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## Women who "age too fast". Female work, bodies and health in the gold mines of eastern Democratic Republic of Congo.

### Abstract

Mining activities have particular effects on women's health, but these effects have hardly been documented in the literature. This article fills the gap by focusing on women's lived experiences in artisanal and small-scale gold mining (ASGM). Based on interviews with more than 150 women working in the mines in the city of Kamituga, eastern Democratic Republic of Congo (DRC), we illustrate how women feel the impact of their work on their bodies and reflect on how this impact could be mitigated. We analyze women's lived experiences in terms of the most common infectious diseases, as well as physical and psycho-social trauma. We argue that ASGM has gendered effects on the workforce's health and that, to better protect female workers, we need to take a holistic approach to their health problems and address structural constraints.

**Keywords:** artisanal small-scale gold mining, women, health, safety, protection

### 1. INTRODUCTION

Worldwide, about 30% of the workers in artisanal and small-scale mining (ASM) are women<sup>1</sup>. In sub-Saharan Africa the proportion of women is higher, about 40 to 50%, although these figures are uncertain due to the informality of the activities (Hinton et al., 2003; IGF, 2018). For a long time, the roles and positions of these women have been poorly understood. Moreover, within the group of politically marginalized ASM workers, female workers are even more marginalized as they are mainly involved in so-called secondary activities, like washing and crushing, or in services and goods provision (Weldegiorgis et al., 2018).

In the past decade the topic has received more attention, both at the academic and at the policy level. On the policy front, there has been an increased interest in ASM formalization in general (Hilson et al., 2017), with a recent recognition of gender as a cross-cutting issue in formalization strategies (UNITAR, 2018). This is also reflected in the publication of gender impact assessment toolkits (Eftimie et al., 2012; Côté, 2020) and recommendations (USAID, 2020), the implementation of gender equality projects<sup>2</sup>, the creation of female miners' associations (Hilson et al., 2018) and the organization of dedicated conferences<sup>3</sup>. The academic understanding of the roles and socio-economic position of women in ASM has been greatly enhanced by a body of scholarship focusing on gender dynamics in ASM (Bashwira et al., 2014; Bashwira, 2017; Bashwira & Cuvelier, 2019; Brottem & Ba, 2019; Bryceson et al., 2013; Buss et al., 2019; Hayes & Perks, 2011; Heemskerk, 2003; Hinton et al., 2003, 2006; Kelly et al., 2014; Lahiri-Dutt, 2011; Lahiri-Dutt & Macintyre, 2006; Werthmann, 2009; Yakovleva, 2007). Some researchers have specifically focused on the ways in which women are affected by the formalization of ASM activities, including the grouping in cooperatives (Hilson et al., 2018; Muheki & Geenen 2018; Kamundala, 2020).

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<sup>1</sup> <https://www.delvedatabase.org/data>. Accessed on 01/09/2021.

<sup>2</sup> For instance, ARM's Proudly women miners <https://www.responsiblemines.org/en/project/proudly-women-miners/> or IMPACT's Digging for equality <https://impacttransform.org/en/work/project/digging-for-equality/>.

<sup>3</sup> For instance, the World Bank <https://www.worldbank.org/en/events/2020/09/09/getting-to-equal-in-a-changing-world-second-global-gender-in-oil-gas-and-mining-conference>.

However, there are very few studies focusing specifically on the health and safety of women in the mining workplace (Lynas, 2018). A recent scoping review identified few studies that included vulnerable populations, and none focusing specifically on the health status of women of reproductive age or children who were directly involved in ASM activities (Cossa et al., 2021: 13). It concluded that “women of reproductive age and children were rarely investigated as stand-alone groups”. In terms of health issues, by far the most attention has been paid to the issue of mercury pollution from artisanal and small-scale gold mining (ASGM), while other health issues remain under researched (Cossa et al., 2021). It was therefore a good time for Delve - a global data platform for ASM - to declare 2021 the year of occupational health and safety in ASM<sup>4</sup>.

With this article we aim to improve our understanding of women’s health in ASGM. The study does not make use of human or environmental samples or medical case reports, but relies on qualitative data gathered through interviews, focus group discussions and participatory observation in Kamituga.

Kamituga hosts some of the largest ASGM sites in the province of South Kivu in eastern Democratic Republic of Congo (DRC). Gold has been mined there for about a century (Geenen, 2015), first by Belgian companies (colonial until 1960, postcolonial until 1996), then by ASGM miners (from 1970s). In the 1980s ASGM production began to outweigh industrial production, which was suffering from fluctuating prices on the world market, combined with a domestic political and socio-economic crisis. During the wars of 1996-1997 and 1998-2003, ASGM attracted thousands of workers looking for relative security and an income. After the war multinational companies tried to relaunch industrial gold production, and the Kamituga concession came in the hands of Canada-based Banro Corporation. It never started producing in Kamituga and condoned the presence of around 15,000 ASGM miners. Meanwhile, the Congolese government - partly under pressure from international donors concerned about the phenomenon of conflict minerals - introduced a series of reforms aimed at formalisation and transparency. Yet, ASGM production in the whole of eastern DRC still largely escapes formal regulation. Domestic and foreign investors - including Chinese but also from neighbouring countries - are now bringing in new extraction and processing technologies such as ball mills for crushing and cyanidation, which is increasingly transforming the artisanal production into small-scale mining, as other contributions to this special issue detail. This article pays specific attention to the effects of these transformations on the health of female workers.

In this context, we argue that ASGM has gendered effects on the workforce’s health, and that to better protect female workers, we need to take a holistic approach to their health problems and address structural constraints such as women’s socio-economic and cultural marginalization. In what follows, we first present the literature on work and health of women in ASM. Then, we proceed to our case study. We will describe in detail what activities women undertake in and around the mines, and how these activities impact their health.

## 2. WORK AND HEALTH IN THE MINES: INSIGHTS FROM THE LITERATURE

Women engage in a wide variety of activities in ASM. They work in stone sorting, washing, crushing, waste processing and transport. In addition, they provide a range of services such as restaurants, bars, small shops, and sexual services (Weldegiorgis et al., 2018). For some of these activities, the division of labour between the sexes is clear. The clearest example is the fact that in most ASM mines in the world, women are forbidden to work underground. While this is commonly justified with reference to the physical efforts involved, or to cultural taboos (many male workers believe the gold will disappear when women are present – in some cases when women having their period), in many contexts it is an effective tool for socio-economic exclusion (Kelly et al., 2014; Lynas, 2018). But interestingly, these norms are also malleable and may be adjusted in view of the material value, the season, or the specific activity (Hinton et al., 2003). As such, the gender division suddenly becomes less clear. For instance, stones - in bags of more than 50 kilograms - are carried by both men and women. Yet on closer inspection, there is often a differentiation in the nature of the stones (e.g. hard rocks versus waste sand) or the route (e.g. long versus short distances) that either men or women take.

