members (non-miners)	5	1 (mixed with miners)	6
Family members of miners	3	1	4
<b>Total FGDs</b>	<b>11</b>	<b>5</b>	<b>16</b>
<b>Health facility assessments</b>	<b>4</b>	<b>5</b>	<b>9</b>

## Lessons learnt with regards to the sampling:

- The FGDs were conducted in 4 (Birim-North District) and 2 (Tarkwa-Nsuaem Municipality) mining communities. As a consequence of the higher number of visited communities the time and efforts required for travelling and coordination of the activities increased substantially.
- Many KIs preferred to participate with colleagues that they could consult with about some specific aspects. It was a good practice to designate a main respondent (usually the boss) and invite him to ask his staff in case of uncertainties.
- For the HFA it was good to have an administrative staff member together with a health care provider present as some questions are very specific.
- The community mobilizers need to be well informed about the study population, especially about the required sample size. It will be useful in future for the study team to physically meet with mobilizers before the day of data collection to reinforce the arrangements rather than doing all the preparatory communication by phone and email. Further, they should be present while the respondents are being organized for the interviews and FGDs.
- About 10-12 days are required for one person to undertake all the required KIIs, FDGs and HFAs in one ASGM site. To be able to complete the study in 5-6 days per site the tasks can be divided among a team of 3-4 trained investigators and research assistants.

# Community profiling

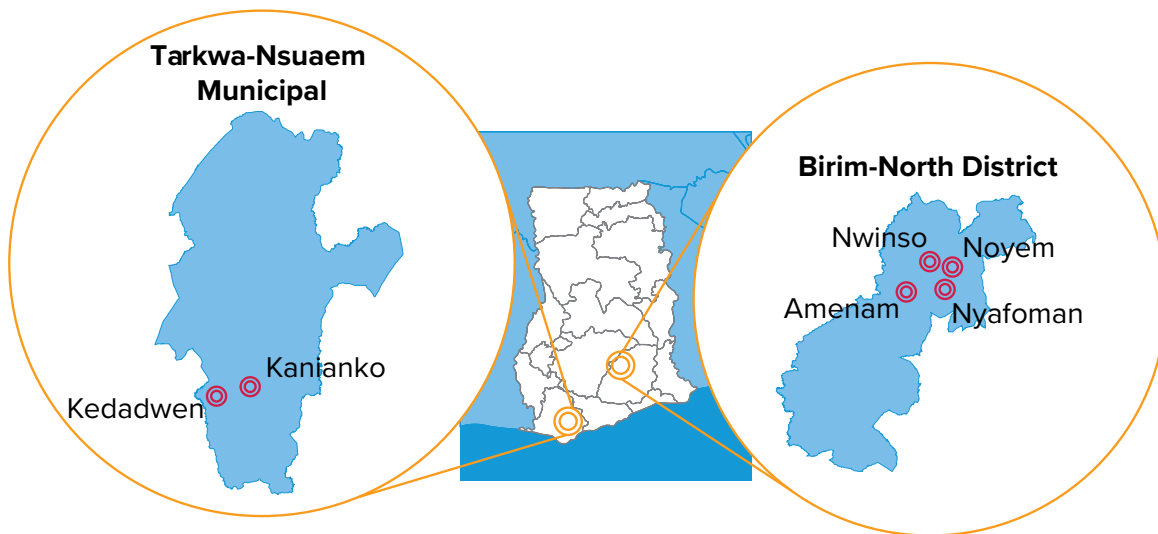
## ASGM sites

The fieldwork was conducted in two districts, Birim-North District and Tarkwa-Nsuaem Municipal. Large-scale multinational mining projects are dominating the scenery in their capitals, New Abirem and Tarkwa, respectively. However, many small-scale and artisanal miners are operating in the surrounding communities. The map in Figure 2 shows the locations of the communities.

The ban on illegal ASGM introduced in 2017 led to a drastic reduction in mining activities in Ghana. Since the ban was lifted in December 2018 efforts are made to register the miners and their operations or organize them as community mining projects. At the time of the visit according to district officials,

one small-scale mining project had undergone the full registration process in Birim-North District and three have done so in Tarkwa-Nsuaem Municipality. In both sites, however, many small-scale miners were working without any registration. District officials and community members reported that the numbers were significantly below the numbers before the ban. Artisanal miners are reportedly active mainly at night to avoid prosecution by the authorities. Consequently, no active artisanal mine could be visited in Birim-North District and only one was visited in Tarkwa-Nsuaem Municipality. The information for the community profiles outlined below therefore stems from the KIIs and FDGs conducted in the different communities as well as from the District Medium Term Development Plan (DMTDP) of the two study districts.

Figure 2: ASGM study sites



**Birim-North District**

The Birim-North District is located in the Eastern Region of Ghana. New Abirem is the district capital. As a town with around 7,100 inhabitants it provides higher level of public social services for the surrounding settlements, such as health, administration, education or security. The main road transecting the district and connecting New Abirem with other major towns and the regional capital Koforidua is only partly tarred and in very poor condition. In some villages there is a CHPS compound providing basic primary health services. For more advanced services the district hospital (New Abirem Government Hospital) is located in New Abirem and the Nkawkaw Holy Family Hospital located in Nkawkaw. The referral facility at the regional level is the Koforidua Regional Hospital. However, as a consequence of the poor road conditions travel times to the district hospital and the regional referral facilities are long and too expensive for some of the FGD participants. There are also three private clinics from which some persons source care.

The vast majority of the population (86%) are engaged in the agriculture sector. The major crops cultivated in the District include cocoa, oil palm, citrus, maize, plantain, cassava, cocoyam and vegetables.

Historically, mining has been a part of the district for over 200 years. Miners are either working at the industrial mine, in small-scale mines or work as artisanal miners, so-called “galamseyers”. The industrial mine located in New Abirem has been operational since 2013. In 2017 this mine had 818 employees. A larger, yet unknown number of people are engaged as small-scale and artisanal miners. They are mainly active in the northern part of the district between New Abirem and Pankese/Akoasi where they undertake both alluvial and hard rock mining. These activities have led to environmental degradation and to pollution of the air and water bodies.

During the peak period before the ban, many miners migrated to the area and even Chinese investors started building their residences in the villages. Today, although not as numerous, the galamseyers are still working in this area.

Four mining communities, Nyafoman, Noyem, Amenam and Nwinso, were visited during the field work for KIIs and FGDs. These are briefly characterized in Table 4.



**Figure 3:** Abandoned small-scale mine in Birim-North District**Table 4:** Study sites in Birim-North District

	Noyem	Nyafoman	Amenam	Nwinso
<b>Population</b>	2,073	2,041	1,276	3,055
<b>Health facilities</b>	CHPS	CHPS	CHPS	None
<b>Access to drinking water</b>	3 water access points Stream water	5 water access points	5 water access points Stream water	5 water access points
<b>Mercury use</b>	Yes	Yes	Yes	Not assessed (n/a)
<b>Cyanide use</b>	No	No	No	n/a
<b>Miners' origin</b>	Mostly locals, some migrants from neighboring regions	Mostly locals, some migrants from neighboring regions	Mostly locals, some migrants from neighboring regions	n/a
<b>Seasonal nature</b>	Miners also work on their farms part time. Since the ban they work more often on the farms.	Before the ban miners employed people to work on their farms. Today most former miners do only farming.	Before the ban there was mining all year around. Now farming has become the primary source of income.	n/a

## FIELD STUDY FINDINGS

### Tarkwa-Nsuaem Municipal

The Tarkwa-Nsuaem Municipal is one of 22 districts in the Western Region of Ghana. The district population is estimated to be 181,224. The administrative capital Tarkwa has a population of 28,954 and provides higher level public services for the surrounding settlements, including health administration, education or security.

The main road in the municipality runs from the coast to the north and it is the only tarred road. Otherwise the link-road network in the municipality is very bad. Some of the communities become inaccessible during the rainy season, making delivery of health services increasingly difficult in those areas. There is potable pipe-borne water in the urban areas. Boreholes, hand-dug wells, streams and rivers serve the peri-urban and rural communities. Sanitation is a major problem in the urban areas. The municipality is connected to the national electricity grid that serves most major communities. Communication network is gradually improving in the municipality. Mobile telecommunication services cover most parts of the municipality.

There is a significant mining sector in the municipality, both large-scale and ASGM. Today, two industrial mines are active: Anglogold Ashanti

Iduapriem Mine and the Goldfields Mine. A large part of the mining community is, however, engaged in small and artisanal mining sites. There is both surface and underground mining going on throughout the municipality.

Agriculture is the dominating sector in the municipality. However, the agricultural sector is increasingly under pressure since the local residents place premium on the extractive industry and hence land owners convert agricultural land into mining pits.

There are 61 health facilities in the municipality (Table 5). Today government or public facilities constitute 75% compared with 44% in 2015. The increase in the number of public facilities is a result of creation of more functional CHPS zones in line with the new CHPS strategy of enhancing provision of basic primary health services. For more advanced services, the Tarkwa Municipal Hospital and the Apinto Government hospital are located in Tarkwa. The referral facility at the regional level is the Efiu Nkwanta Regional Hospital in Takoradi. However, the poor road conditions, travel times and cost of travel prevent some members of the municipality from seeking medical care. Table 5 shows facilities by level and ownership.

**Table 5:** Health facilities in Tarkwa-Nsuaem Municipality

Health Facilities	Public	Private	Total
Hospitals	2	6	8
Health Centres	8	0	8
Clinics	0	7	7
Maternity Homes	0	2	2
RCH Centres	1	0	1
CHPS	35	0	35
Total	46	15	61
Proportion (%)	75%	25%	100

The two ASGM communities visited during the fieldwork for KIIs and FGDs included Kiananko and Kedadwen, located in Nsuaem in the southern part of the municipality. Health facilities visited include the Municipal Hospital in Tarkwa, Nsuaem

Health Centre, Community Clinic, Kedadwen both in Nsuaem Sub-municipality; Iduapriem Community Clinic, Adieyie and Teberebie Community Clinic both located in the Iduapriem sub-municipality. The two mining communities are briefly described in Table 6.

**Table 6:** Study sites in Tarkwa-Nsuaem Municipality

	Kanianko	Kedadwen
Population	2,419	1,993
Health facilities	None	CHPS
Access to drinking water	1 bore hole	Water bodies and 1 borehole
Mercury use	Yes	Yes
Cyanide use	No	No
Miners' origin	Mostly locals, some migrants from neighboring regions. A few from neighboring countries and as far as China (the latter have mostly left the area since the ban).	Mostly locals, some migrants from neighboring regions.
Seasonal nature	Before the ban, mining was the primary 'all-year-round' activity but now it's mainly commercial motor-bike transportation ("okada").	Mining was the primary activity but after the ban it is now second after farming.

The only visit to an active mining site occurred at Kanianko. The miners were busily working but some made time to interact with the study team with the help of a community elder. At the site, there were only men actively engaged in the mining with women selling food, drinks and water nearby. Mostly young and middle-aged men were mining at this site.

The main type of gold mining was hard rock involving digging, crushing and milling of rock, sluicing and amalgamation with mercury. The mercury was added to the washed ore. After removal of excess water the mercury was burned. The workers usually did not wear any PPE while handling chemicals. The water used for sluicing and excess water squeezed after addition of mercury went into a sump. Although the sump was contained, mercury could eventually be washed into water bodies when it overflows in the event of heavy rainfall, thereby contaminating the water.

Almost all the miners were working without gloves, masks or any other PPE except for a handful wearing Wellington boots. Despite very slippery ground in and around the pits following heavy rainfalls, the majority of the miners going underground were wearing rubber sandals (nicknamed 'kayabs') popularly patronized by them for this type of work as they are considered to be more comfortable for ascending into and climbing out of the pits. At the

time of the visit, no blasting was done but it was reported that blasting is common when new mineral deposits are discovered. The pits were supported by wooden planks to prevent them from collapsing.

## Vulnerable population groups

Many KIs did not see any population groups as being neglected or particularly vulnerable in terms of access to health care. This is mainly attributed to the widespread coverage of the National Health Insurance Scheme (NHIS). However, some respondents identified certain groups that commonly were not covered by the health insurance scheme and thus had difficulties accessing or affording care. These included the extremely poor (particularly women and children), the physically challenged and sometimes migrants/outsideers. Foreigners are not allowed to mine in Ghana. Their illegal status could further impede their access to health services. Further, some elderly persons were reported to lack the support of their children, leaving them without financial support needed for paying for health services.

Although prompted, miners were not seen as marginalized by the majority of respondents. However, one KI mentioned that miners were less likely to have NHIS subscriptions, which were seen as necessary to afford care.

## FIELD STUDY FINDINGS

In Tarkwa-Nsuaem Municipality some remote villages were disconnected from the nearest health care facility during the rainy season due to the poor

state of access roads. In these circumstances, they resort to traditional healers in the community or use home-made remedies for their ailments.

### Lessons learnt with regards to the observational tool:

- Due to the illegal nature of artisanal mining activities it was not possible to visit an active mining site in Birim-North. Instead, informal exchanges with miners and insights from district development plans helped to get a picture of the extent of mining activities and health care system in the study sites.
- The structure of the observational tool was useful to identify and record potential hazards. However, due to the weather conditions the notes were taken retrospectively. Plan the site visits during dry conditions if feasible.
- In Tarkwa-Nsuaem Municipality, there was a lot of reluctance by miners to show the study team an operational site due to some level of mistrust of the motive of the visit. There was fear of getting arrested by the government authorities. It took the intervention of the community mobilizer (also a fellow miner and executive member of the miners' association) as well as a traditional leader to persuade the miners to grant the study team access to the site.

**Figure 4:** Underground mining pit at Kanianko



# Environmental and socio-economic impacts of ASGM activities

## Environmental impacts

Awareness or willingness to report environmental impacts varied greatly between the different KIs. Government officials and environmental health officers reported a variety of impacts while health care providers usually only knew about the issues

on a general level. Interestingly, some ASGM community leaders hardly saw any environmental impacts of ASGM activities, even when prompted.

The responses by the KIs are summarized in Table 7 below.

**Table 7:** Environmental impacts according to KIs

Leading themes	Specific issues
<b>Changes in landscape</b>	<ul style="list-style-type: none"> <li>■ Unprotected open pits</li> <li>■ Stagnant water in former pits serving as breeding sites for mosquitoes</li> <li>■ Collapsing pits</li> <li>■ Deforestation</li> <li>■ No reclamation of land after cessation of activities</li> </ul>
<b>Use of mercury</b>	<ul style="list-style-type: none"> <li>■ Fish in local water bodies accumulate mercury</li> <li>■ Burning and smelting of mercury is often done in badly ventilated huts in the centre of the communities without any PPE</li> </ul>
<b>Contamination of land and soil</b>	<ul style="list-style-type: none"> <li>■ Polluted waters drain into agricultural land</li> <li>■ Contamination of crops</li> <li>■ Soil becomes infertile</li> <li>■ Reduced crop yield leading to food shortages</li> <li>■ Littering and increased waste dumping</li> </ul>
<b>Contamination of water</b>	<ul style="list-style-type: none"> <li>■ Contamination of water through chemicals, including mercury and cyanide</li> <li>■ Water becomes muddy from alluvial mining activities</li> <li>■ Open defecation leading to fecally contaminated waters that are also used for drinking and irrigation</li> <li>■ Water from alluvial mining sites is further used for irrigation and during shortages also for drinking</li> </ul>
<b>Contamination of air</b>	<ul style="list-style-type: none"> <li>■ Contamination of air through burning of mercury amalgam</li> <li>■ Dust generation due to drilling, blasting and digging affects crops and surrounding communities</li> </ul>
<b>Physical hazards</b>	<ul style="list-style-type: none"> <li>■ Vibrations and noise during blasting</li> </ul>

## Socio-economic impacts

Table 8 summarizes the leading themes and specific socio-economic impacts raised by KIs. The economic impact of the mining activities was overall seen as being positive. Beyond being an employment opportunity, the ASGM activities have promoted local businesses and improved housing conditions. However, many KIs also pointed at inequalities in connection with this economic growth. Many community members not directly involved in the mining sector do not profit. In contrast, they are equally affected by higher prices for housing and food.

