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Occupational Health and Safety Practices among Small-Scale Mining Workers in Ghana

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ABSTRACT

Small-scale mining is a benchmark for poverty reduction in developing countries. It contributes immensely to national income for countries with mineral reserves and mining activities. Despite the contribution of small-scale mining to Ghana, the industry pays little attention to health and safety practices among miners. This study investigated occupational health and safety practices among small-scale miners using a descriptive survey design. A total of 295 participants were selected from small-scale mining firms in the Wassa Amenfi (West, East, and Central) District. Data were gathered from the study participants using a structured questionnaire. Results of the study revealed that 78.98% (233) of the respondents were aware of available regulations regarding workers' safety. Safety measures adopted by the various mining companies were; safety training (35.00%), the use of PPE (33.00%), regular monitoring (28.00%) and prompt reporting of incidents (4.00%). Miners were exposed to various types of hazards and injuries sustained among miners included cuts, fractures, sprains, broken arms, and entrapment. The commonly used PPE were safety boots (37.00%) whilst the overall coat was the least (8.00%) used among miners. Regardless of improvement in occupational health and safety practices in recent times, occupational health and safety should be given the needed social, legal, and moral attention in the mining industry by the government and other stakeholders. Further research should be conducted in the area of vulnerability of women in the mining sector.

Keywords: Health, Safety, Practices, Small-Scale, Mining

INTRODUCTION

Gold mining's contribution to the economy of many countries is massive. The mining industry in every country is made up of both large-scale mining and artisanal and small-scale mining (Agyarko *et al.,* 2014; G'afurovich *et al.,* 2020). It is the world's second oldest and most important industry after agriculture (Bagah *et al.,* 2016). It is currently the fifth largest industry in the world and it plays a crucial role in the country's economic development. The trade of mineral commodities represents a substantial part of international trade. There are two kinds of mining; surface and underground mining (Bagah *et al.,* 2016; Ofosu *et al.,* 2020). Surface mining, also called open-pit mining or strip mining is undertaken if the mineral deposit lies on the surface of the earth. This method is usually more cost-effective and requires fewer workers to produce the same quantity of more than underground mining does. Underground mining on the other hand is used when the mineral deposit lies deep below the surface of the earth. Mining investment, irrespective of the type or kind of mining

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being undertaken is capital intensive. The mining industry remains a vital contributor to the global economy (Stemn, 2018). As a result, the mining industry contributed twenty-seven percent (27%) of the total tax revenue in 2012, with gold alone recording approximately $5.6 billion from 4.3 million ounces (Kyeremateng-Amoah & Clarke, 2015). In 2014, the industry also contributed GH₵1.24 billion in tax revenue to the government and employed 12,148 Ghanaians (Long *et al.,* 2015). Mining continues to be a high-risk as well as a high-reward business for mining companies and communities because the mining business is a hazardous operation and consists of considerable environmental, health, and safety risks to miners (Chu *et al.,* 2017) especially the small-scale mining in developing countries.

Small-scale mining is a single-unit mining operation with an annual production of unprocessed material of 50,000 tons or less (Ofosu *et al.,* 2020). It makes use of simple tools lacks technology, and is hazardous under labor-intensive conditions. The activities of small-scale mining operators pose a great threat to the environment (Asiedu, 2013) and this has heightened interest from the public and many researchers. Although, it has been a source of employment for some sects of the youth (Amponsah-Tawiah & Dartey-Baah, 2011), and also contributes to the overall gold production annually, its environmental consequences are myriad and very critical. Furthermore, small-scale mining involves the exploitation of mineral deposits using rudimentary tools and primitive mining and processing techniques (Owusu-Boateng & Kumi-Aboagye, 2013). It often employs unskilled labor and stark illiterates who for diverse reasons, have little or no sensitization for the consequences of their actions, on their health and safety and the environment (Mudyazhezha & Kanhukamwe, 2014; Antoci *et al.,* 2019). Across Africa, in countries with rich mineral reserves and barren economies, thousands of the unemployed dig for fortunes operating illegally and unregulated in the form of small-scale mining. Small-scale mining which is usually characterized as informal, illegal, and unregulated by government, is an important source of livelihood for many poor families and is characterized by poor technological practices with significant environmental, social, and health costs ((Lu, 2012, Stemn, 2018). Small-scale miners use primitive extraction techniques, with dynamite, pick axes, mercury, and the strength of their arm. In Ghana where the small-scale/artisanal sector employs about 300,000 people most of whom are starkly illiterates and employ very primitive methods in mining at the expense of their lives (Bagah *et al.,* 2016) leading to various occupational hazards.

