

Economic and Social Challenges Faced by Injured Artisanal and Small-scale Gold Miners

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Abstract

Miners in Artisanal and Small-scale Mining (ASM) operations have been evidenced to sustain injuries frequently. However, literature review reveals a lack of research in this domain especially in understanding the challenges faced by injured miners and their families. Consequently, in order to address this lacuna, the current study aims to provide a comprehensive insight into the post-injury economic and social issues. A semi-structured qualitative interview was administered to severely injured miners. The survey comprised questions pertaining to the study participants' economic, social and lifestyle challenges post sustaining the injury. Severely injured miners were identified, purposively selected and interviewed until the sample achieved ideal saturation. This point was reached after the interview of thirty-three seriously injured miners. The thematic analysis results revealed a reduction in economic sufficiency, negative social health and alterations in lifestyle. The study concluded an impending need of educating the miners on the ASM-related hazards and associated health problems. The study encourages the mine owners and relevant government institutions to develop policies that protect injured miners and their families. Overall, this study has enhanced the understanding of the issues faced by workers in the informal or formal small-scale industries.

Keywords: *Artisanal and small-scale mining; serious injuries; economic and social impacts.*

1. Introduction

Artisanal and Small-scale Mining (ASM) is an important factor for poverty alleviation especially in mineral-rich rural areas of developing countries. Millions of men, women and children engaged in this activity as a ‘necessity’ (International Labor Office [ILO], 1999). Despite its great role in improving livelihood and increasing rural development, the sector is still lacking universally accepted definition (Hentschel, 2003). The difference is demonstrated worldwide with each individual country considering varied parameters such as: the number of workers, production rate, capital investment, level of mechanisation, size and nature of the operation (ILO, 1999). In this paper, ASM is defined as a type of mining method that employs crude or low-tech equipment to exploit mineral or metal deposits, and it can be undertaken either by an individual, a family, community and/or small-scale cooperatives (Hentschel, 2003).

Despite the lack of common definition, universally, ASM activities are widely characterized by inadequate occupational health and safety (OSH) standards (Hentschel, 2003). This is mainly attributed to the poor safety culture. ASM operators and sites owners rarely take safety seriously as they always focussed more on production (ILO, 1999). An organization with good safety culture encourages: hazards identifications and controls training, issuing of personal protective equipment (PPE), safe operation of machines, daily safety briefing and good working conditions. However, if the organization does not uphold safe operations, the consequences are always detrimental to human wellbeing. The United States Nuclear Regulatory Commission (U.S.NRC) investigate the coal mining accident that happened in southern West Virginia, whereby twenty-nine coal miners were killed (U.S.NRC, 2012). The findings indicated that the company paid more attentions to production than safety. Also, the review revealed that a poor working environment significantly contributed to this catastrophic accident.

ASM operation is considered one of the most dangerous activity across the globe. In fact, the risk of accidents in this activity is believed to be six to seven times higher compared to large-scale mining operation especially in developing countries (ILO, 1999). The activity is characterized by adverse working conditions as exemplified in figure 1. As a result, accidental injuries are frequent phenomenon. A discussion with the worker representatives and public health officials in Migori County, Kenya revealed that artisanal and small-scale gold miners in the area regularly experienced accidents with disastrous outcomes. A case in point was the recent mine collapse in Osiri, which resulted in six fatalities (Otieno, 2018). Some of the current published epidemiologic studies outside Kenya have collaborated this revelation (Calys-Tagoe et al., 2015; Elenge et al., 2013; Kyeremateng-Amoah et al., 2015; Long et al., 2015). Figure 1 shows different ASM working sites in Osiri Gold Mine.



Figure 1. ASM working areas in Osiri Gold Mine

The complexity of mining accident

Depending on the research designs, the investigators of ASM-related injuries have only identified the physical hazards and certain personal characteristics as the risk factors. In spite of this information, accidents in ASM operations continue to occur with serious consequences. This is because the studies adopted the reductionist view. According to this viewpoint, the injury or other phenomena is reduced into basic components and described by rational of deduction (Dekker et al., 2011). The risk factors for the injuries were determined by logistic regression. This view of the event possessing linearity is often insufficient to completely and usefully understand the issues related to mine safety (Komljenovic et al., 2017).

Considering the complexity associated with the occurrence of injuries and associated negative impacts, it is important to apply complex system approach to determine the underlying causes of injuries as well as challenges faced by seriously injured miners and their families. A complex system is literally one in which there are multiple interactions between many different components (Rind, 1999). Mining accident as a complex system is composed of a human component, organizational component and technical component (Maria et al., 2017).

From the definition, it can be inferred that several factors act together to contribute to mining accident within the complex systems (Komljenovic et al., 2017). Human error is one of the factors identified to influence accident; however, it is not the root cause (Department of Energy [DoE], 2009). Statistics showed that about 80% of the accidents are attributed to human error. But, when this percentage is broken down, it reveals that indeed human error interacts with other factors to facilitate the event occurrence (DoE, 2009).

In addition to operators' error, managerial ignorance is one of the key factors that has impact on mine safety. Failure by the leadership to learn from the past experiences produced recurring event of mining accidents (Komljenovic et al., 2017). In fact, this study stated that

the individual human behaviour is always influenced by the environment in which it takes place. In ASM operation, mine owners and even miners believed that production superseded safety. Therefore, miner's behaviour is to ignore hazards to achieve production target. In addition, if the accident occurs, leadership or miners are not held accountable. Moreover, accidents, injuries and post-injury impacts are rarely documented except in the catastrophic events that have been reported by media.

The lack of proper organizational structure in ASM is another source of a problem for increased accidents. As stated in the definition, most ASM sites are operated by the individuals, families, communities and occasionally small cooperatives (ILO, 1999). This leadership structure coupled with lack of government supports and effective management often leads to non-compliance with local or international safe mining practices (Hentschel, 2003). A well-established industry has organization components such as safety culture, decision-making process and several other attributes (Komljenovic et al., 2017). However, in the case of ASM operations, there are no clear operating policies and procedures, work instructions, documentation, training etc. (Smith et al., 2016). As a result, limited shields exist that prevent the occurrence of accidents and subsequently injuries.

Technologically, ASM still relies on rudimentary tools and techniques whether in mining or processing stage (ILO, 1999). Nevertheless, it has been established that technological evolution and modern organization create an important source of complexity in relation to mine safety (Komljenovic et al., 2017). Both “structural” and “dynamic” complexities are introduced to increase integration among various systems (Dekker et al., 2011). Consequently, modern organizations such as mining industries become complex socio-technological-economic entities involving many interacting and interdependent elements with barely foreseeable long-term behaviour (Komljenovic et al., 2017). For ASM operation, such

technological complexities are limited due to the backwardness of the sector (ILO, 1999). The technological deficient of the sector has been blamed for low production and poor OSH (Intergovernmental Forum [IGF], 2018).

To better understand the effects of human and organization consequences on workplace accident within the complex systems, number of models have been developed. However, the model created by DoE entitled “Anatomy of an Event” gives clear picture of the role played by both human and organizational factors (DoE, 2009). This model as shown in figure 2 was recently modified by Komljenovic et al. (2017). The advantage of the new model showed events as complex interactions with number of potential influences and accident scenarios (Komljenovic et al., 2017).

