Occupational hazards, injuries and illnesses associated with small scale gold mining. A Case of Ward 19, Zvishavane, Zimbabwe

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Abstract

The paper sought to identify major occupational hazards, establish causes and nature of physical injuries and illnesses associated with small scale gold mines in Zvishavane. Three out of eleven identified mines from ward 19 were randomly selected for the study. Juxtaposed with observations, questionnaires were administered to all 34 mine employees in the respective mines to identify the types of hazards in the mines. Interviews were then conducted with three mine owners from each mine to establish the mines status quo with regards to injuries and illnesses. It was revealed that dust; heat, humidity, tools and equipment were the common hazards in all the mines. Substandard maintenance of tools and equipment as well as working under the influence of alcohol were identified as the major causes of injuries. These injuries included, among others, 20% lacerations, 20% cuts and 17 % crushes. The main reported illnesses were pneumoconiosis related due to the dusty environments the workers were always exposed to. The paper therefore advocates for more financial support from the mine owners towards employees' safety in order to ensure a health and vibrant workforce for sustainability in production. Fundamental training programmes should be put in place to educate particularly the mine owners on the ultimate accrued benefits of safety on the employee and the nation at large.

Keywords:*Occupational hazards, Injuries, Illnesses, Small Scale Mines, Zvishavane.*

Introduction

Occupational health and safety issues pose a serious public health contest that has a potential of leading to serious social and economic costs if appropriate and immediate measures are not taken. An approximate number of 271 million workers in the world suffer from work-related injuries and 2 million die annually as a

result of fatalities and illnesses (Tadesse and Kumie 2007). The estimated economic loss caused by work-related injuries and diseases is equivalent to 4% of the world's Gross National Product (Bugnosenm 2000). The effect of injuries and illnesses is 10 to 20 times higher in developing countries, where a larger proportion of the world's workforce is situated (Tadesse and Kumie 2007). Regrettably, the majority of the workforce lacks access to occupational health services. According to Carrol (2008) only 5 to 10 percent and 20 to 50 percent of the workforces in developing countries and developed countries, respectively, have access to some kind of occupational health service. Workers in small-scale mining are at greater risk of work-related injuries, chronic illness, stress, and disability or even death because of low educational and literacy rates which are coupled with exposures and inadequate training.

According to Bull *et al* (2002) an injury rate of 317 per 1000 exposed workers was observed in a study that was carried out on a total of 268 small scale mine workers in Norway in a period of one year. In a discrete study conducted in Thailand in 2001, 189,621 cases of occupational mishaps including deaths, disabilities, and cases of over 3 days lost from work were observed. Information available on industrial injuries in Africa indicated that work-related injuries had relatively greater regularity as well as gravity as compared to the developed world state of affairs. According to Zimbabwe Chamber of Mines (2010), the injury rate among small scale industrial workers in Zimbabwe was 131 per 1000 exposed workers per year in 2007. This figure rose to 789 per 1000 in 2008 and the proportion of severe injuries increased from 18% in 2007 to 37% in 2009 (Chimamise 2013).

The Economic Commission of Africa (2007) observes that very limited attempts have been made to identify work-related injuries and their determinants even among large industrial workers in Ethiopia. The injury rate among 4,462 industrial workers in Addis Ababa was 80 per 1000 exposed workers per year (Tadesse and Kumie 2007). Work-related injuries result from a complex interplay of multiple risk factors. Exposures to physical, mechanical and chemical hazards, tied with unsafe practices by workers are the leading causes of work-related injuries (Bugnosenm 2000). Similarly, psycho-social factors, work arrangements, socio-demographic characteristics of workers, environmental and social conditions are other potential risk factors. Reports from France, U.S and China revealed that men have the highest rates of work-related injuries than women (Amick, etal, 2000). However, according to Kebede (2008) studies conducted in eleven urban

industries and textile factory in Addis Ababa revealed that gender had no association with the prevalence of work-related injuries but instead, age had.