Occupational hazards in the mining sector can be divided into health hazards and safety hazards. Health hazards are those hazards that result in the development of illnesses or diseases. However, safety hazards are those hazards that cause accidents at workplaces that result in physical harm to the workers (Abbasi, 2018). These two hazards are further spread into various types and these can be physical, chemical, biological, ergonomic, and psychosocial. The physical hazards of mining include but are not limited to falls from dust, noise, heat (Abbasi, 2018), height, rock falls, fire and other explosions, submerging of underground mined area, release from collapsed bulkheads, and air blast from block caving failure. These physical hazards are hurtful injuries and stretch from slight to deadly. Chemical hazards are related to chemicals and these include arsenic (Santra *et al.,* 2017), mercury, silica, coal dust, asbestos, nickel compounds, hydrofluoric acid, hydrogen sulfide gas, explosive (Abbasi, 2018) xanthate reagent, etc. These chemicals have a range of effects on the miners. Effects of these chemicals include respiratory disease, gastrointestinal disorder, liver malfunction, nervous system disorder, hematological diseases like anemia, leucopenia, thrombocytopenia, diabetes severe cardiovascular malfunction, etc. Their effects are mostly fatal. The constant exposure to chemicals especially mercury undermines the health of miners and increases medical costs, which further raises the need for and dependency on mercury to extract more gold (UNEP, 2019). Several studies have observed elevated levels of mercury in the hair, urine, blood, and nail samples of people residing in

artisanal gold mining areas. The production of minerals brings income and foreign exchange. Biological hazards are associated with living things or organisms. These include snake bites, diseases from bacteria, viruses, fungi, and blood-borne pathogens in secluded mining areas (Abbasi, 2018). Mining involves the use of heavy machines yet many miners do the activity without machines or use physical strength.

In addition to the above, high humidity and heat stress are part of ergonomic hazards (Yi *et al.,* 2016). Most miners resort to the use of stimulant substances to boost their strength to increase their performance. This makes miners use drugs and alcohol thus causing psychosocial hazards. In 2012, an online search of Ghanaian newspaper articles resulted in 19 articles reporting 23 separate incidents of accidents and injuries among small-scale miners occurring between 2007–2012 (Brewster, 2013; Inan *et al.,* 2017). Eight main incident types were described, with the most common being collapses trapping miners (30%), followed by drowning (17%), and violent incidents and falls into mine pits (13% each). Crushing, burns, suffocation, and firearms injuries were among the other types of incidents reported. Most of the incidents (70%) took place in illegal mines, and the vast majority (87%) of the reported injuries resulted in fatalities. Seventy-six fatalities were recorded in total, with a range of 1–18 fatalities per incident. While these data have potentially substantial reporting biases, the study (online search of Ghanaian newspaper articles) does provide some insight into the nature of injuries in Ghanaian small-scale mining sites (Long *et al.,* 2015; Stemn, 2018).

Furthermore, hazardous physical conditions and activities throughout the process raise concerns about occupational injuries. Even in high-income countries with strong and well-enforced occupational health and safety regulations, mining is a hazardous activity. However, the statistics on major accident events such as fatalities and reportable incidents have not shown the corresponding levels of improvement (Abbasi, 2018). The lack of safety regulations and enforcement, education, and training, and functional infrastructure and equipment may lead to elevated injury rates in low- and middle-income countries, particularly in small-scale mining. It has been reported that small-scale miners may have 6–7 times more non-fatal accidents than large-scale operations, but only a few studies have documented occupational safety measures by workers. A report from the Inspectorate Division of the Ghana Minerals Commission (2014) has shown that while in 2008 accidents that caused both minor injuries and no injuries were 58, the number increased to 1,201 in 2014. Overall workplace injury also increased from 9,664 cases in 2017 to 18,070 cases in 2018 (Ghana Mineral Commission, 2019).

To improve health and safety measures at the workplace to ensure continuous labor productivity, every business entity needs to put in place pragmatic health and safety practices that will address industrial accidents resulting in injury and death of workers. Occupational health and safety (OHS) concerns the tasks of protecting workers and worksites, reducing the number of occupational accidents, minimizing insufficient information, and improving awareness of employees, from a multi-disciplinary point of view (Inan *et al.,* 2017). Unsafe conditions in mines lead to several accidents and cause loss and injury to human lives, damage to property, interruption in production, etc. The level of occupational safety and health compliance and implementation in Africa has been reported to be generally low compared with the other continents of the world. The increase in investment and mining activities not only presented economic opportunities for Ghana but also brought some occupational health and safety challenges (Kyerematen-Amoah & Clarke, 2015). It is reported that staff of the mining sector are frequently at risk of occupational injury due to the abundance of risk factors such as rock falls, fire explosions, mobile equipment accidents, entrapments, and electrocutions (Stemn, 2018).