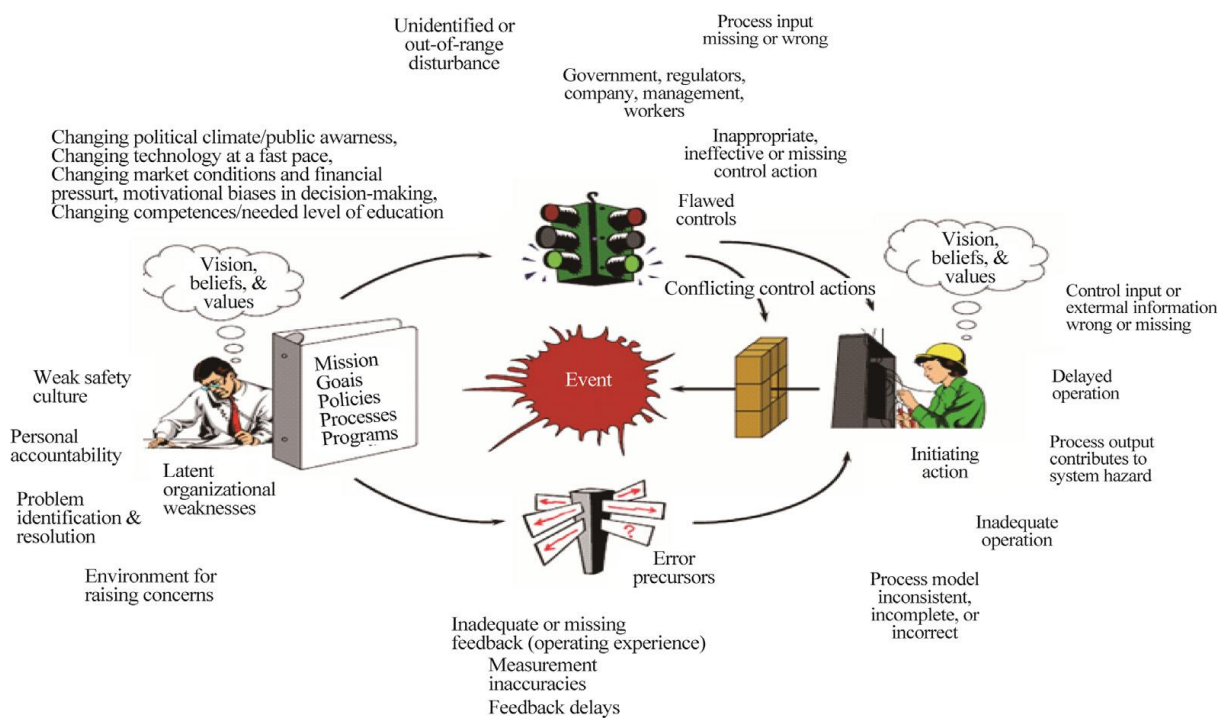


Figure 2. Anatomy of an event as modified by Komljenovic et al. (2017).

An event is “an unwanted, undesirable change in the state of facility structures, systems, or components or human/organizational conditions (health, behaviour, administrative controls,

environment, etc.) that exceeds established significance criteria” (DoE, 2009). Komljenovic et al. (2017) stated that human performance is an occurrence of event error. That means, the human error is a symptom within the event for which the cause must be found (direct causes). Therefore, investigators should determine why event occurred and why it was not stopped (fundamental causes). This fundamental causes should target organization while the direct causes are associated with preventive barriers, mitigating barriers and error precursors (Komljenovic et al., 2017).

The preventive barriers include the training, qualification, procedures and work practices. These barriers stopped making of the errors within the complex systems. While mitigating barriers limit the consequences that may follow an inadequate action. For example, steel cap boot is a mitigating barrier to limit any consequential mishaps. Precursors include the elements in working environment, or invisible constraints within the task. Job stress, job dissatisfaction and poor management and supervision influence on the cognitive processes required for safety and proper operation of the task (Komljenovic et al., 2017).

Human and organization performance cannot assume that decision-making is often rational. Therefore, in decision-making process, cognitive and motivational biases are likely to occur, which always impact on mine safety (Komljenovic et al., 2017). The cognitive bias is defined as “a systematic discrepancy between the “correct” answer in a judgmental task, given by a formal normative rule, and the expert’s actual answer to such a task” (Montibeller, 2015). While motivational biases, on the other hand, is refer to distortion of the judgement (decision-making) due to desirability or undesirability of events, consequences, outcomes, or choices (Montibeller, 2015). The main cognitive biases for occurrence of mining accident are: overconfidence, omission of important variables, myopic problem representation. The motivational biases are: desirability of options/choice, groupthink, confirmation biases,

desirability of options/choice, and undesirability of a negative event or consequence (Komljenovic et al., 2017).

Beyond injury occurrence

It is not only the occurrence of injury that is complex, but also post-injury consequences. Occupational injuries are known to have direct negative impacts on injured persons as well as “spill over” effect on family members, friends, communities, employers, and insurance companies. The European Commission (EU) (2011) conducted a survey where it was observed from an employee’s perspective, injury results in not only pain but other adverse fallouts such as suffering, undesirable impacts on his/her family, a possible decrease in physical ability, and salary loss. In addition to the employee, the report highlighted extra accident cost burden for the employer, i.e., production losses and increased insurance premiums (EU, 2011).

According to Brown and Harris (1989), the term “life events” represents situations that yield an emotional disorder and often involve danger, thereby, leading to significant changes in health, lifestyles, and success or failure of the victims. Artisanal and small-scale miners have been evidenced to operate in volatile social environments that subject them to the inevitable encounter with circumstances of varying kinds that are mostly impulsive. In this case, when miners are exposed to life events such as severe occupational injuries, they are inevitably exposed to emotional fluctuation and psychological heaviness.

When experiencing a life event, the human body responds by conducting cognitive evaluations based on nature, severity and its ability to handle the events in accordance with the psychological traits and tendencies, social support system, and existing knowledge (Zhang et al., 2014). Following which, the individual is able to choose the right strategy in order to cope with the situation based on these evaluations (Zhang et al., 2014). Consequently, artisanal and

small-scale miners who demonstrate an inability to mobilize their social and internal resources towards rebalancing their minds tend to suffer from overpressure and the loss of action.

According to the S-O-R theory of human errors, as propounded by Thurley, the contrivance of human behaviour is viewed as the procedure, wherein, an organism responds when stimulated, thereby, causing the blend of judgment, insight, and action (Li et al., 2006). In this case, it is imperative to properly address the incidents involving miner' accidents in order to ensure that they do not attribute towards psychological overpressure, thereby leading to a decline in their psychological and physiological functions (Zhang et al., 2014).

The injuries can be prevented through the utilization of modern mining equipment as well as tightening of the policies and regulations governing the sectors. In absence of sufficient financial and social support from the mine management and other relevant governing bodies, the injured workers and their families are subjected to deteriorating economic situation and declining social health as well as lifestyle (Camm, 2005; Dembe et al, 2001; Kim et al., 2013; Lax et al., 2008). In addition, this situation subsequently causes psychological issues in both the injured workers and their families.

The objective of this study is to explore qualitatively the economic and social challenges faced by injured persons and their families. The findings of this research will not only provide a clear understanding of safety in ASM operation but also revealed economic and social consequences of mining-related injuries. This information is critical for injury prevention and post-injury consequences management. Figure 3 showed a complex model for causes and consequences of injuries.

