AN INVESTIGATION OF FACTORS CONTRIBUTING TO OCCUPATIONAL ACCIDENTS AMONG MINEWORKERS IN THE DIMENSION STONE QUARRY MINE OF THE MUTOKO RURAL DISTRICT COUNCIL, ZIMBABWE

BY

NAME OF STUDENT: KASHIRI, L.W.

STUDENT NUMBER: 11634799

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SUPERVISOR: DR N.S. MASHAU

CO-SUPERVISOR: MR E. MHLONGO

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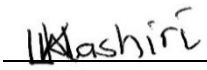
DECLARATION

I, **KASHIRI LISA WADZANAI** hereby affirm that the mini-dissertation titled: “An investigation of factors contributing to occupational accidents among mineworkers in the dimension stone quarry mine of the Mutoko Rural District Council, Zimbabwe” is my personal work and has not been submitted for any degree in this University or any other institution, and that all citations and material in additional sources have been appropriately acknowledged by complete references.



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KASHIRI LISA DATE

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LIST OF ACRONYMS AND ABBREVIATIONS

EIA:	Environmental Impact Assessments
HSE:	Health Safety Executive
ILO:	International Labour Organisation
MRDC:	Mutoko Rural District Council
MSHA:	Mine Safety and Health Administration
NIOSH:	National Institute of Occupational Safety and Health
OHS:	Occupational health and safety.
OHSMS:	Occupational Health and Safety Management system.
PPE:	Personal Protective Equipment.
SPSS:	Statistical Package for Social Sciences
WHO:	World Health Organization in association

ABSTRACT

Background: Globally, quarry mining is one of the popular but highly hazardous industries to work in as compared to other industries. It exposes employees to a range of health hazards

Purpose: To investigate factors contributing to occupational accidents in dimension stone quarry of Mutoko Rural District Council, Zimbabwe.

Methodology: A quantitative approach using a descriptive cross-sectional survey design was used to investigate factors contributing to occupational accidents in the dimension stone quarry mine of the Mutoko, Zimbabwe. A sample size of 253 was determined by the Slovin's formula. A stratified selection technique was used to choose participants from all the five dimension quarry mines. A self-administered open and close-ended questionnaire was used to collect the data. Data was coded and entered into a computer using Microsoft Excel 2010, and analysed using the Statistical Package for Social Scientists version 26.0.

Results : About 87.3% of the participants revealed that there were incidences of unsafe aspects of the work in the quarry that can harm their health. 23% were trained participants on safety precautions, and 46% of the respondents did not use protective clothing while at work. The cross tabulation and the chi-square test was statistically significant, as it showed that education level influences the occurrence of occupational accidents (P= 0.000) Results further revealed that age influences the occurrence of occupational accidents with the conclusion that the older a person gets, the more likely they are to have accidents or get injured at the quarry mine workplace (P= 0.000)

Conclusion: The findings take the lead toward a conclusion that participants had work-related health and safety challenges related to quarrying activities. The researcher urges the authorities to ensure that the quarry management and quarry workers follow the regulations on occupational health and safety.

Keywords: Dimension stone quarry, Factors, Investigation, Mine, Occupational accidents,

CHAPTER 1: INTRODUCTION

1.1. BACKGROUND OF THE STUDY

In spite of many safety and health intervention studies, occupational accidents remain a challenge, especially in underground mining and quarrying (Zwetsloot, 2017). According to the National Social Security Authority (NSSA, 2014), in 2014, occupational deaths increased by 49%, and occupational injuries increased by 36% from the previous year in Zimbabwe. The p7revalence of occupational accidents in mining and quarrying industry remains a challenge to mining and quarrying leadership (Cooper, 2015)

Universally, rock quarrying is very popular, but it is also one of the most hazardous industries to work in (Okafor, 2016). The European Agency for Safety and Health at Work (2015), states that people who work in the quarry mines are more likely to be killed in an occupational accident than construction workers, and 13 times more likely to die at work than those in manufacturing industries. The World Health Organization (WHO, 2015), nots with concern that 1.7 million people worldwide die annually of work-related injuries and illnesses. The Mines Inspection Agency of Greece (MIAG), recorded a 37.7% fatality rate (number of fatal accidents per 100,000 workers) for the overall quarrying sector between 2004 and 2014. In France, about 44% of all fatal occupational accidents in 2014 were related to quarrying, while in Germany, between 2013 and 2014, 48% of all accidents reported were from the quarrying sector (International Labour Organisation, 2015). Due to the high number of accidents, injuries, illnesses and fatalities throughout the world, the quarrying industry has frequently been classified as an unhealthy industry (Smallwood and Haupt, 2017).

The biggest challenges in quarry and underground mining operations is safety (Verma and Chaudhari, 2017). This statement is supported by recent mining disasters such as the infamous Soma disaster in Turkey (January 5, 2015), which claimed the lives of 301 workers, the Chile mining accident (August 5, 2010), the Crandall Canyon disaster in United Sates of America (August 6, 2007) wherein six miners and three rescuers were killed at the Crandall Canyon mine in Emery County when the mine collapsed, the Xiaojiawan coal mine disaster in China (August 29, 2012), and the Tanzanite mine disaster of 2002 that claimed 65 lives after floods swept into the mine tunnel (Boniface, 2013). These incidents and many more have contributed to the classification of mining as the most hazardous occupation in the world. Although mining employees represent only 1% of the global workforce, they account for about 8% of workplace fatalities. Workplace injuries in the mining industry worldwide have also been reported to be very high by the International Labor Organization (ILO, 2017).

Research on first aid and medical treatment for people who have been injured in Australia done by Foster in 2017, revealed that at the quarries, workers who are injured receive insufficient treatment and first aid and also there was lack of proper transportation of injured persons, which ended up worsening the injuries. The study furthermore discovered that most quarry mine workers were not trained in first aid.

In Africa, most of the work-related health problems and fatalities in the quarry sector are linked with labour intensive operations (Chigoda ,2010). The major airborne hazards in the mining industry include several types of particulates, naturally occurring gases, engine and exhaust fumes, as well as biochemical fumes and dust. The principal physical hazards in the quarry mines include noise, vibration and heat, all these hazards differ in their occurrence, depending on the type and depth of the quarry mine. There is also a high risk of transmission of infectious diseases such as tuberculosis and the Human Immunodeficiency Virus among the quarry miners who live together in secluded locations.

Quarrying operations involve drilling, crushing of rock materials, and blasting, and the products produced are mostly used for industrial, domestic and agricultural purposes. The numerous effects created by these processes are both size and location dependent. Manifestations of specific impacts are on the air, water, soil, earth surface, flora and fauna, and human beings (Enger, et al., 2015). The negative effects that the quarry has on the environment include land degradation, soil erosion, decline of ground water, dust and the production of noxious gases

Between 2002 and 2017, 200 mining-linked fatality rates were verified each year in South Africa (SA Chamber of Mines, 2017). The coal, platinum and gold mining sectors contribute over 80% of the fatalities recorded in the mining industry (SA Chamber of Mines, 2016). Since 2003, the reductions in fatalities and injuries have been 20 – 25% short of annual targets set by stake-holders at the mine health and safety summit of 2003 (Hermanus, 2007). These statistics show the enormity of the challenge surrounding mining safety in South Africa.

The situation of quarries in Zimbabwe can be mirrored by quarrying environments elsewhere however, however, the extent of workplace injuries and fatalities is not well known, the quarrying in Zimbabwe suffers from a lot of limitations such as lack of basic knowledge, safety measures, poor working conditions, low socio-economic status of workers, lack of clear quarrying legislation, and environmental dilapidation, which all need exceptional attention. Some workers get injured, others are constantly ill, while some die due to work conditions (Chigonda, 2010).

The safety and health agency reported that in 2014, occupational deaths increased 49% and occupational injuries increased 36% from the previous year in Zimbabwe (NSSA, 2014). NSSA (2014) reported that 71% of the registered companies in Zimbabwe were compliant with

occupational health and safety regulation, whereas 29% were not , thereby exposing employees to occupational hazards risk. Although accident prevention strategies exist in Zimbabwe, limited empirical evidence addresses strategies to improve occupational safety and health (Zwetsloot, 2017). Occupational safety and health include organization policies, regulations, procedures, leadership, and training that guide workers behaviours and practices in the workplace (Kim et al., 2016). Improving workplace safety and health requires well-defined safety and health behaviours, attitudes, and commitment (Amponsah-Tawiah & Mensah, 2016)

Most of the dimension stone quarries in the country have been operating since 1970, producing granite stones which are used for different purposes, such as tombstones and kitchen furniture.These mining companies have a history of accidents and fatalities. As stated in the Safety and Health policy 2014 of Zimbabwe, the dimension stone quarries are bided by other legal bodies to improve the safety and health of its employees. Regardless of all the procedures and measures taken to prevent accidents, they still occur at an alarming rate.

1.2. PROBLEM STATEMENT

Quarry mines have a reputation for being a particularly unhealthy industry (HSE, 2012) because their rate of work related injuries and illness. These work-related injuries, illnesses and deaths are a results of the physical nature of the work involved, coupled with poor workplace health and safety standards in quarrying activities. Occupational health and safety hazards are more pronounced in manual quarry operations as is the case in the dimension stone quarry mines in Mutoko Rural district Council. The Natural Stones Mine (NSC) which is one of the dimension quarry mine in Mutoko witnessed various quarry accidents with a significant amount of these accident going unreported . According to the annual report of Natural Stones Company (2016), approximately six mineworkers get injured weekly in these mines. There have been several reported accidents at NSC for instance, five people died instantly and six others hospitalised in august 2017 after quarry walls collapsed(NSC 2017 annual report). After this incidence the quarrying activities at the Natural stones Company was stopped by the District Commissioner for two weeks for investigation. Given the rise in occupational accidents as indicated, little is known regarding the factors contributing to occupational accidents among mine workers in dimension stones quarry mines of Mutoko Rural District Council

1.3 RATIONALE OF THE STUDY

Work-related dangers related to the quarry specialists are well inquired about generally; be that as it may, little is known about work-related well-being within the African quarrying industry (Smallwood & Ehrlich, 2011), whereas the total quarrying risks proceed to constitute the biggest category of work- related mishaps and regularly result in drawn out incapacities (NIOSH, 2015). The quarry workers are exposed to a variety of health hazards, thus, the health problems among quarry workers are relevant because of the number of high-risk activities involved, and the peripatetic nature of the workforce.

In Sub-Saharan African public health institutions, child mortality, malaria, water quality and HIV/AIDS have overshadowed occupational health problems, with a vast majority of contemporary research based on the above public health problems (Spee, 2016). Moreover, the research that comes close to the plight of quarry workers is focussed on urban industries, forgetting quarry workers, whose plights go unnoticed until a calamity occurs. To combat the health-related problems associated with quarrying activities, understanding the biodata of the quarry workers and the conditions of the working environment is important, because regardless of the apparent risks, they still venture to work within the quarries. According to the Zimbabwe mining resource (2010,) the dimension stones quarry mines in Mutoko are one of the biggest quarries in Zimbabwe, and have had the highest number of manual quarry workers as compared to other quarries country wide, but the occupational injuries and fatalities in these mines continue to occur at an alarming rate and there are no known studies which have focused on investigating the factors contributing to these occupational accidents in the dimension stones quarry mine in the Mutoko Rural District Council.