In Ghana, the operations of small-scale miners are regulated by the Minerals and Mining Act, (2015 Act 900) of Ghana. According to the Act, anybody licensed to carry out

small-scale mining may win, mine, and produce minerals by an effective method and shall observe good mining practices, health and safety rules and observe rules regarding the protection of the environment during the mining operations. Many factors contribute to injury in the mining industry. Among these factors is the lack of knowledge on the part of workers of the dangers associated with their work. Fatigue, inattentiveness, and most importantly lack of adherence to safety rules at workplaces are major contributing factors. Even though adherence to occupational safety has become an important mechanism for improving work output, there are continual reports of injuries and other occupational-related issues from the mining industry in Ghana. The issues of workplace safety are relatively neglected in most companies since little attention is given to policy considerations or strategies to reduce the toll of workplace hazards and injuries. According to the Minerals Commissions Annual Report of 2018, the small-scale mining sector within the Wassa Amenfi West Municipalities is engulfed with low occupational health and safety practices that have resulted in fatalities and injuries, and it is against this background that this study deems it fit to bridge these gaps by assessing occupational health and safety practices among small-scale miners in Ghana

METHODOLOGY

Location of the Study Area

The study was conducted in Wassa Amenfi (West, East, and Central) Districts (figure 1) in the Western Region of Ghana.

Amenfi West

Amenfi West Municipal is located in the middle part of the Western Region of Ghana. It is bounded to the west by Sefwi Wiaso and Aowin Suaman districts, to the south by Jomoro and Ellembele, to the southeast by Prestea- Huni Valley, and to the north by Bibiani-Anwiasi-Bekwai and to north-east by Wassa Amenfi East. It lies between latitude 5^{o} 30’ and 6^{o} 15’N and longitude 1^{o} 45 W and 2^{o} 11’W. It has a total land area of 3,464.61 Square kilometers and is made up of over 250 communities (Ghana Statistical Service (GSS), 2014).

Amenfi East

The Wassa Amenfi East District is one of the districts in the Western region of Ghana. The district can be found in the middle part of the region. It lies between Latitudes 5^{o}, 30^{1} N and 6^{o}, 15^{1} N, Longitudes 1^{o}, 45^{1} W and 2^{o}, 11^{1} W. It is bounded to the west by Wassa Amenfi West District, to the east by Mpohor Wassa East District, to the south by Prestea Huni Valley District, and to the north by Upper Denkyira West and East District (GSS, 2014).

Amenfi Central

The district is located in the middle part of the Western Region of the country. It has an estimated land size of 1,845.9 square kilometers with 131 communities. It is bounded to the North by Bibiani-Anhwiaso-Bekwai and Upper Denkyira West Districts and Sefwi-Wiawso Municipal; to the North-West by Aowin District; to the South by Prestea Huni-Valley; to the East by Amenfi East District and to the West by Amenfi West District. It lies between latitudes 5^{o} 20’N and 6^{o} 7’N and longitudes 2^{o} 9’W and 2^{o} 27’W (GSS, 2014).