A respondent in the Tarkwa-Nsuaem Municipality also reported about inequalities between the sponsors/mining concession owners and the miners that go into the pits. The latter often do not always get employed leaving them at times without enough income to feed their families.

Social impacts were manifold. Most importantly, the rise in prostitution and womanizing (leading also to teenage pregnancies), substance abuse and the low school attendance were noted. Other impacts were generally seen in connection with the influx of people leading to sites with already insufficient public infrastructure.

**Table 8:** Socio-economic impacts according to KIs

Leading themes	Specific issues
<b>Economic impacts</b>	<ul style="list-style-type: none"> <li>■ Income opportunity</li> <li>■ Creation of secondary markets, such as small shops or kiosks</li> <li>■ Miners have a high income, especially when activities were on their peak before the ban</li> <li>■ At the peak of the ASGM activities before the ban there was more money circulating. Now there is a recession</li> <li>■ Increase in prices for rent</li> <li>■ Increase of food prices</li> <li>■ The environmental, social and health impacts will cost the society a lot of money</li> </ul>
<b>Livelihoods</b>	<ul style="list-style-type: none"> <li>■ The mining sector is a big employment opportunity in the rural, farming-dominated areas</li> <li>■ Shifting of livelihood activities from farming to mining</li> <li>■ Farmers are being compensated when miners want to start operating, thus providing them with an extra source of income</li> </ul>
<b>Education and school enrolment</b>	<ul style="list-style-type: none"> <li>■ Children and adolescents drop out of school or do not enroll in school to work in the mines</li> <li>■ Some children skip school intermittently to earn some money in the mines</li> <li>■ Child labor in mines</li> <li>■ The rise in teenage pregnancies also led to school drop-outs among teenage girls</li> <li>■ Some miners reportedly use the income to afford school fees</li> </ul>
<b>Conflicts/crime</b>	<ul style="list-style-type: none"> <li>■ Miners are often becoming violent when they are using drugs</li> <li>■ Conflicts between land owners and miners</li> <li>■ Violent conflicts between ASGM gangs</li> <li>■ Since the ban on artisanal mining there is an increase of thefts and robberies in the communities</li> </ul>
<b>Social issues including drugs, alcohol and prostitution</b>	<ul style="list-style-type: none"> <li>■ Miners try to get young women which leads to an increase in teenage pregnancies</li> <li>■ STIs are on the rise</li> <li>■ Prostitution has increased and experienced a boom with ASGM activities</li> <li>■ Miners do not save or invest their money. They usually spend it for alcohol, drugs or sex.</li> <li>■ Smoking, drug and alcohol abuse common among miners</li> </ul>

Leading themes	Specific issues
<b>Non-locals, in-migrants</b>	<ul style="list-style-type: none"> <li>■ Large influx of in-migrants was experienced. For example, in 2000 New Abirem was the fastest growing district (also due to the construction of the industrial mine)</li> <li>■ Secondary migration by women trying to offer sexual services. They get exploited by male miners.</li> <li>■ Displacement of people from mining sites</li> </ul>
<b>Inequalities</b>	<ul style="list-style-type: none"> <li>■ Some community members profit from the mining activities as the miners have to pay the local leaders for the right to mine. Farmers often lose money due to reduced crop yields and are affected by inflating prices.</li> <li>■ Few are getting rich from the mining activities but many stay poor being affected by rising prices</li> <li>■ The sponsors and concession owners are the ones earning most money. The miners that go into the pits do not always get employed and there are times when they are badly paid.</li> </ul>
<b>Social cohesion</b>	<ul style="list-style-type: none"> <li>■ Mining disrupts the community cohesion</li> <li>■ Money issues lead to a lot of divorces</li> <li>■ It became more common that people have multiple sexual partners</li> <li>■ Children and adolescents engaged in the mining sector loose the respect for their parents</li> <li>■ Children frequently don't sleep at home when they go in the mines</li> </ul>
<b>Living conditions</b>	<ul style="list-style-type: none"> <li>■ Worsened sanitation at the mining sites and in the communities as a result of the influx of migrants</li> <li>■ Lack of public infrastructure to host the additional population</li> <li>■ Improved housing conditions (e.g. roofing and floor materials)</li> <li>■ Overcrowding</li> <li>■ Investments of the small-scale mining companies in local infrastructure, such as community gathering points</li> </ul>

## Health-related issues in the ASGM context

Tables in the annex demonstrate trends documented for health conditions for the different locations.

In 2017 and 2018, the top three causes of outpatient department (OPD) attendance in the Tarkwa-Nsuaem Municipality were upper respiratory tract infections, malaria and rheumatism. In comparison, at the regional level (Western region) the top causes were malaria, followed by upper respiratory tract infections and rheumatism (Table 21 and Table 22).

Similarly, in Birim-North District, the top three causes of OPD attendance were malaria, upper respiratory tract infections and rheumatism for both 2017 and 2018. The trends are similar to that of the Eastern region (Table 23 and Table 24).

According to data from New Abirem Government Hospital, the top 5 causes of death for 2018 in their catchment area were pneumonia, hypertension, HIV infections, pulmonary tuberculosis (TB) and malaria, most of them being conditions that could be linked with ASGM (Table 28).

Between 2015 and 2018, the number of new cases of HIV reported for Birim-North shows an upward trend (Table 27) while that for Tarkwa-Nsuaem shows a downward trend (Table 26).

### General health situation

Table 9 summarizes the health issues mentioned by KIs for different population groups. Specifically with regards to the artisanal and small-scale miners, accidents, lung diseases (TB, silicosis, asbestosis) and a rise in STIs and teenage pregnancies was reported. In connection with the use of mercury, numbness of the fingers and severe coughs were reported.

**Table 9:** Health issues according to KIs

Population group	Common health issues
<b>All ages</b>	<ul style="list-style-type: none"> <li>■ Malaria</li> <li>■ Diarrhea, cholera</li> <li>■ Upper respiratory tract infections</li> <li>■ Snake bites</li> <li>■ Rheumatism</li> <li>■ Joint pains</li> <li>■ Weight loss</li> </ul>
<b>Children</b>	<ul style="list-style-type: none"> <li>■ Anemia</li> </ul>
<b>Women</b>	<ul style="list-style-type: none"> <li>■ Hypertension</li> <li>■ Diabetes</li> <li>■ Skin rashes</li> <li>■ HIV and other STIs</li> <li>■ Headache</li> <li>■ Waist pains</li> <li>■ Teenage pregnancies</li> </ul>
<b>Men</b>	<ul style="list-style-type: none"> <li>■ Hypertension</li> <li>■ Diabetes</li> <li>■ TB</li> <li>■ HIV and other STIs</li> </ul>
<b>Miners</b>	<ul style="list-style-type: none"> <li>■ Laceration of fingers</li> <li>■ Severe coughing (from irritation caused by burning acid while purifying the gold)</li> <li>■ TB</li> <li>■ Chest infections</li> <li>■ Numbness in fingers</li> <li>■ Silicosis, asbestosis</li> <li>■ Weight loss</li> <li>■ Swollen feet</li> <li>■ Accidents/injuries</li> </ul>

Frequent health issues as reported by participants from the FGDs varied among the different population groups (Table 10). Most interestingly, mercury-related health outcomes were reported

among different population groups, including those not directly engaged in the AGSM activities (non-mining community members, elderly).



**Table 10:** Health issues according to focus group participants

Population group	Common health issues
<b>Family members</b>	<ul style="list-style-type: none"> <li>■ Malaria</li> <li>■ Typhoid</li> <li>■ Bilharzia</li> <li>■ Joint pains</li> <li>■ Hypertension</li> <li>■ Painful movement of fingers</li> <li>■ Coughs</li> <li>■ Headaches</li> <li>■ Diarrhea, cholera</li> <li>■ TB</li> <li>■ Alcoholism</li> </ul>
<b>Women</b>	<ul style="list-style-type: none"> <li>■ Stillbirth</li> <li>■ Teenage pregnancies</li> <li>■ STIs</li> </ul>
<b>Children</b>	<ul style="list-style-type: none"> <li>■ Skin rashes</li> <li>■ Coughs</li> </ul>
<b>Elders</b>	<ul style="list-style-type: none"> <li>■ Malaria</li> <li>■ Severe coughs</li> <li>■ Hypertension</li> <li>■ Numbness and dizziness</li> <li>■ STIs (syphilis, HIV/AIDS)</li> <li>■ TB</li> <li>■ Eye problems</li> <li>■ Joint pains</li> </ul>
<b>Non-miners</b>	<ul style="list-style-type: none"> <li>■ Fatigue</li> <li>■ Hypertension</li> <li>■ Arthritis</li> <li>■ Diabetes</li> <li>■ Numbness in leg</li> <li>■ Tremors in leg</li> <li>■ Diarrhea</li> <li>■ Malnutrition due to infertile land</li> <li>■ Coughs</li> <li>■ Malaria</li> <li>■ Skin rashes</li> <li>■ TB</li> <li>■ Body pains</li> </ul>
<b>Miners</b>	<ul style="list-style-type: none"> <li>■ Malaria</li> <li>■ HIV/AIDS</li> <li>■ Chronic cough with blood due to exposure to dust and mercury</li> <li>■ Numbness in hands</li> <li>■ Headache from mercury vapors</li> <li>■ Stomach problems/diarrhea due to consumption of water from the mining pits</li> <li>■ TB</li> <li>■ Weight loss</li> <li>■ High blood pressure, palpitations</li> <li>■ Body pains</li> <li>■ Skin rashes</li> </ul>

## Awareness of ASGM activities

In general, the KIs were well informed about the mining activities in the study sites. Despite the current illegal status of some of the miners the KIs within the public administration (i.e. officials from the district assembly, and environmental health officers) were very knowledgeable about where and what the miners are doing. KIs from the health sector were aware of the mining activities, however, to a varied degree.

## Awareness of mercury use

Most KIs and FGD respondents thought that ASGM miners are generally ignorant on the implications of mercury, whereby 'ignorant' implies both 'not knowing' and 'not caring'. One CSO leader pointed to the fact that in some communities mercury is vaporized in so called "kitchens" that are located in badly ventilated huts in the middle of the communities. Apparently, the awareness or the willingness to move these kitchens to the outskirts of the villages is very low.

## Awareness of ASGM health issues

### **Among government officials**

From the KIs' perspective, miners are often not well educated about the health effects of ASGM, including mercury use. And even in case they are aware, it is neglected in favor of the economic opportunity ("they are here for the money"). Even less informed are the community members. They may know that the chemicals can cause harm but they do not understand the nature and pathway of the health impacts.

In general, a lack of available information sources about the different health risks of ASGM for the miners and the surrounding community members was noted.

### **Among health care providers**

The local health care providers all reported some ASGM health issues. Most prominently, the inhalation of dust leading to different lung diseases and accidents were recognized as health issues of miners. However, many health care providers only reported that chemicals are used and are a threat to health without reporting any specific health outcomes.

### **Among traditional community, ASGM and CSO leaders**

The leaders mainly reported few of the physical (heat, humidity, noise), chemical (exposure to mercury and high dust levels), biomechanical (explosives and machinery leading to accidents) and psychosocial (substance abuse) hazards as threats to the health of miners.

### **Among FGD respondents/miners**

Miners are considered to do a risky job. However, the awareness of the specific health issues was rather low among all respondents. Further, the miners were not well aware about the alternatives to reduce or replace the chemicals in the mining process. Many KIs reported that the miners tend to underestimate the risks of their activities. Other KIs felt that the miners are well aware of the risks but simply ignore them. In many FGDs, the need for more education materials and awareness campaigns about the health impacts of mining in general and chemical use in particular was brought up.

## Health risks and effects of ASGM

A myriad of health risks and effects of ASGM were described by KIs (Table 11). Most respondents identified the exposure to dust or chemicals in the air as health risks of ASGM activities. The air in the pits is reportedly very bad, leading to frequent bloody coughs. According to a physician at the New Abirem Government Hospital, silicosis and asbestosis cases are often misdiagnosed as TB due to the lack of awareness of the health care providers about ASGM-related health issues.

The community members in Birim-North District complained about black particles in the rain water. Although they have never had the water tested, they associated their presence with the activities at the industrial mine in New Abirem.

Also, water pollution was described to affect the communities near artisanal mining sites, both chemically ("mining goes with water") and biologically (widespread open defecation). The small-scale mines nowadays have toilets as a consequence of improved regulations.

In both sites, the mining pits were described as mosquito breeding grounds leading to an upsurge in malaria cases in the surrounding communities.

**Table 11:** Health risks and effects of ASGM according to KIs

Leading themes	Specific issues
<b>Occupational hazards</b>	<ul style="list-style-type: none"> <li>■ Accidents and injuries</li> <li>■ Drowning in pits</li> <li>■ People falling into pits</li> <li>■ Mental health problems including depression</li> <li>■ Working in confined spaces</li> <li>■ Exhaustion and fatigue</li> <li>■ Noise</li> <li>■ Use of explosives</li> <li>■ Heat and humidity</li> <li>■ Vibration</li> <li>■ Low oxygen levels</li> </ul>
<b>Environmental health hazards</b>	<ul style="list-style-type: none"> <li>■ Lack of sanitation facilities at mining sites, open defecation</li> <li>■ Polluted drinking water</li> <li>■ Chemical pollution of rivers, consumption by community of contaminated fish</li> <li>■ Environmental contamination by lead</li> <li>■ Contaminated rain water</li> <li>■ Mercury vapor in air around the burning sites</li> </ul>
<b>Vector-related hazards</b>	<ul style="list-style-type: none"> <li>■ Introduction of river blindness into some communities</li> <li>■ Malaria</li> <li>■ Mining is creating stagnant water bodies that become breeding sites for mosquitoes</li> </ul>
<b>Chemical hazards</b>	<ul style="list-style-type: none"> <li>■ Exposure to dust</li> <li>■ Mercury exposure: inhalation and direct contact</li> <li>■ Cyanide exposure</li> <li>■ Exposure to asbestos and silica</li> <li>■ Exposure to lead</li> </ul>
<b>Social and livelihood hazards</b>	<ul style="list-style-type: none"> <li>■ Teenage pregnancies</li> <li>■ Conflicts between miners and farmers</li> <li>■ Drug and alcohol abuse</li> <li>■ Food shortages</li> <li>■ Thefts</li> <li>■ Fights and stabbings</li> <li>■ High cost of living</li> </ul>
<b>Health effects</b>	<ul style="list-style-type: none"> <li>■ Respiratory diseases, pneumoconiosis</li> <li>■ TB</li> <li>■ Hypertension</li> <li>■ Headache</li> <li>■ STIs, including HIV/AIDS</li> <li>■ Increase in malaria cases</li> <li>■ Cholera outbreak in New Abirem</li> <li>■ Chest infections</li> <li>■ Kidney failure</li> <li>■ Lead poisoning</li> <li>■ Numbness in extremities</li> <li>■ Palpitations</li> <li>■ Bodily pains</li> <li>■ Skin rashes</li> </ul>

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Health risks and health effects described by FGD participants are shown in Table 12.