1.5 SIGNIFICANCE OF THE STUDY

The study might serve as a convenient update of the threats related to quarry mining and can be valuable to miners, employers, approach producers and advocates in that it will offer information that might educate policy-makers of safety in quarry mines. The study may also assist the Ministry of mines and resources , and Department of Health to strengthen and promote safety in workplace. This may also benefit the mineworkers through encouraging and promoting safety in workplace and could point to how relevant knowledge on safety contributes to lesser injuries to miners and its overall benefit to the company. The study might bring to the fore which area of safety training is lacking as well as the additional safety equipment needed to maximize workers' safety .Furthermore, the study might also serve as a springboard for further research in the same line

1.6 AIM OF THE STUDY

To investigate factors contributing to occupational accidents among mineworkers in the dimension stone quarry mine of the Mutoko Rural District Council, Zimbabwe.

1.7 OBJECTIVES OF THE STUDY

The objectives of this study were to:

- Describe the human factors contributing to occupational accidents in mineworkers of the dimension stone quarry of the Mutoko Rural District Council, in Zimbabwe,
- Assess the environmental factors contributing to occupational accidents of mineworkers in the dimension stone quarry of the Mutoko Rural District Council in Zimbabwe, and
- Assess the operational factors contributing to occupational accidents in mineworkers of the dimension stone quarry of the Mutoko Rural District Council, in Zimbabwe.

1.8 CONCEPTUAL FRAMEWORK

This study was underpinned by the Epidemiological Model which is also known as the Epidemiological Triad or Triangle. In this study, the model guided in the development of objectives in order to investigate the factors contributing to quarry mine accidents, focusing on the mine environment, miners' human factors and the operational factors. The model was used to develop a questionnaire in order to capture data on factors which contribute to accidents from the mineworkers, focusing on the environment in which mining is taking place, operations, and the workers themselves (Hattingh & Accut, 2010).

The interaction between humans as the host, the operations as the agent, and the environment in which the operation takes place, indicates the close relationship between a state of well-being and illness. This also applies to safety, if one of those three factors (host, agent or environment) causes a problem, accidents may occur in the mine which may cause serious harm not only to the employee, but also to the community at large. For example, if the human host has a physical problem such as poor eyesight, the agent is affected in such a way that operations cannot be carried out, procedures cannot be followed, and safety of workers is threatened (Hattingh, et al., 2010). Figure 1 shows the causes of accidents in the epidemiological triad triangle

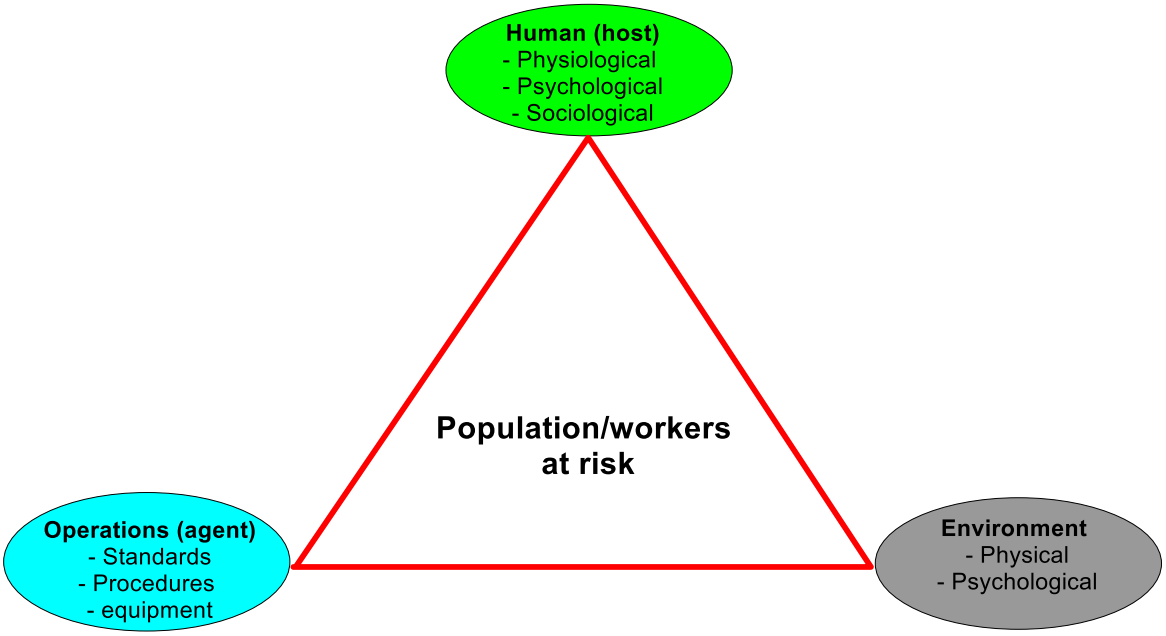

Figure 1: The epidemiological triad (Hattingh & Accut, 2010)

The epidemiological triad in Figure 1 shows the three main factors which contribute to the occurrence of accidents in the workplace, which are the human factors, operational factors and environmental factors. If there is poor lighting in the mine environment, the worker (host) cannot see, procedures cannot be performed effectively, equipment cannot be used according to standards, and this may result in an accident. The identification of the relationship between the agent, environment and the workers is the first step towards a thorough description of the occurrence of the injury or accident. The pattern of occurrence permits identification of the problem at greater risk.

1.9. DEFINITIONS OF CONCEPTS

Quarry mining

A quarry is an open pit mine in which dimension stone, rock, construction aggregate, riprap, sand gravel, or slate is excavated from the ground. The products of dimension stone quarries are prismatic blocks of rocks such as marble, granite, limestone, sandstone and slate (Acutt & Hattingh, 2015). In this study, the quarry mining refers to quarry mines of the Mutoko Rural District Council, in Zimbabwe.

Factors

Factors are circumstances, facts or influencers that contribute to a condition that helps produce or influence a result (Acutt & Hattingh, 2015). In this study, the term factors refers to influences such as the human, environmental and operational factors that may contribute to accidents or injuries at dimension stones quarry mines of the Mutoko Rural District Council Zimbabwe

Investigation

An investigation is a formal or systematic examination or search, or the act or process of examining a crime problem, specially to discover the truth (International Labour Organization, 2012). In this study investigation refers to the search for factors contributing to occupational accidents at dimension stone quarry mines of the Mutoko Rural District Council, Zimbabwe.

Occupational accident

An occupational accident is characterized as an undesired circumstances emerging out of work that grants rise to sick well-being or harm to the body (Worldwide Work Organization, 2012). In this study, an occupational accident refers to a work-related exposure to an unplanned event which results in injury or ill-health or death experienced by mine workers while working at the dimension stones quarry mines of the Mutoko Rural District Council, Zimbabwe

Occupational injury

An occupational injury refers to any injury endured by a person, or any death resulting from occupational accidents (Ministry of Health and Social Services of Namibia, 2016). In this study, an occupational injury refers to the injury sustained by the mine worker arising from an accident at a mining site at the dimension stones quarry mines of Mutoko, Zimbabwe.

1.10 ARRANGEMENT OF CHAPTERS

This study is divided into six chapters as follows:

Chapter 1 introduced the study, gave the statement of the problem, purpose, significance, aim, objectives and definition of key terms.

Chapter 2 is centred on the literature review, which highlights the overview of occupational accidents on an international level, in other African countries, and in Zimbabwe. It also examines factors that contribute to occupational accidents in the quarry mines which are environmental factors, operational factors and the human factors

Chapter 3 outlines research approaches that were applied in the data gathering, collection, presentation and analysis of the study.

Chapter 4 presents the research findings.

Chapter 5 presents an interpretation and discussion of the findings.

Chapter 6 presents the realized conclusions and suggested recommendations.

1.11 CHAPTER SUMMARY

This chapter provided the background of the study. It covered the occupational accidents that have occurred in other countries outside Africa, in other African countries and in Zimbabwe. It also covers the problem of the study, rationale of the study, significance of the study, theoretical framework and definition of concepts.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents a review of literature on the occupational accidents and health hazards associated with quarry mining and the factors contributing to occupational accidents in quarry mines which are the human factors, environmental factors and operational factors.

2.2 OCCUPATIONAL ACCIDENTS AND HEALTH HAZARDS ASSOCIATED WITH QUARRY MINING

Rock quarrying and stone crushing is a global phenomenon and has been the cause of concern everywhere in the world, including the developed countries. Quarrying activity is a necessity that provides much of the materials used in traditional hard flooring, such as granite, limestone, marble, sandstone, slate and even just clay to make ceramic tiles. However, like many other man-made activities (anthropogenic factors), quarrying activities cause significant impact on health and the environment (Okafor, 2016), for example, it is often necessary to blast rocks with explosives in order to extract material for processing but this method of extraction gives rise to noise pollution, air pollution, vibration and damage to biodiversity an the fragments from the rock may harm the quarry workers if they do not wear the proper Personal Protective Equipment to protect themselves.

In the European Union (excluding Greece and Northern Ireland), some 8.1 % of those aged 15 to 64 that worked or had previously worked in Quarry reported a work-related health problem in the 12 months prior to a Labour Force Survey 2017 module on accidents at work and work-related health problem, this was equivalent to approximately 23 million persons (ESAW, 2017). Results from the survey showed that the occurrence of work-related health accidents and injuries generally increased with age, but the rate of increase slowed down for workers aged 55 to 64 years due to these workers leaving the workforce early. Workers with a low level of education reported work-related health problems and accidents more often than their colleagues. In particular, this group of workers was more often identified with musculo-skeletal health problems as their most serious work-related health problem, whereas persons with higher levels of education most often identified stress, depression or anxiety as their main work-related health problem. Furthermore, manual workers more often reported work-related health problems than non- manual workers. Work-related health problems mostly occurred in agriculture, mining and quarrying sectors. Upto 13% of workers in the mining and quarrying sectors reported health problems during the same period of the survey with back problems (28%), neck, shoulder, arm or hand problems (19%), and stress, depression or anxiety (14%);

musculo-skeletal problems were most often reported as the main work-related health problem 59.8 % (Labour Force Survey 2017).

A report from the Australian Institute of Mining and Metallurgy gave the attrition rate as one in three within the first 12 months (Duffy, 2012). According to the findings of a research by Ahmed et al. (2016) 8% mines and industrial workers in Australia reported dislocation, 4% fracture of vertebrae column, 6% traumatic amputation, 12% open wounds, 28% contusion with intact skin surface and the most prevalent injury was sprains and strains, accounting for over 40% of all injuries.