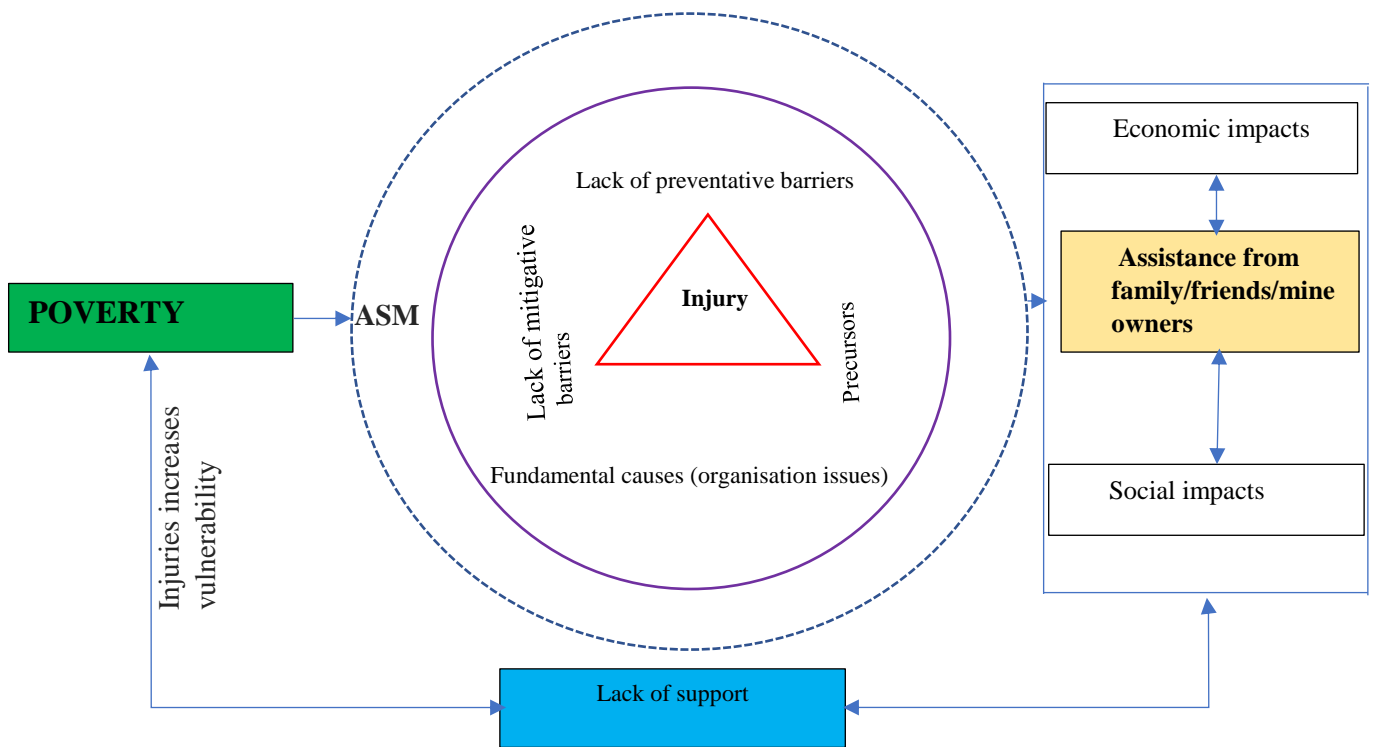


Figure 3. Complex model for causes and consequences of injuries

2. Method

To achieve the research objective, semi-structured interviews were conducted with severely injured artisanal and small-scale gold miners. The study samples were seriously injured miners who could provide the necessary insight into complex issues of post-injury economic and social consequences.

2.1 Study Area

The study was implemented in Osiri Artisanal and Small-scale Gold Mining (ASGM) in Migori County. Migori County is situated in Western Kenya, with neighbouring Lake Victoria in the west and Republic of Tanzania in the south. Previously, the mine was called Malcader, however, lately, it is known as Osiri or Karibu mine. The site has several small pits or underground workings which are run independently by different owners, but all the business operate under the common aegis of cooperative leadership.

2.2 Sampling and participants

The qualitative approach does not mandate a specific rule for determining the sample size which usually is based on the saturation point (Mark, 2010). In such cases, the interviewing process continues until additional participants fail to provide new information pertinent to the research objectives (Fusch, 2015). In this study, the sample size was determined by the richness of information obtained with every interview. The ideal saturation was achieved when no new themes or ideas were emerging from the recruiting of more participants. That is, newly interviewed participants did not provide new themes or ideas that is different from the previous interviewees. In addition, Mason et al. (2010) reviewed five hundred and sixty PhD studies to determine the sample sizes that have been used by authors and found that 85% of total proportion of qualitative studies reached saturation after interviewing 25 participants. This research had slightly higher number of participants, as the saturation was reached with 33 participants. The methodology of purposive sampling which is widely used in qualitative research was considered appropriate for identifying these cases. This strategy was adopted in alignment with the objectives to interview individuals with firsthand experience of post-injury economic and social problems.

The inclusion criteria for the interview included: (1) sustaining minimal one injury during ASGM operations, (2) over 18 years of age and (3) freely providing consent for the interview. While the exclusion criteria included: (1) employed as mine leaders, (2) government officials, (3) not seriously injured and (4) under 18 years old.

2.3 Instrument

The information on economic and social challenges faced by the severely injured ASM workers (i.e., study participants) was captured using semi-structured interview instrument comprising of nine open-ended questions. The questionnaire was constructed based on the

findings reported in the pertinent literature. Essentially, all the study participants were asked the same nine questions in order to ensure that their responses relate to the research objectives. During the semi-structured interviews, the researcher asked for further clarification when needed (i.e., on need basis), and accordingly explored new ideas emerging from the participants' responses.

2.4 Procedures

Prior to the commencement of the interviews, the primary authors conducted extensive sensitizations and consultations with the key stakeholders. This conglomerate included mine workers, and the cohort was identified in alignment with the purpose to explain study purpose and protocols, as well as discuss research documents and interview process. The authors focused on engaging and developing an in-depth understanding of the seriously injured miners without the involvement of local officials and mine owners. In fact, miners who voluntarily consented to take part in the study provided their telephone numbers and were subsequently contacted to arrange the time and place for the interviews.

All the interviewees were extended the opportunity to bring along their closest relatives for emotional support if they so desired. Each interview commenced with the researcher's introduction, followed by an explanation of the research purpose, the data collection instruments, and sharing the examples of possible questions for the interview. Participants were given sufficient time to understand the deliverables expected from the respondents and give their final consent/approval for the interview. The informed consent form and semi-structured interview instrument were signed necessarily by all the study participants before commencing with answering the questions.

The interviews were documented through note-taking, whereby the researcher also recorded participants' verbatim responses. Before moving on to the next question, the verbatim

response was read out to the respondent for validation and accuracy. Despite the time-consuming feature of note-taking, the process also presents several inherent advantages compared to audio recordings (Ranney et al., 2015). Particularly, in addition to safeguarding against equipment failure, the note-taking process also allows for immediate validation of the captured data. Each interview lasted 60 minutes on average and was predominantly held in the Kiswahili dialect. Upon completion of each interview, the researcher transferred the field notes into a Word document, which was subsequently translated into English to produce the final 33 transcripts that constituted the corpus of analysis.

The demographic characteristics of the interviewed miners are shown in Table 1. Of the interviewed participant cohort, the age group 18-34 were over 50% of the total sampled population. Also, the majority of the participants were male and married.