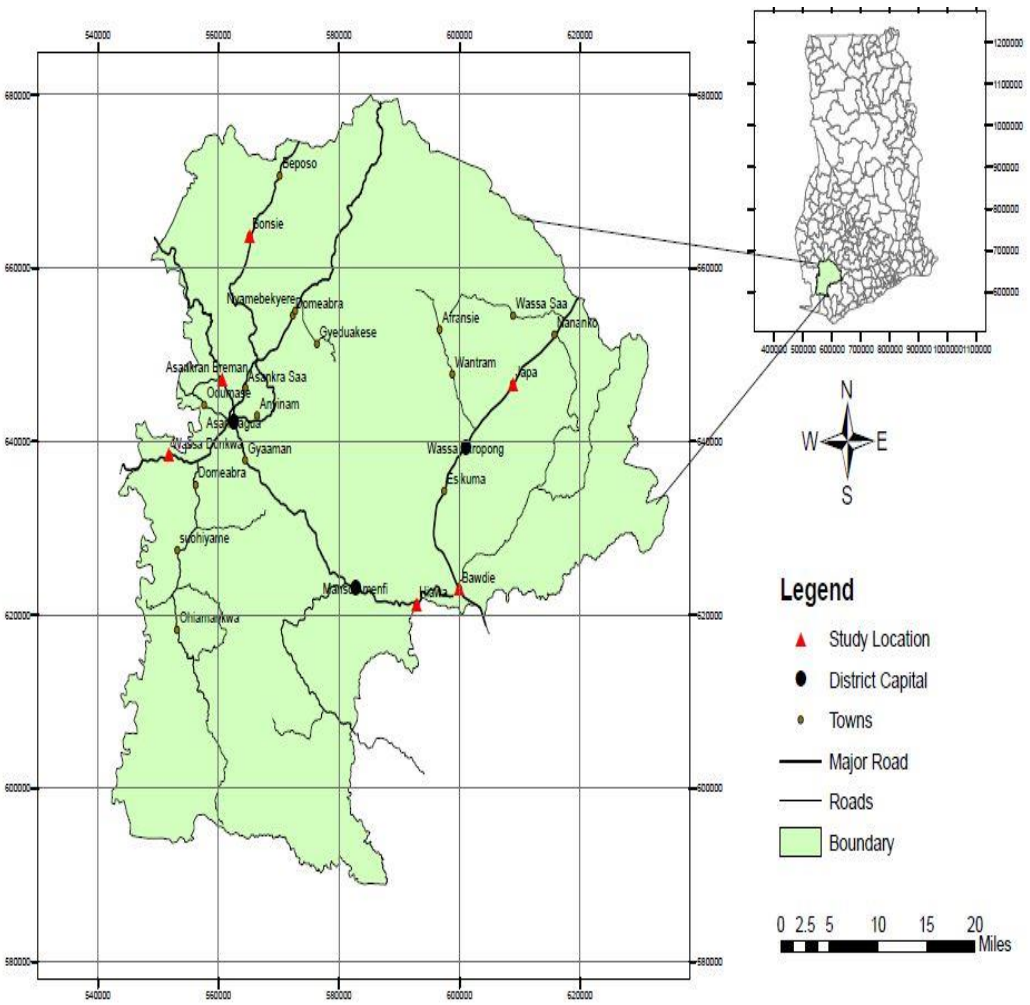

Figure 1: Map of the study area; Wassa Amenfi (West East and Central)

Study Design, Data Collection and Analysis

A descriptive survey design was adopted for this study. The population for the study was personnel of some identified small-scale mining firms in the Amenfi West, East, and Central. A total of 295 participants were sampled for the study. Slovin's technique was deployed to calculate the sample size. Slovin's formula is written as:

$$n = N \div (1 + Ne^2)$$

Where n = Number of samples, N = Total population, and e = Error tolerance.

Table 1: Sampling size

S/N	Mining company	Total pop.	Sampled pop.
1	Obeng	65	56
2	Akropong Community Mine	55	48
3	Awino Mine	75	63
4	Prince Express	50	44
5	Minta Mines	40	36
6	Breman Com. Mine	55	48
	Total	340	295

A structured questionnaire was used for data collection. A multi-stage sampling procedure that involves a purposive and simple random sampling technique was used to select the participants. Purposive sampling was used to select the small-scale mining sites namely; Obeng Mines, Akropong Community Mines, Awino Mines, Prince Express, Minta Gold Mines, and Breman Community Mines while simple random sampling was used to select mine workers. Respondents consent was sort. Data gathered was analysed using SPSS.

RESULTS

Demographic Characteristics of Respondents

The demographic characteristics considered in the study included age, sex, educational status, and marital status, (Table 2). The majority of the respondents 108 (37%), in the study had an age range of 30-39 years. This was followed by 106(36%) with an age range of 20-29 while 40-49 years recorded 59 (20%). Ages from 50 years and above recorded 12 (4%) and those below 20 years recorded 10 (3%), (Table 2). The results showed that small-scale mining was dominated by young people making it a youthful activity. Most of the respondents 266 (90%) were males and 29 (10%) were females. This indicates that small-scale mining in the study areas was a male-dominated industry. The educational status of the respondents was very high as most of the respondents had received formal education. The majority of the respondents 150 (51%), had a JHS/Middle level of education. Primary education was 68 (23%), SHS/O'level was 56 (19%), tertiary education 12 (4%), and no education/school 9 (3%). The marital statuses of respondents were married, single, divorced, and widowed. Married respondents dominated the study with 158 (54%) while 131 (44%) were singles, divorced, and widowed 3 (1%) each (Table 2).