Among the FGD participants, the awareness of the health risks that they and the miners are exposed to was very low. In three focus groups they did not feel threatened or feel any health impacts of the ASGM activities. Also, compared to awareness of the KIIs the variety of chemical hazards identified was much lower among the FGD participants. This may indicate a lack of awareness of the health risks associated with these substances.

Also in the FGDs in both sites, the exposure to high levels of dust after the blasting was reported. Because of the fear that other miners could find

valuable rocks before them the miners enter the pits soon after the explosions, leaving no time for the dust to settle. Another factor is that because of their current illegal status they are afraid that they will have to give up their activities soon. Hence, they try to mine as much as they can in the time that they have left, ignoring the health risks.

Surprisingly, some of the social determinants of health identified by the KIIs were not described by the miners or community members. For example, drug and alcohol abuse was not described as an ASGM-related health issue.

Miners in general only reported about the occupational health risks and their exposure to dust.

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

Leading themes	Specific issues
<b>Occupational hazards</b>	<ul style="list-style-type: none"> <li>■ Heat and humidity</li> <li>■ Exhaustion, fatigue</li> <li>■ Injuries from blasting or machinery</li> <li>■ Falling into pits</li> <li>■ Collapsing pits</li> <li>■ Low oxygen levels in pits</li> <li>■ Vibrations</li> <li>■ Stress</li> <li>■ Heavy loads</li> </ul>
<b>Environmental health hazards</b>	<ul style="list-style-type: none"> <li>■ Drinking dirty (unsafe) water</li> <li>■ Drinking water from mining pits</li> <li>■ Contamination of the food prepared at the mining site</li> <li>■ Air pollution from the blasting at mining sites</li> <li>■ Contamination of farmland following spillages of mine waste</li> </ul>
<b>Vector-related hazards, animals</b>	<ul style="list-style-type: none"> <li>■ Malaria</li> <li>■ Snake bites</li> </ul>
<b>Chemical hazards</b>	<ul style="list-style-type: none"> <li>■ Inhalation of mercury vapors</li> <li>■ Exposure to high dust levels</li> </ul>
<b>Social and livelihood hazards</b>	<ul style="list-style-type: none"> <li>■ Teenage pregnancies</li> <li>■ Fights</li> </ul>
<b>Health effects</b>	<ul style="list-style-type: none"> <li>■ Chronic cough</li> <li>■ Kidney failure</li> <li>■ STIs, including HIV/AIDS</li> <li>■ Malaria</li> <li>■ Headache</li> <li>■ Cardio-vascular diseases</li> <li>■ TB</li> <li>■ Bodily pains</li> <li>■ Skin rashes</li> <li>■ Numbness in hands</li> <li>■ Diarrhea</li> </ul>

## Accidents and injuries

KIs and community members were asked about the nature and frequency of accidents in their community. A series of mining and non-mining related accidents were reported (see Table 13). The largest fraction of accidents was road traffic accidents involving motorcycles (in Birim-North). Since the ban, the number of accidents at the mining sites has gone down. However, accidents and even deaths in the pits are still reported.

Interpersonal violence is also common in the mining communities. The reduced number of potential mining sites has brought the mining groups closer to each other and closer to community lands, leading to clashes between rival mining gangs or between miners and farmers. These fights often result in cuts and bruises.

**Table 13:** Mining and non-mining accidents according to KIs and community members

Leading themes	Specific issues
<b>Mining accidents</b>	<ul style="list-style-type: none"> <li>■ Falling in unprotected pits</li> <li>■ Entrapment in collapsing pits</li> <li>■ Cuts from machines</li> <li>■ Bruises, fractures and lacerations from falling rocks and trees (during blasting)</li> <li>■ Drowning in pits</li> <li>■ Injuries from slipping in the pits</li> <li>■ Loss of fingers and limbs in explosions</li> </ul>
<b>Road traffic accidents</b>	<ul style="list-style-type: none"> <li>■ Lots of motorcycle accidents</li> </ul>
<b>Other work-related accidents</b>	<ul style="list-style-type: none"> <li>■ Accidents of farmers using machetes</li> <li>■ Injuries at construction sites</li> <li>■ Flooding</li> </ul>
<b>Interpersonal violence</b>	<ul style="list-style-type: none"> <li>■ Fights between families or mining gangs</li> <li>■ Rarely, gun fights</li> </ul>
<b>Animal</b>	<ul style="list-style-type: none"> <li>■ Dog bites</li> <li>■ Snake bites (mainly farmers)</li> </ul>

## Use of protective measures

All respondents reported that the use of PPE is very low to non-existent. Very few miners use gloves, steel boots or masks. Most miners work barefoot and without a shirt because of the heat. In Tarkwa–Nsuaem, however, some were seen going down the pits in rubber sandals (popularly called kayabs) and a few walking around in Wellington boots. Some use a wet cloth to cover the nose when entering the pits after blasting or when handling chemicals. Only in two FGDs with miners in Birim-North District some reported wearing goggles and gloves.

Some miners believed that PPEs would not protect them from the hazards faced in the pits. Other miners admit that PPE would be good, but they concede that it will be inconvenient to work with PPE and is considered a waste of money and time.

For example, the heat would not allow them to wear protective clothing, the helmet would be too sturdy to get through the narrow mining tunnels and boots are not practical for climbing the steep pit walls. Those who use the rubber sandals claim those are more convenient for work in the pits.

Similarly, KIs also noted a lack of willingness to procure PPE. Miners reported that they do not have the money to buy or do not know where they can find PPEs.

## Health seeking behavior

Health seeking behavior as perceived by KIs is described in Table 14. In Birim-North District most KI respondents perceived miners as not accessing the modern health facilities except

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in emergencies. They tend to wait until their conditions worsen and they are unable to work anymore. In Tarkwa-Nsuaem Municipality, fewer respondents reported self-medicating as a first-line treatment.

Ignorance, the pressure of work, fears of being caught mining illegally and financial constraints were mentioned as main obstacles to accessing health care. In Tarkwa-Nsuaem Municipality, an additional problem was the poor condition of roads linking the villages with the health care facilities.

**Table 14:** Health seeking behavior of miners according to KIs

Leading themes	Specific issues
<b>Access to health care</b>	<ul style="list-style-type: none"> <li>■ Many miners first treat themselves with home remedies or drugs from traditional medicine sellers</li> <li>■ For accidents/injuries miners mostly report to health facilities</li> <li>■ With diseases they often wait until the disease worsens and they cannot work anymore</li> <li>■ In Birim-North District, the general population goes directly to the health facilities; in Nsuaem, traditional medicine is also common among the non-mining community members</li> </ul>
<b>Obstacles</b>	<ul style="list-style-type: none"> <li>■ Fear of being identified as a miner. There were instances where colleagues brought a severely injured miner to the hospital and left him alone in order not to get arrested</li> <li>■ They often lie when reporting the reasons for their health conditions</li> <li>■ In Nsuaem, the roads are in a very bad state</li> <li>■ Ignorance of the importance of receiving treatment early for ailments</li> </ul>
<b>Affordability and willingness to pay for health care</b>	<ul style="list-style-type: none"> <li>■ High transportation cost</li> <li>■ Miners often have (more than other population groups) no valid NHIS subscription</li> <li>■ Some medications are not offered for free even for people with NHIS subscriptions and some community members (including miners) cannot afford to pay for their medications. Many miners do not save towards their health care.</li> </ul>

Table 15 shows issues around health seeking behaviour for participants of FGDs. There were large variations in the perceived costs of medical care between the different groups. Some groups rated costs to be very high while others perceived health care to be rather affordable. Also, insurance coverage varied substantially between the groups. However, there were no clear differences between the study sites.

In contrast to the KIs only very few FGD respondents reported not accessing health care. However, traditional medicines and home-made medications were often chosen over the modern medicines, partly due to financial constraints.

The bad conditions of roads leading to the referral facilities were in both sites perceived as an obstacle to accessing care.

**Table 15:** Health seeking behavior of miners according to focus group discussion participants

Leading themes	Specific issues
<b>Access to health care</b>	<ul style="list-style-type: none"> <li>■ Miners often go directly to the hospitals in the district capital but often get rejected because of the lack of insurance coverage or inability to afford the treatment</li> <li>■ After the first-line treatment (in health facilities), miners prefer to continue treatment with traditional remedies</li> <li>■ Those without NHIS subscription often revert to home-made remedies or traditional medicines sold by vendors coming to the villages</li> <li>■ The check-ups are perceived to be too expensive</li> <li>■ For injuries, usually the hospitals and CHPS compounds are visited directly without prior treatment at home</li> <li>■ First aid skills in case of accidents are very limited. At some sites very basic first aid is done by the miners at the site</li> </ul>
<b>Obstacles</b>	<ul style="list-style-type: none"> <li>■ Inability to get treated at the nearest CHPS compound. They often get referred to the hospitals, which is associated with additional transportation costs</li> <li>■ Unavailability of drugs at the CHPS compounds and health centres requires the patients to travel (sometimes over long distance) to buy their medicines at private pharmacies</li> <li>■ Bad road conditions</li> <li>■ Means of public transport are unavailable at some sites</li> </ul>
<b>Affordability and willingness to pay for health care</b>	<ul style="list-style-type: none"> <li>■ Since the ban, affordability of health services and transportation has become a problem for the miners</li> <li>■ Transportation costs are high</li> <li>■ Some are covered by the NHIS; however, many drugs are not covered by the scheme</li> </ul>

## Health promotion activities

According to most health care providers, the ASGM communities are among the general target populations of their health promotion activities in the CHPS compounds, health centres and at religious gatherings or in community meetings. These are usually done by community health nurses and include education on the most common diseases and most important health determinants (maternal and child health, malaria, diarrhea, STIs and teenage pregnancies, water and sanitation). In Birim-North there are regular TB and HIV screening campaigns.

Overall, there is a lack of education materials. The information is mainly spread in discussion fora and in counseling sessions. At the CHPS compounds a number of posters about various aspects of health were observed.

No environmental health issues are addressed in the health promotion activities in Birim-North District. Two of the health care providers in Tarkwa-Nsuaem Municipality reported on education activities about the importance of environmental hygiene. Only one respondent from the Tarkwa Municipal Hospital mentioned health promotion activities specifically

tailored to AGSM-related health issues. These included the risks of ASGM and its impacts on the environment. These health promotional activities are mostly carried out in schools and churches to engage the community at large and is open to every individual in the community no matter the age, gender or work they are involved in.

There were large differences in the perception of the health promotion activities between the study sites. In Birim-North District the respondents mirrored the health topics mentioned by the KIs listed above. In contrast, the communities in Tarkwa-Nsuaem Municipality mentioned receiving health information through a child welfare clinic which targets mothers and their children. In addition, the communities learn from radio and TV programs about some health issues. Knowledge about mining-related health issues is passed on from the elderly experienced miners to their younger counterparts.

In Birim-North District the community respondents also noted that NGOs were active in their villages, providing information about malaria and nutrition. One community in this district complained about an NGO taking blood samples and carrying out pulmonary function testing without returning with the results or providing any form of information.

In the FGDs with miners, a strong need for education on safer mining practices, mining-related health issues and treatment was expressed. This information could also be passed on by them to immigrants coming to mine at their sites. Further, regular water quality testing was one of the priority needs as

reported by the focus group participants, particularly in Birim-North District where the communities complained about black particles in the rain water and the changing color of the river water, both of which are sources used as drinking water.

### Lessons learnt with regards to the implementations of the KIIs and FGDs:

- In the FGDs, questions requiring hand raising were challenging when translation was needed and when the groups were too big. Alternatively, the translator can be briefed prior to the discussion and conduct this part without the involvement of the interviewer.
- The interviews were of appropriate length for respondents at the directorate-level in local administrations or health facilities.
- In some contexts, asking about the origin of the miners could be sensitive as foreigners are not allowed to mine. However, in the study sites, no foreigners were reported to be present.
- The FGDs participants appreciated the opportunity to ask questions to the study team. In some settings, these evolved into bigger Q&A sessions with larger sections of the community.

## Health system capacities and readiness

### Capacities and readiness according to users

The perception of the capacity of the health system to respond to ASGM-related health issues differed substantially between the different respondent groups. Government officials (i.e. planning officers, environmental health officers) deemed the health facilities to be sufficiently equipped and staffed with adequately trained health care workers. In New Abirem the health care providers even receive additional training on mining-related health issues and the industrial mine had supported the upgrading of a health centre to the currently existing New Abirem Hospital and also provided equipment for one CHPS compound. On the other hand, KIIs in the community (i.e. local leaders) noted the limited capacities for treatment at the CHPS compounds and complained about frequent referrals to the hospitals in the major towns. Also, not all facilities are open around the clock.

This was also reflected in the FGDs. While the participants acknowledged the efforts of the health care workers in the CHPS compounds to provide

adequate treatment they noted a shortage of diagnostic equipment, treatment capabilities and medicines, thereby requiring them to travel to the nearest hospitals for issues such as TB, larger cuts or bone fractures. Satisfaction with the health care provided was overall higher in the communities in Tarkwa-Nsuaem Municipality. There, most respondents expressed confidence in the quality of services at the Nsuaem Health Centre and community clinics. Even though CHPS/community clinics in the villages were not fully equipped or staffed, most provide 24 hour services and staff seemed able to handle most minor cases from the communities, making referrals when necessary. Apart from the government referral facilities, the municipality has a large network of general and specialist private facilities to which community members may also be referred.

### Capacities and readiness according to providers

At the administrative level of the health sector (i.e. health authority officials) the capacity and readiness



was seen to be moderate. The local health sector would be unable to respond to the health needs in case of an incident (i.e. spillage) or for treating special cases.

In the study sites, training is insufficient for responding to the special needs of the ASGM community. For example, nurses do not receive any specific education on mining-related aspects of health. This would be particularly important for the CHPS compounds where no medical doctors are present. Also, at the hospital level there is a lack of specialists, such as nephrologists or pulmonologists.

Further, the health authority officials reported that the equipment in the CHPS compounds is very basic. The hospitals are better equipped and can usually provide care for the majority of patients. Both in New Abirem and Tarkwa, the surgical care is of high standard. However, they do not have the capacities to diagnose specific poisonings.