Women often face a range of specific socio-economic, cultural and institutional constraints related to land and inheritance, mobility, or decision-making (Bashwira, 2017; Eftimie et al., 2012; Hinton, et al., 2003, 2006; Lahiri-Dutt, 2011; Muheki & Geenen, 2018). It has also been documented that women perform less-remunerated tasks and are in a lower position of power (USAID, 2020), including in the DRC (Radley, 2021). Yet, a minority of

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<sup>4</sup><https://delvedatabase.org/news/join-us-to-improve-occupational-health-safety-in-artisanal-and-small-scale-mining>. Accessed on 01/09/2021.

women are working in management positions, such as shaft owners, equipment saleswomen or gold traders. This has been reported in countries such as Ghana, Mozambique, DRC and Bolivia (Bashwira & Cuvelier, 2019; Hinton et al., 2006; Labonne, 1996; Werthman, 2009).

Major health risks in ASM are related to dust exposure, polluted water and accidents (Cossa et al., 2021; Geenen et al., 2021). Dust exposes miners and surrounding communities to lead (Smolders et al., 2019) and silica (Gottesfeld et al., 2019). Silicosis is also known as miners' disease (Rees and Murray, 2020), and is sometimes complicated by tuberculosis (silicotuberculosis), leading to respiratory problems and even death (Lara, 2020). The problem of mercury has been most extensively documented for the case of gold mining. UNEP (2018) estimates that 10 to 15 million miners worldwide work directly with mercury, much of which ends up in aquatic systems. The literature also lists several specific risks for women. Women are more vulnerable to heavy metals exposure due to their reproductive role (Lynas, 2018; Nyanza et al., 2019). Even at low doses, exposure can affect the developing foetus, resulting in severe birth defects, congenital malformations, developmental disorders, low birth weight or higher risk of stillbirth. Specific exposures such as mercury and arsenic can cause developmental delays such as cognitive, motoric, hearing and visual deficits in young children (Calys-Tagoe et al., 2015; Lynas, 2018; Nyanza et al., 2019; Sana et al., 2017; WHO, 2016). In the Katangese Copperbelt, southern DRC, Van Brusselen et al (2020) examined 138 newborns with visible congenital malformations and 108 control infants. They found that paternal occupational exposure to mines was the factor most strongly associated with birth defects. Women are vulnerable to lead poisoning through hand-to-mouth contact for children (Gottesfeld et al., 2019) or through clay ingestion (Smolders et al., 2019). Green clay - commonly known as *mabelé* in the DRC - is commonly taken to soothe discomfort and nausea during pregnancy.

Some women are forced to bring their babies or children to the site where they play on contaminated soil or in polluted water (Arthur-Holmes & Busia, 2020). Due to unsanitary water and sanitation facilities in the mines, women are at high risk of developing water-borne and vector-borne diseases such as cholera and malaria. Also, food insecurity reduces natural immunity and makes women and children vulnerable to infectious diseases and undernutrition. In addition, unsafe sexual behaviour increases the risk of developing sexually transmitted infections (STIs) (Lynas, 2018; WHO, 2016; USAID, 2020). Indeed, one of the "escape routes" for many women in severe poverty is to provide sexual services (Bryceson et al., 2013). Engaging in this activity makes them vulnerable to physical and sexual abuse which may lead to social isolation and stigmatization (Kelly et al., 2014; World Bank, 2020). According to one study in eastern DRC making use of Demographic and Health Survey data, women living closer to a mine have a 5% higher risk of being victim of sexual violence (Rustad et al., 2016). Due to this stigmatization, it becomes even more difficult for these women to leave the mines and reintegrate into their communities. In addition, this activity can lead to untreated STIs such as HIV/AIDS, which in most cases lead to a fatal outcome due to lack of medical care or reproductive health services (Kelly et al., 2014; Tsang et al., 2019; USAID, 2020). In Congolese mining zones, the prevalence of HIV is reported to be at 4.5%, which is considerably higher than the national average of 1.1% (Matundu Mbambi & Kandolo, 2016, based on data from 2012). As sexual exploitation, violence and abuse are common in ASM, women's psychological well-being is yet to be documented, although there is strong evidence of a negative impact on their mental health (Hinton et al., 2003).

### 3. METHODS

This study is part of an action research project on health and environment in ASGM mines in the DRC funded by the Flemish Interuniversity Council (VLIR-UOS) and carried out by the Expertise Center on Mining Governance (CEGEMI) at the Catholic University of Bukavu and the Institute of Development Policy (IOB) at the University of Antwerp. The project is implemented by a multidisciplinary team of thirteen junior and three senior researchers with backgrounds in agronomy, biology, medicine, public health, economics and anthropology. After a joint methodological reflection, the team designed the following data collection methods: semi-structured interviews (with an interview guide for each type of participant), focus groups, participatory mapping, participatory risk inventory, participant observation, and the study of medical records (see Table 1). Data was collected during two research visits of one week each, in April and August 2021.

The city of Kamituga was chosen because it hosts some of the most important gold mines in the province of South Kivu in the DRC. Four mining sites were targeted for data collection: Calvaire, Kazibe and Mobale, the three largest sites, and the smaller site of Butwa located further away from the city centre. In each site we started with participatory observation, after which team members proceeded with a purposive sampling dependent on their topic of interest. In this article, we report on the data gathered from female workers and

other women living and working around the mines. We intentionally sampled workers from different categories (such as crushers, transporters, and stone sorters, as will be detailed below) to include a diversity of experiences. We also sampled some women who are not directly involved in mining, but in supporting activities (such as petty trade and restaurants), although they represent a smaller share in our sample (see table 1). We combined this purposive sampling technique with convenience sampling. We visited the women at their workplace and invited them for an interview, if they were willing and available, we wanted to avoid at all costs pressuring them into an interview. In some instances, women were willing to talk but could not abandon their tasks, which resulted in our interviewers walking along and doing their interview on the move.

Several individual team members had previous research experience in Kamituga. This embeds the study in a long-term engagement with the mining site which does not just include data collection, but also training sessions, science communication and sensitization activities, carried out by CEGEMI. Interview recordings (with consent) were transcribed verbatim, imported into NVivo software and coded using NVivo Collaboration Cloud. The conclusions from this research are not automatically transferable to other contexts, yet they do reflect major trends that have been described in the literature on ASM, both in terms of labour dynamics and health effects.