Table 1. Demographic characteristics of the interviewed participants (n = 33)

Characteristics	Frequency	Percent
Age group		
18-34	19	57.60
Over 35 years	14	42.40
Gender		
Male	31	93.90
Female	2	6.10
Marital status		
Married	31	93.90
Single	2	6.10

2.5 Data Analysis

Thematic analysis of the interview data was conducted using the NVivo 12 software. Correspondingly, the deductive approach of analysis was used to develop major themes and sub-themes. The research questions and principle of complex systems in figure 2 and 3 were used to guide thematic analysis, in alignment with Braun and Clarke's (2006) iterative step-by-step procedure described below:

In the first step, the transcripts were read and reread, line by line several times, thereby allowing the researcher to fully immerse himself in the data and gain an in-depth understanding of the same. Following which, in the second step, the words, phrases, sentences, and specific quotes were coded in order to facilitate the emergence of themes. This step is referred to as open coding, wherein, the aim is to capture the richness of the qualitative information (Boyatzis, 1998). In the third step, a thematic map was developed, as suggested by Braun and Clarke (2006), in order to devise a way to visualize the codes. This visual representation accorded the researcher with optimal opportunity to contemplate and identify the intersecting links and relationships between codes. In the fourth step, all phrases and paragraphs that corresponded to the themes were extracted and classified as quotes. This was followed by a comprehensive analysis of essence and aspect of data captured by themes, which was intended at evaluating the sufficiency of the theme towards explaining the 'overall story' related to the dataset and subsequently the research objective (Braun and Clarke, 2006). The quotations were synthesised systematically to showcase the foremost ideas. In the last stage, the researcher provided a detailed description of the findings, wherein, the number of quotes accompanied the description results to safeguard the study robustness.

3. Results

The thematic analysis of qualitative interview data revealed six main themes, which are presented in this section. The verbatim quotes were taken directly from the participants' transcripts in order to substantiate the emergent key themes or sub-themes, denoted with the code P and followed by the transcript number.

3.1 Mine safety and cause of injuries

This theme assessed the type and causes of injuries. The human and organization model in figure 2 was used to determine the state of preventative, mitigating and precursor barriers as well as fundamental causes (organisational factors).

3.1.1 Injury occurrence

Before we asked participants about the causes of injuries, we tried to identify the nature of injuries they have suffered. Most of the injured participants reported ruptured spinal cords, back pain, fractured legs, and joints as well as the shoulders.

“When we were digging and loading out the rock, the wall opened and one of the rock landed on my back and leg. The major injury was in my back.” (P012).

“My leg and arm were trapped under a rock and when the rock was removed, several bones in my leg were fractured.” (P006).

“While I was digging, the wall cracked, and the rock hit me in the back, breaking my spinal cord.” (P010).

In addition to the physical trauma and musculoskeletal pain resulting from these accidents, some participants cited unfortunate incidences of injury fatalities either immediately or while undergoing treatment.

“I and my three workmates entered the shaft and start digging. But at around 10 am the roof caved on us. In this sudden caving, two of my colleagues were killed, and I was seriously injured.” (P008).

The participants were asked about any preventive barriers or issues that might have led to injury occurrence. All the participants interviewed reported complete lack of OSH training as well as knowledge on hazard identification and controls. They only see wall or roof collapses as the harmful hazards. In addition, none of them had any formal training on the use of semi-mechanised equipment.

..... I have never been trained on how to operate hand held drill or other equipment... as you can see my hands and elbows were injured several times, but my only concern is roof failure (P001).

In addition to stories provided by participants, no single work instruction or procedure document was provided by the miners or mine owners during the fieldwork. Also, the research observed that miners starts all the tasks without looking around for potential harms.

Because of high number of hazards and lack of preventative barriers, participants were asked about available basic mitigating barriers. All participants reported lack of basic PPE such as safety glove, helmet, steel cap boots, ear mask etc. Some of participants further explained that they have never worn or seen any PPE among their workmates.

“..... occupational health and safety of oneself and colleague is not always a top priority. I have never used any personal protective equipment or had health and safety training while working in this operation.” (P001).

The identification of issues related to precursor barriers showed that most participants working area had widespread presence of occupational hazards, which contribute to the

accidental injuries. Moreover, these incidents, in fact, assume substantial adverse proportions inside the underground workings. Correspondingly, the majority of the seriously injured miners reported that they were injured while operating in the underground.

“I was injured while working in the underground. When we were digging and loading out the rocks, the wall collapsed and one of the rocks landed on my back and leg. The major injury was in my back.” (P012).

The researchers observed causal undertaking of tasks with complete disregard for safety. The underground working environment had no proper ventilation and lighting. In addition, miners entered underground through the shaft using the wooden ladders. Moreover, underground workings are not well scaled; walls and roofs were not protected for any potential collapses and generators used to pump waters produced carbon monoxide.

The informal discussion with mine owners, worker representatives and public health officers revealed that number of fundamental or organization causes are responsible. Firstly, sites are operated with no formal government surveillance and recording of any incidents. Therefore, mine owners are not held accountable. Secondly, within the mine sites, there are number of shafts run and operated by families and individuals without proper management structure. Thirdly, working is on causal basis. That is, some miners tend up to work when they are looking for easy money. Fourthly, mine owners and local governments have no programs in place to improve safety culture.

3.2 Consequences of injuries

Following understanding of the safety culture and nature of injuries, we have investigated how individuals including their families have survived with such severe injuries and whether their social life has changed. These results are discussed in theme 3.2.1 – 3.2.5.

3.2.1 Functional limitation

Depending on the nature and relative degree of injury severity, the participants reported functional limitation (physical inability) to perform the tasks or functions they would be able to undertake prior to being injured. And, resultantly, some of the participants were forced to change their jobs to physically less restrictive and less labour-intensive roles.

“I stayed-off work for a duration of 2 years when I got injured, but now the mine owner has allowed me back on work, however, in the processing plant because it is less physically demanding and does not require me to stand up or work in awkward positions. I crush rocks, and wash and sieve them while sitting.” (P001).

“It has been 3 months since I got injured and I continuously feel severe pain every time I bend to pick or lift something. I have come back to work but now am engaged in light duties such as guarding the entrance of the shaft and communicating, in case of any problem to the mine owner.” (P002).

While others reported that they have not Returned-To-Work (RTW) at all due to the severity of injuries. Some reported a permanent disability or presently undergoing treatment. Thus, pushing them into a difficult and demanding financial position.

“The incident happened in February and I still feel the pain. The injury has not fully recovered, and I haven’t gone back to work since.” (P008).

Only a few participants reported having changed their jobs from mining to jobs outside of the ASM operations.

“The injury has forced out of mining activities and now I sometime ride boda boda (motor cycle) to support my family.” (P010).

In addition to on-job restrictions, some of the injured participants mentioned experiencing functional limitations in performing their household roles. They also reported that their physical inability had forced some of the family members to shoulder more responsibility. For example, women and children were cited by the participants to assist in or assume the injured persons' previous household roles.

“The role of the household management has shifted from me to my mother and somehow my wife. I cannot even clear bushes due to the pain in my shoulder and my head when I bend.” (P008).

“The injury has forced me to cut down on the number of hours I initially used to spend working on the farm and other income-generating activities. My wife has to shoulder some of the household responsibilities until I will fully recover.” (P013).

3.2.2 Economic impact

The economic impacts of severe injuries on miners and their dependents were assessed through computation of the associated medical costs, assistance provided by the mine owner or management and lifestyle changes.

3.2.2.1 Medical costs

Almost all the participants reported to have shouldered their own medical expenses in addition to the financial support garnered from the family post-injury. Commonly, the participants cited depletion of individual savings, which subsequently led to the selling of assets, fundraising and borrowings to cover the costs of the medical costs.

“My medical expense was 35,000Ksh (Kenya shillings) excluding the first-aid fees. I managed to pay half from savings and selling the cattle, and my mother paid half. My

mother was forced to borrow from friends in order to cover this percentage, as the little she had was not enough.” (P007).