Knowledge of Health and Safety in Mining

Table 3 shows the results of respondents' knowledge of health and safety in mining. Knowledge of health and safety in mining was assessed and the results revealed that most of the respondents had high knowledge of health and safety in mining 289(98%). Respondents indicated that safety in mining means; protection from hazards, recording 193(65%). This was followed by the wearing of PPE 50(17%) and regular hospital check-ups 46(16%). Very few of the respondents had no idea about safety in mining 6(2%). Respondents from Awino small-scale mining company had the highest knowledge level of safety in mining 63(21.36%). Respondents from Obeng Mines had 56(18.98%), AKCM company and Breman Community Mines recorded 48(16.27%) each, Prince Express had 44(14.92%) while Minta company had 36 (12.20%) (Table 3). There was no significant difference (P=0.997301) between knowledge of health and safety in mining and within the various companies as all companies were mostly at the same level of understanding regarding safety.

Awareness of Available Regulations Regarding Worker's Safety

The study showed that the majority of the respondents were aware of available regulations regarding workers' safety 233(78.98%). Sources of awareness of the respondents were from mining companies 217(73.56%), online 10(3.39%) and television 6(2.03%). Again Respondents from Awino had a greater level of awareness of available regulations regarding workers' safety 47(15.94%). This was followed by Obeng 46(15.59%), PE 43(14.58%), AKCM and Breman 35 (11.86%) each, and Minta 27 (9.15%) (Table 4).

Safety Measures Deployed in Small-Scale Mining

Safety measures put up by the companies were investigated and the study revealed that safety measures by the companies included safety training, regular monitoring, and prompt reporting of incidents. Safety training was the highest safety measure adopted and executed

across the various mining companies 259(35%). PPE was the next recording 244(33%), regular monitoring was 209(28%) and prompt reporting of incident recorded 27(4%) (Table 5). There was no significant difference (P=0.264596) regarding safety measures put in place by the companies.

Adherence to Safety Measures in the Small-Scale Mining Industry

Adherence to safety measures in the small-scale mining industry is very important in the prevention of occupational hazards. Compliance with occupational safety & health (OSH) rules and regulations at work (M=4.31 SD=0.479) was the highest safety measure respondents indicated that it was necessary in the small-scale mining industry. This was followed by the wearing of personal protective equipment (PPEs) in the organization (M=4.25 SD=0.477), employees having representatives in the health and safety committee (M=4.19 SD=0.834), presence of health and safety cultures followed by employees (M=4.06 SD=0.680). The rest of the factors are presented in Table 6.

Tools and Equipment Used in Small-Scale Mining Activities

Tools and equipment used in small-scale mining activities in the study area include pick axes, shovels, excavators, and pumping. Pickaxe and shovel usage were the highest, recording 287(27%) each while pumping machines and excavators 274(25%) and 221(21%) respectively. There was no significant difference (P=0.508823) regarding tools and materials usage in small-scale mining activities (Table 7).

Types and Sources of Occupational Hazards Encountered in Small-Scale Mining

Table 8 shows the types and Sources of occupational hazards encountered in Small-Scale Mining. Types of occupational hazards included physical, chemical, biological psychosocial, and ergonomic hazards. Sources of physical hazards included non-wearing of PPEs, working from height and around dangerous environments, high levels of noise during drilling, blasting, milling, and other operational activities, exposure to dusty conditions at the working place, and accumulation of smoke emitting from diesel-operated equipment at working areas. The majority of the respondents indicated that exposure to dusty conditions at the workplace (3.50) was the highest source of physical hazard.

This was followed by the accumulation of smoke emitting from diesel-operated equipment in working areas (2.67), not wearing PPEs (2.33), working from height and around dangerous environments, and high levels of noise during drilling, blasting, milling, and other operational activities (1.50). Psychosocial hazards include employees working for long hours, employees having adequate time to rest after working hours and there is frequent violence among workers. There is frequent violence among workers (4.50) was the major psychosocial hazard respondents indicated that they faced at work. Employees work for long hours and employees have adequate time to rest after working hours (2.33).

Ergonomic hazards include materials being lifted unaided, working in awkward body posture and performing the same task repeatedly, workers working for long hours frequent bending during work, and lifting of heavy materials. Lifting of heavy materials (3.00) was the major ergonomic hazard. This was followed by materials being lifted unaided (2.33), working in awkward body posture, performing the same task repeatedly for workers working for long hours (2.17) and there is frequent bending during work (1.50). Biological hazards include workers standing in dirty water while working, the presence of reptiles/insects, the presence of stingy insects, workspace unclean and unclear of mold and fungi, and sharp materials disposed of unsafely and securely.