Table 1. Overview of data collected

Data collection methods	April	August
Focus groups with male mine workers	5	5
Focus groups with female mine workers	6	4
Focus groups with male non workers	1	0
Focus groups with female non workers	2	0
Individual interviews with male mine workers	30	18
Individual interviews with female mine workers	22	22
Individual interviews with male non workers	1	0
Individual interviews with female non workers	2	0
Interviews with women in the maternity ward	0	13
Interviews with cooperative leaders	6	5
Interviews with government officials or authorities	2	7
Interviews with medical staff	7	19
Participatory mapping (one per site)	3	1
Participatory risk inventory (one per site)	3	1
Files analyzed at the hospital	42	38

#### 4. WOMEN AT WORK IN KAMITUGA

This section describes the tasks performed by women, paying particular attention to the impact of mechanization and the introduction of new technologies. It should be noted that this description applies to underground mining, which is the most common form in the sites we visited. Figure 1 maps the different stages of gold production, as well as the material flows (in orange) and the place of women therein (in blue). It should be noted that this includes women directly involved in gold processing on the left. On the right, it mentions



in it using a pan or *biporo* (banana bark). After crushing, the powder is again put into bags and transported to the *loutra*, where small pools of water have been set up. The sand that remains in the *loutra* after washing is called *kokora*. This is again collected by *mamans bizalu* who bring it once again to the ball mills for further grinding (ITF-20210414-55). This makes the production process seem almost endless and provides opportunities for a range of workers to find something, even if it is only a *mushale* (measure for 0.14 gram) of gold.

Female transporters, or *transporteuses*, carry the stones, sand and dust from the *domaine* or *loutra* to the *concasseurs* and back. The distances are usually not very long (a couple of hundred meters), but the dirt tracks are very difficult to walk (especially during the rainy season) and often very steep. The bags may weigh between 50 and 70 kilogrammes. According to our interviews, the female transporters are paid 0.35 to 0.5 USD per bag (ITF-20210819-57; IF-20210414-52). Entry into these activities is relatively easy. It does not require particular skills, although physical ability is an important requirement, and little financial capital is needed as starting capital. *Mamans minyangala* and *bizalu* buy the stones from the owners, which requires a starting capital of 10 USD according to one interviewee (IF-20210414-52). For some women this already constitutes a barrier. While working these women acquire several skills, such as the ability to distinguish between *majiwe* and *pembe*, or the appreciation of the fineness of the powder that remains in the mortar.

Kamundala (2020, p. 423) found that women are systematically paid less than men. In Kamituga, for instance, a *twangaise* is paid 3 USD for crushing 15 kilograms of stone, while a man earns 4 to 5 USD for the same work. Based on a survey in different mining sites in South Kivu, Kamundala & Mukasa (2017) found that 80.5% of female-headed households are poor, compared to 68.97% of male-headed households. We do not have systematic data on the incomes of our interviewees, but the figures they mention can give an idea. A manual crusher says that she earns between 3,000 and 5,000 FC per day (1.5 to 2.5 USD) (ITF-20210414-53). A manual grinder speaks about FC 2,000 to 4,000 (1 to 2 USD) (ITF-20210416-86). A *minyangala*, who used to be a transporter and grinder, says that her new job brings 2.5 times as much as her old job, i.e. around 1 USD per day as a transporter and grinder compared to 5,000 FC or 2.5 USD as a *minyangala* (ITF-20210817-17).

Most women we interviewed engage in these activities out of necessity or lack of alternatives as stated in the following quotes: "We choose this work because we have no other work to do" (FGFT-20210416-83); or "How do you expect us to survive when we sleep hungry? We are forced to come here" (ITF-20210412-13). Almost all say they want to leave this activity as soon as an opportunity arises, preferably in small trade. The process of gold production in Kamituga has changed considerably over the past decade. Doctoral research from Geenen (2015) describes a process that is exclusively manual, relying only on the physical strength of *twangaises* to crush the stones. In 2011, the first mechanized ball mills were introduced, locally called *concasseurs*. By the end of 2012, 70 ball mills were concentrated in one site (Calvaire) where they were condoned by the concessionaire, Banro Corporation (Mulonda et al., 2019; Radley & Geenen, 2021). Currently 232 ball mills are operational in 19 different sites. Where a *twangaise* grinds 15 to 25 kg per day, the machine does 300 kilograms in 30 minutes (Radley & Geenen, 2021). Despite acknowledging the dire conditions they were working in, many *twangaises* regret that the ball mills have taken their jobs: "The ball mills have come to kill the work here" (ITF-20210411-2). In terms of income, *twangaises* say that before the introduction of the ball mills, they could earn 3,000 to 5,000 FC per day (1.5 to 2.5 USD) from crushing 5 mortars. Sometimes *twangaises* keep some stones for themselves (these stones are stolen and kept in the famous *wazekwa*, pockets under their cloth), which brings their income to 4,000 to 5,000 FC (2 to 2.5 USD). Now, their income is around 1 to 2 USD (ITF-20210411-2; ITF-20210416-86). The introduction of mechanised ball mills has also opened new opportunities. The possibilities for the *mamans bizalu* are increasing because the machine can grind larger quantities into finer powder, making it more profitable to process leftovers and sand (see also Bikubanya and Radley in this issue). Since 2011, a few female workers have grouped in a women's cooperative, headed by a female leader, the only female pit owner who enters underground. At the field visit in April 2021, they had installed their own ball mill, but were facing fierce opposition from the customary authorities and the other cooperatives present on the site.

## 5. WOMEN'S HEALTH IN KAMITUGA

This section presents the pathologies and specific health risks faced by women in our study (see table 2). As mentioned, this study is based on qualitative data only. It does not pretend to be an exhaustive overview, nor does it come to generalizable conclusions about the prevalence or the severity of pathologies in ASGM sites.

However, it gives rich insights into the lived experiences of women who live and work in such sites. In what follows, we first present the main infectious diseases faced by the women, those related to water, sanitation and hygiene (WASH), nutritional problems and sexually transmitted infections (STIs), then we present the physical and psychosocial traumas.

Table 2. Pathologies and specific health risks faced by female miners

Pathologies and specific health risks faced by female miners	
CAUSES	RISKS
<i>Lack of clean water</i> <i>Poor sanitation and hygiene</i>	Diarrhoea Typhoid fever, schistosomiasis and malaria Urinary infections Skin diseases
<i>Poor nutrition and weaning</i>	Undernutrition Weakened immunity Health and development consequences
<i>Unprotected sex</i> <i>Unavailability and misinformation of (free) contraception</i>	High risk for sexually transmitted infections
<i>Hard physical work</i> <i>Unprotected use of machines</i>	Physical trauma (sore, hardened palms and split nails) Injuries by using machines "Fatigue" and muscular pain Pregnant women: spontaneous abortion
<i>Discrimination</i> <i>(Domestic) violence</i>	Psycho-social trauma

5.1. Infectious diseases

5.1.1. Water, sanitation and hygiene (WASH)

Sanitary and hygiene conditions are precarious in ASGM sites. Toilets are often absent and at one site, workers relieve themselves in the water, while further on, women work in the water to wash stones:

"If you walk around here, you'll find faeces everywhere. Even in this river where we are working, you will find faeces. There are no toilets and there is dirt everywhere" (ITF-202104-57).