Quarrying operations generate large quantities of dust that cause a variety of respiratory diseases amongst quarry workers. Pneumoconiosis, the general term given to a range of lung diseases caused by breathing dusts, typically causes chest tightness, shortness of breath and coughing (Encyclopædia Britannica, 2017). According to (Duffy, 2012), continued exposure may result to the develop of chronic bronchitis or emphysema. Silicosis is the most likely form of pneumoconiosis and is dangerous to mine and quarry workers. Silicosis is contracted by breathing respirable silica dust in one of its pure crystalline forms. As a result, crushing or blasting rocks with crystalline silica present is likely to leave nearby workers at a high risk of contracting the disease

Britannica, 2017 stated that use of hand-held vibrating tools in quarries causes a health problem known as Hand–Arm Vibration Syndrome (HAVS), whose symptoms include tingling, numbness, loss of grip strength and pain Nyantubu,et al., (2017) conducted a study at a quarry site in South Africa, where 156 workers with occupational exposure to vibration, and 140 workers with no exposure to vibration were randomly selected for the study. The results showed that the prevalence of HAVS in vibration-exposed
workers was 15%, with a mean latent period of 5 to 6 years compared to the non-exposed, with 5% prevalence. The two groups, however, gave a history of exposure to rock drills. Noise-induced hearing loss is also a common health problem associated with quarrying and, according to Futatsuka, et al. (2015), noise is mostly produced by either impact or vibration. This happens at the stone crushing unit, when boulders are crushed and transported along conveyors, at the boulder loading point when boulders are fed into receiving pit, and at the sieves when the gravel is sorted. Noise can have the following effects on the health of workers and owners: distortion of sounds (hearing something, but not understanding), temporary or permanent hearing loss, a continual ringing in the ears for which there is no cure also referred to as tinnitus in medical terms, a quickened pulse rate, increased blood pressure and a

narrowing of the blood vessels, abnormal secretions of hormones, muscle tensing, nervousness, sleeplessness and fatigue (Nyantubu,et al.,2017) .

2.3 FACTORS CONTRIBUTING TO OCCUPATIONAL ACCIDENTS IN QUARRY MINES

This literature study will be broken down into sections according to the objectives and the epidemiological triad that have been outlined in chapter one, this section will explain factors contributing to occupational accidents in mine such as, human factors, mechanical factors and environmental factors.

2.3.1 Human factors that contribute to accidents in Quarry mines.

Kovacs, et al., (2020) state that most of the accidents in the quarry mines are caused by human error. Bae, (2019) adds that these human factors include physiological, psychological, quality of work and safety values. Branco, et al., (2019) define human error as any deviation from the performance of a specified or prescribed sequence of actions.However, as operators endeavor to become more efficient and productive, and have to deal with time pressures, their instructions and written procedures are almost never followed precisely. Leveson (2015), continues that a common method for workers to apply pressure to management without actually going on strike, is to work to rule, which can lead to a collapse in productivity.

Leveson (2015),stated that humans are progressively sharing more control of systems with automation and are moving into situations of higher-level decision making with automation implementing the decisions. These changes are leading to new types of human error and a new distribution of human errors; for example, an increasingly significant factor in accidents is the inadequacies in communication between humans and machines. This can lead to several recent accidents that were blamed on operator error, although they could more correctly be categorized as a consequence of a flawed system and interface design. Multiple errors can be made here, such as not fully understanding the data, not receiving enough data, forming the wrong conclusions and taking the wrong action. This leads Leveson (2015), to state that going forward from here, formulating new and more effective accident models will necessitate transferring the emphasis in explaining the role of humans in accidents from error or deviations from normative procedures to pay more attention on the mechanisms and factors that shape human behavior.

Branco, et. al., (2019) states that accidents are not necessarily the operator's fault; often the factors that caused the operators error may be the prime cause of the accident. Furthermore, Bae, (2019) defines four central factors that influence human behaviour and as such can influence an accident. These four factors are ergonomics, anthropometrics, physiology, and

psychology. Ergonomics refers to the design of machines and equipment such that it matches the capacities of the people who will be operating it (Duarte, et al.,2019) . Ergonomics can be made up of the working environment, such as temperature, lighting, noise and space, mental capacity of humans (for example, to match the design to the mental ability and skills of the operators and maintenance staff), the human control loop, information (for example, unambiguous and sufficient data in order to lead to a clearly defined course of action, as too much data can cause confusion and bewilderment and too little data may cause a wrong conclusion), and operator controls for example, the arrangement of controls must be in some logical order and in some sort of symmetry to help prevent the operator selecting the wrong item in a moment of panic or loss of concentration

Anthropometrics deals with humans being different (for example, different sizes and shapes due to sex or ethnicity), which needs to be taken into consideration in design (for example, short people cannot see out of a car window or an overweight person cannot work in a confined space).

Physiology deals with the human physical factors and limits. Wong (2015) states that despite a human having five senses, they in general only use two in the working environment, these being sight and sound. Furthermore, there are two main causes of accidents associated with physiology; these are task overload and fatigue.

Duarte, et al., (2019) state that psychology is significant in how people perform, as well as the attitudes they have. What is more, humans are not robots, and they reason and have emotions that affect the way they behave. There are five factors that psychology can be divided into, firstly, mental state of humans, which are emotional factors that are challenging to account for and to detect such as lack of concentration, lack of motivation, a conscious disregard to instructions, (Bae, 2019). Secondly, a fixed mind set, such as operators cutting corners because they know their performance is measured by productive output. Next, complacency, which refers to a relaxed state of mind without fear or stress, in this case an operator is no longer alert for possible hazardous situations. Fourthly, mental capacity; it is known that everyone has different capacities and overloading a person inflicts a risk of mental breakdown and possibly chronic depression. Lastly, communication should be clear, for example, management needs to ensure a suitable shift overlap to allow clear communication between shifts to prevent anything being misunderstood (Paul and Maiti,2015).

Paul and Maiti (2015), observe that employees who are more involved in their jobs exhibit better safety performance, which consequently diminishes occupational injuries. Furthermore, occupational stress and the safety environment predict the employee's job involvement and occupational hazards induce more occupational stress in the workers while

social support mitigates the same. This leads Paul and Maiti (2015) to conclude that job stress and the safety environment are the two key factors that influence work related injuries in mines. Furthermore, Kunar, et al. (2017), and O'Toole (2015), identify age as influencing the occurrence of accidents; they believe that younger people are more likely to suffer occupational injury due to a lack of knowledge.

In addition to this, Hoyos, et al.(2018) identify more human behavioral factors that influence the occurrence of accidents. Namely, insufficient acceptance of technical safety precautions, lack of information in order to work safely, lack of knowledge or training (limit to human capacities for perception and information processing), and production rate (pressure resulting from too little time or from compulsion to perform). Hoyos, et al., (2018) identify repetitive work as a factor that influences accidents, additionally, repetitive work can lead to fatigue, and as Wong (2013) says, fatigue is a major cause of accidents. Furthermore, Theron & van Heerden (2016), claim that fatigue is one of the major causal and/or contributing factors when it comes to causes of fatalities in the mining industry. Schutte (2010), confirms this by stating that there have been numerous accidents in the Zimbabwe mining industry where fatigue was acknowledged as either causal or contributory.

Schutte (2017), and Theron and Van Heerden (2016) point out that fatigue is not merely tiredness, but also a feeling of weariness or a deficiency of energy that does not go away with rest, and it has a direct effect on alertness and work performance. Theron and Van Heerden (2016), identify two varieties of fatigue, namely, physical fatigue in which a person's muscles are unable to perform activities as effortlessly as they normally do, and psychological fatigue in which it is a challenge to concentrate for extended periods of time. Theron and Van Heerden (2016) note the harshness of fatigue by stating that by remaining awake for 17 hours is equivalent to having a 0.05 blood alcohol level, and by staying awake for 20 hours is equivalent to having a 0.1 blood alcohol level. In South Africa, the legal blood alcohol limit to drive is 0.05 and to enter some mines this limit is 0.00. However, fatigue cannot be picked up through a simple breathalyzer, and as such, organizations need to be very cautious of fatigue.

Schutte (2017), states that high levels of fatigue cause reduced performance and productivity in the workplace and increase the threat of accidents and injuries taking place, as well as affecting the capacity to think clearly, which is imperative when making safety related decisions and judgments. Theron an van Heerden (2016), add to this by stating that a person's capacity to function can be significantly affected by fatigue. This leads to the understanding that the effects of fatigue include decreased performance and productivity and increased potential for incidents/injuries to transpire. Fatigue can lead to incidents/injuries due to it affecting a number of key mental and physical abilities. For example, fatigue can

result in impaired concentration, poor judgment, reduced hand-eye coordination and slower reaction times.

Lastly, Schutte (2017) adds that the threat of fatigue is inherent in shift work and work that is physically or mentally demanding, repetitive or requiring high vigilance. Theron and van Heerden (2016), state that fatigue can be a normal and important human response to physical exertion, poor eating habits, emotional stress, boredom or lack of sleep and thus needs to be handled and controlled cautiously.

2.3.2 Environmental factors that contribute to accidents in quarry mines

As identified by Hoyos, et al*.,* (2018), the environmental factors that influence accidents include, temperature, humidity, lighting, noise, dust, toxic and harmful concentrations of gases in the underground working environment. For the purpose of this section, three groupings have been used, namely, time of day, temperature & humidity and noise. The lighting factor will be combined into the time of day. The location factor, dust and toxic and harmful gases will be incorporated into the occupation factors, under the management factors

Temperature, humidity, and lighting are a few of the environmental factors influencing incidents, as identified by Schutte (2017). These three factors can be loosely related to the time of the day, as well as the time of year, thus the section on time of day relating to incidents is explored. Hoyos, et al*.,* (2018), Theron and van Heerden (2016), and Schutte (2017) all agree that more accidents occur during night shifts because it is more demanding to concentrate at night when a person would ordinarily be sleeping/resting. Additionally, the physiological inclination to sleep at night and to be awake during the day is influential, and problems can occur when disrupting this tendency. This can lead to fatigue, as discussed earlier, which causes reduced workplace performance and productivity, as well as an increased risk of accidents and injuries.

However, in a study performed by Jansen and Brent (2015) amongst multiple mines in Rustenburg in 2003, the majority of fatal accidents occurred during the morning shift when early inspection takes place and working areas are being made safe. Additionally, 33% of the fatally injured were in supervisory positions, indicating possible inadequate safety awareness. Furthermore, Attwood, et al., (2016) identify from a statistical analysis of a database of more than one thousand offshore accidents, in an attempt to extract possible relationships between the accidents and the operations being undertaken at the time, that about 32% of injuries between 10am and 11am were categorized as fatal or major, compared to 19% for the remaining 23 hours, However, one can deduce that despite it being seen as more dangerous to work late at night, there are more employees working during the day and thus the sample

space exposed to hazards and risks during the day time is larger and hence more accidents occur during the day.