Workspace is unclean and unclear of mold and fungi (3.50) exposing most small-scale miners to biological hazards. This was followed by sharp materials disposed of unsafe

workers standing in dirty water while working (3.33) each and the presence of stingy insects (2.00). Chemical hazards include the usage of chemicals that are poisonous and corrosive, usage of chemicals throughout mining operations, not wearing PPEs when dealing with chemicals, and workers exposed to substances that can be inhaled, ingested, or absorbed into the body.

Injuries and Accidents in Small-Scale Mining

Injuries encountered in the small-scale mining in the study area included cuts, fractures, sprains, broken arms, and burns. The majority of the respondents 166(55%), indicated that cut was the most accident or injury sustained in the industry. This was followed by broken arm recording 93(31%), fracture 36(12%), and burns 7(2%). There was a significant difference (P=0.0000) in injuries and accidents among workers of small-scale mining in the study areas (Table 9).

Personal Protective Equipment Used by Small-Scale Miners

Personal protective equipment included helmets, safety boots, hand gloves, eyeglasses, and overalls. Safety boots were the most common PPE used 284(37%). Helmets were the next PPEs used, hand gloves131 (17%), followed by eyeglasses and overall 99(13%) and 60(8%) respectively. There was a significant difference (P=0.0000123) in personal protective equipment used by small-scale miners (Table 4.10).

Table 2: Demographic characteristics of respondents

Parameter	Responses	Frequency	Percentage (%)
Age	Below 20 years	10	3.4
	20-29 years	106	35.9
	30-39 years	108	37
	40-49 years	59	20
	50 years and above	12	4
Sex	Female	29	10
	Male	266	90
Educational status	No education	9	3
	Primary	68	23
	JHS/Middle form	150	51
	SHS/O Level	56	19
	Tertiary	12	4
Marital status	Married	158	54
	Single	131	44
	Divorced	3	1
	Widowed	3	1

Table 3: Knowledge of health and safety in mining

Safety in mining	Companies						Total (%)
	AKCM (%)	**AWINO** (%)	**BREMAN** (%)	**MINTA** (%)	**OBENG** (%)	**PE** (%)	
Protection from hazard	26(8.81)	34(11.53)	33(11.19)	30(10.17)	35(11.86)	35(11.86)	193 (65)
Regular hospital check-up	9(3.05)	13 (4.41)	5 (1.69)	(0.00)	11 (3.73)	8 (2.71)	46 (16)
Wearing of PPE	13 (4.41)	16 (5.42)	7 (2.37)	3(91.02)	10 (3.39)	1 (0.34)	50 (17)
No idea	0.00	(0.00)	3 (1.02)	3(1.02)	(0.00)	(0.00)	6 (2)
Total	48(16.27)	63(21.36)	48(16.27)	36(12.20)	56(18.98)	44(14.92)	295(100)

Note: P-value=0.997301

Table 4: Source of awareness of available regulations regarding workers safety

Companies	Sources				
	No (%)	Yes (%)	Mining Firm (%)	Online (%)	TV
AKCM	13(4.41)	35(11.86)	35(11.86)	0.00	0.00
AWINO	16(5.42)		45(15.25)	2(0.68)	0.00
BREMAN	13(4.41)		31(10.51)	3(1.02)	1(0.34)
MINTA	9(3.05)		21(7.12)	5(1.69)	1(0.34)
OBENG	10(3.39)		46(15.59)	0.00	0.00
PE	1(0.34)		39(13.22)	0.00	4(1.36)
Total	62(21.02)		217(73.56)	10(3.39)	6(2.03)

Table 5: Safety measures by companies

Companies	Safety measures			
	Safety training (%)	Regular monitoring (%)	PPE (%)	Prompt reporting of incidents (%)
PE	44(5.95)	43(5.76)	43(5.82)	4(0.59)
OBENG	56(7.56)	46(6.16)	46(6.22)	0
AWINO	63(8.51)	47(6.30)	47(6.36)	0
AKCM	48(6.49)	35(4.69)	35(4.73)	0
BREMAN	33(4.46)	26(3.48)	45(6.08)	8(1.19)
MINTAH	15(2.03)	12(1.61)	28(3.79)	15(2.22)
Total	259(35)	209(28)	244(33)	27(4)