The lack of clean water causes diseases such as diarrhoea (bacillary and amoebic dysentery, cholera) and other water-borne diseases such as typhoid fever, schistosomiasis and malaria, which are endemic in the Kamituga health zone (Geenen et al, 2021). Among the women we interviewed, some spend their days seated in polluted water, much of which is almost stagnant. The most frequently heard complaints were about urinary infections and skin diseases.

With respect to the urinary infections, one woman describes the symptoms as follows:

"Most of the time you're there and you put yourself, you go and get the sand, once you are back you feel that your back hurts and water starts to flow from your vagina. If you sit on the ground for too long and you stand up, you notice that water is flowing" (ITF-20210414-53).

Another woman explains that her infection was treated at the hospital, and the doctor linked it to her work:

"It really comes out and when you go to urinate, it's like you've dumped a whole bunch of curd there. It's often periodic. I went to the hospital because of infections like that. They took me in, they started to do the curettage, they started to put it on the plate, the whole plate filled up with white discharge, I was really hospitalized because of the infection problems [...] The doctor told me that it's because you spend all day in dirty water" (ITF-20210413-23).

Indeed, the literature shows that urinary and digestive tract infections may well result from exposure to river or stagnant water via the transcutaneous route. Bacteria generally survive for 7 days to 3 months in stagnant water, while parasites usually survive longer. For viruses it is difficult to specify (Rogeaux, 2005; MSD, 2021).

Regarding skin diseases, many women complain that their skin gets "itchy":

"Often when you're in the water you get used to scratching your body. There are no things growing on our bodies, but we are used to scratching ourselves and getting infections too" (ITF-20210413-24).

As some skin diseases are contact diseases, infections manifest themselves as skin pruritus and scratching or erythema. Miners, generally working without shoes and gloves, get these infections from the germs in the water. The bacteria that probably causes these recurring infections is *E. coli*, a bacterium that lives in dirty water (Bush, 2020).

Lacking alternatives, these women cannot give up their work. Some use traditional medicine to treat these infections, while others say they do nothing because they cannot pay for medication or treatment (IFM-202100817-34).

### 5.1.2. Nutrition

As is common in many mining areas (Banchirigah & Hilson, 2009), agricultural activities are neglected in Kamituga since labour tends to move to the mines where income is higher and faster (Geenen et al., 2021). As the state of the road is poor, imported food is very expensive. A medical staff member explains:

"The food is not good in any case, because people do not farm, all are interested in the mines" (IPM 202104-90).

Low agricultural production, combined with high market prices for food, means that many families in Kamituga do not have an adequate diet. They eat little protein-rich food and survive on *sombé* (cassava leaves), *fufu* (cassava porridge) sometimes complemented by small, dried fish that have low nutritional value but are readily available. Most families only eat once or twice a day, with some extreme cases eating nothing:

"You are going to come back in the evening without bringing anything, the children will start crying. You only drink water and sleep until tomorrow. The children get used to this. My little boy gets up in the morning and says, mommy I'm going to school, because he already understands the situation. But for little kids when they see people walking by with a doughnut in their hand they start crying. They ask insistently because they are so hungry" (FGFT-20210411-1).

Nutritional diseases resulting from undernutrition affect different segments of the population, but especially children. A doctor explains:

"*Utapyamulo* [malnutrition] affects children more. The skin flakes, the hair turns grey and the child dies" (IPM-202104-78).

Poor nutrition contributes to weakened immunity, which increases the risk of serious infections. Inadequate intake of vitamins and minerals can be devastating to cognitive functioning and can lead to various health and developmental consequences such as intellectual disability (UNICEF, 2019). Moreover, mothers have no choice but to get back to work very soon after giving birth. In many cases, infants are left at home alone or under the

supervision of older brothers or sisters. Weaning therefore starts very early, which puts the children's health at risk. The porridge they are fed, of cassava flour with added sugar, contains little nutrients (FGFT-20210820-78). Many women testify to this:

"At two weeks old, I prepare cassava porridge in hot water and give it to my children either once or twice a day, depending on what I have found" (ITF-202101821-92).

Prenatal care is essential because it provides pregnant women with care, information about healthy lifestyles, and health monitoring for both mother and infant. This helps to reduce the risk of pregnancy complications as well as birth defects, low birth weight and other preventable health problems. Postpartum care also includes looking for clinical signs of serious illness in the new-born, promoting exclusive breastfeeding, and providing information on family planning (Calys-Tagoe et al., 2015; Lynas, 2018; Sana et al., 2017). Although several female workers attend the prenatal consultations, they do not follow the doctor's instructions. After giving birth, they almost immediately resume their work at the mines. This is again because they have no alternative income sources and need to provide for their families on a daily basis:

"Well, most of the time if the doctor tells us to stop, and if we don't have a lot of money to support our family, we can't stop, he's just going to tell us that and then tomorrow we go to our job" (IF-20210414-52).

### 5.1.3. Sexually transmitted infections (STIs)

Women's presence in mining sites is often linked to (forced) transactional sex (USAID, 2020). Therefore, mining sites have been documented as high-risk places for STIs. For the case of Kamituga this has been confirmed by the medical staff we interviewed. Based on interviews with women, in-between forced sex and consensual partnership, a wide range of transactions and interactions exist, as argued by Bryceson et al., (2013). Many women know they take a risk, but see no alternative but to 'use' their body to access certain benefits, for instance, in exchange for stones or *bizalu*:

"But you don't know the kind of people you are with, you don't know what their health is like, what their blood is like. You just go, you go to give yourself, you will have the stones in return, but you don't know what diseases this person will transmit to you and then you will die" (ITF-20210413-25).

Most women do not use condoms to protect themselves. This is not only due to the low availability or the financial cost, but also to the social stigma as condoms are "for prostitutes". That is why girlfriends and wives do not use them, even if they know their husbands have sex with other women (ITF-202104-41).