“This situation forced me to borrow some money from my friends, after spending all of my savings and selling some of the assets. Also, my family managed to raise some funds but still the money was not enough to pay for the medical bills” (P012).

Very few participants mentioned having been extended any support or help by the mining management in order to cover their medical bills. Also, in the cases, where the management did offer help, notably, only a minimal part of the bill was paid by the management, thereby, leaving the bigger part of the bill to the injured miner.

“.... I did not receive enough assistance from the mine management. The only assistance provided by the mine owner was the transportation from the place of accident to the hospital and clearing of the initial first aid charges. The mine owner made it clear that subsequent to the initial aid, I have to bear the rest of the medical bills.” (P002).

“The mine owner paid for the quarter of medical bills as well as first aid and transportation fees which was a big help.” (P009).

“I was rescued and transported to the hospital by pit owner who later cleared the first aid money. But afterward, I was left without assistance for the major part of medication. I had to eventually cut short the medical care because the family could not bear the expenses.” (P009).

Few participants mentioned having been insured, and hence insurance catered to partial expense. However, as the amount was insufficient to cover the entire medical expense, the

participants were forced to seek help from family and friends. Conversely, the participants without insurance undertook the burden of entire medical expense.

“To make matters worse, I was not insured and therefore I had to clear the bills without much assistance from any other quarter.” (P001).

Some of the participants who could not afford to pay the medical expenses reported to have opted for a traditional healer for treatment since they are cheaper.

“Now I visit a traditional healer who massages my feet and ankles since I cannot afford to go to the hospital.” (P013).

“..... I have started to consult traditional doctors, and sometimes when I collect enough money for transport, I travel to a nearby health centre that is run by a non-governmental organization.” (P013).

3.2.2.2 Assistance rendered by mine management

All the participants typically reported that the mine management failed to extend any help to the injured in the clearing of hospital bills. In addition, a major percentage of respondents did report that the management helped them by providing transport to the hospital and clearing the initial first-aid bills. However, following the initial payment, the participants had to assume the responsibility for the subsequent treatment bills, which were too high.

“No, I did not receive enough assistance from the mine management. The only assistance provided by the mine owner was transport from the place of accident to the hospital and clearing of the initial first aid charges.” (P002).

Some of the participants reported to have approached the mine management in order to garner assistance in clearing their hospital bills but the attempts were futile as the management declined their requests.

“The mine management or the pit owner did not provides any assistance. I requested them for help, but they declined, and I cannot force them.” (P033).

The participants noted that as per their employment contract, the mining management was not bound by any by-laws to extend any financial support to address occupational hazard related accidental injuries. Hence, the participants were forced to find alternative ways of clearing their medical bills, and whatever help the management offered was on humanitarian grounds and not due to any mandatory clauses.

“Because these activities are not legalized when injured, you are responsible for all medical expenses.” (P025).

However, according to the responses of some participants, they did receive partial assistance from the mine management. This may be attributed to their interaction levels with the top management as quoted below:

“The mine owner provided me with necessary assistance, although there is no legal requirement to pay for the medical expenses. This may be partly due to the fact that we are very close.” (P017).

As such, the study made an observation that the mining management was beyond any legal obligation to cater for the medical bills resulting from mine injuries; and hence, the participants were forced to cater to their own medical bills. It was also established that the mine management presented an absolute lack of compensation policies/programs to address such scenarios.

“Every injured miner individually shoulder the medical and other expenses when involved in accidents. As regards compensation program, here at the mine, no compensation programs exist.” (P019).

3.2.2.3 Lifestyle impact

It was observed that multiple factors including, the lengthy RTW duration, job changes, hefty medical bills, lack of enough assistance from mine management, as well as not being insured, contributed cumulatively towards the reduction of injured persons and their families’ lifestyles. This alteration is evident from drawing comparisons between their earnings from mine job and lighter duties like washing and cleaning. The majority of injured miners mentioned a reduction in their income to less than half of previous earnings from mine job. Apparently, the job of a digger provides relatively higher returns despite being one of the most dangerous jobs. Prior to being injured, the individuals earned about an average of 1500Ksh a day as compared to the light jobs, which could only pay an average of 250Ksh a day. This reduction in earnings caused a strain on their economic situations and affected their family.

“The changing of roles has affected my economic situation a lot. My income has reduced from 2500Ksh to 500Ksh.” (P003).

“This leg injury has significantly changed my life. My income ceased immediately after I got injured, and as a result, I have been struggling to sustain my family. When I was not injured, my daily income was 2500Ksh a day but now I am lucky to even get 200Ksh a day. Also, the injury has impacted my ability to perform other supplementary jobs such as cattle rearing and ploughing. The little I get from mining is the only source of income now.” (P005).

As such, the responses evidence that the injury adversely impacted the quality of life and living standards of the family, with most participants reporting challenges in sustaining

their normal life due to affordability issues. This was attributed to the exorbitant medical bills which exhausted the family savings, compounded with the inability of the breadwinner to work and source any income. It was also reported that in certain cases, the affected family could not afford meals, which forced them to only have one meal a day and even go without meals on several occasions.

“We are currently surviving on hand to mouth equation. Sometimes my family has to go without food.” (P005).

“I cannot engage in the difficult tasks such as slashing and digging. Therefore, personally, my economic situation has worsened, and I depend on the handouts from my family. I used to earn to around 4000Ksh day but now I am getting nothing.” (P008).

Moreover, attributed to the financial strain in the family, the wife of the injured household head was forced to start fending for the family and assume the breadwinner’s responsibility. Some of the wives went to work on light jobs at the mines, while others started small businesses to help meet the family needs.

“I used to be the breadwinner but my mother who is 60 years old and my wife have taken over until I am fully recovered. My mother ploughs the land and sells vegetables. While my wife is engaged in small businesses around the community and at the mine site.” (P008).

“.....Because I was the breadwinner and could not walk properly again, my wife took up the responsibility for catering for the family. Whatever little I get from riding boda is spent on the food. My wife gets very little, she is early childhood development education (ECDE) teacher but not yet officially absorbed into the system. Also, my

parents are adversely affected because I used to plough their farm and assist them financially.” (P010).

Participants also reported that their children’s schooling had been greatly affected. While some children were forced to drop from school because of lack of school fees, the children enrolled in private schools were transferred to public schools due to affordability issues. This decline was predominant in households, where the injured was the household head and as such the main breadwinner.

“My family has been affected by my economic situation. I used to be the only person who worked and provided for the family but now my income cannot feed the family as well as educate my children. This difficult financial situation forced my wife to seek an alternative job to supplement my income. Also, the children have been taken from private school to public school.” (P012).

“Due to the situation my elder son who is in secondary school had to drop out this year and now he is working at someone else’s land.” (P014).

3.2.3 Mental and emotional trauma

It was observed that the injury and dire economic situation resulted in mental and emotional trauma amongst the injured participants. Because of decreasing physiological function, some of the injured participants also reported transitioning to diverse job roles, i.e., functions which they considered less manly in their culture. As a result, they experienced a dip in their self-esteem with their counterparts (i.e., fellow men) who were, in fact, employed in higher paying and physically demanding jobs like digging in the shaft. This greatly affected their interactions with their friends and colleagues employed at the mines who could not understand their situations.

“I would feel worthless amongst my peers if I worked in the sieving and cleaning and they worked in the shaft.” (P025).

In addition to self-esteem, most of the participants reported being stressed and depressed due to their conditions. The use of family savings and selling family assets in order to clear their treatment bills made them feel bad and regretful about the injury. The participants reported experiencing feelings of being a burden to their family and/or being helpless when the family was struggling financially. Some of them have even reported of contemplating suicide at some point.