2.3.1.1 Temperature and Humidity

Gerassis, et al., (2019) stated that temperature and humidity are two work related hazards miners are exposed to daily, which undoubtedly impose additional stresses and partake in influencing the occurrence of an accident. Theron and van Heerden (2015), adds that workers exposed to thermal stress for prolonged periods become fatigued which leads to heat exhaustion and contributes to multiple physiological disturbances such as excessive cardiovascular strain and hyperthermia. Also, as discussed earlier, fatigue is a prominent contributing factor to accidents. Hoyos, et al., (2018) identify that in a work environment of temperatures over 30°C, there is an evident and relatively radical deterioration in performance which increases unsafe worker behavior and thus increases the potential for an accident to occur.

2.3.1.2 Noise

Theron and van Heerden (2015), and Bae, (2019), all agree that noise is a factor that leads to accidents as well as increased fatigue. It reduces alertness, overpowers acoustic signals such as warning cries, sirens and machine sounds and it hinders communication when protective devices must be worn to protect one's hearing.

Hermanus (2017) stated that the well-known problem in mining, noise exposure, is due to the use of heavy equipment, drilling and rock breaking, transferring material, sorting and milling of rock, and confined working conditions. Hermanus (2017) identifies that from available data for noise exposure to South African miners, that nearly half the employees are exposed to deafening noise, and of these workers, more than 90% work in zones in which noise exceeds the 85dBA time weighted average, with 11% working in zones in which the noise levels are even higher.

2.4 OPERATIONAL FACTORS CONTRIBUTING TO OCCUPATIONAL ACCIDENTS IN THE QUARRY MINE

2.4.1 Management

As identified by Ramsey, et al. (2016), management factors include coordination of people, machine and environmental factors in production, no loopholes in management, and no defects in a system. This section focuses on three factors, namely, production rate which relates to the stress placed on an employee, shift length which incorporates the time into the shift, and occupation which acknowledges there are different risks associated with different occupational functions in the mining sector. The effects of management interventions are not explored.

2.4.2 Production rate

Hoyos, et al., (2018) state that overloaded production, production rate and task overload are some main causes of accidents. Production rate influences the occurrence of accidents because it generates a pressure resulting from insufficient time to complete a task or it creates a compulsion to perform, at which time safety is not a primary concern. Additionally, Ramsey, et al. (2016), identify that higher workloads, result in higher values of UBI. Paul & Maiti (2015) add to this by identifying that production pressure is a significant factor in accident development. Furthermore, Paul and Maiti (2015), state that pressure on production seems to lead to an escalation in disabling injuries, which as a consequence reduces the production. Lastly, Leveson (2014), finds that written procedures and instructions are seldom followed precisely as workers endeavor to become more efficient and productive and have to deal with time pressures. This also leads to the increased potential for accidents to occur.

2.4.3 Shift length

Attwood, et al. (2016), claim that the time into the shift has noteworthy effects on worker safety related behavior. Furthermore, Attwood, et al., (2016) identify that in the offshore oil and gas industry, in the first hour subsequent to a shift change, a large percentage of accidents occurr. In addition, Hoyos, et al., (2018) identify that the risk of an accident is higher during a shift change

2.4.4 Machines

According to Wang and Guo (May 2013), there are three important machine factors that influence accidents which include equipment condition, ability to adapt to the change of the external environment and machine running stability. It should also be noted that, an item of equipment failing and triggering an incident is not necessarily the root cause of the incident but improper or insufficient maintenance, which linked to human behavior, could be identified as the root cause of the incident and not the equipment. However, with respect to this research and for the purpose of this study, these factors will not be included due to the fact that the model to be created is focused on being mine specific and not equipment specific. Although, it should be stated that the occupation section under the management factors will account for factors such as if the employee works behind a desk or is involved in hauling etc., because occupation is a more generalized and measurable factor linking groups of equipment to employees that work with them.

2.5 CHAPTER SUMMARY

This chapter presented a review of literature; the consulted literature endorses that the fact that occupational accidents in the quarry mines are influenced by poor human, operational and environmental factors. Zimbabwe has no good policies and strategies to ensure that there is safety in the quarry mines and that the mineworkers get accessible healthcare in case of any injury or accident at work, the healthcare system in Zimbabwe is dysfunctional in many ways. The next chapter is a presentation of the research methods which are explained in detail.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter explains the methods for this study. It includes the research design, the study setting, population, sampling, and the sampling technique that was used to do data collection, tools, validity, reliability, pilot study, data collection and analysis processes, ethical consideration and dissemination of study findings.

3.2 RESEARCH APPROACH

For the purpose of this study, the researcher resorted to a quantitative research approach and investigated factors contributing to occupational accidents among quarry mineworkers of dimension stones mines in Mutoko, Zimbabwe. A quantitative research approach measures the magnitude, size, or the extent of the phenomenon, and as such, it allows the investigation of many factors, which relate to the research questions, including the investigation of the relationship that may exist between various factors (McCusker and Gunaydin, 2015). Quantitative approach in this study made it possible for the researcher to identify the relationships between variables, and to present the results in tables and charts.

3.3 RESEARCH DESIGN

According to Creswell and Creswell (2017), research designs are plans and procedures for research that cover the decisions from broad assumptions to detailed methods of data collection and analysis. This study adopted a descriptive, cross-sectional survey design, it was chosen because the researcher collected data at one point in time. Furthermore, a cross-sectional survey design was used to assess and describe the factors contributing to occupation accidents in quarry mine workers of the dimension stones in Mutoko, Zimbabwe.

3.4. STUDY SETTING

The study was carried out in the Mutoko Rural district of Mashonaland East Area in Zimbabwe, Sothern Africa, which is situated 143 km Northeast of the capital city Harare, along the road going to Mozambique and Malawi, and was at first set up as an regulatory station for the British Realm in 1911. The locale is basically occupied by the Buja individuals, who have settled in Mutoko, from a portion of what is presently Mozambique. The region‘s essential dialect is Shona, in spite of the fact that English education is moderately high and there are other occupants from Mozambique. Unemployment is high at 48.3% and the poverty rate is shockingly at 50.2% (ILO, 2017). The primary source of income is agriculture, with the majority of people being subsistence farmers. The primary crop is maize, followed by ground nuts (peanuts), and table vegetables. Maize, sunflowers (for seeds), sorghum and millet are grown

commercially. Mutoko is known for its exceptional tomato and mango farming. The Mutoko area is also known for being a very mountainous region of Zimbabwe, and as such, is an important source of granite stone, therefore granite mining is its main industry. There are five dimension quarry mines in the Mutoko Rural District Council. There are nearly 30,000 families (ZIMSTATS, 2012), 17 clinics, and 4 hospitals. The area has electricity, 3 hospitals, a post office, and banking facilities. Mutoko has a total population of 123 862 (ZIMSTATS, 2012) people, and is divided into 29 wards. Employment is also provided by the extensive granite and quartz mining industries in the region. Local health services include the Mutoko District Hospital, the Nyadire Mission Hospital, and the Louisa Guidotti Hospital. It has a teachers' college and a nursing college, which are funded and owned by the United Methodist Church. It is no surprise that most of its community members are qualified nurses and teachers. This observation alludes to its high literacy and educational level. Traditional healers are also frequently used as a source of health care in the region. Other local health providers include a limited number of private practices and pharmacies, as well as, where and when government support is available, rural public health clinics and community health workers.

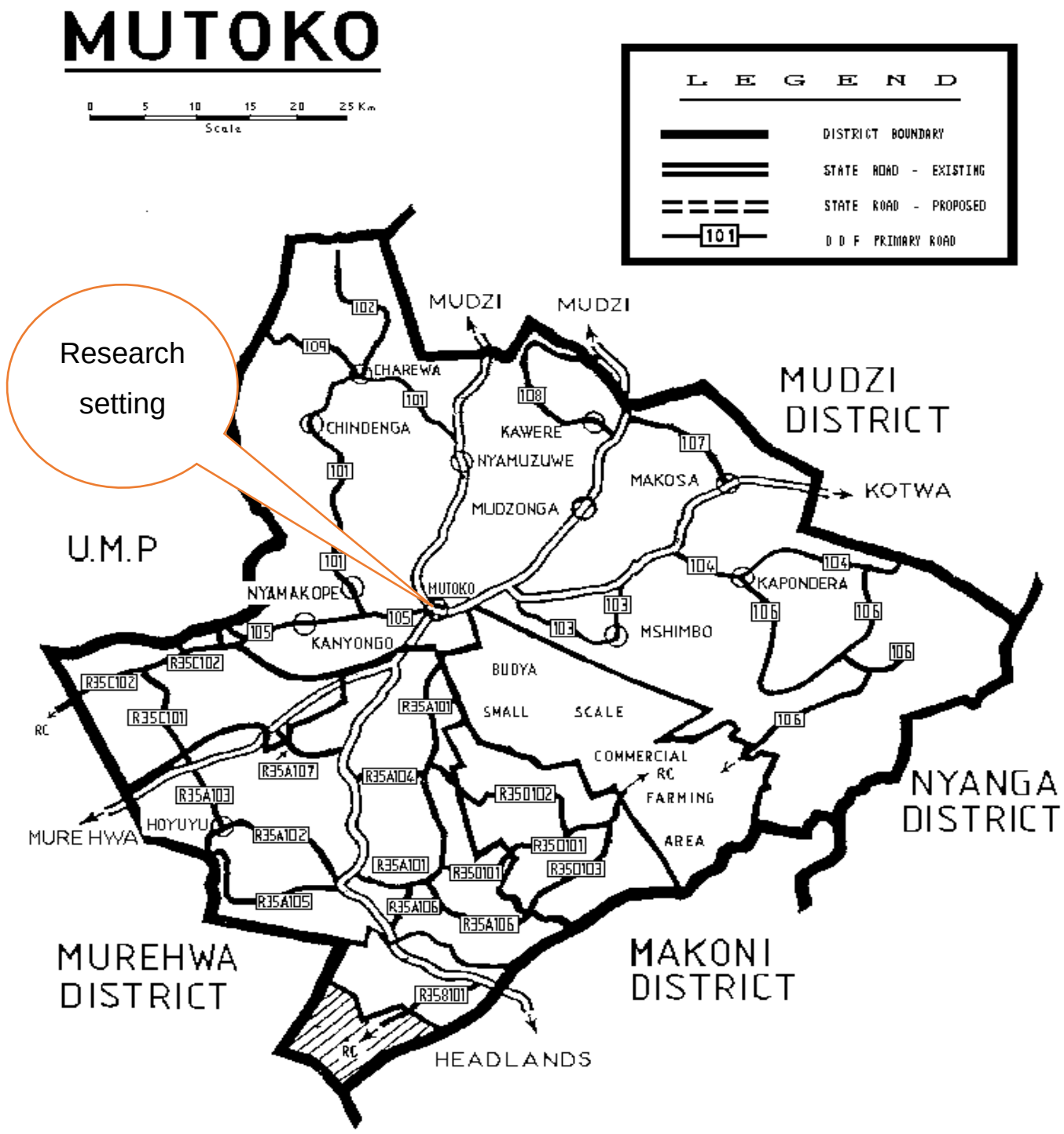

Figure 2: Map of Mutoko Rural District Council (Maps of the World, 2014)