## 5.2. Physical and psycho-social trauma

### 5.2.1. Physical trauma

Female workers suffer long-term consequences from the hard work they do and are exposed to specific risks in the workplace. *Twangaises*, for instance, run the risk of injuring their hands while pounding. They frequently get sores on their fingers, develop hardened palms and split nails. While crushing the stones, sharp pieces may hurt the eyes and skin. *Mamans bizalu* or transporters, who bring material to the ball mills, are at risk of being injured by these machines. In fact, according to our interviews it is quite common for women to get injured as their long clothes risk getting trapped in the machines. Several cases were reported, including the case of a woman who had her breast amputated by a ball mill, and a pregnant woman who lost her lower limbs (FGFT-20210414-49; FGFT-20210416-83). In response to these accidents, some ball mills owners have put-up warning signs, others have prohibited women from approaching the machines. As with the prohibition to work underground, this can be justified by risk prevention. Yet, it may be another strategy to exclude women from reaping more benefits. Moreover, the Congolese mining regulations prevent pregnant women from working in the mines, which has in some cases been used as an exclusion mechanism. Another strategy to exclude women is accusing them of witchcraft. One interviewed woman interpreted it in precisely this way, saying that the measure is imposed by men who have "madness in their heads" (IF-20210414-52). She adds:

"It is because we are told that the machine is starting to kill many people, the men are shouting that all the women should not go near the machine because when they go near, they do witchcraft that makes many people die" (IF-20210414-52).

The continued exposure to hard physical work causes what mine workers commonly refer to as "fatigue". This fatigue manifests itself in their bodies (mainly muscular pains), in their appearance (losing weight and appearing older), or in a lack of sleep. In a focus group with female traders, many of whom had previously worked in the mines, one woman says:

"In mining, there is money, but it is hard work, which causes a lot of fatigue in the body" (FGF-20210416-84).

These women feel they are ageing fast and damaging their bodies. A *maman bitalu* says:

"First of all, it is a job that makes us too skinny, which makes us tired. It brings us many diseases that a person could not have before. It makes us age too fast, especially for us women who give birth. This kind of work is not really the work we should do, but it is just out of poverty that we do this kind of work" (ITF-20210414-51).

Here is an excerpt from a focus group that confirms these remarks, but also shows the sense of humour and solidarity that may provide some comfort in these harsh conditions:

"C [researcher]: And in your opinion, does this work have a negative impact on your health? A: Yes! Was I like this before? C: What were you like? A: I was too brown and fat. B: But when she came here during the famine, she became skinny, her skin... A: Because she does work that requires a lot of physical effort. D: Besides, she works under the sun, from morning till night. A: We have become like solar panels. C: Oh, so you are being recharged with solar energy? A: That's what they call us, if we had plugs on us, we should just start charging phones. All: [laugh] D: Look how we already look like old women and yet we are not old. B: We are still young, but this activity, sorry!" (FGFT-20210416-83).

For them, being "brown and fat" is equal to being healthy and beautiful. But the work in the mines, under the sun and with a lot of physical demands, gives them the impression that they are ageing too fast. A *maman twangaise* tells us that she even has sleeping problems because she continuously repeats the same movement in her sleep:

"You arrive home too tired because the work is too heavy. You will even prepare the food and you will have no appetite. During the whole night you will be remembering the *pilon* [stick they use to pound] because it will even disturb your sleep all night and it will affect your health" (FGFT-20210411-1).

Many women share stories about how this fatigue impacts their libido and sexual performance, leading to problems at home. Some say their husband will not understand and "beat you when you refuse to sleep with him" (FGFT-20210416-82).

To fight against this fatigue, many workers take drugs such as Amphastar (made of paracetamol and diclofenac) or Thiamine (vitamin B1). One woman explains:

"These medicines will help you for one or two days, but after that you will still feel tired so you will have to take more" (ITF-20210412-14).

Pregnant women working in the mines put their health and pregnancy at risk. For instance, female transporters, told us that they lost their unborn baby through spontaneous abortion because they carry up to 50 kilogramme loads over long distances while pregnant:

"Yes... three times with a lot of blood loss and that is due to heavy work or when you have lifted heavy things. Often [it happens during] early pregnancy in developmental age" (ITF-202104-58).

Out of economic necessity, they continue to do the same heavy physical labour during their pregnancy, until the last days before giving birth:

"Even if you are going to give birth today and you are already having contractions, you come here to work first" (FGFT-20210416-85).

### **5.2.2. Psycho-social trauma**

Women working in the mines are frequently victims of discrimination, which reflects the lack of social consideration of women in the society. First, as indicated before, women do not have access to the higher remunerated positions and cannot access the underground mines - for physical, cultural and/or socio-economic reasons. Second, many women report that they are frequently scammed, or not paid what they owe. Their bargaining power is lower than that of men. One woman says:

"It [discrimination] does happen. You can see a man coming, you've already given him your money to bring you the stones, but he'll go and eat your money and he won't bring you the stones" (ITF-20210416-85).

In such cases women cannot resort to the police or the court, as all working transactions are done informally. Their social position does not allow them to claim their rights in another way. However, we note that there is a lot of solidarity among the female workers. Some women's associations exist, which may play an important role in the struggle for their rights.

After long days of work and sometimes humiliation in the mines, some women are victims of domestic violence by their husbands, either verbal or physical. According to data from the United Nations (UN), 51% of Congolese women suffer from physical and/or sexual intimate partner violence during their lifetime<sup>5</sup>. A couple of interviewed women mentioned that they have left their partner or husband for this reason, or that they would do so if they become victims of repeated violence:

"When I noticed that every time my husband comes, he beats me up, there is a lot of risk that I might die before my time; I got out, I left" (ITF-20210414-53).

However, to do this, the woman needs to be financially independent, or she has to count on a strong social network. In case of repeated violence, or other problems in the household, the workplace may also become a refuge. It does not only provide an income that allows for some independence, but it also provides a safe space, as this woman indicated:

"Personally, I feel better when I am at work than when I am with my husband, I often don't like to go home and stay with my husband" (ITF 20210414-53).

Many women in the mining area suffer from psycho-social trauma. The stigma attached to their gender, the lack of respect, and the feeling of inferiority affect their mental health. A female worker clarifies:

"Because you are a woman, you have no value in front of the men here" (ITF-20210414-53).

For one nurse we interviewed, the consequences are visible:

"This trauma manifests itself in insomnia, heart palpitations, often we notice it during the prenatal consultation, dizziness, anger, stomachache, hypertension and lack of appetite" (IPM-20210816-7).

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<sup>5</sup> See <https://evaw-global-database.unwomen.org/fr/countries/africa/democratic-republic-of-the-congo> (consulted 12/03/2022).

## 6. WORKING TOWARDS BETTER HEALTH FOR WOMEN

In this section we reflect on some of the structural constraints female mine workers face, and how these constraints can be navigated and overcome to move towards a better protection of women in the mines.

First, the women are constrained by the economic context in which they live, characterized by high degrees of informality and few opportunities for income generation. As mentioned, agriculture is not considered to be an attractive option as mining generates faster and better revenues (Geenen et al., 2021) and women have less access to agricultural land than men (Iragi, 2019). Most interviewed women admit they would start gold trading if they had the starting capital. This activity is considered more profitable and less tiring and harmful to their health.

