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Vulnerability to infectious diseases and risk reduction measures among galamsey gold mining communities in Ghana: A narrative review

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Special Edition on Galamsey

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Abstract

Galamsey is an artisanal and small-scale gold mining practice that is illegal in Ghana. Miners, their families and communities are at an increased risk of infectious diseases due to the short - and long-term health and environmental effects of galamsey activities. Infectious diseases are caused by pathogens such as bacteria and viruses and can spread from person to person directly or indirectly. Some of the mechanisms of the increased risk of infectious diseases associated with Galamsey include poor sanitation in mining communities, leading to the proliferation of gastrointestinal and diarrhoeal diseases such as cholera and typhoid, and alterations in the environment and natural ecosystems that enhance the transmission of emerging/re-emerging diseases and other priority diseases such as malaria, dengue fever, yellow fever, rabies etc. The legislative instrument that guides mining activities in Ghana, the Minerals and Mining Act 2006 (Act 703), as well as other minerals and mining laws/policies, provide a framework for mining which protects the environment and human health. Enforcement of these by regulators and law enforcement actors is key to reducing these infectious disease vulnerabilities in mining communities. Health promotion and sensitisation of miners and members of the mining communities will help prevent and mitigate the health risks posed by galamsey mining activities.

Keywords: Artisanal and small-scale gold mining, infectious diseases, zoonotic spillover, galamsey

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INTRODUCTION

Artisanal and small-scale gold mining (ASGM) is mining that takes place on a relatively smaller concession of land (up to 0.1 km^2) [1,2]. The exact definition of ASGM is varied but has some defining characteristics. It is informal, usually illegal and has limited capital investment in the trade [3]. The work processes employed are typically rudimentary, inefficient and labour-intensive, resulting in low productivity in terms of commercialisation. The illegal form of ASGM is referred to as galamsey in Ghana. In recent times, however, more sophisticated equipment has been used in ASGM. Persons engaged in the trade are usually poor people with low levels of education. Worldwide, between 15 - 40 million people are employed by the ASGM sector, which accounts for 20 - 25% of global gold production [4]. In Ghana, an estimated 1 million persons are employed directly by the sector [1]. It contributed to 43% (2.1 million oz) of total gold production in 2018, 36% in 2019, and 30% in 2020 in Ghana [5].

In Ghana, about 70% to 80% of all small-scale mining is informal [1]. The license for small-scale gold mining in Ghana is given to Ghanaians, who can partner with other nationals to provide mining resources. General health risks of miners include accidents, heat strokes, heat exhaustion, infectious disease hazards, dust, toxic chemicals, violence, and social vices [6,7]. ASGM is the world's single most important source of mercury exposure in the environment, putting the miners and their communities at high risk of mercury exposure and its attendant effects. However, employment for the poor and ready market for the precious

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mineral sustains the trade [8]. Miners, ex-miners, their families and persons living in mining communities have an increased vulnerability to infectious diseases such as malaria, typhoid fever, and cholera. Most of these are directly related to the processes involved in gold exploitation as well as other contextual factors. Literature discussing the comprehensive multifactorial vulnerability to infectious diseases due to ASGM is limited. This paper- a narrative review, explores both the direct and indirect short and long-term factors that increase the risk of infectious diseases associated with ASGM.

The mining process in ASGM

The ASGM involves excavation of the gold ore, which can be obtained from the earth's surface (surface mining), deep within the earth's crust or from river beds (alluvial mining) [9]. Processing involves several stages. First is the crushing and milling of the ore, followed by the concentration of the gold. Concentration of the gold is done using gravity and sedimentation during the panning/washing of the milled ore. Mercury is then added to the concentrated gold to form a mercury amalgam that is burnt or roasted to separate the mercury from the gold. The gold is refined by further heating.

Vulnerability to infectious diseases in galamsey

Infectious diseases are caused by organisms that include bacteria, viruses, fungi and parasites. These are biological agents that tend to spread from person to person directly, through the air, through contaminated inanimate objects, food/water, or biological vectors such as mosquitoes and rats. Infectious diseases constituted the most frequent group of diseases in the Illness category among prehospital emergencies in illegal gold mining sites in Guiana [10]. The risk of infectious diseases can be divided into short-term and long-term factors, as shown in Figure 1.

Short-term direct factors (mining process-related factors)

Blasting, drilling, crushing, milling, sieving of the ore, etc., release dust particles into the atmosphere, which can cause silicosis when inhaled over time by miners, their families and communities [11]. Silicosis increases the risk of tuberculosis by 30 - 40 times. The triad of HIV, TB and Silicosis, a public health problem when present, carries a relatively high mortality rate among patients [12,13]. In 2014, the World Bank estimated that South African miners had the highest occurrence of TB cases than any other profession globally (2500 – 3000 cases per 100,000 people) [14]. The release of dust particles into the atmosphere also carries the risk of increased incidence of acute respiratory tract infection, especially among children [8]. Children living in Obuasi, a mining town in Ghana, were found to have significantly more cases of acute upper respiratory tract infections than children in Asankragwa, a non-mining town, in a comparative study [15]. In Suriname and DR Congo, similar findings were reported [16]. Living in gold mining towns was found to be the only significant risk factor for developing pneumonia in a retrospective cohort of children in Fiji [17].