Figure 3: Map of Zimbabwe (Air Broker Center International, 2009)

3.4 STUDY POPULATION

According to Dyer and Forister (2016), a study population is the entere group of persons or objects that are of interest to the researcher..The population for this study was comprised of all quarry mine workers of Dimension Stones Quarry mine in Mutoko. The dimension Stones quarry Campany has a total of 720 workers (Ministry of Mines, Mutoko 2018) , with approximetly 686 people working as quarry mineworkers, and 34 people doing adminstrative work. Table 1 shows the number of quarry mineworkers in each Campany

TABLE 1: POPULATION FRAME

Name of Quarry mine	Number of mine workers
Iford Services	160
New Investment	117
Manwick	80
Gurure	109
Natural Stones Company	220
Total	686

3.5 SAMPLING

According to Muhib, (2016), sampling is the process of selecting units from a population of interest so that by studying the sample we may fairly generalize our results back to the population from which they were chosen. The study adopted a probability sampling to sample mineworkers in each mining company. Total sampling was used, therefore, all the dimension quarry mines in the Mutoko Rural District Council formed part of the study. Thereafter stratified sampling was used to sample participants

3. 6 INCLUSION CRITERIA

The following was the criteria for inclusion in this study:

- Male and female quarry mineworkers aged 18-65 were included in the study. The researcher concentrated on this age group because it represents all the age groups that are, the youth, middle age and the old.
- All the quarry mine workers and supervisors were included to form part of the study

3.7 SAMPLE SIZE

According to Dyer & Forister (2016), there is no fixed number or percentage of subjects that determine the size of an adequate sample. Studies have indicated that the bigger the sample, the more the significance of the results. The study used Slovin's formula to determine its sample size.

n = sample size of the adjusted population.

N= population size

e^- = accepted level of error set at 0.05.

N= 686

$$n = \frac{N}{1+N(e)^2}$$

$$=\frac{686}{1+686(0.05)^2}$$

=686/ (1+686(0, 0025)

=686/ (1+1,715)

=686/2.715

=253

Table 2 shows the sampling frame, the number of people in each quarry mine, number of people who participated in each of the five dimensions stone quarry mines in Mutoko, and their percentages

Table 2: Sampling Frame

Name of quarry mine	Number of mineworkers	Number of participants	Percent (%)
Iford Services	160	160/686×253=59	160/686×100=23
New Investment	117	117/686×253=43	117/686×100=17
Manwick	80	80/686× 253=30	80/686×100=12
Gurure	109	109/686×253=40	109/686×100=16
Natural Stones Company	220	220/686×253=81	220/686×100=32
Totals	686	253	100

3.8 SAMPLING PROCEDURE

Stratification is the process of dividing members of the population into homogeneous subgroups before sampling (De Vos,Strydom, Fouche and Etlport, 2016). The stratified sampling was used according to the five different working departments which are Jack hammer drillers, Blasters ,Dumb truck operators, Check lines and Excavator operators, thereafter random sampling in each strata , simple random sample allows every member and set of members have an equal chance of being included in the sample, the researcher used plain papers written yes or no and mix them in a box and request the participants in each strata (department) to pick one without looking , all those who had papers written ”yes” participated in the study and those who picked the papers written no did not participate in the study.

3.9 DATA COLLECTION INSTRUMENT

Data collection is a process of collecting information from all relevant sources to find answers to a research problem, test the hypothesis and evaluate the outcomes. For the purposes of this study, the researcher adapted and modified the WHO stepwise questionnaire that assesses the risk factors and the contributing factors to diseases and accidents in workplace. The questionnaire was used to obtain demographic information and the factors contributing to occupational accidents. The questionnaire consisted of open- and close-ended questions, including the Likert scale. The questionnaire was comprised of four sections: Section A focused on demography ,Section B human factors, Section C focused on environmental factors and Section D on the operational factors contributing to occupational accidents. The questionnaire was developed in simple English and translated to the local language, Shona, by a language professional.

3.10 VALIDITY AND RELIABILITY

Attention was paid to validity and reliability in order to ensure quality data and results.

3.10.1 Validity

Validity is the degree to which an instrument measures what it is supposed to measure (Si'ayah, & Setiawan, 2019). To ensure the content validity of the instrument, the drafted questionnaire was submitted to the supervisors of the study for expert scrutiny regarding the relevance and readability of each question. One of them is an expert in mining and geology and he checked the instrument to ensure that the relevant content was covered. The use of correct information in modifying the questionnaire was done to address the study's aim and objectives; ensuring that the questions were related to the research topic to avoid the study's biasness or obtaining data which was not related to the topic.

3.10.2 Reliability

Reliability is defined as the extent to which results are consistently accurate over time (Velasufah, & Setiawan, 2019). To ensure the reliability of the questionnaire, the test-retest method was done using the 10% of sample through administering it at two different times in the Mutoko quarry mine (25 participants). The researcher randomly selected one dimension quarry mine in Mashonaland East province, which was not part of the study The results of the same response were then compared with the second response to see if there was consistency in their responses after one week. Cronbach's alpha, which measures the degree of internal consistency ($0 \leq \alpha \leq 1.0$) of the instrument was used to test the correlation coefficient. The outcomes of the first responses by each individual were compared with the responses on the

second time and the correlation coefficient was 0,857 and it was acceptable because the results had a correlation -coefficient of close to 1.

3.11 PRE-TEST OF THE INSTRUMENT

According to Creswell (2016), a pre-test is a preliminary test administered to a statistically smaller sample of respondents before a full-scale study. The researcher conducted a pre-test among a smaller sample of quarry mine worker who were not selected to be part of the study within the five-dimension mines in order to confirm if the modified questionnaire is valid and easily understood by the respondents. The pre-test helped the researcher to be familiar with the data collection instrument. The questionnaires were distributed among 25 quarry miners (5 per mine) which is 10% of the sample. The questionnaires were administered in Shona or English depending on the language favoured by respondents. The necessary corrections of the research instrument were done on the questions relating to the human factors contributing to occupational accidents in quarry mines.

3.12 DATA COLLECTION PROCEDURE

The data collection process is an important aspect of research. As such, inaccurate data collection leads to invalid results. In quantitative approach, there are several methods of data collection which include clinical trial, observation, and surveys. For this study, the researcher, administered a paper-pencil closed-ended questionnaire to the participants (mineworkers) during lunch and tea break. The researcher arrived at the mine in the morning. Each visit was scheduled before hand, wherein the ethical clearance letter and request for permission to conduct the study in the mine was submitted to mining management. The researcher introduced herself to prospective participants, where she also explained the purpose of this study. Consent forms were issued to each prospective participant for their comfort. The questioners was handed out by the researcher during tea break in their assembly points, the questionnaire was collected on the same day because it took approximately 15-20 minutes to complete, the researcher took 5 days to complete the data collection because the researcher visited one mine each day till the fifth mine, this was done because these mines are not close to each other and, with the current fuel crisis in Zimbabwe, transport was a problem for the researcher to collect data in all the five mines in one day. This process was continued in all departments in all mines until the required number of respondents was obtained. The final sample size which was used is 253 quarry mine workers.

3.13 DATA ANALYSIS AND MANAGEMENT

The collected data was coded and captured on excel and later analysed using the Statistical Package for Social Sciences (SPSS) version 26. Descriptive statistical was used to summarise data and the results was presented in frequency tables and charts. The results were presented in chronological order as reflected in the questionnaire. Each variable was analysed and presented independently. The Chi-square test was employed to ascertain associations between variables with a significance level set at 0.05.

3.14 ETHICAL CONSIDERATIONS

Saujani, (2016) defines ethics as standards for conduct that differentiate between tolerable and intolerable behaviour. Ethics in research are important because they are values that are essential to collaborative work, such as fairness and mutual respect. It is importance that researchers incorporate ethics in their research in order to avoid harm to the respondents, as well as to ensure that the respondents participate in the research have full knowledge of the aim, dangers and benefits of the research are . For the purpose of this research the following ethical principles were considered: informed consent, confidentiality, avoidance of harm, maintaining of human dignity and voluntary participation

3.13.1 Ethical Clearance

The proposal was presented to the Department of Public Health Research Seminar and the School of Health Sciences Higher Degree Committee for quality assessment. The proposal was also submitted to the University of Venda Higher Degree Committee (UHDC) for further scrutiny and approval. Thereafter, it was submitted to the University's Research Ethics Committee for further assessment and to request ethical clearance which was obtained

3.14 Permission to conduct the study

The researcher consulted the Ministry of Mines to seek permission to conduct the study using mineworkers as participants. The permission was granted (Annexure C), the supervisors from different mining departments in the dimension stone quarry mines were informed about and were consulted before hand.

3.15 Informed Consent

The consent form was given to each participant to sign. The researcher ensured that all the essential information such as the purpose of the study and its significance, as well as voluntary

participation were in the information letter attached to the consent form (Annexure A) to enable the participants to make informed decisions before signing it. Participants were informed of their rights to refuse to participate in the research if they so wish or that they might withdraw at any time if the need arise

3.16 Confidentiality

The researcher took responsibility to maintain confidentiality of the given information by participants. According to Saujani, (2016) confidentiality is all about protecting a persons' private information from unlawful access. Researches have a strong obligation to ensure that they know and shield the rights and overall wellbeing of their participants, irrespective of the nature of their research. Every participant on the research was entitled to privacy about their thoughts, beliefs, ideas and personal understanding. The data was kept in a locked cupboard at all time and was not shared with anyone except the supervisors.

3.17 Anonymity

In this research the participants were assured anonymity in answering the questionnaires and to achieve this, participants did not write their names or provide any other identification.

3.18 Protection from harm

According to Onen, (2016) researchers must take specific care to ensure that individuals are not abused or harmed in any way during the course of a research. When conducting research on people, harm and risks must be reduced while benefits are maximized. Moreover, any ethnic, spiritual, governmental, societal, gender or other variances in a research population should be considerably and appropriately handled by researchers, during the course of the research. The researcher made sure that no harm, be it emotional or physical, was caused on the respondents. The researcher constructed questions in an appropriate way to avoid causing uneasiness and emotional distress throughout the course of answering the questionnaire. Additional potential hazards like psychological stress were considered and the researcher safeguarded them.

