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Mining's Impact on Environmental and Human Health: A Case Study of Ramba County's Gold Mine

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**Mining's Impact on Environmental and Human Health: A Case Study of
Ramba County's Gold Mine**

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Abstract

This research project aims to gain a greater understanding of the health implications that Ramba County's goldmine has on miners, their families, and the environment. While this study observes the community-at-large, inclusive of visiting miners and extended family members of workers, it will focus on women who engage in artisanal and small-scale gold mining (ASGM). Millions of people in the developing world depend on ASGM for their livelihood, evident in this case study in Ramba County.¹ However, while gold is associated with wealth, there is great irony in the fact that those working within the mining industry are being exploited and live in extreme poverty that spurs additional health problems. The physical nature of this job is dangerous, specifically the exposure that workers have to mercury, an element used in the ASGM process. Women face the highest burden of negative health outcomes as a result of the gold mining process. Despite long hours of tiresome work, while also taking care of their children and daily house chores, the unpredictability of the job has put many women in Ramba County in great economic stress. Their low socioeconomic status exacerbates health problems that stem from their job, worsening the cycle of poverty that she and her family are already in. Additionally, the environmental impact the mine has had on existing farmland and the livelihood of farmers has impacted output, and therefore driven prices of staple foods. This strengthens the existing barriers that women miners in Ramba County experience when it comes to accessing affordable and healthy food for themselves and their children. A low-nutrient diet spurs poor health outcomes, worsening the cycle of poverty. Through conducting one-on-one interviews with various stakeholders, personal narrative is used as a tool for understanding the gold mine's direct and indirect effects on health. Clear patterns have emerged that align with various other gold mine case studies that highlight this industry's exploitative practices that disproportionately impact women. While the cycle of poverty and ill-health is difficult to break, miners have provided a few recommendations that may serve as catalysts for a healthier generation.

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Background/ Introduction

With our globe's increasing population and advances in technology, the demand for raw materials is also rising. The mining industry is notorious for its exploitative practices. The health and well-being of miners, specifically those who engage in artisanal and small-scale gold mining (ASGM), as well as their families and close-by community members, are often adversely affected. ASGM, defined by the United Nation's Minamata Convention on Mercury, is "gold mining conducted by individual miners or small enterprises with limited capital investment and production." Artisanal and Small-Scale Mining (CASM), a World Bank initiative, elaborates on economic and social implications ASGM has on workers and residing community members. The World Bank describes ASGM as a practice that usually occurs in the most remote and rural areas by poorly educated people that lack other employment opportunities.¹ Definitions of ASGM have commonalities that note the labor-intensive nature of the job, limited mechanical tools and income exploitation. Therefore, the cycle of poverty is rampant in communities that rely on ASGM employment. Understanding this vicious cycle, the amount of negative health implications that stem from low socioeconomic status is extreme. Various case studies have been conducted that show the negative health, social, economic, and environmental consequences that miners and their families experience.² It is important to note that these four areas are intersecting and exacerbate one another. While health risks are present for all persons involved in ASGM, women disproportionality face a myriad of health risks.

Ramba Village, located in Siaya County, is a gold mining community. Home to San-Martin's gold mine, it attracts not only community members but outsiders in hopes of striking gold. Majority of residents are widowed mothers, many of whom have lost their husbands to HIV/AIDS. Most visiting miners are men who rent out housing space seasonally on the mine site. Majority of those living on-site year-round are women, meaning that they endure the burden of negative health consequences associated with living in such toxic environments. San-Martin is a Tanzanian mining company that has bought out land from community members and has created a large mining site where individual miners can utilize with a cost. The mining process in Ramba is as such:

Step 1, Extraction: Hard rock deposits are dug and collected from either San-Martin's mine or an individual's private property. This step is male dominated.

Individual's Mine (in backyard):



San-Martin's Mine:



Step 2, Rock Crushing/Refining: Rocks are first crushed by hand into smaller pieces. These pieces are then taken to a refining machine. This step is female-dominated and require them to rent out a machine from those who own their own. Often, before suing the machine, women will hammer the rocks into small bits.



Step 3, Gold Extraction: Once the rocks are grinded into fine sand, gold is extracted. Mercury is used to aid in this process.



Step 4, Sell Gold: Outside vendors will purchase gold from female vendors.

The effects of environmental and physical hazards that miners are exposed to during this process are felt hardest by women and their children.³ Some environmental and occupational health implications and injustices that have been cited in other case studies include low income of workers, chemical hazards, high rates of respiratory infections and increased disease susceptibility, physical hazards, and water contamination. These direct consequences of mining have indirect effects such as drug and alcohol abuse, violence, and food insecurity that further exacerbates poor health conditions. Women miners in Ramba are living in a never-ending cycle of poverty that has generational impact. The mining industry brings up both, human and environmental issues, creating for interwoven and complicated public health concerns that need immediate attention.