Ponding of rivers, especially from alluvial Galamsey mining activities and stagnation of water found in and around mining sites, enhances the breeding of mosquitoes. This carries an increased risk of transmission of mosquito-borne diseases such as malaria, dengue, yellow fever and elephantiasis [9,18,19]. A cross-sectional study carried out in Ghana showed that malaria prevalence in artisanal gold mining towns among children under five years is higher than that found in non-artisanal gold mining communities [20]. A malaria surveillance system in Guiana, among armed forces, linked high malaria incidence to illegal small-scale gold mining [18]. Again, the routine wading through these stagnated water and moist soil increases the risk of

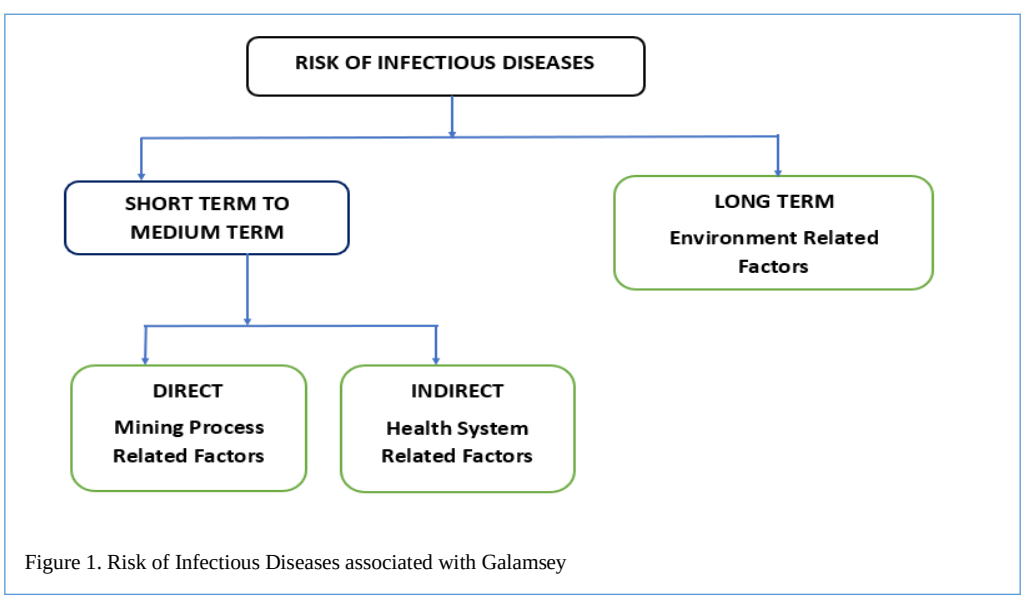

Figure 1. Risk of Infectious Diseases associated with Galamsey

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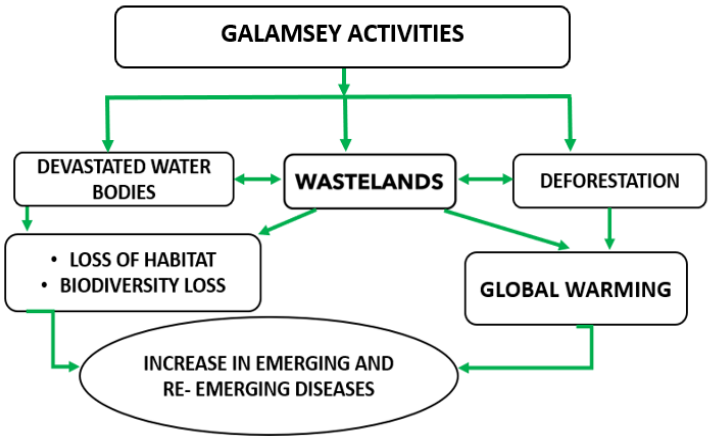

Figure 2. The environmental risk of infectious diseases due to Galamsey

worm infestations transmitted through the skin, as well as other skin infections. Poor sanitation has frequently been found in and around the mining towns. Miners are discouraged from erecting water sanitation and hygiene (WASH) facilities at the mining sites because these are temporary sites in remote areas [9]. Also, chemical and heavy metal pollution of drinking water sources leads to the shutdown of water treatment plants, making community members turn to untreated water sources for their daily water needs. Open defecation, inadequate WASH facilities and polluted/ untreated drinking water sources increase the risk of diarrhoeal diseases, notably cholera, shigellosis, giardiasis, E. coli, Hepatitis A & E, Cryptosporidiosis, guinea worm, etc. [8]. In-migration into mining towns leads to overcrowding, which carries an increased risk of respiratory tract infections and scabies. Associated increased promiscuity in mining towns leads to increased prevalence of sexually transmitted infections such as gonorrhoea, syphilis, chlamydia and HIV infection [9].