Tadesse and Kumie (2007) observes lack of experience, knowledge and technical know-how as factors that increase the chances of work related injuries among young workers. Many workers begin working at an early age and in many instances without adequate, if any safety training at all. Chinamise (2013) also regards low education status, low monthly salary, and low working experience (5 years or less) in present job, lack of health and safety training, sleep disorders, job category and alcoholic consumption as common risk factor for work-related injuries.

Information regarding the status of the magnitude and factors affecting work-related injuries in small and medium scale mines in developing countries is scarce (Kebede 2008). There were serious debates concerning the health, safety and welfare of people working in small-scale mines with some studies suggesting that small-scale mines were more dangerous to work in than in medium and large scale mining industries (Tadesse and Kumie 2007). Schneid (2009) argues that it is difficult if not impossible to tell the number of deaths and accidents that occur in small-scale mines due to under-reporting and the concealing nature of the sector. According to the International Labour Organisation (1999) the three countries with the highest number of small-scale mines in the world are China, India and Pakistan and they have significantly higher numbers of fatal accidents. The report says "In China more than 6,000 fatalities were estimated to occur in small-scale mines each year (ILO 1999).

In Zimbabwe, between 300 000 and 400 000 people are involved in small scale gold mining (UNDP 2009). Small-scale miners record as many as 3 fatalities and 15 serious injuries per 1000 workers each month, equivalent to almost 1 percent of the national workforce being killed each year (NSSA 2000). These problems are mainly caused by miners who re-enter closed mines to illegally win gold from pillars and sometimes burrowing into compacted river banks. According to the International Labour Organisation (1999), human and financial incapacities contributed to deaths and injuries. Inadequate, inappropriate or unsafe equipment are real problems in many small-scale mines. Collapses from unsupported tunnels, rock falls, perpetual dampness, inadequate ventilation, faulty equipment, exhaustion and constant exposure to heat, noise and dust also affect health and

safety. Loewenson (2007) argues that the frequent anarchy prevailing in the often gold rush conditions of many small-scale mine sites meant that health and safety considerations were often ignored.

Given the background that there is no up-to-date information due to fast changing policies and conditions in Zimbabwe, this paper therefore unveiled the causes and nature of injuries and illnesses associated with small scale gold mines with a particular reference to Ward 19 in Zvishavane. Of concern is that available information is biased towards large scale mines without really taking into account the situation obtaining in small scale gold mines especially in isolated areas like Ward 19, Dayadaya in Zvishavane. Besides having mines in ward 9, more mining prospects were being discovered in the area yet safety challenges are already manifesting in the few existing mines. Therefore it was of paramount significance that the researchers investigated the situation to have the latest understanding of the situation in order to assist the sector as it continues to grow. With the indigenisation policy in Zimbabwe, mining activities were on the rise at all levels, in particular small scale mining which do not demand large investments or capital. Despite having some published works on occupational injuries (Tadesse and Kumie 2007; Kebede 2008; ILO 1999) the subject under study requires constant follow-ups, especially in isolated and remote places like Dayadaya in Zvishavane.

Study Area

The research was carried out in early 2013 in Dayadaya Ward 19 which lies in Zvishavane District, in the Midlands Province. It is located about 20 km West of Zvishavane town. The ward has a population of about 11000 people. The area is characterized by extensive plains with soils ranging from red sandy loams to clays. Ward 19 lies in natural region IV of Zimbabwe where rainfall is erratic, ranging from 400 mm to 600 mm. The vegetation in the area is predominantly *dichrostachys cinera* (mupangara), cumbersome (mubhondo), scrub acacia, Mopani, *Acacia mearnsii* and *Brachystegia bohemii*. The mean altitude is 1500m above sea level. Ward 19 lies in the Great dyke and contains several valuable minerals like Gold, Asbestos, copper, nickel, and platinum. The major economic activities carried out in the area were mining and cattle ranching. There were 11 registered and functional small scale mines in ward 19 and all of them were on gold mining. Figure 1 shows the location of Ward 19.