Table 6: Adherence of safety measures in small scale mining industry

S/N	Safety adherence	SD	D	N	A	SA	Mean
1	Wearing of Personal Protective Equipment (PPE)	-	-	3(18.8)	7(43.8)	6(37.5)	4.25
2	Compliance with safety cultures	-	-	3(18.8)	4(25.0)	9(56.3)	4.06
3	Employees' representation in the Health and Safety Committee	-	-	-	5(31.3)	11(68.8)	4.19
4	Employees' compliance with rules and regulations at work	-	-	-	5(31.2)	11(68.8)	4.31
5	Workers refuse to report minor injuries or near misses	3(18.8)	-	-	6(37.5)	6(37.5)	3.80
6	Workers refused to wear (PPEs)	-	-	-	4(25.0)	12(75.0)	4.25
7	Report hazardous conditions to the management	2(12.5)	5(31.5)	-	2(12.5)	7(43.8)	3.13
8	Employees responsible for their health and safety	2(12.50)	4(25.0)	-	3(18.8)	7(43.8)	3.31

Note: SD: strongly disagree, D: disagree, N: neutral, SA: strongly agree, A: Agree

Table 7: Tools and equipment used in small-scale mining activities

Company	Pick axe (%)	Shovel (%)	Excavator (%)	Pumping machine (%)
PE	44(4.1)	44(4.1)	44(4.2)	44(4)
OBENG	51(4.8)	51(4.8)	30(2.9)	51(4.7)
AWINO	62(5.8)	62(5.8)	62(5.9)	62(5.7)
AKCM	48(4.5)	48(4.5)	48(4.6)	48(4.4)
BREMAN	46(4.3)	46(4.3)	15(1.4)	40(3.6)
MINTAH	36(3.5)	36(3.5)	22(2.0)	29(2.6)
Total	287(27)	287(27)	221(21)	274(25)

Note: P=0.50882

Table 8: Types and sources of occupational hazards encountered in small-scale mining

HAZARDS	SA (%)	A (%)	N (%)	D (%)	SD (%)	Mean
Physical Hazard						
Non-wearing of PPEs	33.3	33.3	00	33.3	00	2.33
Working from height	50	50	00	0	00	1.50
High level of noise from operational activities.	50	50			00	1.50
Exposure to dusty conditions at the workplace.	16.7	00	00	83.3	00	3.50
Accumulation of smoke emitting from diesel-operated equipment in working areas	00	66.7	00	33.3	00	2.67
Psychosocial Hazards						
Long hours of work for employees	33.3	33.3	00	33.3	00	2.33
Frequent violence among workers	00		00	50	50	4.50
Adequate resting time	00	83.3	00	16.7	00	2.33
Ergonomic Hazards						
Manual lifting	33.3	33.3	00	33.3	00	2.33
Awkward body posture and repeated performance of task	50	16.7	00	33.3	00	2.17
Working for long hours	50	16.7	00	33.3	00	2.17
Frequent bending during work	50	50			00	1.50
Lifting of heavy materials	00	50	00	50	00	3.00
Biological hazards						
Presence of reptiles	00	50	00	50	00	3.00
Workers stand in dirty water while working	00	50	00	16.7	33.3	3.33
Presence of stingy insects	00	100				2.00
Dirty working environment	00	33.3	00	50	16.7	3.50
Sharp materials disposed of unsafely	00	33.3	00	66.7	00	3.33
Chemical hazards						
Exposure to poisonous chemicals	00	100	00		00	2.00
Not wearing PPEs when dealing with chemicals	00	50	00	50	00	3.00
Use of chemicals for mining operations			00	100	00	4.00
Usage of chemicals that are poisonous and corrosive	0	66.7	00	33.3	00	2.67

Note: SD: strongly disagree, D: disagree, N: neutral, SA: strongly agree, A: Agree

Table 9: Injuries and accidents in small-scale mining

Companies	Injuries and accidents			
	Cuts	**Fracture**	**Broken arm/leg**	**Burns**
PE	29(9.6)	0	22(7.4)	0
OBENG	29(9.6)	0	17(5.6)	0
AWINO	29(9.6)	0	17(5.6)	0
AKCM	21(7.0)	0	14(4.7)	0
BREMAN	31(10.2)	16(5.3)	12(4)	3(0.9)
MINTAH	27(9.0)	20(6.7)	11(3.7)	4(1.1)
Total	166(55)	36(12)	93(31)	7(2)

Note: P=0.0000

Table 10: Personal protective equipment used by small-scale miners

Companies	Helmets	Safety boots	Hand gloves	Eyeglasses	Overall
PE	23(2.9)	44(5.8)	14(1.8)	10(1.3)	0
OBENG	45(5.6)	56(7.4)	17(2.2)	17(2.2)	3(0.4)
AWINO	49(6.2)	62(8)	21(2.7)	21(2.7)	6(0.8)
AKCM	39(4.9)	48(6.2)	17(2.2)	17(2.2)	4(0.5)
BREMAN	27(3.4)	48(6.2)	36(4.5)	21(2.2)	27(3.6)
MINTAH	15(1.9)	26(3.4)	26(3.4)	13(1.7)	20(2.6)
Total	198(25)	284(37)	131(17)	99(13)	60(8)

Note: P=0.0000123

DISCUSSION

The bio-data of the respondents revealed the characteristics of the miners. The results of the sex of the respondents differed from that of Lu (2012) who stated that women are largely seen in the mining sector, particularly small-scale mining. In this study, there were more males than females. Though Nyambe and Amunkete (2009) stated that Africa has the highest percentage of female miners at 40-50%, this study revealed that only 10% were females.