Health care providers reported the lack of training and equipment in unison at all levels. At the CHPS compounds in Birim-North District and health centres/community clinics in Tarkwa-Nsuaem Municipality they reported to have only basic equipment and training to treat basic health problems. They also bemoaned the unavailability of drugs. Most of these drugs are considered as essential drugs for higher level facilities, according to Ghana Health Service/MoH policy. The respondents in the local and regional hospitals noted the lack of specialized care, such as for poisonings. At no level of the health system were there capacities to diagnose and manage chemical poisonings comprehensively. On the other hand, the referral hospitals were well equipped to diagnose and manage priority diseases, such as TB.

Also, in terms of training, all levels reported to have received too little education on mining-related health issues. Doctors receive training on environmental health issues, among which chemical exposures, including mercury poisoning, are included. However, these issues are not discussed in depth. One respondent at the New Abirem Government Hospital just underwent occupational health training and was very knowledgeable about miners' health. However, he also noted that the awareness of ASGM health issues was rather low among the general practitioners. Another issue reported was the regular rotation of staff at the CHPS facility level. Newly arriving nurses who may not have worked in mining communities previously have to be trained to recognize health symptoms related to ASGM activities.

## Health facility assessments

The HFA covering human resources, services, infrastructures, medical equipment, diagnostic capacities and drug availability in Birim-North District and Tarkwa-Nsuaem Municipality are available in the annex of the document.

In Birim-North District, the HFA confirmed some of the statements of the KIs and community members. Indeed, the CHPS compounds only offer very limited trauma care. Moderately to severely injured cases were referred to the closest hospital (usually the government hospital in New Abirem). Services offered in these compounds include primary health care services, immunization and maternal care. The staff at the CHPS compounds included nurses, midwives and community health workers. Hence, no medical doctors were available near the mining sites. The lack of diagnostic equipment and drug storage minimizes the service capacity for other health conditions, such as TB and non-communicable diseases beyond diabetes.

The district and regional referral facilities were better equipped in terms of human resources, medical and diagnostic equipment and available drugs, allowing them to treat a larger variety of cases. However, both hospitals lack a poisoning specialist and an occupational health specialist who have undergone formal training. Further, at no facility were chelators for mercury poisoning or antidotes for cyanide poisoning available.

In Tarkwa-Nsuaem Municipality the Nsuaem Health Centre and the Tarkwa Municipal Hospital were comparably better equipped and staffed than the other health centres and the CHPS compound in Adeyie included in this study. Again, no specialists dealing with health issues specific to miners (i.e. poisonings, serious trauma) were available.

Overall, the same picture as in Birim-North was observed in Tarkwa-Nsuaem Municipality. Smaller facilities handle basic public health issues (e.g. maternal and child health) and minor trauma while the bigger health centres and the referral hospital in Tarkwa handle more complicated cases and offer surgical care. In all CHPS compounds at both sites, no running water was available.

Figure 5: Old patient records in Noyem CHPS



Despite their relevance in ASGM areas the Municipal Hospital in Tarkwa and the regional hospital in Koforidua were the only facilities offering liver function testing. In all facilities, poisonings were only diagnosed based on the anamnesis (history and physical examination). For confirmation, samples would need to be sent to a laboratory in Accra.

In both sites, TB drugs were usually not kept in stock at the CHPS compounds. TB was diagnosed

at the higher level facilities. Drugs were then supplied for the patients at some of the local CHPS compounds if they lived close by. In a FGD one of the miners complained that TB drugs were hardly available on time, because drug availability depended on the diagnosed patients travelling to the hospital in the district capital to replenish stock.

### Lessons learnt with regards to the health facility assessments:

- Health statistics were readily shared. The disease surveillance officer who facilitated the process was present (New Abirem) during the KII and HFA.

- It was helpful to have multiple respondents simultaneously for the HFA as they could each give information about their area of expertise.

### Health system priority needs

Among all health issues discussed, KIIs and FGDs participants were asked on perceived health system priority needs to address ASGM-related health issues. Table 16 lists the key issues reported by KIIs.

Most prominently, the need for training and awareness campaigns about the different mining-related health issues for health care workers, the

miners and the mining communities were brought up. Awareness about these issues was seen as a key step in changing the mining practices.

At the level of the health facilities the KIIs called for more diagnostic equipment and higher drug availability. Upgrading the facilities close to ASGM sites was proposed; this would allow doctors to provide more specialist care, thereby reducing the need for referrals to the hospitals.

**Table 16:** Health system priority needs according to KIs

Leading themes	Specific issues
<b>Community training and health promotion</b>	<ul style="list-style-type: none"> <li>■ Intensification of education of the general population on the risks to miners and communities of ASGM, particularly linked to the different exposure pathways of mercury</li> <li>■ Awareness of the miners about the impacts of their activities is perceived and the importance of safe mining practices (i.e. reduction/replacement of chemical use, use of PPE) as a first step to take precautions</li> <li>■ Education on sexual and reproductive health issues (i.e. HIV prevention, teenage pregnancies), malaria, TB and injury prevention in mining communities</li> <li>■ Screening for TB</li> </ul>
<b>Training of health care workers</b>	<ul style="list-style-type: none"> <li>■ Health care providers need to be trained on mining-related health issues</li> <li>■ The training should be conducted by the Ghana Health Service in collaboration with the private sector (e.g. industrial mining companies)</li> </ul>
<b>Infrastructure</b>	<ul style="list-style-type: none"> <li>■ Accommodation for health staff needed to minimize commutes and thus ensure that the facilities are staffed at all times</li> <li>■ Need for resting areas at health facilities for relatives of patients on admission</li> <li>■ Vehicle for accessing the communities for health outreach programs</li> </ul>
<b>Equipment, diagnostics and treatment</b>	<ul style="list-style-type: none"> <li>■ Need for additional equipment to address miners' health issues</li> <li>■ Diagnostic and treatment capacity must be strengthened at the facilities close to the mining sites</li> <li>■ Need for additional drugs to address ASGM-related health issues</li> <li>■ More staff are needed at facilities near ASGM sites</li> <li>■ Upgrading of CHPS to health centres to offer more advanced care (as appropriate to ASGM-related issues) to reduce numbers of referrals</li> </ul>
<b>Access/affordability</b>	<ul style="list-style-type: none"> <li>■ Consideration to making NHIS subscription affordable for all</li> </ul>
<b>Livelihood</b>	<ul style="list-style-type: none"> <li>■ Equip people to pursue alternative livelihood strategies, other than mining</li> </ul>
<b>Law enforcement</b>	<ul style="list-style-type: none"> <li>■ Registration of miners</li> <li>■ Designate, regulate and monitor mining zones</li> <li>■ Environmental monitoring (water, air, soil) by the environmental health department at the district assembly</li> </ul>

The communities reported the lack of adequate health care in the health facilities in their communities (see Table 17). In Tarkwa-Nsuaem Municipality one community, Kianko (which had developed around ASGM), was not even served by a health facility, requiring the community members to travel far distances on the badly maintained road.

Hence, the respondents called for the establishment of a CHPS compound or even a clinic in their community. In these communities the need for improvement of public infrastructure, such as water and sanitation facilities, was also more frequently mentioned than in the sites in Birim-North District.

**Table 17:** Health system priority needs according to focus group discussion participants

Leading themes	Specific issues
<b>Community training and health promotion</b>	<ul style="list-style-type: none"> <li>■ Health education specifically targeted to ASM</li> <li>■ Vector control</li> <li>■ Awareness campaigns on mining-related health risk for the communities near the ASGM sites</li> <li>■ Water safety planning in mining areas</li> <li>■ Advocate for the safe use of chemicals, including those used outside the mining sector (i.e. pesticides)</li> <li>■ Water quality monitoring</li> </ul>
<b>Equipment, diagnostics and treatment</b>	<ul style="list-style-type: none"> <li>■ Equip CHPS compound with additional staff and medication to reduce the need to travel to distant hospitals</li> <li>■ Expand range of services offered at the CHPS compounds</li> <li>■ Ensure availability of medicines at health centres</li> </ul>
<b>Access/affordability</b>	<ul style="list-style-type: none"> <li>■ Transport costs are too high</li> <li>■ Treatment costs are very high despite NHIS coverage</li> <li>■ Drugs should also be covered by the NHIS scheme</li> </ul>
<b>Infrastructure</b>	<ul style="list-style-type: none"> <li>■ Improve public sanitation facilities</li> <li>■ Provide more drinking water access points</li> <li>■ Improve road conditions</li> <li>■ Provide health facility in the remote communities (in Tarkwa-Nsuaem Municipality)</li> </ul>

# Institutional and stakeholder aspects

## Civil society organizations

At both sites, CSOs are actively engaging miners in their educational activities. These activities include those focusing on the safe use of chemicals, particularly mercury, and the importance of the use of PPE. In Tarkwa-Nsuaem Municipality, they collaborated closely with the GHS for health talks for their association members. For the CSOs in Birim-North District, health was only touched on in their outreach activities as a secondary issue in connection with mercury exposure or accidents in pits. However, the engagement of the health sector in this study was welcomed and perceived as previously lacking.

The CSOs see themselves as a suitable entity to enter the mining communities because they are well accepted. Since the ban, representatives from the

district assembly have been viewed with suspicion by the miners. However, in Birim-North District the CSOs had up to the time of the study been unable to reach the galamseyers with their activities because they were hiding, for fear of prosecution by the government authorities. In the future, these miners will be more specifically targeted as it was recognized that they are strongly affected by the problems of mercury use and lag behind with the use of PPE.

## Government

The ban on artisanal mining has changed a lot the interaction between the ASM and the government representatives. Currently, the sector is being formalized, meaning that miners are being registered and mining permits given. As part of it, the

community mining project is an initiative aiming at engaging the local communities in the mining sector and empowering local authorities in regulating and supervising their activities. However, many miners have not undergone the registration process and continue to mine illegally, sometimes partially at night to hide from the authorities.

With regards to health, little has been done by the government that specifically addresses ASGM-related health issues. The past activities mainly address health issues in the communities in general, such as TB screening and general health education about the most common public health conditions. In Kanianko, the health authorities actively engage with the miners in the area. They advise them on safety measures to take when in the field, issues of sanitation, effects and prevention of drug abuse and HIV/AIDS among others and the importance of attending the hospital when they are injured or suffering from any form of ill-health.

Many plans for future activities in relation to health in ASGM sites were reported by the KIs. Interestingly, one of the KIs reported that there is a plan for addressing miners' health in the MoH. However, there were no documented implementation plans. Other examples mentioned in the Tarkwa-Nsuaem Municipality local government include health education sessions in churches and mosques, providing alternative livelihoods, liaising with larger mining companies to assist with training for ASGM operatives and training communities to monitor the ASGM activities within their jurisdiction.

### Inter-sectoral and inter-organizational collaboration

All KIs were convinced of the importance of inter-sectoral collaboration for addressing ASGM-related health issues and the issues related to mercury use in particular. For successfully reducing the use of mercury at the mining site and its health impacts, people from the ministries of health, environment, mining and education have to work together with the local governments and community leaders, NGOs, and the private sector.

However, this collaboration has not been operative to its full potential. Part of the problem was seen in the lack of awareness at the central level of the issues in the remote ASGM sites. Hence, there was a call for decentralization of the collaboration. Especially the need for more monitoring capacities at the local level was noted. Commonly there is collaboration with the private sector (i.e. industrial mines) for the monitoring of water and air quality. However, many of the KIs do not trust the published results.

KIs also proposed other collaborations to specifically address certain ASGM-related health and environmental issues. For example, the health authorities could work together with the environmental protection agencies and the police to enforce safe mining practices and environmental protection. Others proposed that the health sector engages in active collaboration with the University of Mines and Technology and the Minerals Commission. These institutions currently provide education to small-scale miners. The health sector could introduce health aspects in these trainings.

In summary, there has been some inter-sectoral and inter-organizational collaboration that at least partially touched on health issues in mining communities and addressed the use of mercury in the ASGM sector. However, according to the KIs these collaborations have to become more efficient in working together in order to have an impact at the local level.

### Community initiatives

KIs and FGDs participants were asked what the ASGM communities could do themselves to improve their situation, especially their health situation. Propositions made are listed in Table 18 below. The predominant opinion among the KIs and the FGD participants was that miners ignore the risks of their profession and thus enter the pits without any PPEs. Most respondents called for more awareness and education of the miners about their health risks.

**Table 18:** Proposed community initiatives

Leading themes	Specific issues
<b>Awareness raising</b>	<ul style="list-style-type: none"> <li>■ Miners could recognize the risks of their profession</li> <li>■ Miners should be aware of the risks their activities pose for the community and the environment</li> <li>■ Obtain training on ASGM-related health issues, specifically those related to the use of chemicals</li> <li>■ Get informed about where to get help in case of an accident or disease</li> <li>■ Engage in education of peers (e.g. through formation of ‘awareness clubs’)</li> <li>■ Learn how to spend and invest money to plan for potential hardships</li> </ul>
<b>Personal protective equipment (PPE)</b>	<ul style="list-style-type: none"> <li>■ Invest in PPE</li> <li>■ Obtain education on PPE</li> <li>■ Accept and use PPE</li> <li>■ Buy better equipment (e.g. better torches, machines)</li> <li>■ Stop ignoring the risks of their operations</li> </ul>
<b>Health promotion</b>	<ul style="list-style-type: none"> <li>■ Use insecticide treated nets at home</li> <li>■ Attend regular health check-ups</li> </ul>
<b>Safer techniques</b>	<ul style="list-style-type: none"> <li>■ Adopt safer mining techniques (stop using mercury and cyanide)</li> <li>■ Secure mining sites to prevent people from falling into pits</li> <li>■ Invest in equipment to reduce chemical use and human exposure (e.g. retorts)</li> </ul>
<b>Self-regulation</b>	<ul style="list-style-type: none"> <li>■ Engage in monitoring of mining activities in collaboration with the district assembly and mines inspectorate</li> <li>■ Miners could be included in the monitoring activities</li> </ul>
<b>Common financial investments</b>	<ul style="list-style-type: none"> <li>■ Contribute to the improvement of the health facilities</li> <li>■ Jointly invest in public drinking water infrastructure and education facilities</li> <li>■ Pool money to buy safer mining equipment</li> <li>■ Create a community-based health insurance pool to fund their health care</li> </ul>

# 6 Conclusions



“ Most health care providers recognized that they are only trained and equipped to respond to primary health care issues, limiting them in their response to ASGM-related health issues.

”

# Conclusions

In this study, two ASGM sites in the Eastern and Western Regions, respectively, in Ghana were visited in August and September 2019 for a rapid HSA. 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. Perceptions from KIIs and community members that the local health facilities are not adequately equipped to address mining-related health issues were backed up by the results of health facility assessments.

*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 outcomes reported by artisanal and small-scale gold miners and by health care providers living and working in ASGM areas were largely concordant. Differences were mainly seen in the terminology used to describe the symptoms (e.g. arthritis vs. joint pain). However, the perception of the health risks associated with ASGM substantially differed between the mining community members and KIIs. While both described a myriad of occupational and environmental hazards, social and livelihood issues were mainly described by the key respondents. Also, KIIs were more knowledgeable of the different exposure pathways associated with the different chemicals used in the mining processes. These findings may indicate that: (i) the KIIs that were largely located in the district capitals are not well informed about the social structures in the remote

ASGM communities; (ii) miners and community members lack the knowledge to identify exposure pathways to chemicals and hence fail to recognize health effects thereof; (iii) soil and water pollution with chemicals is a big concern for the mining communities, health care providers and local authorities; and (iv) occupational hazards are manifold and lead to frequent accidents.