Statement of ISP Problem

Although research has been done on other gold mine sites, geography, culture and population health is unique to each mine. An in-depth case study on the health implications of Siaya's goldmine is needed in order to effectively address the health issues in culturally appropriate ways. When researching this particular mine, there are a limited number of articles that credit the mine's employment as nothing but positive and helping to "alleviate poverty."⁴ However, when speaking to local people, I have discovered that there are various health issues occurring within the areas that are direct and indirect effects of the gold mine that fuel the cycle of poverty miners are in. Further research must be conducted to understand the implications of the mine on human health, environmental health, and the inextricable link between the two.

Justification of Problem

Understanding the health implications of the gold mine in Siaya will enable the development of proper interventions that can effectively address problems. Additionally, if health issues are known and are correlated to the mine, health care workers will be more aware and proactive about mitigating contributing factors. Miners will also be more aware of health issues associated with their jobs and take proper steps that will reduce exposure to risks. Additionally, simply knowing what is happening at the mine and providing workers with the opportunity to be part of research that sheds light on exploitative practices, can give rise to policy changes that seek to better their livelihood and restore their human right to safe and non-exploitative working conditions.

Objectives of ISP

The purpose of my research is to understand the relationship between the built environment (the creation of the gold mine) and its effects on environmental and human health. *What are the health implications of the mine on health?* The direct and indirect consequences of the mine on human and environmental health will be explored, shedding light on their inextricable link. Additionally, it will become clear that women and their children are subject to a disproportionate amount of negative health consequences. This research will also assess workers' understanding of health risks associated with mining. Research findings can guide future policy development and can raise awareness about the need to invest in the health and wellbeing of miners and adopt a safer and ethical ASGM work process.

Literature Review

Health Consequences of Mine on Human Health

Chemical Hazards

Miners are susceptible to inhaling, absorbing and ingesting chemicals throughout the mining process. Common chemical exposures include mercury and cyanide.

Mercury: Used to amalgamate the gold

Mercury intoxication can impact one's neurological, kidney and autoimmune functioning. Lung health is also of concern as mercury can cause airway irritation and chest tightness. Nausea, vomiting, headache, fever, chills, diarrhea are all side effects of elemental mercury absorption via the lungs. Additionally, under certain environmental conditions, mercury can be released into the environment and be transformed into methylmercury which can be absorbed by fish, and therefore humans who eat the fish.⁵

Cyanide: Used to extract gold

Cyanide, less common in ASGM than mercury, also has negative health consequences if exposed improperly. Cyanide can interfere with human respiration at the cellular level and can lead to rapid breathing, tremors, and even death.⁶

Biological Hazards

While there are many infections that ASGM communities experience, the most common biological hazards include waterborne and vector-borne diseases, sexually transmitted infections, HIV/AIDS, and tuberculosis. Due to lack of quality sanitation infrastructure, water quality is an issue. Stagnant water that collects as a result of the holes created from mining provides a favorable environment for reproduction of mosquitos that carry malaria. The seasonal nature of ASGM can lead to high-risk behavior that facilitates the spread of sexually transmitted infections such as HIV.⁷

Physical Hazards

Musculoskeletal disorders and overexertion are two other common biological hazards that miners experience. Shoulder disorders are common and are a result of heavy lifting.

The uncomfortable positions that miners are in for long hours of the day can cause overexertion. A more extreme biological hazard is the physical trauma that miners, specifically those who are responsible for retrieving rocks underground, experience. Fractures, impalement, burns, and eye injuries are common. Explosions to create large underground tunnels also contribute to major injuries for workers and have led to death. Crushing devices and other ASGM processes create for loud environments. “Noise exposure is associated with the following health outcomes: hearing impairment, hypertension, ischemic heart disease, and stress.”¹ Heat and humidity also contribute to the labor-intensive nature of ASGM and can lead to faintness, dizziness, and shortness of breath.

Other Hazards

Drug and Alcohol Abuse

The migratory nature of ASGM contributes to drug and alcohol use amongst workers who use them to cope with the stresses of the job.⁷

Violence

Drug and alcohol abuse can lead to violence against partners (domestic violence), co-workers, and community members. Additionally, sex work is also common in ASGM communities as it is a means of income for female miners who are in financial stress due to the low wages of mining. Women face higher rates of violence and STIs.⁸

Nutritional Deficits

As it is, miners find it difficult to secure adequate and nutritious foods for themselves and their families. Environmental degradation exacerbates this problem as output is reduced, leading to an increase in prices.