3.19 Human Dignity

In this study, human dignity was respected and observed at all cost. Respect for human dignity is the fundamental aspect underlying research ethics and is anticipated to safeguard the interest, physical, psychological or cultural honour of a person (Albrechtsen, 2016), The researcher treated all the respondents with uttermost respect**.**

3.20 Voluntary participation

According to (Neuman, 2011) in the procedure of conducting an investigation, the researcher must not force anybody into participating. Therefore, the researcher, before engaging the respondents in the research study ensured that they know that participation would be done at their own free will and that they have the right to withdraw at any time should they feel uncomfortable or endangered in the research procedure. The respondents were not forced in any way to participate in this study

3.21Dissemination of the Study Findings

The study's findings and its recommendations will be kept at the University of Venda library and will be published in peer-reviewed and accredited national and international journals and presented at seminars and conferences in South Africa and elsewhere.

3.22 CHAPTER SUMMARY

Chapter 3 described in detail the research methods which the researcher used in conducting the research. The chapter outlined the techniques in which the methods were used in-order to address the objectives of this study. Some of the methods used are research design and approach, sampling procedures, plans for data collection, instrumentation, ethical considerations and data analysis. After these methods were utilized, data was collected and that is leading to the next chapter Chapter 4, which is the presentation of the findings.

CHAPTER 4: RESULTS

4..1INTRODUCTION

This chapter presents the results of the study based on the collected data. The results are summarized in tables, and charts which are complemented by brief write ups that describe the trend in the tables and charts. The results are statistically presented in the form of frequencies and percentages with the chi-square test and cross tabulation. The response rate was 100%, with all 253 participants having agreed to take part in the study and completed the questionnaire.

4.1.1 Demographic factors

Two hundred and fifty-three questionnaires were distributed among the five dimension quarry mines in the Mutoko rural district, and they were all completed. Table 3 presents demographic characteristics of the Mutoko quarry mine workers from five different working departments. Demographic characteristics include age, gender, marital status, level of education. Their age ranged from 18 to 44. The majority of the participants age was in the 35-44 (45.1%) range, followed by the 25-34 (37.5%) range; and the lowest was the 18-24 (17.4%) range. Regarding marital status, the majority of the respondents were married 147 (52%), followed by single 62 (25%).

Table 3. Demographical characteristics of participants.

Variable	**Response rate**	
Gender	**Frequency**	**Percent (%)**
Male	185	73
Female	68	27
Total	253	100
Age		
18-24years	44	17.4

25-34years	95	37.5
35-44years	114	45.1
45-54years	_	-
55-64years	_	-
Total	**253**	**100.0**

Educational level		
No Schooling	_	_
Grade 1-7	18	7
Form1-6	106	42
Collage	71	28
University	58	23
Postgraduate	_	_
Total	**253**	100

Marital status	**Frequency**	**Percentage %**
Married	142	57
Single	62	25
Separated	35	14
Widowed	10	4
Divorced	4	2
Total	253	100

If married is partner employed or not	Frequency	Percentage %
Employed	27	19
Unemployed	115	81
Total	142	100

Table 3 presents the demographic characteristics of participants. The findings are statistically presented in form of frequencies and percentages. From the demographic data, males were in the majority and constituted 185 (73%) of the respondents and females constituted 68 (27%). All the workers had formal education, with only 18 (7%) having only a primary school education.

Table 4: Working experience

	Frequency	Percent %
less than a year	109	43
1-5 years	140	55
11-15 years	4	2
Total	**253**	**100**

The **table 4 illustrates** that the majority 140 (55%) had a work experience of 1 to 5 years, 109 (43%) of the respondents had a work experience of less than one year and 4 (2%) had a work experience between 11 to 15 years.

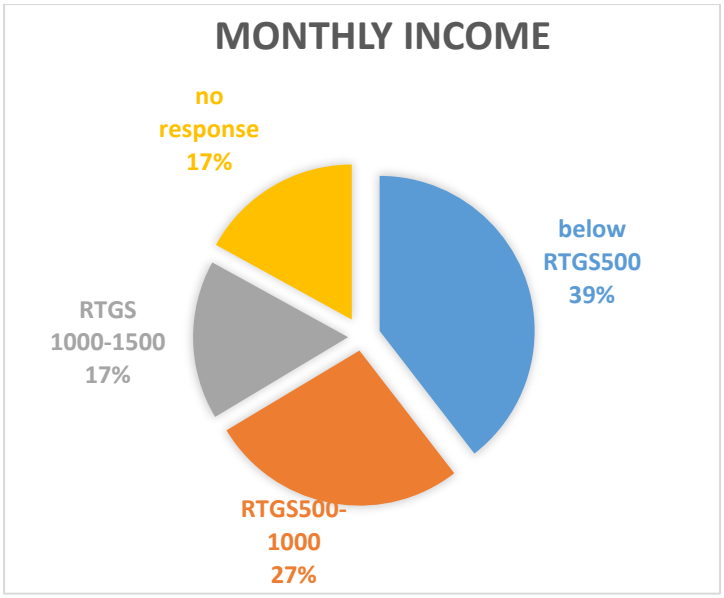

Figure 4 a: Monthly income

100RTGS= 100 South African Rand

Figure 4a shows that the majority 99 (39%) of the respondents earn less than 500 RTGS, 68 (27%) earn between 500- 1000RTGS, 43 (17%) get a monthly salary of 1000 to 1500RTGS, and 43 (17%) of the respondents were not comfortable in disclosing their salaries, therefore they did not respond.

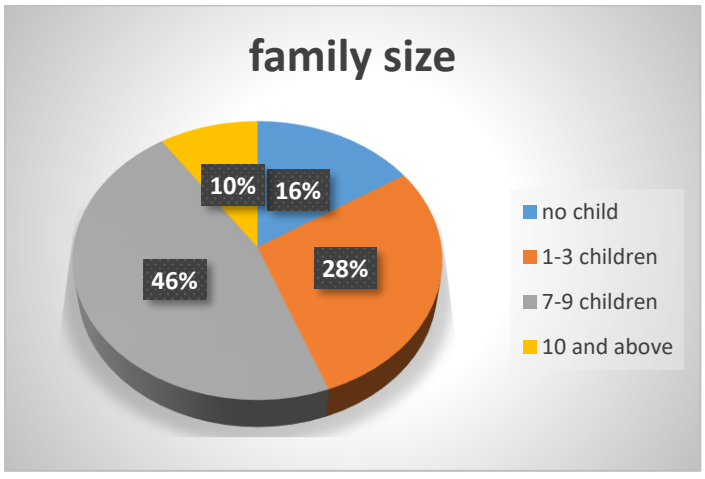

Figure 4b Family size

Figure 4b indicates that most 108 (46%) of the respondents had a family size of 7-9 children and only 25 (10%) of the respondents had a family size of 10 children and more.

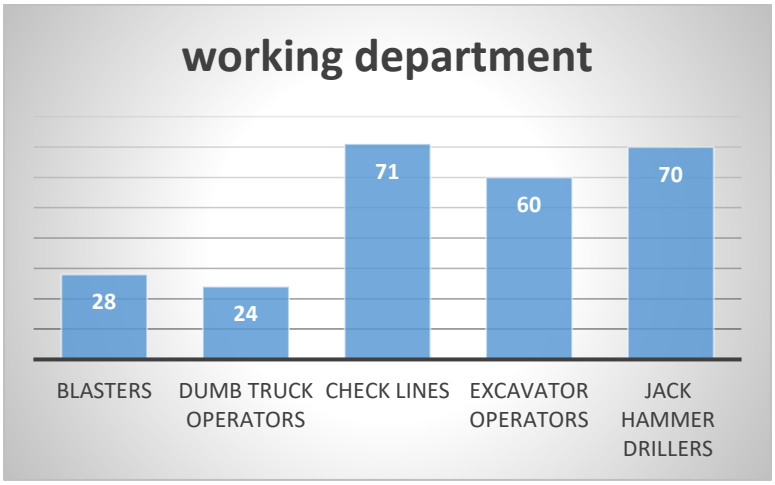

Figure 4c: Working department

Figure 4c indicates that the department with most workers was the check liners, with 71 (28%) respondents, and the dumb truck operators had the least workers, which were with a total number of 24 (9%).

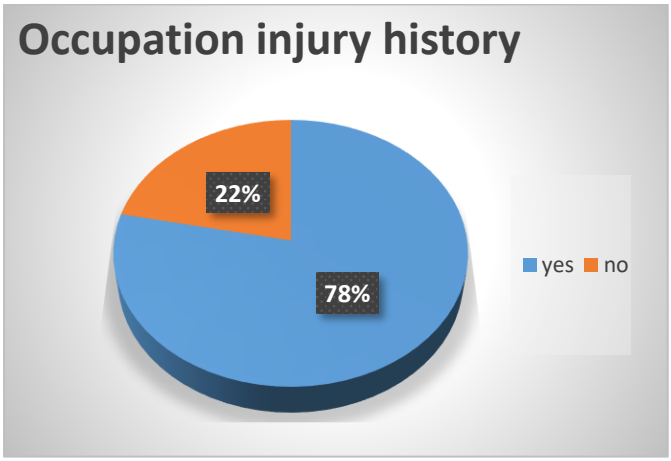

Figure 4d: Occupational injury history

Figure 4d indicates that the majority 197(78%) had been involved in a quarry mine accident, and only 57(22%) had not had any occupational accident before.

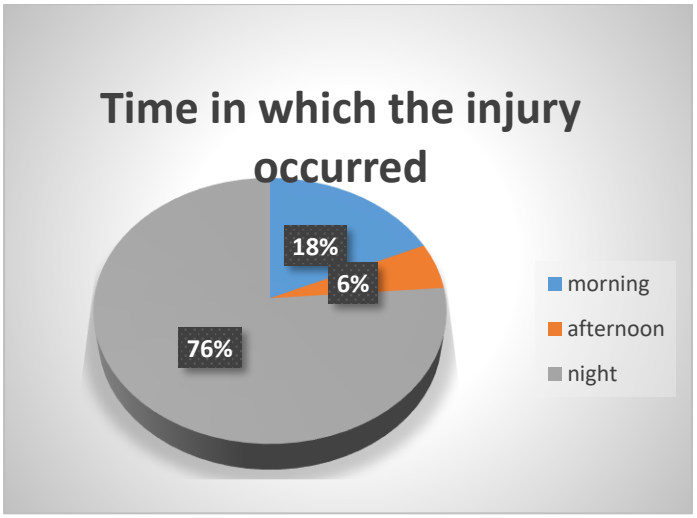

Figure 4e: Time in which the injury occurred

Figure 4d and 4e illustrate that out of 253 respondents, 197(78 %) indicated that they have been involved in an accident and suffered an injury. The results further showed that 150 (76%) indicated that the injury had occurred during the night as they were on a night shift.

4.1.2 HUMAN FACTORS

The participants were asked to answer on the human factors that may lead to occupational accidents, some of the factors included, stress, availability of phycologists or social workers in case of any personal professional help at work , the use of PPE and if there is any alcohol testing done by professional before work every day.