Second, socio-cultural norms expose women to discrimination and violence. As mentioned above, some regulations are disguised as protection measures or cultural taboos, while they are simply excluding women from more profitable activities. In general, discriminatory norms in society result in a high inequality between men and women in the economic, social, cultural and political domains<sup>6</sup>.

Third, the cooperatives and state services providing technical assistance to ASM miners have hardly any specific measures in place to protect women (apart from the only female cooperative that exists in Kamituga). On the contrary, they commonly reproduce the discourse about women needing protection, which de facto results in women's exclusion from the better remunerated tasks. When we asked women about protection at work, some focus groups remained completely silent, or participants said that to protect themselves, they should just stop doing this activity (FGFT-20210416-85). Many say that only God can protect them. When probing further, women said they need at least appropriate clothing such as raincoats and shoes, and shade areas to work in. *Twangaises* also ask for gloves that can protect their hands:

"See, I don't have fingernails because of the work we are doing, I may want to wear gloves to protect myself" (ITF-20210412-13).

*Mamans minyangala* also come up with creative solutions, such as wearing green bags by cutting them like underwear and wearing them over trousers to protect them from dirty water (FGFT-20210416-85), wearing a double layer of underwear and trousers (ITF 2021 0412-13; ITF-20210414-53), or simply avoiding contact with dirty water by standing on a stone (IF-20210414-52). Cooperatives and technical state services can think about designing and implementing such simple interventions. As Hilson et al (2021) argue, people expect the government to assist them in training and providing equipment. In theory, formalization would provide exactly that.

Fourth, there is a problem of medical infrastructure, equipment, and trained health personnel in the mining areas. Even though access to quality health care is difficult for everyone, women face on average even more constraints than men. Many women are widows or single mothers. They often postpone visits to the health centre or hospital due to lack of money. One woman says, "When you go to the hospital you always have to worry about the cost of the bills" (ITF 20210820-84). She adds that for this reason she prefers to buy some medicine at the pharmacy. Self-medication is common, as well as traditional healers and prayer rooms. A woman we met at the maternity testifies that this might have fatal consequences:

"First, we buy some medicines from the pharmacy, when we see that the child starts vomiting all the time. When that doesn't work, we take him to the prayer room. It is cheaper. I am afraid of the hospital bills. For example, once my child was seriously ill, I took him to the pharmacy, but it didn't work. I took him to the prayer room and then the mother who prayed told me to take the child to the general hospital, I didn't do it and the child died" (IFM 202100817-34).

The female workers "navigate" these structural constraints in various ways, as Bashwira and van der Haar (2020) put it. This also depends on their backgrounds, which are quite diverse. Some women were born in

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<sup>6</sup> DRC ranks 149<sup>th</sup> on the Gender Inequality Index, which considers reproductive health, empowerment and labour market participation. See <https://evaw-global-database.unwomen.org/fr/countries/africa/democratic-republic-of-the-congo> (consulted 12/03/2022).

Kamituga, but many come from elsewhere. They are looking for new opportunities in life or fleeing from problems. For many of them, coming to the mines is the best option after having faced various setbacks in life, such as the death of parents or a husband, divorce, war, or the impossibility of continuing their studies. In one of the focus groups there was a young girl who started working as a *twangaise* after the death of her mother, who was also a mine worker. She stopped her studies in the sixth grade and now works to provide food for her younger brothers and sisters (FGFT-20210817-16). Her case is by no means unique. These women accept the work in the mines as the "best of the bad choices" and should not be treated as mere victims. Every day they make remarkable efforts to provide for their families.

To better protect female mine workers, we argue that interventions are needed at different levels. First, state services, cooperatives and pit owners need to be informed about the specific health risks faced by female workers. An awareness of women's vulnerability should not result in a priori excluding them from specific tasks. Rather, those who are controlling or assisting miners, need to collaborate with female workers to understand their specific needs as well as their skills. Women's specific contribution in the gold production needs to be valorised to the same extent as men's, both in terms of financial remuneration and social consideration. Better training of medical staff, especially on the specific risks and pathologies women face, is needed. There is also a need to raise awareness about discriminatory norms. Women's associations could help to build another image of women in mining, as key players rather than marginalized actors in the production process. Finally, women must have access to quality health care, which should be provided by a multidisciplinary team of nurses, social workers, doctors, physiotherapists, midwives and gynaecologists. The state must therefore take its responsibility and provide free and good quality primary health care. In addition, the community needs programmes to prevent and reduce violence and abuse. Female victims of violence need reintegration assistance to avoid their exclusion from society and to rebuild their social environment. Above all, to improve sanitary facilities, there is an urgent need for financial support, material and human resources.

## 7. CONCLUSION

Although the presence of women in ASM is increasingly recognized, there is still a need to better understand their needs, especially in the domain of health. Based on interviews and focus group discussions in the largest ASGM mine of South Kivu province in eastern DRC, we argue that ASGM has gendered effects on the health of the workforce. In this article we present some specific risks and pathologies faced by different categories of female workers. First, it is important to state that the effects indeed differ between different categories of workers, even if some women flexibly move between work tasks depending on their needs and the availability of work. But in general, *minyanga* – because of their continuous exposure to dirty water – face different risks than *twangaises* – exposed to dust and repetitive body movements – and transporters – exposed to heavy weight and sometimes long walking distances. Second, it should be noted that technological transformations and mechanization of ASGM similarly have gendered effects. In Kamituga, this is most obvious in the recent introduction of ball mills. Mechanized ball mills have pushed many *twangaises* out of work, which has in turn opened possibilities for *minyanga* and *bizalu* and has extended the production process almost *ad infinitum*.

We argue for a holistic approach to understand and address the health problems of these female workers. Our analysis has covered different aspects of women's well-being. We observe that the health dimension is very much entangled with the socio-economic dimension (lack of alternatives, need for family survival) and the socio-cultural dimension (discriminatory norms, violence against women). These impose a certain number of constraints, resulting in insufficient protection of these women in the workplace. If we think about strategies for better protection, we need to take these different dimensions into account. Otherwise, proposals risk being unrealistic or ill adapted to the local context. For instance, many development practitioners have tried to come up with alternative livelihood programmes to lead women out of the mines. Yet, in too many cases these programmes have failed because they could not provide realistic and attractive options. In the Kamituga context it is important to sensitize women about the specific health risks they face, as well as to organize more targeted training for the health staff and for the technical services such as SAEMAPE. It is also crucial to sensitize the broader population about harmful effects of discriminatory norms. Local media and local leaders can play an important role. Female associations, such as the cooperative that has been created in Kamituga, have an exemplary role to play. Thanks to the growing (inter)national attention to the position of women in mining, these associations are well positioned to reach out to (inter)national networks that can support their case. At the same time, this risks creating new tensions with existing associations and cooperatives. Therefore, it is important that women are included in local decision-making processes, rather than setting up structures that are considered to be competing.