Environmental Impact of Gold Mines

ASGM is the largest extraction sector in the world. Approximately 15 million miners in 70 countries take part in the ASGM process, inclusive of women and children. ASGM makes up about 20% of our world’s gold. However, the processes involved in ASGM come at a large environmental cost.⁹

Mercury Emissions/Pollution

Mercury is used in the ASGM process. Miners typically pour mercury into ground ore where it will attach to gold pieces and form into an amalgam of mercury and gold. This substance is then burned to evaporate the mercury, leaving them with gold. Much more mercury is released into the environment than gold is produced. Residual mercury finds its way into the natural environment. Often, mercury ends up in rivers, threatening communities of fish. Bacteria can transform mercury into methylmercury which can then accumulate into the food chain, affecting our fish, and therefore the people who eat the fish.⁹

Land Degradation

ASGM processes also frequently leads to degradation and contamination of the general environment. In order to create space for mines, land must be cleared. Deforestation and clearing of all habitats happen for the construction of the mine. As a result, existing communities, both animal and human, are affected. Holes and trenches are left in the ground which creates for a loss of arable land. Additionally, the likelihood of stagnant water is common, which is a conducive environment for malaria-carrying mosquitos. Environmental degradation also impacts food availability. With less arable land, output of produce takes a hit.

Link Between Environmental Health and Human Health

Often, the connection between environmental health and human health are lost. However, numerous studies have showed that the two are interconnected and are dependent on one another. “For example, air pollution can cause respiratory disease, heavy metals can cause neurotoxicity, global climate change is likely to fuel the spread of infectious diseases.”¹⁰ Agriculture is a huge part of this connection. If the environment is negatively affected, this can adversely affect food output. This, in turn, affects human health and creates for additional food-related health problems. More understanding of the correlation between healthy environment and a healthy body is needed.

Wage Exploitation and Socioeconomic Status in Relation to Health

A case study was conducted in the Democratic Republic of Congo, highlighting the lives of gold miners. “The work of the artisanal gold miners in Ituri is not reflected in official production figures, and in recent years gold production has declined as the gold price has soared.” Gold mining is the main way of life for people in this community. “Women, some with

babies strapped to their backs, form human chains to pass plastic basins of mud from men excavating the shafts. They all work 13-hour days, six days a week. Some earn as little as US\$0.21 a day.”¹¹ Despite long hours of tiresome work, pay is minimal. Consequences of a low socioeconomic status are far reaching and affect the health of the individual, their families, and community at large.

Extensive research has been conducted to show the correlation between socioeconomic status and health. “Evidence has noted that higher income allows individuals to more easily access quality healthcare, afford more nutritious foods, and afford better housing, all of which are related to overall health status.”¹² Additionally, it is important to note the differences in socioeconomic status’s effects on health between genders. A Gallup report published in 2012 lists depression as the illness that most disproportionately impacts those of lower socioeconomic status, and it is known that women are twice as likely to be diagnosed with depression than men.¹³ Additionally, women are typically the primary care takers of their children, adding to their financial stress and responsibility.

Special Considerations for Women and their Children

Environmental injustices disproportionality impact women and children as the burden of ill-health falls on them. Environmental justice is defined as the “fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.”¹⁴ Environmental justice means that everyone enjoys the following:

- The same degree of protection from environmental and health hazards.
- Equal access to the decision-making process to have a healthy environment in which to live, learn, and work.

However, women involved in the ASGM processes are exposed to many of the environmental and occupational health hazards discussed above that greatly affect their reproductive health. Toxins that accumulate in their bodies as a result of exposure to these substances present in the mining space can have negative effects on pregnancy. “The reproductive health hazards associated with ASGM include mercury, arsenic, lead, sulfur, nitrogen oxides and cyanides and heat.”¹ Additionally, social behaviors, such as drug and alcohol abuse, that are common in ASGM environments, may result in reduced fertility, infertility, menstrual disorders, early menopause, and early onset of puberty. Part of reproductive justice is

the right to choose when or when not one would like to have a child. Environmental hazards can prevent one from exercising this right, showing the overlap of environmental and reproductive justice. Another overlap can be seen in another right described in reproductive justice which is the right to parent one's children in a safe and healthy environment.¹⁵ Clearly, this does not hold true for majority of women who work in mines. Women, who serve as the primary caretaker of children, have the additional financial burden and stress of taking care of their children. It is common for women to take their infant children to mine sites as they work as there may be nobody else to take care of their children while they are at work. Due to this, infants are exposed to toxins. Women in the ASGM space are also at higher risk for experiencing sexual violence and social isolation.

Methodology of Conducting Research

Household surveys will be used to collect information on the health of miners and their families as well as be used to assess their workers' understanding of health risks associated with mining. Additional responsibilities and cultural norms leave women miners with higher risk for poor health conditions. The project's goal is to better understand the health implications of the gold mine and the current state of health that miners are living in as a result. To understand my target population better, I interviewed three community health workers. They provided me with context and history of the gold mine and an overview of health problems faced by miners. Through a series of interview questions, I will be able to have the perspective of a community health volunteer. Their deep connection to the land and people of the Siaya County will provide me with a community member's (not a miner's) feelings towards the mine and its impact on both the environment and humans, and the connection between the two. The interview will remain free-form, as follow-up questions may differ depending on initial answers. Interviewing community health workers first will give me context to future interview questions with miners and farmers, seeing if their feelings of mine-impact on health align with actual data provided by community health workers. Community health workers will also serve as my connection to on-site miners and farmers, helping to organizing interview times. Through speaking to miners and observing the mine site, I will gain a better understanding of the current state and how it relates to health.