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

- The artisanal and small-scale gold miners in the study sites identified a large set of occupational hazards (e.g. falls, collapsing pits, injuries in explosions, low oxygen levels in the pits) and environmental hazards, such as contamination of air, soil and water. Compared to other respondent groups, the chemical hazards from exposure to mercury and dust were only superficially described. Additionally, a few social impacts were reported by the miners and the community members. Still, a myriad of different health outcomes were reported as being the consequence of the mining activities. Despite the identification of these health impacts, the use of PPE was very low, as reported by nearly all respondents in the KIIs and FGDs. Reasons for the low uptake of PPE were: (i) ignorance of the risks; (ii) perceived disturbance of miners' activities by PPEs while working in the slippery and narrow pits; (iii) unavailability of PPEs; (iv) high costs of PPEs; and (v) unawareness of the vending points of PPEs. The driving force to keep up the risky mining practices are the potentially large revenues and the lack of alternative livelihoods.



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

- Financial and geographical obstacles in accessing health care were reported in the two study sites. Although under NHIS coverage health care is provided free of charge, three main economic obstacles were identified: (i) not all people were covered under the NHIS and those without coverage included mainly the very poor; (ii) many drugs are not covered or only partially covered under the NHIS, thus increasing the financial burden of long-term and expensive treatments; and (iii) transportation costs were considered to be high in case of referrals. This was even more significant as many health conditions in ASGM sites could not be treated by the local health facilities in the communities. Occupational factors (i.e. being a miner) were not particularly seen as influencing the ability to access care. However, some reported that miners are afraid to report their occupation as they fear prosecution. Geographical obstacles were identified in Tarkwa-Nsuaem Municipality where some communities were cut off from the health facilities during the rainy season. There are 34 functional CHPS zones in 30 electoral areas in the Municipality. However, there is a skewed distribution of the health facilities, where most of the facilities are located in the urban areas.

*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.*

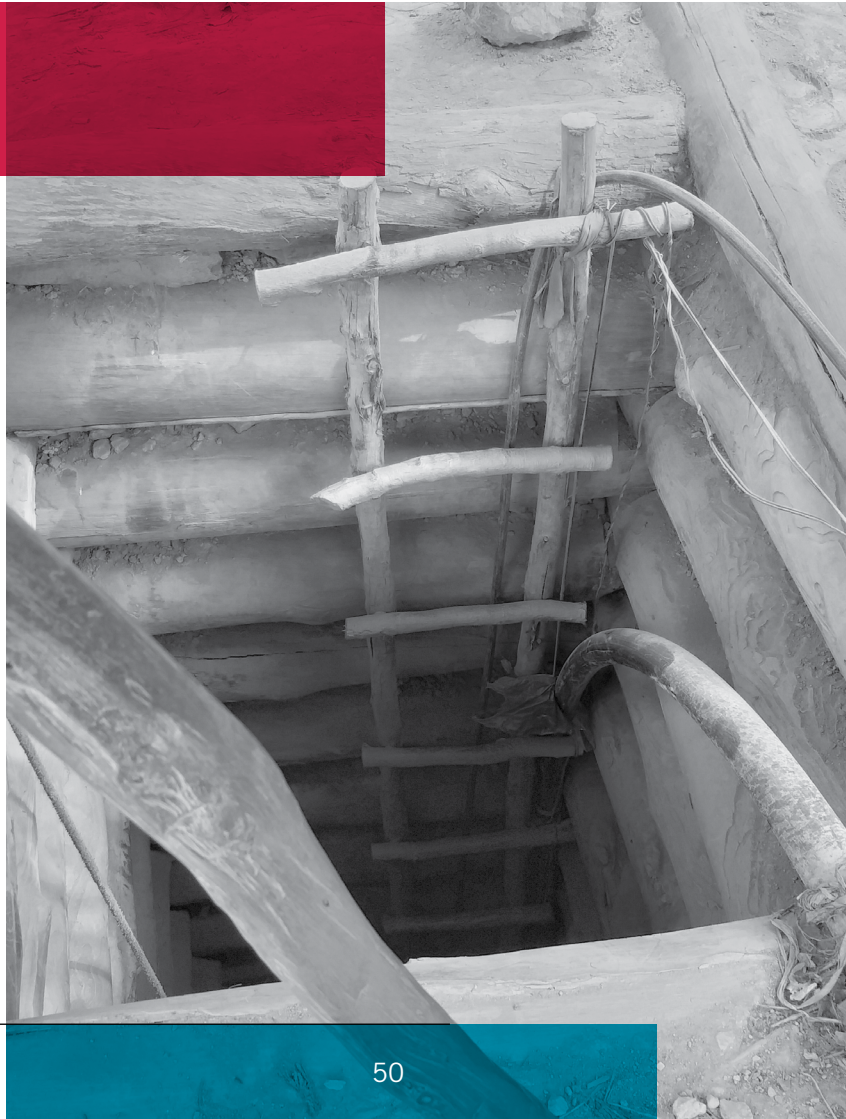
- According to the HFA, the capacity and readiness of the health system to address health problems specific to artisanal and small-scale gold miners, their families and the broader communities is very limited in terms of staff with sufficient training, offered services, diagnostic abilities, and treatment options. Particularly at the community level only basic

services for the most common diseases and maternal care are provided. For more specialized care needed for ASGM-related health issues (e.g. TB diagnostics, surgical care) patients are directed to the local (district) and regional referral facilities. While these facilities provided a wider array of services there is still a lack of staff and medical equipment to recognize and treat some of the health issues specific to the mining communities. For example, in all facilities poisonings were only diagnosed based on the anamnesis (history and physical examination but excluding laboratory support) and medication (i.e. chelators for mercury poisoning or antidotes for cyanide) was not available. KIs identified a lack of training about mining-related health issues within all levels of the health care system. Community members complained that they often needed to be referred to the referral facilities, leaving them with additional costs to be incurred for transportation. In both Birim-North District and Tarkwa-Nsuaem Municipality there was one community without any health facility. In summary, there is a need for more capacities for recognizing and treating ASGM-related health issues, particularly at the community level.

- Especially 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, there was low capacity and readiness of the local health system 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 in their response to ASGM-related health issues such as severe injuries, STIs or chemical intoxications. Health professionals at regional level are better trained and equipped for biomechanical health risks but were equally limited in responding to chemical induced health issues.



# 7 Recommendations



## In this section:

Recommendations at the individual level

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Recommendations at the community level

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Recommendations at the institutional level

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# 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 Ghana.

## Recommendations at the individual level

- Adaptation of safer mining approaches to minimize risks:
  - Building of safer underground shafts through reinforcement of pits with (wooden) scaffolding or similar technology.
  - Ensuring oxygen supply in underground shafts.
  - Enforce minimum waiting time before entering the pits after blasting of rocks to allow dust to settle.
  - Use of retorts and other techniques (e.g. sika bukyia, a gold smelting furnace) that reduce exposure to mercury vapor when burning mercury amalgam.
  - Safe disposal of mercury and cyanide tailings.
  - Move amalgam burning “kitchens” to the outskirts of the communities.
  - Closing/covering of underground pits overnight or when not in use to prevent reptiles or rodents from entering it.
- Use of PPE:
  - Solid shoes: Solid shoes (sneakers, Wellington boots or more solid boots with profile) can protect from falls due to slipping and injuries due to rough ground and falling rocks. Local designs can be developed to suit the needs of the miners.
  - Hats, helmets: Headgear can protect from sun, diminish the impact of and minimize the risk of injuries due to falling rocks.
  - Protective glasses and goggles: Eye protection for rock breaking activities and dust.
  - Gloves: Hand gloves when handling rocks and during washing (sluicing).
- Masks: For protection from inhalation of dust and mercury fumes.
- Overalls: Wearing overalls will provide protection to the skin from dust and mercury particles instead of working bare chested. It will also protect regular clothing that is worn underneath. Careful selection of fabrics from which the overalls are made will help prevent overheating.
- Environmental management and hygiene:
  - Minimal reclamation of land after use such as filling pits to avoid falls of humans and animals or stagnant water bodies that promote mosquito breeding.
  - Stop open defecation at mining sites.
  - Prepare food away from amalgam smelting activities to avoid additional contamination of food consumed at the mining sites.
- Awareness of the importance and value of personal and community health:
  - Adopting a safer and healthier lifestyle (including safer mining behaviors, personal hygiene, avoidance of substance abuse, practicing of safe sex, etc.) will avoid potential future health care costs.
  - Understanding that personal health has a value and a price. Minimal income savings will ensure funds are available to cover for health care needs and avoid economic shocks.
  - Access health care services and attend regular check-ups to avoid the spread of infectious diseases, such as TB or HIV.

# Recommendations at the community level

- Self-regulation of mining activities:
  - Organize mining activities along traditional structures and use existing, traditional mechanisms for land use management and conflict management.
  - The community engages in monitoring of the mining activities, including the adoption of safe mining practices. Collaboration with the district authorities may allow inspections and enforcement of environmental standards.
- Environmental management:
  - Develop a water safety plan including:
    - ◆ Geographically and technically separating polluted waters from water used by communities for drinking, irrigation and other activities. Polluted waters could be retained in sealed ponds with subsequent reuse of the chemicals.
    - ◆ Avoid open defecation at mining sites and environment. Practice defecation in designated areas
    - ◆ Fund, build and use basic latrines (e.g. ventilated improved pit latrines).
    - ◆ Provide safe drinking water at the mining sites.
  - Geographically separate all mining activities, including amalgam burning activities, from the community residential areas.
- Liaise with environmental health department, EPA and Community Water and Sanitation Department for assessing the quality of community water sources used for drinking and irrigation.
- Alternative livelihoods:
  - Promote alternative livelihoods by increasing technical and financial capacities of farmers.
  - Create secondary markets that also promote safer mining such as locally sold PPE.
  - Balance farming and mining activities in communities to ensure self-subsistence and balanced demand and supply of agricultural products.
- Community-based financing:
  - Create a community-based health insurance pool to fund health care costs related to the mining activities for people without access to NHIS.
  - Pool money to buy safer mining equipment, such as retorts.
  - Jointly contribute to investments in public infrastructure that are lacking or in short supply for routine use and in case of rapid in-migration. The type of infrastructure (e.g. boreholes, sanitation facilities or health care equipment) could be determined by a committee.

# Recommendations at the institutional level

- Health promotion and awareness raising:
  - Target awareness raising activities specifically on ASGM-related health issues to the needs of individual (miners, community members), community (traditional leaders, ASGM leaders, civil society organizations) and institutional levels (local and national government, politicians and decision-makers, health sector) through previously found effective means (e.g. radio, billboards, associations, NGOs, innovative technologies).
  - Engagement with other sectors and organizations in providing training may be beneficial (see below).
  - Promote the use, availability and affordability of PPE by awareness-raising campaigns and micro-financing for local PPE vendors.

## RECOMMENDATIONS

- Health system capacity:
  - Provide local health facilities with training, medical equipment, infrastructure, diagnostic and treatment capacities to address the health issues associated with ASGM activities. This could include extended trauma care and improved drug availability for diseases common in mining communities (e.g. TB) for facilities at the community level and improved diagnostics for poisonings and renal conditions and posting of medical doctors with specialist training in occupational health to referral facilities at district or regional levels.
  - Integrate mining-related health issues in the curriculum of health care providers and environmental health officers at different levels (in school and also as part of continued professional development).
  - Specifically train health care providers arriving in facilities in mining areas to recognize ASGM-related health issues. Fostering exchange between health care workers at the district and the peripheral level through regular meetings.
  - Enforce pre-employment and periodic health screening for miners and host communities for general wellness and bio-monitoring for mercury exposure. The local health care providers could be responsible for the health screening while the Mines Department in collaboration with the Health Directorate could oversee and monitor the activities.
  - Training activities could profit from the collaboration with the private sector (i.e. industrial mining companies) and academia.
  - 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.
- Inter-sectoral and inter-organizational collaboration:
  - Facilitate and enhance stakeholder exchanges between sectors (mining, environment, health, education, agriculture, etc.), traditional leaders, civil society and ASGM communities. This will facilitate tackling environmental, social, livelihood and health issues related to ASGM.
- Close collaboration between local institutions (i.e. district authorities, police, traditional leaders, community organizations) to monitor mining activities, promote safe mining practices and environmental protection, and to settle conflicts peacefully.
- The health sector could engage in the ongoing collaboration between the University of Mines and Technology at Tarkwa and the Minerals Commission to introduce health-related issues in their training activities with small-scale miners.
- Further engage mining associations and community organizations in the enforcement of safe mining practices (including the use of PPE) and educational campaigns.
- Revise current categorization of mining activities separating small-scale from artisanal gold mining.
- Continuing the formalization of ASGM activities contributes to:
  - Officially monitoring mining activities and ensuring compliance to regulations.
  - Allay fears of miners to encourage them to seek medical care in case of work-related health issues.
  - Increase safety in the mines so that the miners can work legitimately and not need to mine clandestinely at night.
  - Properly plan and execute ASGM activities to minimize conflicts and risks (environmental, social, health).
  - Enforce prohibition of burning in residential areas (defined as at least 500m away from residential areas according to UNIDO guidelines). These prohibitions can be incorporated in legal/regulatory authority of EPA, Minerals Commission and incorporated in health education/sensitization activities of the Ghana Health Service.