“This one time I considered committing suicide because I felt useless to my family especially kids and wife. I consider myself as a burden to them.” (P010).

“Personally, I feel worthless as I cannot walk nor am able to work to cater for my family. I feel like there is no point of survival if you cannot do simple things such as going to the men’s room by yourself. I have thought of suicide, but I feel bad for my kids and wife.” (P030).

“I often feel like my medication costs exceed even the funeral cost and therefore I should have died.” (P010).

3.2.4 Substance use

Some of the participants reported that they decided to drink more alcohol in order to forget their adversities. Apart from alcohol, some reported having increasingly engaged in drug abuse by smoking marijuana and bhang because of the mental and emotional trauma they were experiencing.

“Sometimes, I go to the bar with friends to drink alcohol and forget about the problems. I know it is not a solution but at least it clears my mind.” (P003).

“My level of alcohol consumption has tremendously increased and that has somehow affected my relationship with my wife.” (P006).

“I am excessively involved in taking drugs and alcohol, and this has caused tension within the household.” (P006).

3.2.5 Social support

Some of the participants shared that their children, wives, friends, and relatives were supportive towards them, in order to help them cope with the adverse circumstances, by extending financial, physiological as well as mental support. However, some wives had to necessarily assume the role of the men as breadwinner, and this, in fact, made the participants feel bad.

“I am excessively involved in taking drugs and alcohol, and that has caused tension within the household.” (P006).

“I received great support from my family, relatives, and friends, who supported me emotionally and financially.” (P021).

In contrast, some of the injured participants were unable to receive sufficient social support from their respective families and friends, as they considered participants an economic and social burden. This resulted in the injured worker’s isolation and affected his mental and emotional state.

“My relationship with my wife and children has significantly declined over time due to the financial stress and the fact that I do not provide enough support in the household.” (P001).

“Honestly, my relationship with the family has been somehow strained due to the large medical bills. My immediate family constantly blames me for exposing them to difficult financial situations.” (P011).

“The injury has really affected my relationship with my wife and friends. I used to be a loving and caring husband to my wife but all I hear now is that I am useless and a drunkard. Nothing I do is appreciated in the house. My wife still blames the accident on me despite advice from the family that she should not stress me. One day my wife moved out of our home and went to stay with her parents, but she was convinced later by her parents to come back. (P012).

As a result of the thematic analysis, our study identifies some of the cognitive and motivational biases that have contributed to poor safety culture which led to injuries and associated impacts as shown in table 2 (Montibeller, 2015).

Table 2. The cognitive and motivation bias drive from the thematic analysis of qualitative data (adapted from Komljenovic et al., 2017).

Safety culture	Example of poor safety culture	Cognitive bias/descriptions	motivational bias/descriptions
Occupational health and safety (OSH) training which help miners to make an informed decision about the tasks at hand and work environment since I started working in this type of mining activity for the last 2 years, I have never been trained on issues to do with safety. I learned how to operate safely as years goes by (P003)	<ul style="list-style-type: none"> • Myopic problem representation (<i>an important variable is overlooked</i>) (Komljenovic et al., 2017). • Omission of important variables (<i>oversimplified problem representation is adopted based on incomplete mental model</i>) (Komljenovic et al., 2017). 	<ul style="list-style-type: none"> • Desirability of options/choice (<i>This bias leads to over- or underestimating probabilities, consequences, values, or weights in a direction that favours a desired alternative</i>) (Montibeller, 2015). • Groupthink (<i>Voicing untrue opinions or keeping silent due to social pressure</i>) (Komljenovic et al., 2017).

<p>Proper hazards identification and control mechanism to help miners to identify, control and report hazards. This will reduce injuries and improved safety culture.</p>	<p>..... I am not aware of other hazards apart from the rock fall which caused my injured, and carbon monoxide that killed two people last year (P017).</p>	<ul style="list-style-type: none"> • Overconfidence (<i>the Decisionmakers provide estimates for a given parameter that are above the actual performance</i>) (Montibeller, 2015). 	<ul style="list-style-type: none"> • Undesirability of a negative event or consequence (<i>This bias occurs when there is a desire to be cautious, prudent, or conservative in estimates that may be related to harmful consequences</i>) (Montibeller, 2015).
<p>Working processes in which daily tasks are outline and instructions provided.</p>	<p>..... I have worked here for a long time and no single day that the mine owner explained to us how to safely perform any tasks. The instructions we often get relate to production and benefits (P024).</p>	<ul style="list-style-type: none"> • Myopic problem representation (<i>Idem</i>) • Omission of important variables (<i>Idem</i>) 	<ul style="list-style-type: none"> • Undesirability of a negative event or consequence (<i>Idem</i>)
<p>Incident reporting and recording mechanisms, whereby injuries are documented by the mine owners and reported to the local government to improve safety.</p>	<p>..... as a leading hand, I do not record and report on the injuries that happened in my work area. If there is a record, then it is possible with the nearby health facility. I only knew of severe injuries (P031).</p>	<ul style="list-style-type: none"> • Overconfidence (<i>Idem</i>) • Omission of important variables (<i>Idem</i>) 	<ul style="list-style-type: none"> • Confirmation biases (<i>The bias occurs when there is a desire to confirm one's belief, leading to unconscious selectivity in the acquisition and use of evidence</i>) (Montibeller, 2015). • Undesirability of a negative event or consequence (<i>Idem</i>).
<p>Mine owners should be safety conscious. Production should not replace safety.</p>	<p>.....we are encouraged to achieve good tonnages with no focus on the hazards and controls (P019).</p>	<ul style="list-style-type: none"> • Myopic problem representation (<i>Idem</i>) • Omission of important variables (<i>Idem</i>) 	<ul style="list-style-type: none"> • Desirability of options/choice (<i>Idem</i>). • Undesirability of a negative event (<i>Idem</i>).

Individual miners' accountability, whereby individual take care of their own safety and that of their workmates.	... this activity is my sole source of livelihood... returning home safely is always on my mind, but because of the working conditions, I always hope for the best every day (P011).	<ul style="list-style-type: none"> • Myopic problem representation (<i>Idem</i>) • Omission of important variables (<i>Idem</i>) 	<ul style="list-style-type: none"> • Desirability of options/choice (<i>Idem</i>). • Undesirability of a negative event or consequence (<i>Idem</i>).
Effective safety communication, where miners raise any safety concerns with mine owners and the necessary action taken. we rarely raised safety issues with the mine owners. Some of us did raise the safety issues when a government official visits a few months ago but nothing has changed (P023).	<ul style="list-style-type: none"> • Myopic problem representation (<i>Idem</i>) • Omission of important variables (<i>Idem</i>) 	<ul style="list-style-type: none"> • Desirability of options/choice (<i>Idem</i>). • Undesirability of a negative event or consequence (<i>Idem</i>).
Institute insurance policies or compensation programs to help miners and their families financially and emotionally. Thus, allowing them to return to work after full recovery and limited recurrence of injuries. although I got injured at the mine, the medical costs were shoulder by me and family. I used my saving, and my family sold some belongings to offset the cost of injuries. The impacts of medical costs were also felt by an uncle who provide a loan to cover other extra costs that we could not afford (P002).	<ul style="list-style-type: none"> • Overconfidence (<i>Idem</i>) • Omission of important variables (<i>Idem</i>) 	<ul style="list-style-type: none"> • Confirmation biases (<i>Idem</i>). • Undesirability of a negative event or consequence (<i>Idem</i>). • Group thinking (<i>Idem</i>).