I will then interview miners and farmers, majority of which are women as the burden of ill-health outcomes is most greatly felt by them. Again, these one-on-one interviews will remain free-form, allowing miners to tell me how they believe the mine has impacted their health directly and indirectly. I will also verify health issues listed by community health workers with miners and will be asking questions about pay and hours and whether or not they believe it is fair and enough to sustain a healthy life. Farmers are a group of individuals that I want to interview as they can provide me with more information on the impact the mine has had on the environment, and therefore their livelihoods. I will be asking questions about crop output and associated costs. Understanding the two perspectives, I will be able to draw conclusions between the connection between environment and its exacerbation of ill-human health outcomes.

In addition to these one-on-one interviews, through a verbal questionnaire, I will ask on-site miners simple "yes" or "no" questions that will allow me to assess their understanding of the

connection between mining and human health, mining and environmental health, and environmental and human health. Additionally, I will ask a simple question that will provide me with understanding of whether or not miners believe they are being exploited. Gathering my findings, first-person narrative and general trends in feelings towards mines and knowledge level on the impact of mining on human and environmental health will be unveiled. The far-reaching consequences of mining on health and well-being will be better understood.

Ethical Considerations

It is important to acknowledge the bias I have as a young American woman. As an outsider, my priority was to create a space in which interviewees felt empowered and in control of how the interview would take shape. Women are a vulnerable group and especially in the setting I was in, where mining practices further exploit women and place the burden of ill-health outcomes on them, I felt strongly about not bringing up topics that could be potentially triggering for them or taboo, such as sexual violence and sex work. Rather, the free-form structure of my interview allowed them to express themselves only if they would like. I was very careful to not push any women to go beyond what they were comfortable talking about. Additionally, all interviews will remain anonymous.

Findings

I had the opportunity to conduct twenty in-depth sit-down interviews with community health workers, miners, and farmers. These interviews lasted from thirty minutes to two hours. In addition to these one-on-one interviews, I conducted ten shorter interviews with on-site miners. The interviews took place in the homes of miners and farmers as well as in the home of the community health worker who served as my connection to miners and farmers. My questions were open-ended and covered a range of health topics that shed light on both human and environmental health issues. Through personal anecdote and lived experiences, I documented quotes from interview participants that exemplify larger health issues related to gold mines.

The following quotes were verbally translated into English (by a translator) from Luo (spoken by interviewee).

One-on-one interviews: Community health workers

Number of interviewees: 3

My first day of interviews was spent with three community health workers. We began with a general overview of the demographics of the existing community. Most residents who lived on mine sites were *“widowed mothers who lost their husbands to HIV. It is customary for women to stay in the site where their husband died which prevent women from leaving this community, even if a job opportunity presents itself.”* Understanding this, most of my following interviews with miners and farmers were mothers, ranging from 18 to 60 years old. My questions for community health workers were broad and spanned various health-related areas and included: biological hazards, physical hazards, chemical hazards, environmental hazards, social issues, and health issues related to socioeconomic status of workers. It is important to note that all of these issues are intersecting and exacerbate one another, creating a very dangerous cycle where disease is omnipresent.

Theme 1: Biological Hazards

When I asked community health workers about common illnesses amongst community members, they noted malaria, pneumonia, coughing, sexually transmitted diseases, anemia, ulcers, and high blood pressure.

Malaria

My first interviewee noted the various factors that miners face that increase their susceptibility to malaria. *“Miners are working in and near still water. Holes that have been dug for mining collect water.”* Areas of still water are great breeding spots for mosquitos. She also noted that *“many people do not use insecticide-treated bed nets.”* When asked why that was, she noted two main reasons. First, *“people are unable to afford them”* and *“there is a shortage at the health clinic nearby that hands them out for free.”* Many community members are either sleeping without nets or if they are, the nets are poor-quality or damaged and need to be replaced.

Pneumonia

Pneumonia, an infection in one or both lungs, causes inflammation in air sacs in lungs, making it difficult to breathe. Aspiration pneumonia is common in this mining

community as inhalation of bacteria is common. Community health workers noted that contagious nature of pneumonia, *“especially in homes with many children.”*

Coughing

Coughing is another common sickness that is a symptom of many other illnesses. The mine site is very dusty and exacerbates one’s cough. Similar to phenomena, one community health volunteer noted, is its contagious nature. In households with many people, it can pose a serious threat to the entire household’s wellbeing.

Sexually Transmitted Infections (STI)

One community health volunteer noted that while STIs are high, it is not an issue of inaccessible contraception. However, the two other community health volunteers said that *“even though contraception is offered, there are barriers in accessing it. Traveling to the health clinic is one example.”* The seasonal nature of mining brings in outsiders from various communities. Additionally, the permanent residents are predominantly widowed mothers. Mining culture has aspects of drug and alcohol consumption that increases one’s likelihood of engaging in risky behavior. Having unprotected sex is likely. Another community health worker discussed high rates of women who engage in sex work as a result of their low pay. All of these factors contribute to high rates of STIs, specifically gonorrhea and HIV.