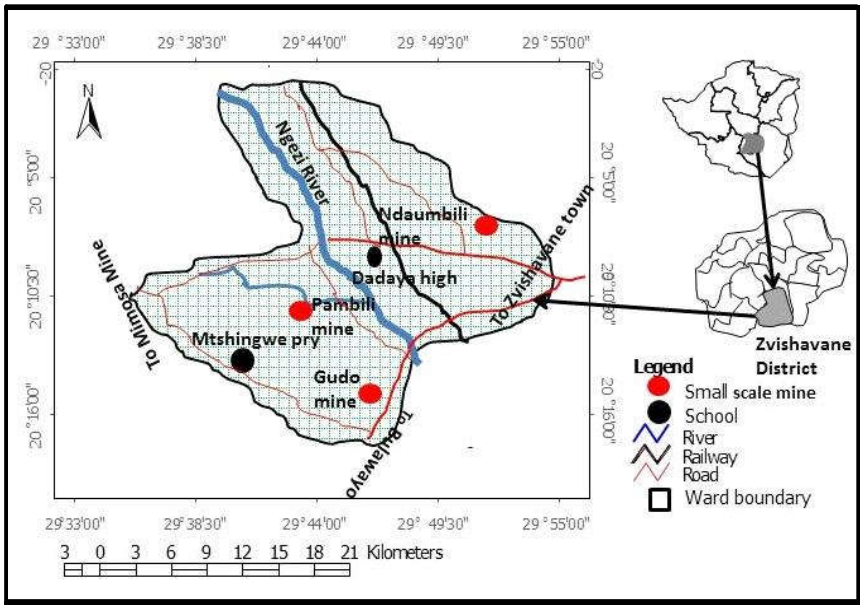


Figure 1: Map of Ward 19, Zvishavane

Methodology

A case study research design was employed in this paper in order to have an in-depth understanding of the subject under study. Questionnaires, interviews and observations were used as the primary data collection tools. The target population was eleven small scale mine owners and employees in Ward 19. Three mines out of the 11 were randomly selected for a sample due to limited resources. However Walford (1995) states that a sample of at least 10% is ideal to generalise trends in a given area. The paper focused on all the mine employees and the three owners of the three selected mines. Participation of target respondents was 100% because of the number of employees which was manageable.

Table 1: Sample population

Name of mine	Employees	mine owners	Total	Percentage of target population
Pambili mine	17	1	18	100
Ndaumbili mine	6	1	7	100
Gudo mine	11	1	12	100

Judgemental sampling was employed to select ward 19 from all the wards in Zvishavane district. The ward was selected basing on its richness in minerals and a higher number of small-scale mines it harboured. The researchers then distributed a total of 34 questionnaires to all the employees in the three selected small scale mines. Interviews were also carried out with the mine owners in order to complement information that was solicited from employees.

Observations were also made on work procedures and practices during operations. The researchers visited all the three small scale mines and conducted walk through surveys. The aim was to observe and identify the operational hazards. Using a check list, the researchers observed the machinery used, working conditions of employees and personal protective equipment (PPE) used by the miners. The researchers also took note of safety behaviours by both mine owners and their employees as they entered areas of potential hazards. Observations on accident reaction were mainly on minor accidents that coincidentally occurred when researchers were onsite for data collection. Photographs complimented the observations as they were used for record keeping. Quantitative data were processed and presented through graphs and tables with the aid of Microsoft excel. Qualitative data from all instruments were categorized into logical subheadings for detailed discussions.

Results and Discussion

Age of respondents and the effect on job performance and safety

It was noted that 36% of the workers were between the age of 21 and 30 years followed by those between 31 and 40 years (26%). The least number of respondents was identified in the above 51 years age group, constituting 6% of the total respondents. Ward 19 had very few employees above 51 years because of the nature of the job which is laborious. Nevertheless, a smaller number of elderly workers could be advantageous as it limits chances of injuries that may result from low concentration and poor eye sight caused by ageing. Suttle (2013) observes that there appears to be some correlation between diminished job performance and age with respect to certain job tasks, especially if a job task requires physical strength. The other 19% comprised of the 11 to 20 years age group. However, according to the Labour Act, Chapter 28.1 of 2002 section 11, "no employer shall employ any person in any occupation, otherwise than as an apprentice who is under the age of fifteen years". Age factor has the capacity to increase risk of exposure to injuries. An under aged workforce might increase the risk of injury due to lack of sense of responsibility (Suttle 2013). Table 2 shows the percentage number of respondents falling under each discussed age group.