4 Discussion

This study was aimed to develop an understanding of the economic and social challenges faced by miners who have experienced severe injuries. To the best of primary authors' knowledge, this study presents the first comprehensive analysis of severely injured miners' firsthand account of their challenges post-injury. The study serves as a platform for the miners to narrate how their quality of life as well as social lifestyle and health has been impacted by injury. The study employs the use of thematic analysis to firmly establish the hypothesis that the injured miners struggled with resultant functional limitations, medical bills,

reduced lifestyle and psychological issues as well as substance abuse despite the financial and social support of family members and friends. Though the study additionally identified a few positive aspects in the well-being of injured miners, the analysis deliberately adopts a subjective approach to focus more on negative economic and social impacts on miners and their dependencies (families).

4.1. Nature and causes of injuries suffered by severely injured miners

The injured miners' description of events leading to injury revealed that most accidents and injuries happened during underground working. This can be attributed to the poor safety culture evident through minimal regards for OSH standards. For example, one of the participants conceded that production superseded their own health and safety. This viewpoint was firmly confirmed by the fact that some of the miners had no prior health and safety training and never used PPE as they operated with 'hope and faith of coming out fine'. The study findings complement a survey conducted by Lecomte et al. (2012), whereby the study findings indicated a high incidence of employee noncompliance with the set federal and corporate regulations to wear the appropriate PPE. The researcher concluded that this was mainly influenced by the ignorance of the employees. Moreover, the responses and the accident incidents established that the increased noncompliance with protocols resulted in an alarming threat to the safety and health of workers.

The study results also revealed that majority of severely injured miners had sustained back injury, spinal cord injuries and fracture in the leg as well as joints, arms, and shoulders. The participants also reported cases of permanent disability and amputations. In addition, the respondents also shared unfortunate incidences where some of their colleagues died instantly at the accident site while others died during treatment. These findings are in line with several studies conducted in sub-Saharan African countries, where injuries were found to be distributed

in different body parts with varying degree of severity and causation mechanisms (Boniface et al., 2013; Calys-Tagoe et al., 2015; Elenge et al., 2013; Kyeremateng-Amoah et al., 2015; Long et al., 2015).

Correspondingly, Rop (2017) conducted a study focused on assessing and evaluating the circumstances during the occurrence of injury and nature of the injury. The study significantly contributed towards the available literature, whereby miners were found to lack mitigation barriers such as safety boots, gloves, helmets, goggles, and ear muffs. The lack of safety equipment is attributed to the absence of funds, negligence, and ignorance of the miners, poor law enforcement from the concerned authorities, and the dearth of skills and adequate training specific to OHS.

4.2. Livelihood and lifestyle of severely injured miners' post-injury

On post-injury consequences, the study found that some participants experienced functional limitations (i.e., on-job and off-job performance restrictions) which forced them to change jobs. Consequently, causing a reduction in the injured miner's income and self-worth. In a study conducted by Floyd et al. (1997), it was found that the majority of injured workers reported back to work soon after the accident due to financial constraints. The study also showed that they continued working in the mines regardless of the experience. Moreover, the injured workers were found to be incapacitated in diverse attributes towards undertaking or resuming their previous duties as before the injury. Thus, they were forced to opt for simpler tasks or even in some cases change to other individual workstations.

In addition to job change at the mine, some of the injured participants had to remove themselves from the activity temporarily during the nursing period or permanently due to disability. The findings correspond with the work of Boniface et al. (2013), which shows that some proportion of the miners went back to work and in fact, continued working in the mines

regardless of their experience. However, some of the injured workers were forced to stop working due to the severity of injuries.

Besides the on-job restriction, the participants revealed that their injuries also resulted in limiting their ADLs (activities of daily living) and daily household roles. As a result, the women and children were exposed to performing tasks such as digging, ploughing and catering for livestock which are culturally considered for male and older people. These findings from the current study correspond to a survey conducted by Hensler et al. (1991), which detailed some of the family impacts from workplace injuries. The results of the study indicated to a great extent that injured individual's involvement in household activities was adversely affected post-injury. The increased demand for care from their family or caregiver was found to be time-consuming, thus reducing their participation level in household activities.

The study also established that occupational injuries significantly impacted the economics of injured persons and their families. The study established that hefty medical bills, lack of support from mine management as well as lack of insurance cover or compensation resulted in distressful financial position. Furthermore, the miners reported a depletion of saving which, in fact, subsequently pushed them to sell their assets and enter debt. The findings concurred that the effect of injury on savings reflected on the outcomes of a study conducted by Subramanian et al. (1991), which indicated that in most cases the impacts of injuries at work were similar to those of no work. The study acknowledged that the financial demands due to additional medical needs impose a greater danger on the families' savings, thereby, making them unable to save money for future expenses. Several other studies (Morse et al., 1998; Cantor et al., 2001), in alignment demonstrated that injured workers and their families are forced by circumstances to mortgage or even sell off some or all of its properties in order to help settle the post-injury expenses.

It was revealed that the mining management extended help and support to very few participants towards covering their medical bills. However, the participants pointed out that the management only paid a partial bill leaving the bigger part of the bill for the injured worker. Correspondingly, Groves et al. (2007) conducted a study on the evident injuries in mining sites. The study findings indicated that in majority cases the organisations were found to incur both direct and indirect costs from workplace accidents and injuries. In several cases, the mine management helped in settling medical expenses for workers injured in their workplaces (costs of their treatment and costs of health). The families of the injured were found to experience considerable financial and emotional suffering and this evidences an impending need to better understand the relationships between occupational safety management style, safety practices and reflected injury records.

It was noted that the mining management was not legally obligated to cater to the medical bills resulting from mine injuries, and hence the participants had no other alternative but to assume responsibility towards their own medical bills. It was also established that the mine management lacked any compensation policies/programs for the employee welfare, specific to this aspect. Mendelson (2003) noted in their discussion that the majority of workplace injuries are resolved within the time frame. The discussion also pointed out that a worker's compensation scheme projects comparatively poorer outcomes for pain management in the patients compared to those being treated for the same problem in a non-compensation environment.

Furthermore, regarding insurance, few participants responded being covered under insurance, which indeed helped them pay partial bills. However, the partial payment still left the large proportion of bills untended, thereby, forcing the participants to seek help from family and friends. The individuals who were not insured had to shoulder the complete burden of the

medical bills. The findings were in alignment with Reville et al. (2001) study which found that private and social insurance helps mitigate the financial effects of workplace injuries on families, although with limited success. The treatment costs for injury show a great variance and, in most cases, and availability of insurance cover helps lessen the expenses burden on the families involved.

The participants also were found to seek medical assistance from traditional healers' due to lack of sufficient money. The findings correspond to a survey conducted by Hensler et al. (1991), which indicated that in most cases traditional healers were used as an option by people facing affordability issues as regards the medical costs, in addition to individuals who still believed in the power of the traditional healers.

As a consequence of the reduced economic position of injured persons and their families, the participants revealed lifestyle impacts (i.e., poor quality of life), alteration between the breadwinners' roles, withdrawal of children from school and debt, amongst others. The findings of the study correspond with the study conducted by Kalyani et al. (2014). Their study indicated the difference between the quality of life before and after injury. The study showed that family health and emotional support for the affected family from friends and family were among the key determinants of the quality of life for the injured person. In another study, the income of the family and its expenditure were studied before and after injury to determine the trend, the study correspondingly revealed that the income was less after injury while expenditure was found to be increasing, which apparently affected the quality of life of the injured person as well as the family (Prinja et al., 2015).