Anemia/ Ulcers/ High Blood Pressure

All three community health workers noted anemia, ulcers, and high blood pressure as being a major health problem within the area amongst women miners. They credited their poor diets to these health problems. *“Because of the long hours and low pay, women do not have time or money to eat healthy foods.”* Nutritious foods are vital for the well-functioning of anyone’s body, especially those who endure tiresome work for long hours of the day.

Theme 2: Physical Hazards

As noted above, there are many physical hazards that contribute to or are a result of health issues. Community health workers noted *“back problems, skin sores, rashes, and exposure to dust”* as common problems for women miners. Men who work on-site and are responsible for retrieving rocks underground also experience impairments and even death while underground. One interviewee said that *“the poor posture that women sit in for hours a day while hammering and crushing rocks contribute to back pain.”* Additionally, handling mercury is very dangerous. The toxic substance has caused workers to have *“sores on their hands.”* All three community health volunteers said that gloves are used by some but because many cannot afford them, *“they are forced to use bare hands while handling mercury.”*

The mine-site is a place with excessive dust, a risk factor for many biological health problems mentioned above. However, this goes beyond the worker themselves, and affects other community members not involved in the mining process. Children of miners are amongst the most vulnerable. Widowed mothers are often accompanied to work with their infant children as they are too young to be in school. Due to this, infants are exposed to dust, causing health issues such as asthma and other respiratory illnesses.

Theme 3: Chemical Hazards

The mining process involves many chemical substances that pose threat to not only community members, but also the environment. The only chemical hazard mentioned by community health workers was mercury. This substance plays an integral role in the mining process within this particular community. However, community health workers noted its detrimental impact on human health (skin sores), and environmental health (contaminated water that affects crop production).

Theme 4: Environmental Hazard

Two community health workers said that they were unaware of how environmental health impacted human health even though many of their previous examples had shown correlation. One community health worker acknowledged this connection. She used the example of food output to draw out the relationship between environment and human health. Various holes have been dug to create additional tunnels for gold mining. As a result, arable land has been destroyed and farmers have less land to grow their crops. As a result, food production is greatly affected,

and in turn, the health of community members suffers. The rising prices of crops in recent years have made “*crops are even more unaffordable than they were before for women miners who are living in poverty.*”

She also noted contamination of water being a problem that can lead to other water-borne diseases. Malaria is also rampant in the area because of the various viable breeding spots that have been created as a result of mining for mosquitos.

Theme 5: Social Issues

Just like external readings suggested, community health workers mentioned the common use of drugs and alcohol that many men, specifically visiting miners, use to cope with the stresses of the job. They also noted the role it plays in violence against women. “*The drug and alcohol use of men is part of the mining culture.*” Women who engage in sex work, as a result of their low earnings from mining, have faced sexual violence. Another social issue that is prominent in this community is school dropout. Again, because of the low wages widowed women make in the community, it is hard for them to pay their children’s school fees. Without education, their children fall into the same cycle of poverty that mothers are in.

Theme 6: Socioeconomic Status of Workers

As mentioned above, workers, despite long and tiring hours of hard work, struggle with finances. The unpredictable nature of gold mining sometimes leaves people with less money than they started with in a given day. This is what a typical input/output looks like for female miners:
One Interviewee’s Breakdown:

What	Expense or Revenue	Average Amount
Bag of Rocks	E	1000 shillings for one bag
Grind Rocks	E	200 shillings to use machine to grind one bag
Process Rocks	--	Manual labor (does not include cost of mercury/equipment fees)
Sell	R	1800 (very unpredictable as some rocks may not contain any gold)

Average Profit: 500 shillings

*While processing rocks has no direct financial costs, there are many health issues that stem from the laborious nature of this task. Additionally, contact with mercury has health consequences. Both may lead to medical fees and days off of work in the future.

It is important to note that this, although an example from one individual, is representative of other female workers. Male workers will have different prices put in/out because they are typically involved in the first step of the mining process (retrieving the rocks). Women usually buy from these men.

Additionally, the company, San-Martin, that has bought out land from residents have a system of “pay” that is extremely exploitative and contribute to the cycle of poverty. As a result of the low pay, many women miners opt to engage in sex work as a means of making more money to support themselves and their families.

Theme 7: Impact of Low Socioeconomic Status

As a result of low income, various health and social issues are exacerbated and created. Three main areas of health were noted by community health workers and include: Poor nutrition, stress, and inaccessible healthcare.

Nutrition

With low income, it is difficult to afford healthy foods. Especially when you are the only provider of the family, responsible for yourself and children, nutritious food is not an option. Environmental damage to arable land has spiked prices, making food even more inaccessible. Additionally, because of low income, workers are forced to work long hours, leaving little time to prepare food during the day for themselves and in the evening for their children.