Table 2: Age groups of respondents

Age Range	Percentage of Respondents (%)
11-20	19
21-30	36
31-40	26
41-50	13
51 or above	6

Having 19% of the employees under the age group of 11-20 and 6% comprising of the aged workforce can increase the chances of injuries and illnesses in the studied mines as these two age groups are greatly compromised due to age factor as aforementioned.

Respondents' Level of Education and effect on safety behaviours

The paper examined the educational levels of the respondents from the three selected small scale mines. It was noted that 13% of the respondents had primary school education, 6% had ZJC, 68% had "O" level, 10% had "A" Level and 3% had at least a diploma or better. This indicates that most employees in the small scale mines in which the research was conducted were literate. The fact that most employees were literate could make it easy for employees to get trained on safety issues. To the contrary, a research which was conducted in Bolivia in 2000 showed that most small scale miners were not educated and most of them could not read and write (ILO (2009). The difference noted in ward 19 could be attributed to high literacy rate that Zimbabwe has, which regrettably, does not tally with the economic performance. Furthermore, the small scale mining industry was performing relatively better such that even the educated opted for such activities due to the financial benefits attached to the sector despite the risks.

Major occupational hazards associated with small scale gold mining in Ward 19.

Employees mentioned several hazards associated with their respective mines. The hazards that were mentioned as well as observed were dust, heat, dampness/ humidity, tools and equipment, compressed air, vibration, sharp objects, noise, mercury and bad hangings. The identified hazards were particularly similar due to the fact that the studied mines were more or less of the same scale with common

working conditions such that the hazards became comparatively common. It was observed that all the mines under study were operating at minimum costs with a major thrust on profit making whilst turning a blind eye on employee safety issues. These hazards were consistent with those referred to by Donoghue (2007) in a study on the common hazards in low capital mining scale, where most hazards were ignored at the expense of the employee whilst priority was placed on production and profits.

Heat and humidity

It was established that the operations in small scale mines were associated with high temperatures and high humidity. The sources of heat in the small scale gold mines were terrestrial heat from machinery like the jack hummer and from the workers themselves. According to one of the mine owners, terrestrial heat increased with depth at around 3°C per 100 m. If temperature and humidity are not managed well, body temperatures rise and workers become susceptible to heat and suffer from heat stress. The high temperatures also increase the humidity in the mining environment through increasing the water vapour from the underground water. Donoghue (2007) points out that high temperature and humidity in deep underground work can cause heat stroke, heat cramps, heat exhaustion, anxiety and low morale. Hence, as workers are exposed to the aforesaid challenges, injuries and illnesses may increase.

Tools and equipment

It was observed that there was still a substantial amount of manual handling in all the three mines. Workers used tools like picks, shovels, chisels and pinch bars for mining. These tools led to significant injuries. Jack hammer was also identified as the most dangerous machine when poorly operated. According to Mutemeri and Petersen (2010), tools and equipment cause a lot of injuries among small scale miners, for instance, shovels and hammers caused cuts and crushes respectively.

Rock falls/ Bad hangings

Rock falls were one of the common hazards observed in the small scale gold mines. After blasting some rocks were left hanging on the roof, those rocks are called bad hangings. If not removed, they can fall at any time and harm workers. Bad hangings can cause any form of injury or even a fatality. According to Mc Phee (2001) the remote control of mobile equipment in underground mining has been introduced to reduce the risk of fatal injuries from rock falls. However, it was noted that there were no remote controlled mobile equipments in three studied

mines implying that the hazard of bad hangings remained a common challenge among small scale mines.

Noise

In all the three small scale mines visited, the problem of noise was prevalent. The type of machinery used and confined work spaces contributed to the noise. It was established that workers exposed to excessive noise can undergo occupational hearing loss. Ndaumbili mine owner indicated that the last time they measured; noise level was above 120 decibels. World Health Organization (2002) acknowledges the existence of noise in mines but further points out that there is actually less noise in small scale mines as compared to large scale mines, the reason being that there is less use of heavy machinery. However, noise remained a hazard in the studied mines mainly because of lack or poor protective clothing and confined work spaces.