Table 5: Psychological factors contributing to accidents

Statement	**SA**		**A**		**D**		**SD**	
	n	%	n	%	n	%	n	%
I come to work when I have stress	165	65	19	8	55	22	14	5
There are social workers and psychologists who helps us with counselling if a worker is having personal problems at home	-	-	-	-	224	88	29	12
I am satisfied with my salary	-	-	18	7	195	78	38	15
I wear my personal protective equipment's each time I am working	135	54	-	-	99	39	18	7
I sometimes come to work under the influence of alcohol	35	14	76	30	138	54	4	2
We are tested for alcohol before starting with work everyday	-	-	-	-	-	-	253	100

We were taught about the proper use of personal protective equipment (PPE)	15	6	44	17	143	57	51	20

Key: SA -Strongly agree **A-**Agree **D-**Disagree **SD-**Strongly disagree

Table 5 illustrates the psychological factors that may contribute to accidents or injury in the quarry mine, out of the 253 respondents who were given the questionnaire the majority 164 (65%), strongly agreed that they come to work when they have stress. All respondents disagreed that there are social workers and psychologists who helps them with counselling if they are having personal problems at home or at work meaning that they deal with their problems with ought seeking professional help, a majority 185 (73%) started that they are not satisfied with their salaries, On the use of alcohol at work and coming to work under the influence of alcohol, 35 (14%) strongly agreed, and 76 (30%) agreed that they sometimes come to work under the influence of alcohol, 137 (54%) disagreed and 5 (2%) strongly disagreed. Furthermore, none of the respondents agreed to be tasted for alcohol before starting work every day 100% disagreed that they are tested for alcohol before starting work daily, therefore they won't be able to know if a person is working under the influence of alcohol or not.

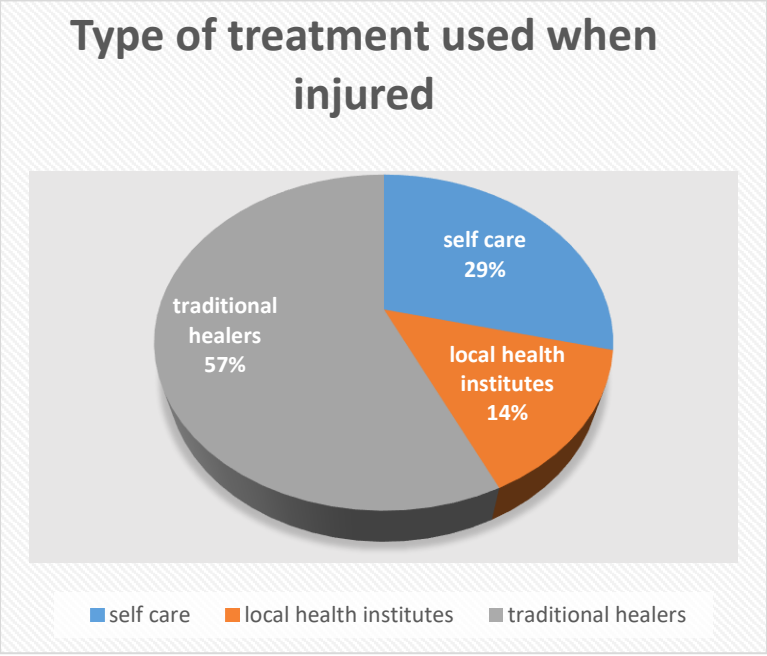

Figure 5a: Type of treatment used when injured

Figure 5a illustrates that a high proportion of the respondents144 (57%) sought to relaying on traditional healers for herbals and 73 (29%) taking care of themselves (self-remedy) in cases

of health problems or emergencies, compared to accessing treatment in local health facilities, with only 35 (14%) seeking treatment from local health institutes.

4.1.3 Environmental factors contributing to accidents.

The environmental factors that influence accidents include, temperature, humidity, lighting, noise, dust, toxic and harmful concentrations of gases working environment. For the purpose of this section, therefore the participants were asked about the different types of environmental factors that may lead to occupational accidents

Table 7: Environmental factors contributing to accidents.

Statement	**SA**		**A**		**D**		**SD**	
	N	**%**	**n**	**%**	**N**	**%**	**n**	**%**
I am able to read the instructions and any danger alerts on the walls at my working premises	**76**	**30**	**135**	**53**	**30**	**12**	**12**	**5**
The noise from the machines and the drillers hinders me from hearing the warning from the sirens	**109**	**43**	**62**	**25**	**53**	**21**	**29**	**12**
Do you think the dust level in the mine may be a hazard to your health	**100**	**40**	**91**	**36**	**37**	**15**	**25**	**10**

Key: SA -Strongly agree **A-**Agree **D-**Disagree **SD-**Strongly disagree

Table 7 illustrates the environmental factors contributing to accidents wherein the majority of the respondents 210 (83%)agreed that they are able to read the instructions and any danger alerts on the walls of their work premises and a minority number of 43 (17%)respectively disagreed to the statement. A percentage of 43% and 25% agreed that the noise from the machines and the drillers hinders them from hearing any warnings from the sirens and 12% of the respondents disagreed that the noise hinders them to hear any danger warning from the sirens. The majority (40%, 36%) agreed that the dust level at the quarry mine may be a hazard to their health while a minority of the respondents (15%, 10%) disagreed with the statement.

4.1.4 Operational factors contributing to accidents

Operational factors include, coordination of people, machine and environmental factors in production, no loopholes in management, and no defects in a system. The question are

focused on three factors, namely, production rate which relates to the stress placed on an employee, shift length which incorporates the time into the shift, and occupation which acknowledges there are different risks associated with different occupational functions in the quarry sector.

Table 8a: Operational factors contributing to accidents (n=253)

Statement	**SA**		**A**		**D**		**SD**	
	n	**%**	**n**	**%**	**N**	**%**	**n**	**%**
New employees are provided with training before working	25	10	91	36	31	12	106	42
shortage of tools and machinery supply in our department	100	40	91	36	37	15	25	10
Regular service of machinery	41	16	60	24	152	60	-	-
Induction on new machines	-	-	49	19	147	58	57	23
Prohibited to work without PPE	-	-	61	24	192	76	-	-

Key: SA -Strongly agree **A-**Agree **D-**Disagree **SD-**Strongly disagree

Table 8a illustrates the operational factors contributing to accidents, out of a total of 253 respondents a majority of 106 (42%) strongly disagreed to have been provided with training before work, Furthermore 40% and 36% respectively agreed that they experience shortages of tools and machinery supply in their department. A majority of 152 (60%) disagreed that their machines are taken to the service regularly whilst a little percent of 16% of the respondents strongly agreed that the machines are taken for service. A majority of 192 (76%) disagreed that an employee who comes to work without PPE is not allowed to work, meaning that a worker who reports to work with ought PPE is allowed to work.

Table8b Operational factors contributing to occupational accidents

Statement	Yes		No	
	n	%	n	%
In the past three months have you been injured at work due to any quarry activities	86	34	167	60

Was the injury reported	38	44	48	56
Did you seek treatment when you were injured on duty	14	16	72	84
Have you been receiving regular medical examination while working at the quarry	59	23	194	77
In the last 6 months have you had a medical examination and physical examination	-	-	253	100

Table 8b illustrates that 86 (34%) had been injured in the past three months at work among the 34% only 38 people reported the injury and 48 people which is a percentage of 56 did not report the injury. The majority 72 (84%) if the injured people did not seek any treatment whilst 14 (16%) went and seek treatment. A higher percentage of 77% denied receiving regular medical examination while working at the quarry furthermore all respondents disagreed that they have had a medical and physical examination in the past 6 months

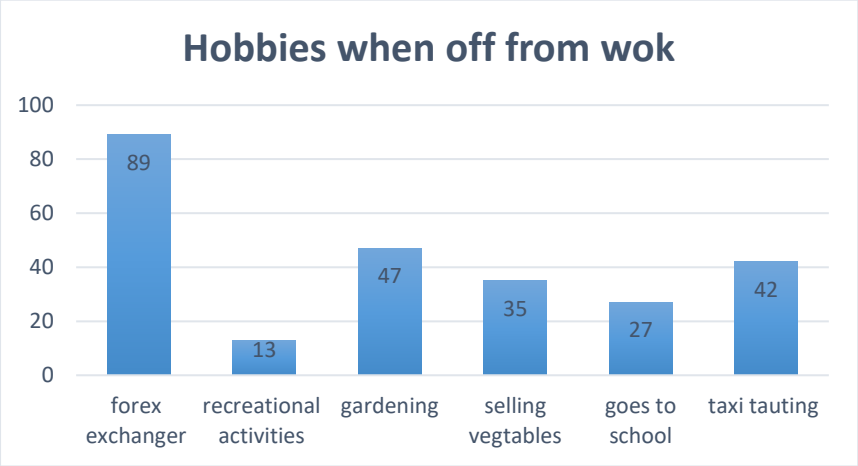

Figure 6a: Hobbies during when off from work

It is clear from the bar Figure 6a that the majority of the workers 89 (35%) work as money changers (foreign exchangers) when they are not a work , with 47 (18%) doing gardening, 42(17%) who responded that they do taxi touting, 35 (13%) are in the business of selling vegetables, 27(10%) go to school, most of them night school, to further their education, and only 13 (5%) of the people responded that the do recreational activities like playing soccer and other activities during their spare time, it is clear that the majority of the people 215 (85%) work extra jobs when they are not on duty, to find means to support their families since the money they get from the quarry mine is not enough to support their families.

Figure 6b: working more than 8hours a day

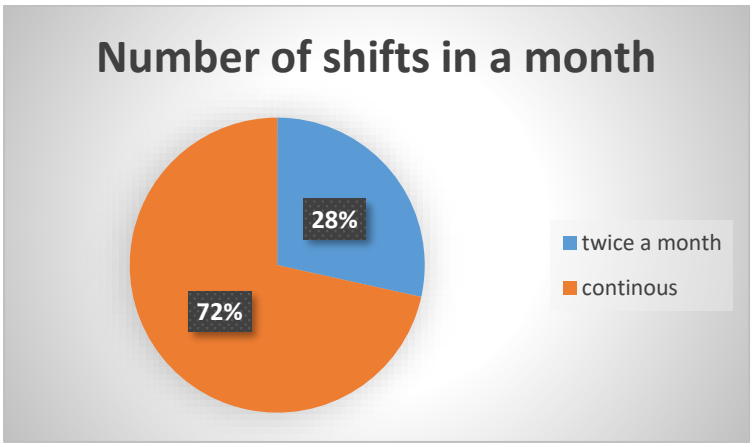

Figure 6c: Number of shifts in month

Figures **6b and 6c** show that the larger population of the respondents 129 (51%) works more than eight hours a day, however, 94 (37%) work more than 8 hours 2-3 times a week, with only 13 (5%) not working for more than 8 hours a week, and 18 (7%) work for more than eight hours once a month. Furthermore, the majority 182 (72%) admitted that they do shift work continuouly in a month and 71 (28%) do shift work only twice a month.