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# Annexes

## Health facility assessments

**Table 19:** Health facility assessment in Birim-North District

	New Abirem Govt Hospital	Nuyem CHPS	Nyafoman CHPS	Koforidua Regional Hospital
<b>A. Basic information</b>				
<b>Location of facility</b>	New Abirem	Nuyem	Nyafoman	Koforidua
<b>Type of facility</b>	District Hospital Birim-North	CHPS	CHPS	Regional Hospital
<b>Duration of existence of health facility (in years)</b>	Since 1973 health centre; 2010 upgraded to hospital	10 years	15 years	1926
<b>Catchment population of the health facility</b>	100000	4660	N/A	2300000
<b>B. Human resources availability: How many of the following human resources are available in your facility?</b>				
<b>General doctor (GP)</b>	3	0		31
<b>Specialist medical doctor</b>	1 (dental surgeon)	0		27
<b>Non-physician / paramedical professional</b>	2	0		42 (incl. lab assistants)
<b>Nursing professional</b>	10 (nurses and midwives)	4	2	309
<b>Midwifery professional</b>		0	1	76
<b>Pharmacist</b>	2	0		10
<b>Community health worker</b>		3		7
<b>Public health officer</b>		0		0
<b>Public health worker</b>		1		2
<b>Environmental health officer</b>	None. But one is attached to facility.	0		1
<b>Laboratory technician</b>	1	0		13
<b>Laboratory assistant</b>	4	0		See above
<b>Radiographer</b>		0		4
<b>Poisoning specialist</b>		0		0

	New Abirem Govt Hospital	Nuyem CHPS	Nyafoman CHPS	Koforidua Regional Hospital
Occupational health specialist		0		Nurse without formal training
Emergency medicine		0		0
Orthopaedic surgeon		0		0
Trauma specialist		0		0
First responder		0		1
Other	Yes	No		Radiologist (1), paediatrician (4), urologist (1)
Which other human resources?	2 nurse anaesthetists nurses, 1 admin			
<b>C. Which health services are offered in your facility?</b>				
Outpatient services	Y	Y	For minor conditions	Y
Inpatient services	Y	No		Y
24-hour emergency services	Y	Y	Very basic + emergency delivery	Y
Blood transfusion	Y	No		Y
Primary health care* services *majority of a person's health needs throughout life	Y	Y	Y	Y
Neonatal resuscitation with bag and mask	Y	Y		Y
Immunization services	Y	Y	Y	Y
HIV testing and counseling	Y	Y		Y
Family planning services	Y	Y	Y	Y
Pharmacy	Y	Y		Y
Intensive care	Y	No		Y
General surgery	Y	No		Y
Emergency trauma/surgical care	Y	Only minor traumas, rest is referred		Y
Radiology		0		Y
Diagnosis, treatment and treatment supervision of TB	Y	They only suspect cases and refer, so no		Y

	New Abirem Govt Hospital	Nuyem CHPS	Nyafoman CHPS	Koforidua Regional Hospital
Diagnosis or management of non-communicable diseases, such as diabetes, cardiovascular disease, or chronic respiratory disease	Y	No		Y
Basic occupational health services	Y	Y		Y
Trauma: Services in case of falls from height and explosion	Y	No		Y
Screening of neurological disorders		No		Y
Screening of pneumoconiosis (interstitial lung diseases) Chest radiography CT		No		Y, CT
Trauma: Electric shock		No		Y
Trauma: Limb, bone fracture	Y	No		Y
Trauma: Brain injury		No		Y
Trauma: Spinal injury	Y	No		Y
Trauma: Wounds caused by cutting, hitting and sticking	Y	Y		Y
Trauma: Burns If yes, what degrees/ levels?	Domestic accidents	Only minor	Very small and superficial	Y, even to 3 <sup>rd</sup> degree (unless very extensive or affecting a lot of the face)
<b>D. Service usage</b>				
Number of inpatient beds:	79	0	0	340
Total number of inpatients (last year):		0	0	19 000
What is the estimated percentage of ASM among total inpatients?	5% (2% from Newmont)	0		<1%
Total number of outpatients (last year):		50 per week => ca. 2500 per year	8-10/day => ca. 3500 per year	250 000
What is the percentage of ASM among total outpatients?	5%	Ca 20%	Very few now. Used to be higher during active mining period	<1%

	New Abirem Govt Hospital	Nuyem CHPS	Nyafoman CHPS	Koforidua Regional Hospital
<b>Number of emergency calls for accidents (monthly average):</b>	4-5 daily (mostly road-traffic)	10	None now, used to be 2-3 per month	5 (but most are referred anyway)
<b>Of which, accidents among ASM:</b>		20%	Don't know	0.5 (they usually don't come here)
<b>E. Infrastructure</b>				
<b>Does this facility have a cellular phone or a private cellular phone that is supported by the facility?</b>	Every department has 1-10	No	No	Y
<b>Is there regular/reliable running water?</b>	Y	No	No	Y
<b>What is the source of electricity?</b>	Grid	Grid	Grid	Grid
<b>Is there a functioning refrigerator?</b>	Y	Y	Y	Y
<b>Does this facility have a functional ambulance or other vehicle for ambulance services, including fuel?</b>	Y	No	No	Not working
<b>Functioning computer</b>	Y	Tablet, no computer		Y
<b>Internet</b>	Y	Y		Y
<b>F. Which medical equipment is available and functional in your health facility?</b>				
<b>Scale for adults</b>	Y	Y	Y	Y
<b>Digital blood pressure apparatus</b>	Y	Y	1 and one with Hg	Y
<b>Pulse oximeter</b>	Y	Y		Y
<b>Oxygen concentrator</b>		No		Y
<b>Oxygen cylinders</b>	Y	No		Y
<b>Oxygen delivery apparatus (functional)</b>	N/A	No		Y
<b>Intravenous infusion kit / IV sets</b>	Y	No	Used mainly for gastroenteritis	Y
<b>Anaesthesia equipment</b>	Y	Y		Y
<b>Sterile gloves</b>	Y	Y	Only non-sterile	Y
<b>Artificial breathing machine</b>	N/A	No		Y (2)
<b>Headrest</b>	Y	No		Don't know
<b>Aspirator (electric, pedal)</b>	Y	No		Y
<b>Pressure cooker for sterilization</b>	Autoclave	No		Autoclave

	New Abirem Govt Hospital	Nuyem CHPS	Nyafoman CHPS	Koforidua Regional Hospital
<b>G. Diagnostic availability</b>				
Do you measure blood glucose level?	Y	No		Y
Do you measure urine protein level?	Y	Y	Y	Y
Does this facility do urine ketone dipstick tests? For diabetes	Y	Y		Y
Does this facility do liver function tests? Specific assay kit - liver function test		No		Y
Does this facility do renal function tests? Specific assay kit - renal function test	Y	No		Y
Does the facility have capacity to test for chemical poisoning? If yes, which ones? What are the procedures?	No	No		No
Diagnosis of mercury exposure Whole blood Urine				
Blood chemistry analyser	Undergoing maintenance	No		Y
Centrifuge	Y	No		Y
Does this facility do haemoglobin testing? Colorimeter, haemoglobinometer? HaemoCue?	Colorimeter	Y, haemoglobinometer	Y	Colorimeter
Do you do full blood count and differential testing?	Y	No		Y
Does this facility do ABO blood grouping testing?	Y	No		Y
TB testing: Microscopy: Ziehl-Neelson, auramine fluorescence microscope? GeneXpert?	Ziehl-Neelson	No		Y, GeneXpert
Do you do Gram stains?	Y	No		Y
Light microscopy	Y	No		Y
Do you do electrocardiograms (ECG)?	Y	No		Y

	New Abirem Govt Hospital	Nuyem CHPS	Nyafoman CHPS	Koforidua Regional Hospital
<b>H. Drug availability</b>				
<b>ART (Zidovudine, Nevirapine, Efavirenz)</b>	Y	Not in stock, but they need to be brought from hospital if they have a patient		Y
<b>TB drugs (first line treatment)</b>	Y	Same as above	Y	Y
<b>TB drugs (second line treatment)</b>		Same as above		Y
<b>Oxytocin / Misoprostol</b>	Y	Y		Y
<b>Penicillin / Ampicillin / Benzadine</b>	Y	No	Y	Y
<b>Erythromycin Respiratory tract infections, chlamydia,</b>	Y	No		Y
<b>Doxycycline</b>	Y	No		Y
<b>Antipyretics (anti-fever)</b>	Y	Y	Y	Y
<b>Diazepam / valium Injectable Oral 5mg cap/tab Treat anxiety, muscle spasms, seizures, insomnia, restless legs syndrome, vertigo,</b>	Y oral and injectable	No		Both
<b>Injectable magnesium sulphate or other anticonvulsant (antiepileptic, antiseizure)</b>	Y	No		Y
<b>Adrenaline injection Used to treat severe allergic reactions (anaphylaxis) to bites, foods, drugs; severe asthma, or heart attack</b>	Y	No		Y
<b>Anti-histamines Allergies</b>	Y	Y		Y
<b>Thiazides Relax blood vessels (for high blood pressure) or edema (caused by heart, liver or kidney failure)</b>	Y	No		Y
<b>Salbutamol, Beclomethasone inhaler Relieve asthma and breathlessness</b>	Y	No		Y
<b>Ceftriaxone injection 1g (antibiotic injection)</b>	Y	No		Y
<b>Ciprofloxacin 500mg cap/tab</b>	Y	No	Y	Y

	New Abirem Govt Hospital	Nuyem CHPS	Nyafoman CHPS	Koforidua Regional Hospital
Ko-trimoxazole suspension	Y	Y		Y
Amoxicillin 500mg	Y	Y		Y
Penicillin injection	Y	No		Y
Gentamycin injection Infectious diseases: chest, urinary tract	Y	No		Y
Diclofenac 50/75mg (Voltaren) Anti-inflammatory	Y	Y	Y	Y
Paracetamol	Y	Y	Y	Y
Sodium chloride injectable solution (NaCl)	Y	No		Y
Betamethasone / Dexamethasone injection Acute allergic reactions, severe shock from surgical or accident trauma	Y	No		Y
Chelators for mercury (DMPS, DMSA)		No		N
Antidotes for cyanide		No		N
<b>I. Care and referral systems in place</b>				
What is the procedure in a suspected case of mercury poisoning? Diagnosis? Care and treatment? Referral?	Call the referral point. Nurse accompanies patient.	Diagnose: suspect cases based on symptoms Treatment: no treatment available at CHPS Referral to New Abirem Hospital	Referral letter, look for transport (taxi or hail from roadside)	Anamneses, vitamin B treatment, Kolebu Accra referral
What is the (referral) procedure in case of burns?	Same as above	Minor burns are treated, others referred	Same as above	Kolebu Accra only when extreme
What is the (referral) procedure in case of trauma (e.g. compound fracture, severe injury, etc.?)	Same as above	Referral	Same as above	General surgeons treat normal cases, complex cases are referred to St. Joseph's Hospital
Proximity of referral hospital (in hours by motorized transport)	Koforidua (2.5h), Nkawkaw (45min)	30mins	New Abirem hospital (ca. 45mins)	2h (to Kolebu, Accra), 20mins (to St. Joseph's Hospital)
Transportation possibility to referral hospital offered by your facility	In emergencies only	No	No	To St. Joseph's yes but not to Accra
Cost of referral in local currency (both ways):	Nkawkaw (150 cedis), Koforidua/Kumasi (400 cedis)	10 ("public transport") - 50 cedis (private taxi)		250-300 (ambulance)

**Table 20:** Health facility assessment in Tarkwa-Nsuaem Municipality

	Iduapriem Community Clinic	Nsuaem Health Centre	St. Destiny Homeopathic & Community Clinic	Teberebie Health Centre	Tarkwa Municipal Hospital
<b>A. Basic information</b>					
<b>Location of facility</b>	Adeyie	Nsuaem	Kedadwen	Teberebie	Tarkwa
<b>Type of facility</b>	CHPS compound	Health Centre	OPD Primary Health Care	Health Centre	Referral facility / General hospital
<b>Duration of existence of health facility (in years)</b>	Since 1991	Since 1977	5-6 years	Since 2014	4 years
<b>Catchment population of the health facility:</b>	4481 (Iduapriem sub-municipality). Probably less as Teberebie is in same sub-municipality	>30 000	>1993	4481 (Iduapriem sub-municipality) Probably less	181,224 at end of 2018 (based on 2000 PHC)
<b>B. Human resources availability</b>					
<b>General doctor (GP)</b>	-	-	Physician assistant (1)	-	6
<b>Specialist medical doctor</b>	-	-	-	-	4 (surgeon, ob-gyn, paediatrician, physician specialist)
<b>Non-physician / paramedical professional</b>	-	1 PA	-	-	22
<b>Nursing professional</b>	1 enrolled nurse	5 enrolled nurses	2 health assistants (clinical)	3-2 ENs & 1 health assistant	54 (nurses & midwives)
<b>Midwifery professional</b>	1 midwife	1 midwife	-	2	
<b>Pharmacist</b>	-	-	-	-	2
<b>Community health worker</b>	5-1 disease control officer & 4 community health nurses	4 community health nurses	-	1	12 (nurses)
<b>Public health officer</b>	-	1 disease control officer	-	-	-
<b>Public health worker</b>	-	-	-	-	1 (nurse)
<b>Environmental health officer</b>	-	-	-	-	1
<b>Laboratory technician</b>	-	Yes (1)	-	-	4
<b>Laboratory assistant</b>	-	-	Yes	1	1



	Iduapriem Community Clinic	Nsuaem Health Centre	St. Destiny Homeopathic & Community Clinic	Teberebie Health Centre	Tarkwa Municipal Hospital
<b>Radiographer</b>	-	-	-	-	1
<b>Poisoning specialist</b>	-	-	-	-	-
<b>Occupational health specialist</b>	-	-	-	-	-
<b>Emergency medicine</b>	-	-	-	-	-
<b>Orthopaedic surgeon</b>	-	-	-	-	-
<b>Trauma specialist</b>	-	-	-	-	-
<b>First responder</b>	Nurses on duty	Nurses	-	Nurses on duty	Any nurse/ medical staff on duty
<b>Other</b>	-	-	-	-	
<b>Which other human resources?</b>	-	-	-	-	
<b>C. Health services</b>					
<b>Outpatient services</b>	Yes	Yes	Yes	Yes	Yes
<b>Inpatient services</b>	-	No (detention)	-	Yes (detention for observation but no admission)	Yes
<b>24-hour emergency services</b>	Yes	Yes	-	Yes	Yes
<b>Blood transfusion</b>	-	No	-	-	Yes
<b>Primary health care* services</b> *majority of a person's health needs throughout life	Yes	Yes	-	Yes	Yes
<b>Neonatal resuscitation with bag and mask</b>	-	Yes	-	-	Yes
<b>Immunization services</b>	-	Yes	-	-	Yes
<b>HIV testing and counseling</b>	Yes	Yes	-	Yes	Yes
<b>Family planning services</b>	Yes	Yes	-	Yes	Yes
<b>Pharmacy</b>	(Dispensary)	(Dispensary)	Yes	(Dispensary)	Yes
<b>Intensive care</b>	-	No	-	-	Yes
<b>General surgery</b>	-	No	-	-	Yes
<b>Emergency trauma/ surgical care</b>	-	Very minimal	-	-	Yes
<b>Radiology</b>	-	No	-	-	Yes

	Iduapriem Community Clinic	Nsuaem Health Centre	St. Destiny Homeopathic & Community Clinic	Teberebie Health Centre	Tarkwa Municipal Hospital
<b>Diagnosis, treatment and treatment supervision of TB</b>	Yes, supervision, once diagnosed & medication supplied from hospital)	Yes	-	Supervision of patient for compliance once diagnosis is made and drugs prescribed from hospital	Yes
<b>Diagnosis or management of non-communicable diseases, such as diabetes, cardiovascular disease, or chronic respiratory disease</b>	-	No	-	-	Yes
<b>Basic occupational health services</b>	-	No	Yes	-	Partially
<b>Trauma: Services in case of falls from height and explosion</b>	-	No (immobilize & refer)	-	Initial treatment / first aid for minor injuries	Yes
<b>Screening of neurological disorders</b>	-	No	-	-	Yes
<b>Screening of pneumoconiosis (interstitial lung diseases) Chest radiography CT</b>	-	No	-	-	No comprehensive screening, chest radiography available
<b>Trauma: Electric shock</b>	-	Observe	-	-	
<b>Trauma: Limb, bone fracture</b>	-	Refer	-	-	Yes
<b>Trauma: Brain injury</b>	-	Refer	-	-	No
<b>Trauma: Spinal injury</b>	-	Refer	-	-	No
<b>Trauma: Wounds caused by cutting, hitting and sticking</b>	Yes	Yes	Yes	Yes	Yes
<b>Trauma: Burns If yes, what degrees/ levels?</b>	Yes Minor, small 1st degree burns	Yes (1st degree)	Yes	Yes; 1st degree (small area)	Yes
<b>D. Service usage</b>					
<b>Number of inpatient beds:</b>	-	13	-	-	158
<b>Total number of inpatients (last year):</b>	-		-	-	7,783

	Iduapriem Community Clinic	Nsuaem Health Centre	St. Destiny Homeopathic & Community Clinic	Teberebie Health Centre	Tarkwa Municipal Hospital
What is the estimated percentage of ASM among total inpatients?	-	Not sure	-	-	Do not know
Total number of out-patients (last year):	-	30,8026	-	-	90,036
What is the percentage of ASM among total outpatients?	-		-	-	Unsure but very low now. Used to be higher during the boom
Number of emergency calls for accidents (monthly average):	At the peak of galamsey, used to be frequent, at least 1 or 2 a week. Now, hardly.	About 2 (mainly Road Traffic Accidents (RTA))	-	1 or 2	Injuries mainly from RTAs
Of which, accidents among ASM:	1	1	-	1 or less.	Don't know
<b>E. Infrastructure</b>					
Does this facility have a cellular phone or a private cellular phone that is supported by the facility?	Yes	Yes	Yes	Yes	Yes, (20-21)
Is there regular/reliable running water?	No (Borehole for the clinic is broken down. It's now used more as a well; water is used for washing. For drinking and cooking, pipe-borne water is fetched from a neighbouring house)	Yes (mechanized well, community treated water)	Yes	No	Yes, Hospital has its own borehole (treated)
What is the source of electricity?	ECG	ECG, generator	Yes	ECG	ECG & automated standby plant
Is there a functioning refrigerator?	Yes	Yes (4)	Yes	Yes	Yes, several. Each department has some.