Chemicals

During the processing of gold, mercury, caustic soda, nitric acid and cyanide were used. These chemicals are dangerous to human health. Nitric acid and caustic soda were used for the purification of gold. These two damage skin cells in the event that they get into contact with the skin. Some of the hazards which were noted in the studied mines were also mentioned by Donoghue (2007) who observes lead, arsenic, mercury and manganese as having the potential to poison employees.

Dust

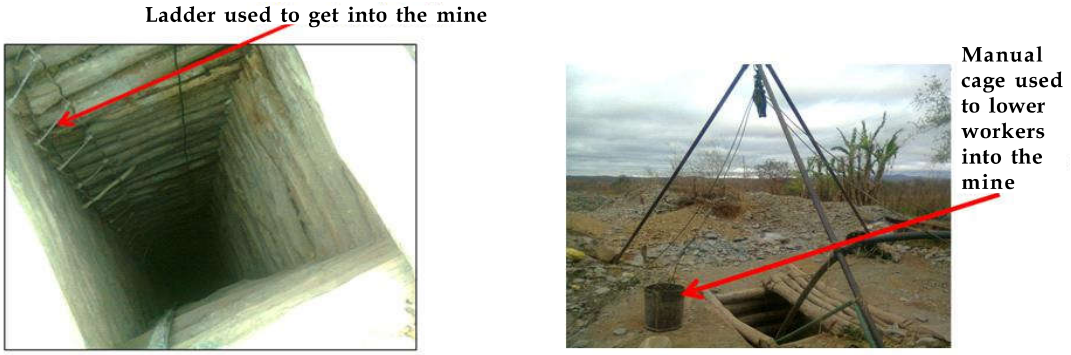
Dust was observed to be a common hazard in all the three mines visited. The causes of dust were drilling, blasting and loading of the ore. In all the mines, employees engaged in dry drilling leading to a lot of dust being emitted. The other cause of dust was blasting, where a lot of dust was generated and would take some time to settle because of the poor ventilation in the mines. According to Heemskerk and Olivieira (2003), one of the most common causes of impurity in mine air is dust, which is released into the air from operations such as drilling, blasting, shovelling, and tipping. Dust is a hazard that can cause pneumoconiosis, a lung disease caused by the inhalation of certain types of gases ranging from mere soil dust. Therefore there is need for sound safety measures that would protect workers from the inherent hazard of dust in all the mines.

Ladders and cages

It was established that there were accidents which were recorded as a result of falling due to slips and trips. The causes of these falls were mainly because of poor

housekeeping and poor personal protective equipment. For instance, some of the gumboots used were worn out and no longer had grip. Questionnaire responses indicated that there were cases of workers falling from heights. The workers were mostly exposed to the hazard during entrance or when exiting shafts. Workers used a tin (manual cage) or a ladder to get into the mine. Plate 1 shows the two methods that were used in the three mines to get in and out shafts. These methods posed the risk of falling as they were not regularly inspected and maintained. According to World Health Organisation (2010) the methods used by small scale miners to get into the mines in developing countries are not yet mechanised and they increase the risk of falling from heights.

Plate 1: *Two ways used to get into the mine*



Vibration

It was noted that whole body vibration is commonly experienced whilst operating air-filled equipment such as the jack hammer. The poorly maintained equipment caused more vibrations as they were not regularly serviced. World Health Organization(2011) pointed out that vibration causes Raynaud's phenomenon, that is, vasospasm characterized by the spasmodic contraction of blood vessels of the fingers, causing the fingers to become temporarily white and numb. According to Schneid (2009), in a survey that was conducted in Korea, the incidence of Raynaud's phenomenon was found to be 33 % among Korean small scale mine workers and that is the same hazard that is affecting miners in Ward 19.

Causes of injuries and illnesses in Ward 19 small scale gold mines.