Stress

Globally, finances pose huge stress on families. Widowed women who bare the responsibility for paying their children’s school fees, food, and medical expenses, face extreme stress that just worsens their health.

Inaccessible Healthcare

In a population where health issues are extreme, healthcare is most needed. However, financial barriers make it difficult to prioritize health, which only worsens existing health conditions. Additionally, taking time off from the job to visit a doctor takes away from time spent in the mine, and therefore seen as a loss of potential income. Even when people do seek healthcare, community health workers noted that there are frequent shortages of necessary drugs. Sex work is a means of income that many women miners engage in as a result of their low pay. STIs are common within women mining communities as a result but often go undetected and treated as healthcare is inaccessible.

One-on-one Interviews: Farmers

Number of interviewees: Seven

Theme 1: Arable Land

All seven of the miners that I interviewed named loss of arable land as the largest issue that has stemmed from the mine. The digging of land has created holes in the ground and has affected farmers' livelihoods. One farmer said that *"There are a lot of potholes which have affected my output."* Another interviewee said that *"Land is no longer productive for farming and has forced many of us farmers into mining."*

Theme 2: Contaminated water

Three of the seven farmers noted the effect of mercury on their livelihoods. One said that *"Mercury has affected the water quality, and in turn has impacted output."*

Theme 3: Respiratory Illnesses and Malaria

Close proximity to the gold mine has put farmers in contact with excessive amounts of dust that contributes to heightened rates of respiratory illness. *"During mining seasons, I have a bad cough."*

Theme 4: Less Rainfall

While this theme may have to do with the larger issue of climate change, four of the five farmers noted less rainfall as one of the issues they have experienced in the past year. *“I have noticed less rainfall in the past few years. I can tell there is less output.”*

Theme 5: Noise Pollution and Homes

Another side effect of mining is the noise pollution it has had on the existing community. Explosions that take place underground to create more tunnels for mining affect homes and their infrastructure. *“When explosions happen, it feels like there is an earthquake and my walls have some cracks now.”*

One-on-one interviews: Miners

Number of interviewees: Ten

Theme 1: Tiresome Work, Not Enough Pay

When asked what the hardest part of the job is, almost every single respondent immediately said that the pay they receive is too low despite long hours on the job. *“I work from 6 in the morning to 6 at night but there are some days I lose money.”* The unpredictable nature of the job leaves workers, specifically women, and their families at high-risk for ill-health.

These are the hours of the ten interviewees and their average pay per week, all of which were widowed mothers.

Interviewee #	Average work schedule/week	Average pay/week
1	6 AM-6 PM, 7 days a week	500 shillings
2	9 AM-5PM, 7 days a week	500 shillings
3	7 AM-5 PM, 7 days a week	500 shillings
4	9 AM-6 PM, 7 days a week	1000 shillings
5	8 AM-5 PM, 7 days a week	500 shillings
6	11 AM-5 PM, 7 days a week	500 shillings
7	8 AM-5 PM, 7 days a week	500 shillings
8	9 AM-5 PM, 7 days a week	0-500 shillings
9	9 AM-5 PM, 7 days a week	500 shillings
10	9 AM-4 PM, 7 days a week	0-1000 shillings

Theme 2: Consequences of Low Pay and Long Hours

Low pay and long hours take a toll on not only the miners' health but also their children's health and others' who they care for. When asked about financial barriers and the effects of long hours, a few themes emerged:

-Nutrition: With increasing prices of crops due to low output (as a result of environmental health concerns stemming from the mine), access to affordable food is unlikely. Not only that, there is little to no time to prepare healthy meals for themselves and their children. After long hours of tiresome on-site work, even if there is time in the evening to prepare a healthy meal, it is difficult to do so because of how tired they are. I asked each interviewee to tell me what a typical day of eating looks like.

Interviewee #	Typical Day of eating (not dinner)
1	Chai
2	Chai, bread
3	Chai
4	Chai, bread, ugali/veggies
5	Chai
6	Chai
7	Chai, some small snack
8	Chai
9	Chai
10	Chai, proper lunch

I also asked them to tell me what a typical dinner looks like for themselves and their children. Most said that they will have ugali (a type of maize porridge eaten in east and central Africa), sardines, and vegetables. However, some did admit that there are nights where they are simply too tired to cook a proper meal and will have more chai and bread for dinner. This, in turn, has negative consequences on their children's health and their health. Especially for school-going children, having nutritious meals is necessary for their well-being and academic success.

-Stress: Mothers also spoke about the stress they feel, especially being fully financially responsible for their children and some other extended family members. Paying for school fees creates a lot of stress. One mother said *"I worry that I won't be able to pay off the school fees. I do not want my child to drop out and have to do this job."*

-Access to health care: Financial and location barriers prevent mothers from accessing necessary care when they and their children are sick. Fear of not working, and therefore missing out on income opportunities, creates another barrier for women when they are making the decision of whether or not they seek help. By not getting the help they need immediately, many suffer and end up going when it is too late or far more expensive than it had to be in the first place.