	Iduapriem Community Clinic	Nsuaem Health Centre	St. Destiny Homeopathic & Community Clinic	Teberebie Health Centre	Tarkwa Municipal Hospital
Does this facility have a functional ambulance or other vehicle for ambulance services, including fuel?	-	No	-	-	No ambulance
Functioning computer	Yes	Yes (2 desktops)	Yes	Yes	Yes, 2 per unit (39 Units)
Internet	-	No	Yes	-	-
<b>F. Medical equipment</b>					
Scale for adults	Yes	Yes	Yes	Yes	Yes
Digital blood pressure apparatus	-	Yes	-	Yes	Yes
Pulse oximeter	-	No	-	-	Yes
Oxygen concentrator	-	No	-	-	Yes (Hospital has a plant.)
Oxygen cylinders	-	Yes (5 but 4 empty)	-	-	Yes
Oxygen delivery apparatus (functional)	Yes	Yes	-	Yes	Yes
Intravenous infusion kit / IV sets	Yes	Yes	Yes	Yes	Yes
Anaesthesia equipment	-	No	-	-	Yes
Sterile gloves	Yes	Yes	Yes	Yes	Yes
Artificial breathing machine	-	No	-	-	Yes (A&E, Theatre)
Headrest	-	No	-	-	-
Aspirator (electric, pedal)	-	Pedal, but not functional at the moment	-	-	Yes
Pressure cooker for sterilization	Boiler, Sterilization	Boiler, Sterilization	-	Boiler, Sterilization	Autoclave in CSSD
<b>G. Diagnostic availability</b>					
Do you measure blood glucose level?	Yes	Yes	Yes	Yes	Yes
Do you measure urine protein level?	Yes	Yes	Yes	Yes	Yes
Does this facility do urine ketone dipstick tests? For diabetes	Yes	Yes	Yes	Yes	Yes

	Iduapriem Community Clinic	Nsuaem Health Centre	St. Destiny Homeopathic & Community Clinic	Teberebie Health Centre	Tarkwa Municipal Hospital
Does this facility do liver function tests? Specific assay kit - liver function test	-	No	-	-	Yes
Does this facility do renal function tests? Specific assay kit - renal function test	-	No	-	-	Yes
Does the facility have capacity to test for chemical poisoning? If yes, which ones? What are the procedures?	-	No	-	-	No
Diagnosis of mercury exposure Whole blood Urine					
Blood chemistry analyser	-	No	-	-	Yes
Centrifuge	-	Yes	-	-	-
Does this facility do haemoglobin testing? Colorimeter, haemoglobinometer? HaemoCue?	-	Yes	-	-	Yes, FBC analyser
Do you do full blood count and differential testing?	-	Yes	-	-	Yes
Does this facility do ABO blood grouping testing?	-	Yes	-	-	Yes
TB testing: Microscopy: Ziehl-Neelson, auramine fluorescence microscope? GeneXpert?	-	Yes (Z-N)	-	-	Yes (auramine, fluorescence microscope, GeneXpert)
Do you do Gram stains?	-	Yes	-	-	Yes
Light microscopy	-	Yes	-	-	& fluorescent
Do you do electrocardiograms (ECG)?	-	No	-	-	Yes

	Iduapriem Community Clinic	Nsuaem Health Centre	St. Destiny Homeopathic & Community Clinic	Teberebie Health Centre	Tarkwa Municipal Hospital
<b>H. Drug availability</b>					
<b>ART (Zidovudine, Nevirapine, Efavirenz)</b>	-	Yes (Zidovudine, Efavirenz)	-	(Not stocked)	Yes
<b>TB drugs (first line treatment)</b>	Supplied per patient from hospital, but not stocked at facility	Yes	-	-	Yes
<b>TB drugs (second line treatment)</b>	-	Yes	-	Not stocked. Available only for patients on treatment from hospital	Yes
<b>Oxytocin / Misoprostol</b>	-	Yes	-	Yes	Yes
<b>Penicillin / Ampicillin / Benzadine</b>	-	Yes	Yes	Yes	Yes
<b>Erythromycin Respiratory tract infections, chlamydia</b>	Yes	-	Yes	Yes	Yes
<b>Doxycycline</b>	Yes	Yes	Yes	Yes	Yes
<b>Antipyretics (anti-fever)</b>	-	Yes		Yes	Yes
<b>Diazepam / valium Injectable Oral 5mg cap/tab Treat anxiety, muscle spasms, seizures, insomnia, restless legs syndrome, vertigo,</b>	Yes	Yes	Yes	Yes	Yes
<b>Injectable magnesium sulphate or other anticonvulsant (antiepileptic, antiseizure)</b>	-	Yes	-	Yes	Yes
<b>Adrenaline injection Used to treat severe allergic reactions (anaphylaxis) to bites, foods, drugs; severe asthma, or heart attack</b>	-	-	-	-	Yes
<b>Anti-histamines Allergies</b>	Yes	Yes	Yes	Yes	Yes
<b>Thiazides Relax blood vessels (for high blood pressure) or edema (caused by heart, liver or kidney failure)</b>	-	-	Yes	-	Yes

	Iduapriem Community Clinic	Nsuaem Health Centre	St. Destiny Homeopathic & Community Clinic	Teberebie Health Centre	Tarkwa Municipal Hospital
<b>Salbutamol, Beclomethasone inhaler</b> Relieve asthma and breathlessness	-	Yes	-	Yes	Yes
<b>Cefriaxone injection 1g (antibiotic injection)</b>	-	Yes	Yes	-	Yes
<b>Ciprofloxacin 500mg cap/tab</b>	Yes	Yes	Yes	Yes	Yes
<b>Ko-trimoxazole suspension</b>	Yes	Yes	Yes	Yes	Yes
<b>Amoxicillin 500mg</b>	Yes	Yes	Yes	Yes	Yes
<b>Penicillin injection</b>	Yes	Yes	Yes	Yes	Yes
<b>Gentamycin injection</b> Infectious diseases: chest, urinary tract	-	Yes	Yes	-	Yes
<b>Diclofenac 50/75mg (Voltaren)</b> Anti-inflammatory	Yes	Yes	Yes	Yes	Yes
<b>Paracetamol</b>	Yes	Yes	Yes	Yes	Yes
<b>Sodium chloride injectable solution (NaCl)</b>	Yes	Yes	-	-	Yes
<b>Betamethasone / Dexamethasone injection</b> Acute allergic reactions, severe shock from surgical or accident trauma	-	Yes	-	-	Yes
<b>Chelators for mercury (DMPS, DMSA)</b>	-	-	-	-	No
<b>Antidotes for cyanide</b>	-	-	-	-	No
<b>I. Care and referral systems in place</b>					
<b>What is the procedure in a suspected case of mercury poisoning? Diagnosis? Care and treatment? Referral?</b>	-	Referral	-	-	Most cases would be missed, because suspicion would be made on the basis of symptoms. To confirm would mean sending human samples all the way to laboratory in Accra.

	Iduapriem Community Clinic	Nsuaem Health Centre	St. Destiny Homeopathic & Community Clinic	Teberobie Health Centre	Tarkwa Municipal Hospital
<b>What is the (referral) procedure in case of burns?</b>	Dressing applied, referral written and patient transferred usually by means of taxi.	Stabilize & refer	-	-	Most would be managed here. Only those with serious complications might be transferred to the regional hospital
<b>What is the (referral) procedure in case of trauma (e.g. compound fracture, severe injury, etc.?)</b>	As above. Immediate referral	Stabilize & refer	-	-	
<b>Proximity of referral hospital (in hours by motorized transport)</b>	About 25-30 minutes to Municipal Hospital	30 minutes by car (Dixcove), 20 minutes to Agona	-	15-20 minutes to Municipal Hospital	2 1/2 hours
<b>Transportation possibility to referral hospital offered by your facility</b>	None. Taxi used	No (Taxi)	-	None. Taxi used	No ambulance available so it is very challenging. At the time of interview, an ambulance from a neighbouring district (1 1/2 hour drive away, Dixcove in Ahanta West District) had to be arranged to convey a patient being referred to Takoradi.
<b>Cost of referral in local currency (both ways):</b>	20-30 cedis for transport – (one way)	Ghc 120 to Dixcove	-	About 20 cedis by taxi	Cost of rental of ambulance – 250 cedis



# Health data for Tarkwa-Nsuaem & Birim-North District

**Table 21:** Top Five causes of OPD Attendances in Tarkwa-Nsuaem Municipal (2015 – 2018)

No.	2015		2016		2017		2018	
	Causes	Cases	Causes	Cases	Causes	Cases	Causes	Cases
1	Upper Respiratory Tract Infections	48,898	Upper Respiratory Tract Infections	47,534	Upper Respiratory Tract Infections	50,149	Upper Respiratory Tract Infections	58,022
2	Rheumatism & Other Joint Pains	23,265	Uncomplicated Malaria Tested Positive	36,361	Malaria	48,284	Malaria	46,568
3	Uncomplicated Malaria Tested Positive	21,992	Rheumatism & Other Joint Pains	13,646	Rheumatism & Other Joint Pains	20,066	Rheumatism & Other Joint Pains	21,302
4	Hypertension	15,973	Diarrhea Diseases	11,126	Anemia	14,426	Anemia	14,691
5	Diarrhea Diseases	14,471	Skin Diseases	9,586	Diarrhea Diseases	11,713	Diarrhea Diseases	11,474
	<b>Grand Total</b>	<b>124,599</b>	<b>Grand Total</b>	<b>118,253</b>	<b>Grand Total</b>	<b>144,638</b>	<b>Grand Total</b>	<b>152,057</b>

**Table 22:** Top Five causes of OPD Attendance in Western Region (2015 – 2018)

No.	2015		2016		2017		2018	
	Causes	Cases	Causes	Cases	Causes	Cases	Causes	Cases
1	Uncomplicated Malaria Tested Positive	354,007	Uncomplicated Malaria Tested Positive	409,821	Uncomplicated Malaria Tested Positive	467,492	Uncomplicated Malaria Tested Positive	536,190
2	Upper Respiratory Tract Infections	345,814	Upper Respiratory Tract Infections	337,688	Upper Respiratory Tract Infections	320,094	Upper Respiratory Tract Infections	369,726
3	Diarrhea Diseases	133,092	Diarrhea Diseases	126,637	Rheumatism & Other Joint Pains	121,248	Rheumatism & Other Joint Pains	137,318
4	Rheumatism & Other Joint Pains	121,149	Rheumatism & Other Joint Pains	112,072	Diarrhea Diseases	120,607	Diarrhea Diseases	125,885
5	Skin Diseases	96,777	Anemia	99,001	Anemia	115,039	Anemia	119,562
	<b>Grand Total</b>	<b>1,050,839</b>	<b>Grand Total</b>	<b>1,085,219</b>	<b>Grand Total</b>	<b>1,144,480</b>	<b>Grand Total</b>	<b>1,288,681</b>

**Table 23:** Top Five causes of OPD Attendance in Birim-North District (2015 – 2018)

No.	2015		2016		2017		2018	
	Causes	Cases	Causes	Cases	Causes	Cases	Causes	Cases
1	Uncomplicated Malaria Tested Positive	42,438	Uncomplicated Malaria Tested Positive	34,970	Uncomplicated Malaria Tested Positive	31,915	Uncomplicated Malaria Tested Positive	37,913
2	Upper Respiratory Tract Infections	25,277	Upper Respiratory Tract Infections	25,065	Upper Respiratory Tract Infections	22,772	Upper Respiratory Tract Infections	26,313
3	Rheumatism & Other Joint Pains	11,476	Rheumatism & Other Joint Pains	11,763	Rheumatism & Other Joint Pains	12,048	Rheumatism & Other Joint Pains	13,141
4	Anemia	9,760	Anemia	7,796	Anemia	8,567	Anemia	10,127
5	Intestinal Worms	4,855	Intestinal Worms	5,667	Intestinal Worms	4,854	Intestinal Worms	6,485
	<b>Grand Total</b>	<b>93,806</b>	<b>Grand Total</b>	<b>85,261</b>	<b>Grand Total</b>	<b>80,156</b>	<b>Grand Total</b>	<b>93,979</b>

**Table 24:** Top Five causes of OPD Attendance in Eastern Region from 2015 to 2018.

No.	2015		2016		2017		2018	
	Causes	Cases	Causes	Cases	Causes	Cases	Causes	Cases
1	Uncomplicated Malaria Tested Positive	633,759	Uncomplicated Malaria Tested Positive	589,683	Uncomplicated Malaria Tested Positive	551,695	Uncomplicated Malaria Tested Positive	659,861
2	Upper Respiratory Tract Infections	551,899	Upper Respiratory Tract Infections	529,346	Upper Respiratory Tract Infections	475,597	Upper Respiratory Tract Infections	550,272
3	Rheumatism & Other Joint Pains	309,932	Rheumatism & Other Joint Pains	288,443	Rheumatism & Other Joint Pains	284,486	Rheumatism & Other Joint Pains	331,709
4	Skin Diseases	184,123	Diarrhea Diseases	178,723	Anemia	166,127	Anemia	188,856
5	Diarrhea Diseases	181,730	Skin Diseases	165,191	Diarrhea Diseases	159,095	Diarrhea Diseases	164,757
	<b>Grand Total</b>	<b>1,861,443</b>	<b>Grand Total</b>	<b>1,751,386</b>	<b>Grand Total</b>	<b>1,637,000</b>	<b>Grand Total</b>	<b>1,895,455</b>

**Table 25:** Four-Year trend of TB in Tarkwa-Nsuaem Municipality & Birim-North District (2015 – 2018)

Tarkwa-Nsuaem				
Year	2015	2016	2017	2018
TB (all forms)	155	144	220	213
Birim-North				
Year	2015	2016	2017	2018
TB (all forms)	62	60	76	74

**Table 26:** HIV Testing and Counselling from 2015 to 2018 in Tarkwa-Nsuaem Municipality

Indicator	2015	2016	2017	2018
Tested	1,915	5,487	5,681	7,431
Positive	396	527	500	361
% Tested Positive	20.7	19	8.9	4.8

**Table 27:** HIV Testing and Counselling from 2015 to 2018 in Birim-North District

Indicator	2015	2016	2017	2018
Tested	980	909	966	6,420
Positive	113	136	141	1120
% Tested Positive	11.8	15	14.6	17.4

**Table 28:** Top Ten causes of Deaths in New Abirem Government Hospital (2018)

	Cases	Number
1	Pneumonia	6
2	Hypertension	4
3	HIV Infection	4
4	Pulmonary Tuberculosis	4
5	Malaria	3
6	Diabetes Mellitus	2
7	Alcoholism	2
8	Septicaemia	1
9	Asphyxia	1
10	Cerebrovascular Accident	1

# 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 Ghana

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 Ghana, 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.