It was established that the major causes of occupational injuries in the three small scale mines were, substandard maintenance of tools and equipment, poor

communication, poor housekeeping, at risk behaviour, use of explosives, inadequate personal protective equipment, lack of training and experience. These causes were also mentioned by Jennings, (1999) in his list of occupational health and safety problems. Figure 3 shows the causes of injuries by risk domain. Most injuries and illnesses were suffered from the lack of PPE 23%, followed by poor housekeeping at 19% and substandard maintenance of tools and equipment at 19%.

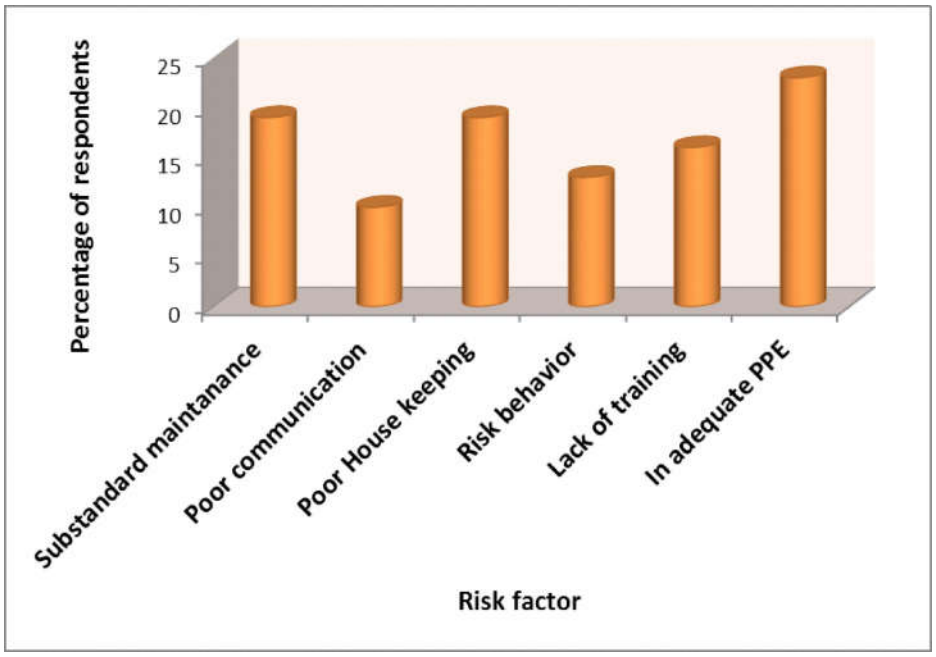


***Figure 3**: Occupational Health and safety analysis by Risk domain*

Lack of awareness and gross negligence by supervisors and employees

From the questionnaires administered, another reason which led to an increase in the occupational injuries and illness was that mine supervisors were not exemplary when it came to health and safety issues. About 77% of the respondents indicated that their supervisors did not observe or exercise safety precautions. Complementing this finding were results from observations, where the researchers witnessed supervisors taking safety measures lightly. In some instances they would get into the mines without adequate PPE even when it was available.

Priority issues between production and Safety

In all the three mines, it was discovered that mine owners considered production first before safety. Sometimes workers would work at a faster and unsafe speed inorder to meet set targets and this lead to injuries. It was established that small scale miners focused more on production than safety because the general perception was that safety issues were costly and it was production only that would bring about profits. This is in line with a view by Mtetwa (2005) who observed that most small scale organisations focus mainly on production at the cost of workers' health and safety and the physical environment. Therefore it was such perception that exposed workers to injuries and illnesses in Ward 19.

Lack of Training

It was noted that most employees who worked in the three selected small scale mines were not trained to perform the tasks that they were doing. Lack of training of the employees led to the increase in injuries and illnesses among small scale miners. According to Economic Commission for Africa (2007), 90% of the workers in small scale mines in Ghana are not trained on the tasks that they are currently performing and on safety issues, as such increasing injury occurrence.

Working under the influence of alcohol.