The changing of breadwinners' roles was also evidenced in the work belonging to Strunin (2004) where the authors revealed that injured workers with back problems encountered challenges in participating fully or partially in certain family roles. For instance,

in the case of married couples, the study found out that in case the husband was injured the wife in most cases was forced to take up the role of a caregiver (i.e., attending to the needs of the injured as well as to provide the family's basic needs). The study revealed that these changes assumed a permanent or transitory status depending on the recovery process of the injured person. Research reveals that the majority of these injuries were inflicted on the males who are typically known to play a vital role in providing the basic needs to their families. Thus, the injury and associated debilitated condition affected his family to a great extent. The study findings corroborate the hypothesis that in some cases, the partners of injured participants have to take the lead in providing for the family.

The impact of injury on family finances was observed when the participants reported that they had to withdraw children from school and incur financial loans. Children were forced to drop from school because of lack of school fees affordability. Also, children were transferred from private schools to public schools. All these changes were attributed to the fact that the injured household head was the main breadwinner. The children were also forced to work at the mines over the school holidays in order to help meet family financial needs. The impacts of work-related injuries and illnesses on the breadwinner, thus have been evidenced to pose a great loss to the family. Proctor and Dalaker (2002) furthermore revealed that the families with one parent, faced worse impacts from work incapacitation due to injuries as the total earnings of the family are affected.

In addition to adverse economic consequences, the study also established a common exposure of the injured workers to mental and emotional trauma, as shared by the interviewed participants. The participants also revealed reduced self-esteem among the co-workers and as such, the injuries affected their relationship with those who misunderstood their circumstances. This finding is consistent with study conducted by Beedie et al. (2000), which revealed that

negative mood states, such as depression (feelings of hopelessness and worthlessness), fatigue (feelings of mental and physical overexertion), confusion (feelings of bewilderment and uncertainty), anger (feelings of annoyance, aggravation, fury and rage) and tension (feelings of nervousness, apprehension and anxiety) are associated with debilitated performance.

Moreover, the participants expressed being stressed as well as depressed because of their current situation. The financing of the treatment through family earnings made some participants feel bad and regretful of being involved in the accident. This feeling, in fact, increased when the participants witnessed the family undergoing financial struggles without any immediate assistant. Resultantly, several participants shared that they contemplated committing suicide. The reflection on the accidents also made some participants blame themselves for being not sufficiently careful, or even engaging in mining activities, while others showed being emotionally vulnerable when recounting the events leading to the accident and associated adversity. The findings correspond to those of Chang et al. (2005); the study observed that workers suffering from industrial accidents had significantly high levels of anxiety and depression. Choi Lim, Choi Kang and Yum (2002) also added that the prevalence of post-traumatic stress disorder among individuals involved in accidents or injury was high, and the symptoms persisted for a longer duration. Miners who experienced the death of their fellow workers were also evidenced to encounter major psychological problems. These depression related findings were also found in the study by Kang et al. (2017), wherein, the participants complained of feeling uneasy, having trouble sleeping and irritability. They were also found to have recurring memories of the accident. Additionally, the participants of the study also reflected on feelings of guilt, shock, and fear.

The current study also demonstrated that injured miners frequently engaged in substance abuse to either forget their problems or relieve themselves from pain. Abraham

Maslow has put it succinctly: ‘What we call normal in psychology is really a psychopathology of the average, so undramatic and so widely spread that we don’t even notice it ordinarily’. William Berry, in his article, challenged people to look at their life and decide on escaping it or embracing it (Berry, 2011). The pattern of abusing drugs and consumption, were as such, majorly found to be used to forget all problems and situations, which is in fact, just a temporary escape.

The social relationship between family, friends and injury miners was also assessed to suffer as a consequence of ASM injuries. Some of the participants reported having been helped by their family and friends financially and emotionally. Mason Ellis in his article, indicated that support system of family, friends, and caregivers after an injury is very vital to recover and adapt to new life (Ellis, 2017). He also added that the characteristics of love, trust, and care also play an essential role. Correspondingly, family relationships and support from friends was found to be of importance to the wellbeing of the injured person, financially as well as emotionally.

Contrastingly, other participants cited the challenge of strained social relationships with their family members. Some of the participants’ wives were not keen to assume the role of caretaker and provide care, and some children had to face bullying at the school because of one of their parent’s disability. Such incidences, naturally, caused a conflict of the injured mineworkers with their wives as well as lowering of self-esteem in the children. The findings established the social effects of injury as revealed in a study conducted by Kang et al. (2017). According to the study results, the workers subjected to industrial accidents experience significantly high anxiety and depression levels. A study conducted by Kaczmarek et al. (2012) found that accidents significantly affected the involved miners’ mental and social life. Among

the miners who were involved in the coal mining disaster in Poland, it is evident that the miners who survived sustained major damage to their health.

Additionally, the participants highlighted that their injuries led to the loss of some friends, as, despite the frequent visits during the initial phase of injuries with the progression of time, the majority faded away. Thereby, the injured participants came to think of themselves as a burden and/or unwanted individual among his/her peers. However, few injured individuals continued to maintain some of their friendships. This pattern of loss of friends is aligned with the data compiled by Kang et al. (2017) showing that the majority of those affected by the accident felt a significant disconnection from other people. Consequently, this isolation posed an adverse effect on their recovery since one of the ways to cope with their feelings entails talking to friends and relatives. Somer et al. (2001) conducted a study on the effect of injury on social life and indicated that injured individual often requires hospitalisation and rehabilitation. These two essential treatment mechanisms, were in fact, demarcated to cause separation from friends and family. As such, post-discharge the relationship levels (i.e., from hospital or rehabilitation centre) between the injured person and others was found to be on a different level.

5. Limitations, conclusion, and recommendations

This study is the first comprehensive qualitative analysis performed on the economic and social consequences faced by the ASM miners. The information gathered was based on the first-hand account from the participants. The study recommended future research to spend a significant amount of time with participants in order to optimally observe and document the daily struggles of injured ASM operators. In addition, the study recommends that quantitative data should be collected in the initial phase, with the purpose to complement qualitative data.

This implies that the numerical values of past earning, present earning, savings, medical expenses' records as well as ranging of social health and lifestyle ranging should be prioritised.

In conclusion, the study has demonstrated that ASGM operations in Migori County experienced several occupational injuries with serious post-injury economic and social implications. The majority of the participants interviewed reported reduced economic sufficiency as well as negative social health and lifestyle changes. The most cited causes of declined economic affordability include job changes and huge medical expenses. The participants also reported facing low self-esteem, loss of friends, depression, family issues, increased drug usage as well as reduced physical abilities to perform daily household roles. Considering these significantly high number of issues experienced by the injured miners, it is imperative that the Kenya government should initiate education-oriented programs for miners on the hazards and associated risks as well as issue miners with necessary PPE and permits. The study, in addition, recommends the development of legal programs that enforced compensation for individuals in the informal sector as well as provide necessary assistance to injured miners and their families.

Ethics Consideration

Prior to conducting the study, the ethics approvals were obtained from the Curtin University Human Research Ethics Committee (HREC) and Strathmore University Institutional Review Board (SU-IRB), while all the pertinent permits were provided by the Government of Kenya (GOK).

Declaration of interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Submission declaration and verification

This Manuscript or parts of it is not under consideration for publication by any other journal.

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Authors' contributions

Mr. Michael Mayom Ajith and Dr. Apurna Kumar Ghosh both contributed substantially to the submitted work and has reviewed and agrees with the submission of the manuscript for review.

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