Some of the health problems we described are rather specific to women, such as the urinary infections and everything that has to do with pre- and postnatal care. Other problems affect both men and women, sometimes at different degrees. Still other problems, particularly the ones that are related to working underground, are rather affecting men. This means that health education campaigns and strategies that will be put in place should be gender sensitive, but they should also point to the interconnectedness of many of these problems, and the shared responsibility. For instance, the problems of bad hygiene and polluted water in the mining sites, can only be addressed through cooperation between all the miners.

Finally, it is important to acknowledge both the structural constraints that are oppressing these women, and the agency they have to choose this job, feed their children and provide for other family needs. Some women even challenge socio-cultural norms and stand up for the rights of other women. One important effort we can make it to support these women in their collective struggles, starting with their recognition as important actors in the gold production system.

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### Reference list

Arthur-Holmes, F., & Busia, K. A. (2020). Occupying the Fringes: The Struggles of Women in Artisanal and Small-Scale Gold Mining in Rural Ghana-Evidence from the Prestea-Huni Valley Municipality. *Gender Issues*, 38, 156-179.

Banchirigah, M., & Hilson, G. (2009). De-agrarianization, re-agrarianization and local economic development: re-orientating livelihoods in African artisanal mining communities. *Policy Sciences*, 43, 157-180.

Bashwira, R. (2017). *Navigating obstacles, opportunities and reforms: women's lives and livelihoods in artisanal mining communities in Eastern DRC*. PhD thesis, Wageningen University and Research.

Bashwira, M. R, Cuvelier J., Hilhorst D., & Van der Haar G. (2014). Not only a man's world: Women's involvement in artisanal mining in eastern DRC. *Resources Policy*, 40, 109-116.

Bashwira, R., & Cuvelier, J. (2019). Women, mining and power in southeastern Democratic Republic of Congo: the case of Kisengo. *Extractive Industries and Society*, 6(3), 960-967.

Brottem, L., & Ba, L. (2019). Gendered livelihoods and land tenure: the case of artisanal gold miners in Mali, West Africa. *Geoforum*, 105, 54-62.

- Bryceson, D. F., Jønsson, J. B., & Verbrugge, H. (2013). Prostitution or partnership? Wife styles in Tanzanian artisanal gold-mining settlements. *Journal of Modern African Studies*, 51(1), 33-56.
- Buss, D., Rutherford, B., Stewart, J., Côté, G., Sebina-Zziwa, A., Kibombo, R., Hinton, J., & Lebert, J. (2019). Gender and artisanal and small-scale mining: implications for formalization. *Extractive Industries and Society*, 6(4), 1101-1112.
- Calys-Tagoe, B. N. L., Ovadje, L., Clarke, E., Basu, N., & Robins, T. (2015). Injury profiles associated with artisanal and small-scale gold mining in Tarkwa, Ghana. *International Journal of Environmental Research and Public Health*, 12(7), 7922-7937.
- Cossa, H.; Scheidegger, R.; Leuenberger, A.; Ammann, P.; Munguambe, K.; Utzinger, J.; Macete, E. & Winkler, M. (2021) Health Studies in the Context of Artisanal and Small-Scale Mining: A Scoping Review. *Int J Environ Res Public Health* 18(4): 1555.
- Côté, Gisèle Eva. 2020. Toolkit: Gender Impact Assessments for Projects and Policies Related to Artisanal and Small-Scale Mining. IMPACT.
- Dubay, A. (2021). *Waterborne disease facts and how to help*. World Vision. Retrieved from [Waterborne Diseases: Facts & How to Help | World Vision Canada](#)
- Eftimie, A., Heller, K., Strongman, J., Hinton, J., Lahiri-Dutt, K., Mutemeri, N., Insouvanh, C., Sambo, M. G., & Wagner, S. (2012). *Gender Dimensions of Artisanal and Small-Scale Mining A Rapid Assessment Toolkit*. The World Bank, Washington.
- Geenen, S. (2015). *African artisanal mining from the inside out. Access, norms and power in Congo's gold sector*, Routledge, Abingdon.
- Geenen, S. ; Stoop, N. and Verpoorten, M. (2021). How much do artisanal miners earn? An inquiry among Congolese gold miners. *Resources Policy*, 70: 101894
- Gottesfeld, P., Tirima, S., Anka, S.M., Fotso, A. and Nota, M.M. (2019) Reducing lead and silica dust exposure in small-scale mining in northern Nigeria. *Annals of Work Exposures and Health*, 63 (1): 1-8.
- Hayes, K., & Perks, R. (2011). *Women in the Artisanal and Small-Scale Mining Sector of the Democratic Republic of the Congo*. High-Value Natural Resources and Post-Conflict Peacebuilding, Earthscan London.
- Heemskerk, M. (2003). Self-Employment and Poverty Alleviation: Women's Work in Artisanal Gold Mines. *Human Organization*, 62(1), 62-73.
- Hilson, G.; Hilson, A.; Maconachie, R.; McQuilken, J.; Goumandakoyea, H. (2017). Artisanal and small-scale mining (ASM) in sub-Saharan Africa: Reconceptualizing formalization and 'illegal' activity. *Geoforum*, 83, 80-90.
- Hilson, G.; Hilson, A.; Siwale, A. & Maconachie, R. (2018). Female Faces in Informal 'Spaces': Women and Artisanal and Small-scale Mining in sub-Saharan Africa. *Africa Journal of Management*, 4 (3), 306-346.
- Hilson, G.; Mondlane, S.; Hilson, A.; Arnall, A. & Laing, T. (2021). Formalizing artisanal and small-scale mining in Mozambique: Concerns, priorities and challenges. *Resources Policy*, 71, 102001.
- Hinton, J., Veiga, M., & Beinhoff, C. (2003). Women and Artisanal Mining: Gender Roles and the Road Ahead. In Hilson, G. (ed.) *The Socio-Economic Impacts of Artisanal and Small-Scale Mining in Developing Countries*. A.A. Balkema, Swets Publishers, Netherlands.
- Hinton, J., Hinton, E. B., & Veiga, M. (2006). Women in artisanal and small-scale mining. In Lahiri-Dutt and Macintyre (eds) *Women Miners in Developing Countries: Pit women and Others*. Ashgate, London.

Intergovernmental Forum on Mining, Minerals, Metals and Sustainable Development (IGF). (2018). Women in Artisanal and Small-Scale Mining: Challenges and opportunities for greater participation. Winnipeg: IISD.