It was found out that 39% of the employees sometimes worked under the influence of alcohol. Those who used alcohol claimed that alcohol boosted their morale and the rigour to work. Manzungu and Sithole (1999) postulate that there is no monitoring of employees in small scale mines and most of these mines do not restrict the use of alcohol. In the same vein, alcohol reduces focus and concentration on tasks, by so doing causing injuries.

Poor Personal Protective Equipment (PPE)

Out of all the 34 employees who filled in the questionnaires, only 2 from Pambili mine and 1 from Gudo mine and 1 from Ndaumbili mine indicated that they had adequate PPE. In total, only 13% of the respondents indicated that they had adequate PPE whilst the remainder clearly pointed out that the mines were wanting in that regard. The reason for the poor PPE as stated by the mine owners was that they could not afford to buy the PPE for all the employees. According to the World Bank (2001) a research which was done in Tanzania and Phillipines indicated that workers in small scale mines had inadequate PPE with 91% and 85% respectively experiencing the shortage.

Inadequate funding for Safety and Health projects

It was revealed that there was no adequate funding invested in safety and health issues in all the mines. The mine owners indicated that they were making marginal profits to the extent that they could not spare some money to invest on safety issues. Unfortunately, the mine owners pointed out that they could only fund in the event that an employee got injured or fell sick at work. The approach was rather reactive than proactive, which in actual fact is costly in the long run. Small scale mine owners faced a major challenge in sponsoring safety as observed by Park (2010) who points out that most small scale mines do not produce enough profits which allow them to fund safety. Ultimately the failure to cater for the safety of employees has resulted in injuries at work as well as illnesses.

Nature of injuries and illnesses suffered by small scale gold miners in Ward 19.

Nature of injuries

It was revealed that the nature of injuries suffered by small scale miners varied from sprains, strains, lacerations, cuts, burns, dislocations, fractures, punchers and crushes. The most common nature of injuries according to the questionnaires were lacerations 20%, cuts 20% and crushes 17%. Other injuries faced were burns 3% and puncture 7%, as shown on figure 3. According to Steenland and Burnnet (2003) a research which was done in the small scale mines in China indicated that the most injuries suffered by small scale miners were cuts, dislocations and electric shock. However, there were no incidents of electric shock which were recorded in Ward 19 mines, the reason being that the mines did not use electricity during the period the study was undertaken.

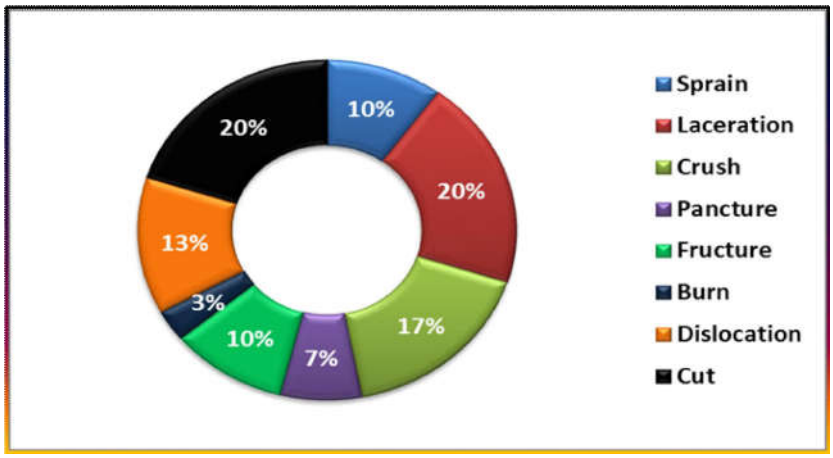


Figure 3: Nature of injuries

A point to note was that workers were injured on different areas of the body. These areas ranged from, *inter alia* eyes, hands, head, legs and chest. However it was observed that most injuries occurred on hands (29%) and legs (16%) as shown in percentages on Figure 4. More hand injuries were due to use of hand held tools without gloves. This finding is supported by Jennings (2006) who also observes that most injuries suffered by small scale miners are mostly suffered on the hands, legs and arms.