Place and date:

---

Place and date:

---

Participant full name:

---

Interviewer full name:

---

Participant signature of thumb print:

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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 Ghana**

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 Ghana, 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
1	_____	_____	_____
2	_____	_____	_____
3	_____	_____	_____
4	_____	_____	_____
5	_____	_____	_____
6	_____	_____	_____
7	_____	_____	_____
8	_____	_____	_____
9	_____	_____	_____
10	_____	_____	_____
11	_____	_____	_____
12	_____	_____	_____
13	_____	_____	_____
14	_____	_____	_____
15	_____	_____	_____

# 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-sectorial 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)?
<b>F. End of the interview</b>	
F1	Do you have any questions you want to ask me?
F2	Thank you for your participation.
F3	End time of the interview:
<b>G. Observations by the interviewer</b>	
G1	Other observations/notes from the interviewer:

# KII Questionnaire – Health authority official

<b>A. KII information</b>	
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>B. Basic information</b>	
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?
<b>C. Awareness</b>	
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?
	<i>Including health risks! Probe for mercury and cyanide exposure if not mentioned spontaneously.</i>
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 stigmatised groups in the community and especially in terms of health and access to health care?
	<i>Probe for artisanal and small-scale gold miners if not mentioned.</i>
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?
<b>D. Health system capacities and readiness</b>	
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-sectorial collaboration happening at the current stage?
	If yes, how and who are the players?
	If not, why not?
<b>E. End of the interview</b>	
E1	Do you have any questions you want to ask me?
E2	Thank you for your participation.
E3	End time of the interview:
<b>F. Observations by the interviewer</b>	
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)?
	<i>Probe for mercury and cyanide exposure if not mentioned spontaneously.</i>
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?
	<i>Including health risks! Probe for mercury and cyanide exposure if not mentioned spontaneously.</i>
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 stigmatised groups in the community and especially in terms of health and access to health care?
	<i>Probe for artisanal and small-scale gold miners if not mentioned.</i>
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?
<b>F. Public system capacities and readiness</b>	
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-sectorial 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?
<b>G. End of the interview</b>	
G1	Do you have any questions you want to ask me?
G2	Thank you for your participation.
G3	End time of the interview:
<b>H. Observations by the interviewer</b>	
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 stigmatised groups in the community and especially in terms of health and access to health care?
	<i>Probe for artisanal and small-scale gold miners if not mentioned</i>
D. Awareness of socio-economic 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?
	<i>Including health risks! Probe for mercury and cyanide exposure if not mentioned spontaneously.</i>
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?
<b>F. Health promotion information</b>	
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?
<b>G. Health system and institutional support</b>	
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?
<b>H. Health facility assessment: capacities and readiness</b>	
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	<i>Continue with separate HFA tool.</i>
<b>I. End of the interview &amp; HFA</b>	
I1	Do you have any questions you want to ask me?
I2	Thank you for your participation.
I3	End time of the interview:
<b>J. Observations by the interviewer</b>	
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 stigmatised 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	<i>If not mentioned earlier:</i>
	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	<i>Continue with separate HFA tool.</i>
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?
	<i>Possible answers:</i>
	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?
	<i>Possible answers:</i>
	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 stigmatised 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?
<b>D. End of the interview</b>	
D1	Do you have any questions you want to ask me?
D2	Thank you for your participation.
D3	End time of the interview:
<b>E. Observations by the interviewer</b>	
E1	Other observations/notes from the interviewer:

# KII Questionnaire – ASGM community leader

<b>A. KII information</b>	
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>B. Basic information</b>	
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?
<b>C. Health system issues and health seeking behavior</b>	
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?
	<i>Possible answers:</i>
	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:	

	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?
	<i>Possible answers:</i>
	Malaria
	Living conditions
	Mental disorders
	Substance abuse
	Dust
	Noise
C7	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 stigmatised 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?
<b>D. End of the interview</b>	
D1	Do you have any questions you want to ask me?
D2	Thank you for your participation.
D3	End time of the interview:
<b>E. Observations by the interviewer</b>	
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?
	<i>Probe for mercury and cyanide exposure if not mentioned spontaneously.</i>
C5	In your opinion, what are the biggest health risks for the general population (community)?
	<i>Probe for mercury and cyanide exposure if not mentioned spontaneously.</i>
	<i>Is mercury exposure also a problem for those not directly using it?</i>
C6	In your opinion, which are the neglected, marginalized or stigmatised groups in the community?
	Especially in terms of health and access to health care?
	<i>Probe for artisanal and small-scale gold miners if not mentioned.</i>
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-sectorial 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?
	<i>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.</i>
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?
<b>C. Health risks perceptions and behaviors in the ASGM working process</b>	
C1	In your opinion, what is currently the biggest risk to your health while you're working?
	<i>Possible answers:</i>
	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
If yes, how do you protect yourself? Why do you protect yourself?	
<i>Possible answers:</i>	
Respirator Gloves	
Boots Long sleeves	
Protective glasses Mask (simple)	
Other, specify:	
If no, why not?	
<b>D. Health promotion activities</b>	
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 do 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?
<b>E. Social, demographic and economic information</b>	
<i>Ask the following questions by hand raising if answer applies!</i>	
E1	Are you born in this region /district?
	<i>Total of participants born in this region/district:</i>
	Where are others from?
E2	<i>Total of participants that are not [country nationals]?</i>
	Where are they from?
E3	Have you been living here for more than 5 years?
	<i>Total of participants that have been living here for more than 5 years:</i>
E4	Are you here with your family?
	<i>Total of participants that are here with their families:</i>
E5	Have you completed primary school?
	<i>Total of participants that have completed primary school:</i>
E6	Are you working in ASGM the whole year?
	<i>Total of participants that are working in ASGM the whole year:</i>
E7	Are you working in ASGM on a seasonal basis?
	<i>Total of participants that are working in ASGM on a seasonal basis:</i>
E8	Is ASGM your primary source of income?
	<i>Total of participants for whom ASGM is the primary source of income:</i>
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	
<i>Ask the following questions by hand raising if answer applies!</i>	
B1	Were you born in this region /district?
	<i>Total of participants born in this region/district:</i>
B2	<i>Total of participants that are not [country nationals]?</i>
B3	Have you been living here for more than 5 years?
	<i>Total of participants that have been living here for more than 5 years:</i>
B4	Are you here with your family?
	<i>Total of participants that are here with their families:</i>
B5	Do you have any children here?
	<i>Total of participants that have children here:</i>

B6	Have you completed primary school?
	<i>Total of participants that have completed primary school:</i>
B7	Is ASGM your primary source of income in the household?
	<i>Total of participants for whom ASGM is the primary source of income:</i>
<b>C. General health issues and health seeking behavior</b>	
C1	In your opinion, what are currently your main health problems?
	<i>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.</i>
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?
<b>D. Health risks perceptions and behaviors in the ASGM working process</b>	
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?
	<i>Do probe for mercury and cyanide if not mentioned spontaneously.</i>
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?
<b>E. Health promotion activities</b>	
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?
<b>F. End of the FGD</b>	
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:
<b>G. Observations by the interviewers</b>	
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)

<b>A. FGD information</b>	
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>B. Social, demographic and economic information</b>	
Ask the following questions by hand raising if answer applies!	
B1	Were you born in this region /district?
	<i>Total of participants born in this region/district:</i>
B2	<i>Total of participants that are not [country nationals]?</i>
B3	Have you been living here for more than 5 years?
	<i>Total of participants that have been living here for more than 5 years:</i>

B4	Are you here with your family?
	<i>Total of participants that are here with their families:</i>
B5	Do you have any children here?
	<i>Total of participants that have children here:</i>
B6	Have you completed primary school?
	<i>Total of participants that have completed primary school:</i>
<b>C. General health issues and health seeking behavior</b>	
C1	In your opinion, what are currently your main health problems?
	<i>This covers all health problems (related to mining or not)! Probe depending on answers you get.</i>
	<i>If they do not mention mining-related issues, ask them about the risks miners might have to their knowledge.</i>
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?
<b>D. Health risks perceptions and behaviors in the ASGM working process</b>	
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?
	<i>Do probe for mercury and cyanide if not mentioned spontaneously.</i>
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?
<b>E. Health promotion activities</b>	
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?
<b>F. End of the FGD</b>	
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:
<b>G. Observations by the interviewers</b>	
G1	Other observations/notes from the interviewer:
G2	Other observations/notes from the community health worker:

# Health facility assessment questionnaire

See Table 19 in the annex.

## 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	<input type="checkbox"/> Hard rock <input type="checkbox"/> Alluvial (river sediments) <input type="checkbox"/> 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	<input type="checkbox"/> Annual, all-year round <input type="checkbox"/> Seasonal: _____ <input type="checkbox"/> Other, specify:

ANNEXES

<p>Organisational structures of the ASGM site</p>	<p><input type="checkbox"/> None  <input type="checkbox"/> Organised, specify:   <input type="checkbox"/> Do not know  Community (land owner) involvement:</p>		
<p>Demographics of workers (add approximations if possible)</p>	<p><input type="checkbox"/> Males      <input type="checkbox"/> Females  <input type="checkbox"/> Children</p>		
<p>Information on migration patterns (if any)</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Extent of in-migration</li> <li><input type="checkbox"/> Origin of migrants</li> <li><input type="checkbox"/> Seasonality of migration, if applicable</li> </ul>			
<p>Where are the different work processes done?  <i>Sketch out the area or narrative. Importantly, where is the amalgam smelting done? On ASGM site, in community, etc.?</i>  <i>Where are the tailings released? Is there a nearby river?</i></p>			
<p>Types of activities observed</p>	<table style="width: 100%; border: none;"> <tr> <td style="vertical-align: top; width: 50%;"> <input type="checkbox"/> Extraction  <input type="checkbox"/> Drilling  <input type="checkbox"/> Crushing  <input type="checkbox"/> Sluices  <input type="checkbox"/> Vibrating tables  <input type="checkbox"/> Whole ore amalgamation  <input type="checkbox"/> Open mercury burning  <input type="checkbox"/> Refining  <input type="checkbox"/> Sifting  <input type="checkbox"/> Shanking </td> <td style="vertical-align: top; width: 50%;"> <input type="checkbox"/> Tunnelling  <input type="checkbox"/> Dredging  <input type="checkbox"/> Milling  <input type="checkbox"/> Centrifugation  <input type="checkbox"/> Gravity concentration  <input type="checkbox"/> Concentrate amalgamation  <input type="checkbox"/> Protected mercury burning (e.g. use of retorts)  <input type="checkbox"/> Carrying loads  <input type="checkbox"/> Excavation </td> </tr> </table>	<input type="checkbox"/> Extraction <input type="checkbox"/> Drilling <input type="checkbox"/> Crushing <input type="checkbox"/> Sluices <input type="checkbox"/> Vibrating tables <input type="checkbox"/> Whole ore amalgamation <input type="checkbox"/> Open mercury burning <input type="checkbox"/> Refining <input type="checkbox"/> Sifting <input type="checkbox"/> Shanking	<input type="checkbox"/> Tunnelling <input type="checkbox"/> Dredging <input type="checkbox"/> Milling <input type="checkbox"/> Centrifugation <input type="checkbox"/> Gravity concentration <input type="checkbox"/> Concentrate amalgamation <input type="checkbox"/> Protected mercury burning (e.g. use of retorts) <input type="checkbox"/> Carrying loads <input type="checkbox"/> Excavation
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<p>Physical hazards observed</p>	<table style="width: 100%; border: none;"> <tr> <td style="vertical-align: top; width: 50%;"> <input type="checkbox"/> Noisy tools  <input type="checkbox"/> Drilling  <input type="checkbox"/> Ore processing  <input type="checkbox"/> Confined spaces  <input type="checkbox"/> Contact with explosives  <input type="checkbox"/> Dust  <input type="checkbox"/> Waste burning  <input type="checkbox"/> Exposure to sunlight (UV) </td> <td style="vertical-align: top; width: 50%;"> <input type="checkbox"/> Blasting  <input type="checkbox"/> Crushing  <input type="checkbox"/> Underground mining  <input type="checkbox"/> Contact with live wires  <input type="checkbox"/> Contact with faulty electronic equipment  <input type="checkbox"/> Air pollution (petrol burning)  <input type="checkbox"/> Vibration  <input type="checkbox"/> Other, specify: </td> </tr> </table>	<input type="checkbox"/> Noisy tools <input type="checkbox"/> Drilling <input type="checkbox"/> Ore processing <input type="checkbox"/> Confined spaces <input type="checkbox"/> Contact with explosives <input type="checkbox"/> Dust <input type="checkbox"/> Waste burning <input type="checkbox"/> Exposure to sunlight (UV)	<input type="checkbox"/> Blasting <input type="checkbox"/> Crushing <input type="checkbox"/> Underground mining <input type="checkbox"/> Contact with live wires <input type="checkbox"/> Contact with faulty electronic equipment <input type="checkbox"/> Air pollution (petrol burning) <input type="checkbox"/> Vibration <input type="checkbox"/> Other, specify:
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<p>Biological hazards observed</p>	<table style="width: 100%; border: none;"> <tr> <td style="vertical-align: top; width: 50%;"> <input type="checkbox"/> Vectors  <input type="checkbox"/> Other, specify: </td> <td style="vertical-align: top; width: 50%;"> <input type="checkbox"/> Stagnant waters </td> </tr> </table>	<input type="checkbox"/> Vectors <input type="checkbox"/> Other, specify:	<input type="checkbox"/> Stagnant waters
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Psychosocial hazards observed	<input type="checkbox"/> Unsafe working conditions <input type="checkbox"/> Cramped living conditions <input type="checkbox"/> Poor living and working conditions <input type="checkbox"/> Other, specify:
Protective measures in use observed <i>Which?</i>	<input type="checkbox"/> Use of PPEs <input type="checkbox"/> Helmets <input type="checkbox"/> Gloves <input type="checkbox"/> Other: <input type="checkbox"/> Boots <input type="checkbox"/> Other:
Additional information	