Iragi, F. (2019). "Symbiosis or antibiosis?" A look at the links between artisanal mining and agriculture. IOB Working Paper 2018.10. Institute of Development Policy, University of Antwerp.

Kamundala, G. B. (2020). Formalization of artisanal and small-scale mining in eastern Democratic Republic of the Congo: An opportunity for women in the new tin, tantalum, tungsten and gold (3TG) supply chain? *The Extractive Industries and Society*, 7(2), 420-427.

Kelly, J. (2014). This mine has become our farmland. Critical perspectives on the coevolution of artisanal mining and conflict in the Democratic Republic of the Congo. *Resources Policy*, 40, 100-108.

Kelly, T. D. J., King-Close, A., & Perks, R. (2014). Resources and resourcefulness: Roles, opportunities and risks for women working at artisanal mines in South Kivu, Democratic Republic of the Congo. *Futures*, 62(A), 95-105.

Labonne, B. (1996). Artisanal mining: an economic stepping stone for women. *Natural Resources Forum*, 20(2), 117-122.

Lahiri-Dutt, K. (2011). 'Digging women: towards a new agenda for feminist critiques of mining', *Gender, Place and Culture*. Australian National University, Canberra, Australia.

Lahiri-Dutt, K., & Macintyre, M. (2006). *Women miners in developing countries. Pit women and others*. Hants, Ashgate.

Lara, A. (2020) *Silicose*. Le Manuel MSD. <https://www.msdmanuals.com/fr/professional/troubles-pulmonaires/maladies-pulmonaires-li%C3%A9es-%C3%A0-environnement/silicose>

Lynas, D. (2018). A good business or a risky business: Health, safety and quality of life for women small-scale miners in PNG. In K. Lahiri-Dutt (Ed.), *Between the plough and the Pick* (pp. 151-170). ANU Press.

MSD, (2021). *The MSD manual*. Retrieved from <https://www.msdmanuals.com/fr/accueil/infections>.

Muheki, S., & Geenen, S. (2018). *Women in (and out of) artisanal mining: opposing policy and women's lived experiences in Lujinji B and Wakayiba mines, Mubende, Uganda*. IOB Discussion Paper. Institute of Development Policy, University of Antwerp.

Mulonda, S. B.; Radley, B. & Geenen, S. (2019). Stop the crushers! Transformation, near dispossession and repression around gold production in Kamituga. In Geenen, S.; Nyenyezi, A. & Ansoms, A. *Central African conjunctures 2019* (158-186). Cahiers africains 93. Paris, L'Harmattan.

Nyanza, E. C., Bernier, F. P., Manyama, M., Hat, J., Martin, J. W., & Dewey, D. (2019). Maternal exposure to arsenic and mercury in small-scale gold mining areas of Northern Tanzania. *Environmental Research*, 173, 432-442.

Radley, B. (2021). Class Formation and Capital Accumulation in the Countryside: Artisanal and Small-Scale Gold Mining in South Kivu, DR Congo. *Journal of Agrarian Change*.

Radley, B., & Geenen, S. (2021). Struggles over value: corporate-state suppression of locally led mining mechanisation in the Democratic Republic of the Congo. *Review of African Political Economy*, 48, 161-177

Rees, D. & Murray, J. (2020) Silica, silicosis and tuberculosis. *Occupational health Southern Africa* 26 (5).

Rogeaux, O. (2005). *Development and health/water-related diseases: classification*. Retrieved from <https://devsante.org>.

- Rustad, S. A.; Østby, G. & Nordås R. (2016). Does Artisanal Mining Increase the Risk of Sexual Violence? Artisanal mining, conflict, and sexual violence in Eastern DRC. *Quality in Primary Care* 24(2): 77–80.
- Sana, A., De Brouwer, C., & Hien, H. (2017). Knowledge and perceptions of health and environmental risks related to artisanal gold mining by the artisanal miners in Burkina Faso: A cross-sectional survey. *Pan African Medical Journal*, 27.
- Smolders, E., Roels, L., Kuhangana, T.C., Coorevits, K., Vassilieva, E., Nemery, B. and Nkulu, C.B.L. (2019) Unprecedentedly High Dust Ingestion Estimates for the General Population in a Mining District of DR Congo. *Environmental Science and Technology*, 53: 7851-7858.
- Tsang, V. W., Lockhart, K., Spiegel, S. J., & Yassi, A. (2019). Occupational Health Programs for Artisanal and Small-Scale Gold Mining: A Systematic Review for the WHO Global Plan of Action for Workers' Health. *Annals of Global Health*, 85(1), 128.
- UNEP (2018) Reducing mercury in Artisanal and Small-Scale Gold Mining (ASGM). <http://web.unep.org/globalmercurypartnership/our-work/reducing-mercury-artisanal-and-small-scale-gold-mining-asgm>
- UNICEF. (2019). *Child nutrition*. Retrieved from <https://data.unicef.org/topic/nutrition/child-nutrition/>
- UNITAR (2018). *Handbook for Developing National ASGM Formalization Strategies within National Action Plans*. Geneva, UNITAR & United Nations Environment Programme.
- USAID (2020). Gender issues in the artisanal and small-scale mining sector. <https://www.land-links.org/wp-content/uploads/2020/05/USAID-ASM-and-Gender-Brief-1-June-20-Final.pdf>
- Van Brusselen, D., Kayembe-Kitenge, T., Mbuyi-Musanzayi, S., Kasole, T.L., Ngombe, L.K., Obadia, P.M., wa Mukoma, D.K., Van Herck, K., Avonts, D., Devriendt, K., Smolders, E., Nkulu, C.B.L & Nemery, B. (2020) Metal mining and birth defects: a case-control study in Lubumbashi, Democratic Republic of the Congo. *Lancet Planet Health*, 4: 158–67.
- Weldegiorgis, Fitsum, Lynda Lawson, and Hannelore Verbrugge. 2018. Women in Artisanal and SmallScale Mining: Challenges and Opportunities for Greater Participation. Winnipeg: IISD.
- Werthmann, K. (2009). Working in a boom-town: Female perspectives on gold-mining in Burkina Faso. *Resources Policy*, 34(1-2), 18-23.
- World Bank. (2020). *2020 State of the Artisanal and Small-Scale Mining Sector*. The World Bank, EGPS, Pact. Retrieved from <https://delvedatabase.org/uploads/resources/Delve-2020-State-of-the-Sector-Report-0504.pdf>
- World Health Organization (WHO). (2016). Artisanal and small-scale gold mining and health.
- Yakovleva, N. (2007). Perspectives on female participation in artisanal and small-scale mining, A case study of Birim North District of Ghana. *Resources Policy*, 32(1-2), 29-41.