Theme 3: Health issues from job

Just as community health workers noted, malaria, respiratory diseases, and physical pain (hand sores and back pain) were the most common health issues experienced. One additional health issue that many women noted was asthma in their children.

Theme 4: Environment

While half of the ten interviewees said they were unaware of environmental impact on their health and wellbeing, all of them did mention issues related to food price, mercury contaminating water, dust from the mine, and noise pollution. This shows that there is a lack of awareness between the connection between environment and human health.

Overall feelings of their job:

When asked about their overall feelings towards their job, I found it interesting that every single miner said that there were more negative consequences than positive outcomes. The only positive that was noted was that this was a job opportunity. The creation of employment in the area has helped decrease levels of theft as more people are occupied. However, all of them recognized that the job has put them in financial stress and has created health problems they did not have previously. Their low socioeconomic statuses further exacerbate their existing health problems. Most of them also noted the energy expenditure of the job. One woman said the following: *“I come home so tired because I work all day. The heat makes it worse. Sometimes I come home and cannot do anything but sleep.”*

I also created a short verbal questionnaire. I had ten on-site miners as interviewees and asked them three “yes” or “no” questions. I wanted to assess their perception of the gold mine on

their personal health, environmental health, and socioeconomic status. Half were men and the other half were women. These are the results:

Women

Interviewee #	Personal health problems?	Environmental health problems?	Is your pay fair?
1	Y	Y	N
2	Y	Y	N
3	Y	Y	N
4	Y	N	N
5	Y	Y	N

Men

Interviewee #	Personal health problems?	Environmental health problems?	Is your pay fair?
1	Y	N	N
2	Y	N	N
3	Y	N	N
4	Y	N	N
5	Y	N	N

Y=Yes

N=No

Both males and females all unanimously agreed on the mine’s impact on personal health and that their pay was not fair considering the number of hours they work. The health issues they noted were similar to what was said during one-on-one interviews. Some miners wanted to expand upon these areas, unveiling some interesting points related to pay, specifically coming from men. Since men are mainly involved in the first step of the gold mining process, digging for rocks, many of them utilize the land owned by the large Tanzanian company, San-Martin. The way in which the Tanzanian company “pays” workers is through rocks. On average, for every ten bags of rocks collected, miners must give 6-8 bags back and keep 2-4 for themselves. Miners acknowledge this as “*exploitative*” and “*not a fair pay for their hard work.*”

Conclusion and Recommendations

The findings from this observational study align with global trends on gold mines' impact on health. Interviews with women miners illustrated the connection between environment and their health. While the exploitative practices of gold mines affect all workers and their families, the burden of ill-health falls on women and their children. The goal of this study was to simply observe Ramba gold mine and its effects on health while also speaking to community members to understand their perception of the mine's impact on health. While conducting interviews, my final question to miners and other community members was what they would change if they had the ability to do so. There were two recommendations that were consistent throughout: Better mandates of safety wear and adoption of policies that ensure children stay in school. I would also include education of mine's effects on environmental and human health as a recommendation.

Recommendation 1: Safety Wear/ Education on Exposure Risks

It was clear that many miners, although exposed all throughout the day to extremely toxic substances, are not aware of the health consequences that exposure poses. Education is needed just so miners are more aware of the environment they are working in. Additionally, methods to prevent and limit exposure to toxic substances would be a tangible solution that miners could practice.

In addition to this, access to affordable safety and mining equipment is needed. In order to fully protect themselves from exposures, gear is needed. "Squeezing with bare hands is dangerous because mercury can penetrate the skin and attach to the fat in human cells, so rubber gloves should be used."¹⁵ Rubber gloves are an example of one method to protect miners.

Recommendation 2: Education

Education is the key to breaking the cycle of poverty. "When people have basic life and literacy skills, economies grow more quickly and poverty rates decline. Children who have the opportunity to learn are able to eventually earn more money and support their own families."¹⁶ When asking mothers who are involved in the ASGM process what they would change if they had the power to do so, every single one of them said that they wanted their children to stay in school. The low socioeconomic statuses of mothers in Ramba create financial barriers. Being able to pay school fees was one of the listed stress factors that a low socioeconomic status that mothers in Ramba experience. One mother said, "*I do not want my*

children to do what I am doing.” In order for children of miners to break the cycle of poverty, receiving an education is necessary. Mothers expressed their fear of having to make their children, like themselves, drop out of school at an early age because they could not afford for their children to stay in school. Policies to encourage children to stay in school should be adopted. Financial support is needed to ensure kids are staying in school. When children stay in school, that not only benefits their immediate family and community at-large, but it will also benefit society as there will be more productive members that will contribute to the economy.