One of the most popular issues in mining is non-compliance with occupational health safety standards. The awareness and implementation of occupational health and safety practices are generally poor in most developing countries (Acquah & Nouban, 2020). The study's results which indicated that almost all respondents (289, 98%) had fair knowledge of safety in mining and this differed from Attakora (2012) whose results revealed that 95 (63.3%) revealed that most mining workers in Obuasi had low knowledge of occupational health and safety regulations. Hentschel *et al.* (2002) stated that many small-scale mining operations are said to be lacking in the following- safety regulations, reinforcement of mine safety requirements, awareness of the risks inherent in mining, and access to better equipment. However, this study revealed a high number of respondents having knowledge of safety in mining. The study was also in line with Attakora (2012) who stated that the majority of the respondents were aware of health and safety regulations in the mining industry. The high awareness in this study could be attributed to a higher percentage of respondents having received formal education and a greater number of respondents having knowledge of health and safety in the mining industry. The study revealed that a greater number of the respondents were aware of available regulations regarding the safety of workers from the mining company. This indicated that the mining industry made an effort to educate their workers on regulations regarding workers' safety. The high levels of knowledge on health and safety might be probably attributed to recent attention that had been paid to Occupational Health Safety Regulations (OHSR) in Ghana, due to the increased mining-related injuries and diseases (International Labour Organization, 2015).

One of the most common occupational health and safety deficiencies in small-scale mining is a lack of awareness of the risks of mining coupled with a lack of education and training (Henstschel *et al.*, 2002). It was no surprise that safety training was part of orientation on first employment in all the mining sites visited in this study. This study also revealed that adequate training on the usage of PPEs was important in the prevention of exposure of miners to occupational health hazards and problems in the workplace. According to Attakora (2012), if workers are issued adequate PPE and OHSR are implemented and if workers are not educated on the use of PPE and observing OHSR, they will still be potentially exposed to occupational health hazards and problems in the workplace. Therefore safety training on the use of PPEs is more important than the mere provision of PPEs.

Livelihoods and risk are closely linked in rural areas of the developing world (Smith *et al.*, 2016). Workers in the mines are exposed to several types of hazards and these include physical, chemical, biological, psychosocial, and ergonomic hazards. Exposure to dust has been the common physical hazard identified among workers in the mining companies in the study. The dust, when inhaled, can cause lung diseases and other respiratory ailments. Exposure to dust can also cause skin irritation and eye damage. These results of these hazards can result in several accidents and other diseases.

Personal protective materials used by miners in this study were helmets, safety boots, hand gloves, eyeglasses, and overalls. In Papua New Guinea, personal protective equipment (PPE) was never used in small-scale mining activities (Lu, 2012). This indicates the usage of PPE by miners in this study is an improvement in the health and safety practices and high awareness, training, application of safety regulation, and literacy. Proper protective equipment is important in the mining industry. This study could not establish the fact as to which category of gender put on PPE. Lu (2012) stated that women miners are also found lacking in proper protective equipment. Workers in small-scale mining industries indicated that they purchase their own PPE. In the study of Hentschel *et al.* (2002), small-scale miners purchase their safety equipment such as helmets, boots, gloves, and face masks.

CONCLUSION AND RECOMMENDATIONS

Compared to previous studies, this study has shown improvement of adherence to occupational health and safety. Occupational health and safety has therefore been a priority in the small-scale mining companies in this study which in effect had a positive impact on accidents recorded. Despite the above, small-scale miners were exposed to all kinds of hazards mainly physical, psychosocial, biological, and chemical hazards. Regardless of improvement in occupational health and safety practices in recent times, occupational health and safety should be given the needed social, legal, and moral attention in the mining industry by the government and other stakeholders. Further research should be conducted in the area of vulnerability of women in the mining sector and challenges must be addressed in the areas of occupational safety and health as well as in the implementation of feasible work opportunities for women in small-scale mining.

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