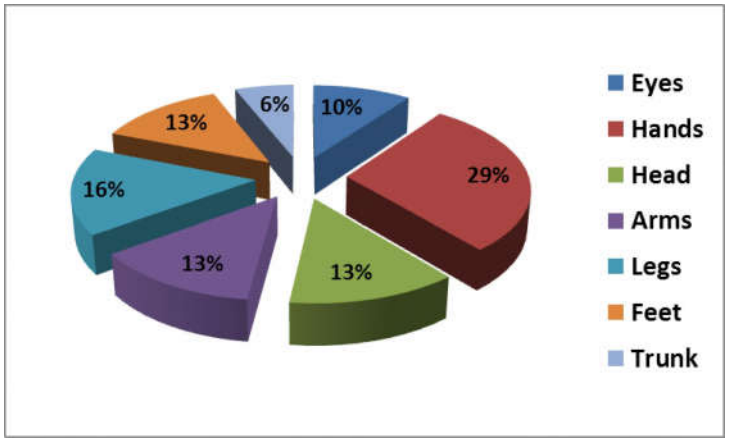


Figure 4: Physical injuries

Nature of illnesses mainly suffered by small scale miners

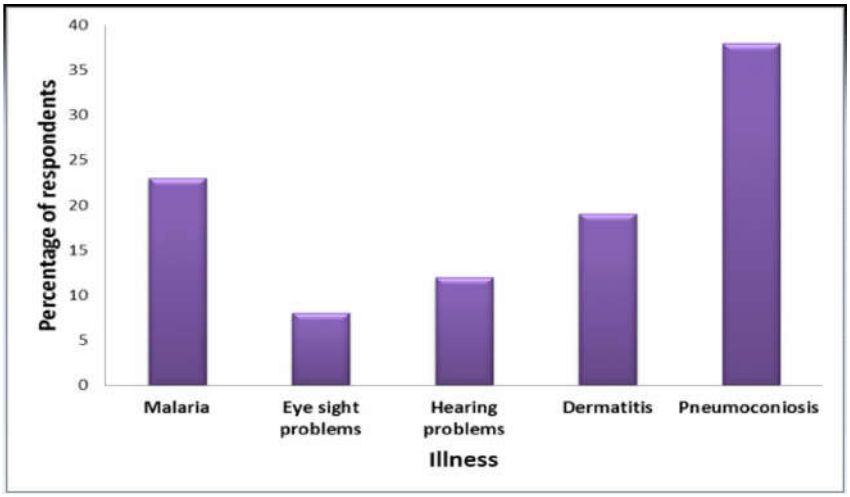


Figure 5: types of illnesess identified in small scale mines

Figure 5 shows the nature of illnesses that were reported among small scale miners. The main occupational illnesses suffered by small scale miners were associated with lung infections (pneumoconiosis) 35%, which were caused by dust and gases from the drilling machines. The other illness which was noted was malaria which was highlighted by 23% of the employees. The respondents pointed out that the situation was exacerbated mainly by the damp conditions in the mining environment which created conducive surroundings for mosquitoes. Hearing and eye sight problems though reported were low (less than 10%), the reason being that the problems usually manifest after a long period of time.

Conclusion

Over and done with, the main hazards in the three small scale gold mines were identified to be dust, heat, tools and equipment, vibrations, noise and bad hangings. It was established that there was little that was being done to reduce the impacts of hazards due to financial incapacity of the owners. Work-related injuries among workers were caused by various factors which ranged from lack of training, at risk behaviours, lack of experience, abuse of alcohol, substandard maintenance of tools and equipment, poor communication, poor housekeeping, use of explosives and inadequate personal protective equipment. The paper revealed that the nature of injuries suffered by small scale miners varied from sprains, strains, lacerations, cuts, burns, dislocations, fractures, punchers and crushes. Illnesses that were noted as common among small scale miners were eye sight problems, dermatitis, hearing problems and pneumoconiosis. The findings also revealed that most of the challenges faced in the studied mines were the same; therefore the government should render safety inclined support to all small scale miners in order to reduce the cases of injuries and illnesses. Further studies should be done to assess the consequences of the injuries and illnesses on production output as well as the impacts of injuries on the socio-economic facets of the employees' lives.

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