Conclusion

My observational study has showed the interconnectedness of environmental health and human health. In order for one to be optimal, the other also needs to be in good standing. Health issues that mines create are only exacerbated by the indirect consequences of the mine, creating a cycle of ill-health. The cycle of poverty that community members of Ramba live in is extremely difficult to break given its complicated nature. My findings highlighted the lack of education that many miners have in terms of knowing the connection between the mine and poor health outcomes. Additionally, there were few people who acknowledged the connection between environmental and human health. Further research must be done to develop effective interventions that take into account the intersecting health issues that are perpetuated by the cycle of poverty.

Appendix

Interview Questions (Verbal)

Interview Questions for Community Health Workers

*Depending on answers, there were additional follow-up questions that are not included here.

Question 1: What are the most common health issues within community? Difference between genders?

Question 2: Health issues related to occupation?

Question 3: Environmental impact of mine?

Question 4: Mercury's impact?

Question 5: If sick, where does one go to receive care?

Question 6: Social issues? Impact on existing health issues?

Question 7: Pay of workers? Impact of socioeconomic status?

Question 8: Overall feelings of the mine and its impact on health?

Interview Questions for Farmers

*Depending on answers, there were additional follow-up questions that are not included here.

Question 1: How has mining affected your work? → mercury? Water issues? Soil fertility? Holes in ground?

Question 2: Any food shortages?

Question 3: Change in income?

Question 4: Health issues? → Respiratory? Malaria?

Question 5: Hardest part of the job?

Question 6: Recent challenges in the past few months?

Question 7: Overall feelings of the mine?

Interview Questions for Miners

*Depending on answers, there were additional follow-up questions that are not included here.

Question 1: Hours/ work schedule?

Question 2: Main source of income? How much on average do you make per week?

Question 3: Number of people you support with this income?

Question 4: Highest level of education?

Question 5: Last time you went to a health clinic?

Question 6: Health problems in the last few months?

Question 7: What do you eat in an average day?

Question 8: Is food affordable?

Question 9: Health issues of kids? When they are sick, who takes care of them?

Question 10: Hardest part of your job?

Question 11: Do you like your job?

Questionnaire

Male or Female	Is pay fair/enough?	Is mine more good than bad for your health?	If mine more good than bad for environment?
M			
M			
M			
M			
M			
F			
F			
F			
F			
F			

Statement of Ethics

(adapted from the American Anthropological Association)

In the course of field study, complex relationships, misunderstandings, conflicts, and the need to make choices among apparently incompatible values are constantly generated. The fundamental responsibility of students is to anticipate such difficulties to the best of their ability and to resolve them in ways that are compatible with the principles stated here. If a student feels such resolution is impossible or is unsure how to proceed, s/he should consult as immediately as possible with the Academic Director (AD) and/or Independent Study Project (ISP) Advisor and discontinue the field study until some resolution has been achieved. Failure to consult in cases which, in the opinion of the AD and ISP Advisor, could clearly have been anticipated, can result in disciplinary action as delineated in the “failure to comply” section of this document.

Students must respect, protect, and promote the rights and the welfare of all those affected by their work. The following general principles and guidelines are fundamental to ethical field study:

I. Responsibility to people whose lives and cultures are studied

Students' first responsibility is to those whose lives and cultures they study. Should conflicts of interest arise, the interests of these people take precedence over other considerations, including the success of the Independent Study Project (ISP) itself. Students must do everything in their power to protect the dignity and privacy of the people with whom they conduct field study.

The rights, interests, safety, and sensitivities of those who entrust information to students must be safeguarded. The right of those providing information to students either to remain anonymous or to receive recognition is to be respected and defended. It is the responsibility of students to make every effort to determine the preferences of those providing information and to comply with their wishes. It should be made clear to anyone providing information that despite the students' best intentions and efforts, anonymity may be compromised or recognition fails to materialize. Students should not reveal the identity of groups or persons whose anonymity is protected through the use of pseudonyms.

Students must be candid from the outset in the communities where they work that they are students. The aims of their Independent Study Projects should be clearly communicated to those among whom they work.

Students must acknowledge the help and services they receive. They must recognize their obligation to reciprocate in appropriate ways.

To the best of their ability, students have an obligation to assess both the positive and negative consequences of their field study. They should inform individuals and groups likely to be affected of any possible consequences relevant to them that they anticipate.

Students must take into account and, where relevant and to the best of their ability, make explicit the extent to which their own personal and cultural values affect their field study.

Students must not represent as their own work, either in speaking or writing, materials or ideas directly taken from other sources. They must give full credit in speaking or writing to all those who have contributed to their work.

II. Responsibilities to Hosts

Students should be honest and candid in all dealings with their own institutions and with host institutions. They should ascertain that they will not be required to compromise either their responsibilities or ethics as a condition of permission to engage in field study. They will return a copy of their study to the institution sponsoring them and to the community that hosted them at the discretion of the institution(s) and/or community involved.

III. Failure to comply

When SIT Study Abroad determines that a student has violated SIT's statement of ethics, the student will be subject to disciplinary action, up to and including dismissal from the program.

I, ___Vivika Fernes___, have read the above Statement of Ethics and agree to make every effort to comply with its provisions.

Date: _____11/28/19_____

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