Short-term indirect factors (health system-related factors)

Many mining communities are located in remote rural geographical locations. Weaker health systems and lower sophistication in the skilled health workforce, facilities and diagnostic capabilities, medications and technologies are characteristic of these remote/hard-to-reach mining towns [9]. Some conditions pose a diagnostic challenge in detection, and therefore, timely management may be missed. An example is typhoid fever. Subsistence miners who are poor have low purchasing power, which constitutes a financial barrier to accessing healthcare [8]. In-migrants also put pressure on these limited health resources, reducing their effectiveness.

Long-term environment-related factors.

Stable ecosystems and biodiversity ensure the resilience of our ecological framework [21]. Galamsey activities degrade the environment by clearing forests, destroying arable land and polluting water bodies, leaving them devastated and deforested as wastelands. Destruction of the environment leads to the loss of the natural habitat of organisms and the loss of biodiversity in the ecosystem [12,22]. As natural habitats are lost, relative populations of definitive hosts reduce. This is due to altered intra- and inter-habitat species distribution, altered movement, and altered interactions with other species and the environment. There may also be an altered interaction between the reservoir of disease and the disease-causing agents, leading to a spillover of zoonotic diseases that were originally not known to be transmitted from man to man [22–24]. Also, the destruction of the environment driving global warming and climate change leads to an increase in the respiration and metabolism of species, as well as the increase in their reproductive rate [25,26]. This also leads to an increase in the relative populations of disease-causing vectors [21]. Encroaching into forests for illegal mining activities also leads to an increased proximity of man to the wild. The resultant effect of these is that disease-causing vectors are more efficient at transmitting disease, and the occurrence of emerging and re-emerging diseases such as Dengue fever, Lassa fever, Marburg and Ebola virus diseases, Yellow fever, etc., increases.

Infectious risk mitigation measures

For these infectious disease risks to be mitigated, it is important that there is enforcement of regulations and safety standards contained in the Minerals and Mining Act 2006 (Act 703) and the Mining Policy 2014 by officers of the Minerals Commission, Ministry of Lands and Natural Resources, Environmental Protection Agency (EPA), Forestry Commission and law enforcement agencies [27]. Parallel to regulations enforcement, Public Health takes a more persuasive approach to social and behavioural change in order to protect life [12]. Studies done in Ghana show that miners have low knowledge levels of these hazards and

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the risks the trade puts on them and their communities. Health education and health promotion measures are key to sensitising them to these occupational and environmental health risks [9]. They should be urged to adopt environmentally safer methods of mining. Some occupational health risk reduction measures include dust control measures, modification of work process, e.g., using wet methods instead of dry, dusty methods, modified milling, use of face masks, boots and other personal protective equipment, practising safer sex, etc. [27,28]. Health education on practising good hygiene, which includes avoiding open defecation, washing hands before eating and washing hands after using the toilet, is key to reducing the risk of diarrhoeal diseases. Environmental health officers should provide technical guidance for the construction of environmentally safe latrines for use in these mining communities.

It is imperative that health-related aspects of research into 'galamsey' are conducted to generate evidence aimed at health interventions. Primary and secondary data on humans, animals and the environment, as well as specifically the perceptions of the miners and the mining communities, need to be sought in the evidence generation [29] to inform public health education in ASGM communities. Healthcare workers, especially those who work within galamsey communities, should be trained to detect and appropriately manage and refer to the range of infectious disease risks galamsey miners and their communities face. This will strengthen the sensitivity of the local health surveillance systems to identify conditions such as diarrhoeal diseases, typhoid fever, infestations and the triad of HIV, TB and silicosis, to mention a few. Strengthening the surveillance system in these communities is important for driving primary and secondary disease prevention.

Conclusion

Informal small-scale gold mining has been in existence for centuries and contributes to the GDP of countries where it is practised. The trade, however, comes with increased vulnerability of the mining communities and society at large to infectious diseases. These include short-, medium- and long-term infectious disease risks that need to be mitigated to protect lives and the ecosystem. Healthcare workers who work within these rural mining communities are better placed to educate the communities on an ongoing basis on the health risks and provide solutions. For this purpose, they should receive adequate ongoing training from healthcare managers. Academics working together with industry, mining communities, government regulatory and health machinery, and partners (financial and technical) should develop multisectoral evidence-based solutions to mitigate the infectious disease risk posed by galamsey.

DECLARATIONS

Ethical considerations

Not Applicable

Consent to publish

All authors agreed on the content of the final paper.

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Competing Interest

None

Author contributions

AAA and BNLCT conceptualised the study. All authors researched and reviewed relevant literature. All authors participated in writing the paper and reviewed/approved the final version submitted.

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Availability of data

The data for this work is available upon request from the corresponding author.

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