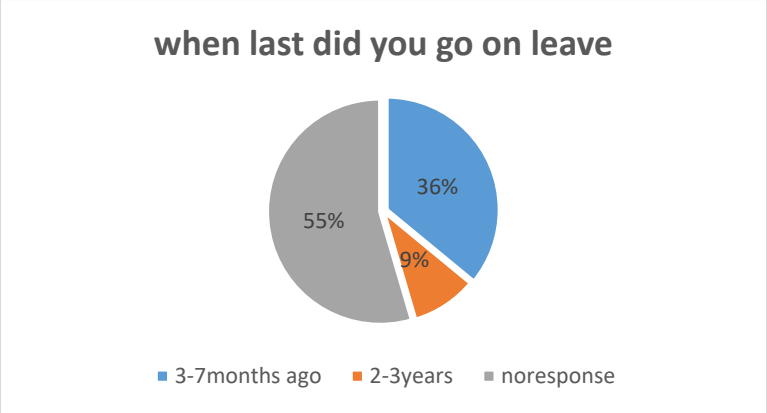

Figure 6d: last leave days

Figure 6d shows that the majority 139 (55%) of the participants did not respond on when last they went on leave, with 91(36%) who last went on leave 3-7months ago, and a smaller number of 23 (9%) who last went on leave 2-3 years ago.

Table 9: Cross tabulation of Age and mine accident or injury history

		mine accident or injury history		Total
		yes	no	
Age	18-24	44	0	44
	25-34	60	35	95
	35-44	93	21	114
Total		197	56	253

Table 9 illustrates the study findings on age and the rate of mine accidents or injury. From the cross tabulation, it is clear that the majority 47% of the respondents who have had occupational injuries were between the ages of 35-44 years and the least 22% of respondents who have had accidents were between the ages of 18-24 years, and 31% of the respondents who agreed to have had occupational accidents were between the ages of 25-34 years. The cross tabulation and the chi-square test was statistically significant, as it shows that age influences the occurrence of occupational accidents with a conclusion that the older a person gets, the more likely they are to get accidents or get injured at the quarry mine workplace (P= 0.000, x^2-25,34 , df=2).

Table 10: Cross tabulation of Level of education mine accident or injury history

		mine accident or injury history		Total
		yes	no	
level of education	grade 1-7	71	0	71
	form 1-6	60	46	106
	College	18	0	18
	University	48	10	58
Total		197	56	253

Table 9.3 illustrates the cross tabulation between level of education and quarry mine accident history. The majority 197 (78%) admitted that they have had occupation accident, of these, most 71 (36%) of the people who have had occupational accidents had a level of education of between grade 1-7 , followed by a 60 (31%) who had a level of education of between form 1 to 6, 9% who had attained collage qualification and 24% who had attained a university qualification. The cross tabulation and the chi-square test was statistically significant, as it shows that education level influences the occurrence of occupational accidents with a conclusion that the people who have a low level of education are more likely to get accidents or get injured at the quarry mine workplace (P= 0.000, x^2- 53,91, df=3).

CONCLUSION

This chapter was a presentation of the study findings. The findings highlight that the quarry miners were not provided with proper training and PPE before starting work, and there were no medical and physical examination done from time after time to check if they are fit to work or not. The findings also show that the respondents depend on traditional medicine and self-care treatment when they are injured at work. The following chapter 5 is the discussion of the findings.

CHAPTER 5: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 INTRODUCTION

In this chapter, results are interpreted, discussed and supported with literature. The study aim was to investigate the factors contributing to occupational injuries in the dimension stone quarry mines of Mutoko quarry workers. The discussion is discussed in line with the objectives of the study based on the output of the descriptive statistical analyses. An overall response rate of 100% (253) was achieved in the study. This means that the results are adequately represented out of the target population from which it was drawn. From the demographic data, males were in the majority and constituted 185 (73%) of the respondents and females constituted 68 (27%). All the workers had formal education, with only 18 (7%) attaining a primary school education only.

5.2. Human factors contributing to occupational accidents in dimension stone quarry

As a human factor contributing to occupational accidents, stress was reported as a legitimate safety and health issue, by the majority in this study, however, there were no available psychologists or social workers to assist these workers. Similarly, studies in America have established that some workers carry stress from their homes to their jobs and others lug their work stress back home with them at night. Consequently, regardless, workers experience stress, and a stressed worker has the potential to be an unsafe worker (Hege, et al., 2019). The present study has established the reasons for stressed employees, pointed out low salaries in which some have opted to alcohol abuse in trying to deal with the stress, given that the specific health practitioners are absent. Furthermore, a drunk worker can be also be viewed as a worker who is at the risk of involved in an accident. Leung,& Olomolaiye (2016) emphasize that safety professionals can play an important role in helping workers cope with stress and prevent an incident from taking place. A study in organizational stress by Quick & Henderson, (2016) further supports that it is very clear that a big proportion of safety problems are due to human error, and that humans should be trained in occupational hazards and PPE, which is not availed in the scenario of the present study.

5.3 Environmental factors contributing to occupational accidents in dimension stone quarry

Results revealed that the majority 76 % of the respondents agreed that the dust level at the quarry mine may be a hazard to their health and that there was presence of dangerous aspects i.e. dust of the work in the quarry that could harm their health. Some of the hazards involved with the quarrying activities carried out by the respondents were manual handling of heavy loads, being hit by the tools, exposure to dust and falling of rock block. This is in line with the findings that a significant proportion of health problems and fatalities in the quarrying sector in Africa are associated with manual operations, (Mamuya, 2020).The findings also agree with those by Mpofu (2019), who reported 165 injuries and 20 fatalities in Zimbabwe with rock fall as the major cause of injuries. The study findings are consistent with those in Encyclopædia Britannica (2011) which asserted that quarrying operations generate large quantities of dust that cause a variety of respiratory diseases amongst quarry workers the findings also agreed with Mankar, et al. (2019), who state that prolonged exposure to dust can lead to respiratory disease and serious health problems such as pneumoconiosis, dermatitis, irritation and inflammatory lung injuries, occupational asthma. In this study, a few respondents indicated that they were unable to read the danger signs on the walls. Han, (2019) indicates that unclear danger signs on the walls is one of the leading factors which might contribute to accidents in workplace which was the situation in this present study**.**

5.4. Operational factors contributing to occupational accidents in dimension stone quarry

The results revealed that poor operational factors contribute to occupational accidents. Out of a total of 253 respondents, a majority (137) 54%, claimed they had not been provided with training before work. This finding disagrees with Freitas & Silva (2017) who state that training is an integral part of risk management for risk identification and communication between all the stakeholders including management, technical and safety personnel, and miners, improving worker safety in mining by providing training to employees is a key target. Walker (2014), agrees that lack of knowledge and training is a major cause of occupational accidents especially in the mining sector. As opined by Carter (2016), training helps employees see and avoid hazards. Carter (2016), argues that a successful training program can positively impact workers' safety by giving them the tools and knowledge to use when faced with emergency. Mine leaders, therefore, need to have training systems in place to keep conscietizing employees on accident prevention (Anger, 2017). According to Ivensky (2016), the safe operation of a mine is dependent on the competence of the employees. Mine leaders need to have training systems in place to measure the competence of their managers, supervisors and miners (Ivensky, 2016; Walker, 2014). A majority of 152 (60%) disagreed that their machines are taken to be serviced regularly. These findings agree with those done by Moyo

(2017) who started that the Zimbabwe quarry industry still lacks adequate machinery and proper machinery services, which is one of the leading causes to occupational injuries in in quarry. In the present study, the quarry mine workers denied having been taken for any form of medical examination for the past six months. These findings disagree with the regulations of International Organization for Standardization (1996), which report that to reduce health risks due to exposure to chemical and physical agents, both collective and individual preventive measures should be adopted, together with the implementation of medical and physical examination at least twice a year. In addition to health history and physical examination, specific laboratory tests are recommended by the International Organization for Standardization (2011,) to be carried out every one or two years, such as spirometry and chest radiography in quarry men exposed to dust, fumes, and gas, audiometry in those exposed to noise, and cold test with measurement of finger systolic blood pressure in users of vibratory tools.

The study findings indicate that the respondents had poor working conditions, with a very little income and a high rate of occupational accidents. A majority (78%) of the respondents indicated that they had suffered an injury in the quarry; however, the respondents did not report the injuries and did not seek any kind of treatment while injured, with most of them depending on traditional medicine and self-care.

5.5 CONCLUSIONS

- It can be concluded from this study that there are occupational accidents and health and safety hazards associated with quarrying activities at Mutoko dimension stone quarry.
- The respondents showed awareness of the presence of occupational health and safety hazards and the related problems associated with quarrying activities.
- The study also concludes that a high proportion of the respondents sought to taking care of themselves (self-remedy) and relying on traditional healers in the case of health problems or emergencies, compared to accessing treatment in local health facilities.
- The quarry workers at Mutoko dimension stone quarry were insufficiently equipped with the occupational safety knowledge and PPE to comprehensively mitigate the occupational health and safety hazards.
- The quarry workers in Mutoko dimension stone did not receive regular medical examinations while working at the quarry.

5.6 RECOMMENDATIONS

To reduce occupational health related problems associated with quarrying activities amongst the quarry workers, it is recommended that the following collective and individual health promotive measures should be adopted:

- The quarry owners and managers should ensure that they adhere to regulations on occupational hazards which provides for the rights of every person to fair labour practices, reasonable working conditions, and a clean and healthy environment.

- Since manual handling of heavy loads is common in every work phase and quarry activity, the workers should be educated and trained in safe handling practices to avoid manual handling of excessively heavy loads by resorting to the use of loaders or excavators to transport the various pieces of equipment, such as cables, hammers, jacks, cushions, and rock blocks. They should also be made aware of the health promotive measures such as use of protective clothing and equipment which should be provided by the quarry management and quarry owners.
- There should be implementation of medical surveillance programmes that provide clinical evaluation at least once a year for the quarry workers. In addition to health history and physical examination, specific laboratory tests should be carried out every one year, such as spirometry and chest radiography in quarry workers exposed to dust, fumes, and gas, audiometry in those exposed to noise, and cold test with measurement of finger systolic blood pressure in users of vibratory tools so as to identify potential health problem and the effectiveness of existing preventive strategies. This is important because many occupational diseases are chronic in nature, having minimal early signs and may be difficult to treat or even incurable, in particular, noise induced hearing loss (NIHL) and pneumoconiosis. The regular medical examination of the workers who are exposed to particular health hazards at work can detect abnormalities or diseases at the early stage so that timely treatment can be given to increase the prospect of cure and reduce the cost of care.
- The government should guarantee that all places carrying out quarrying and mining activities are well informed on the laws and controls to be followed to in arrange to improve safety of quarry workers and environment. The avoidance of work related mischances wellbeing related issues related with quarrying exercises calls for a multi-disciplinary approach such as controlling wellbeing dangers at source by organization measures; utilize of regulatory control, utilize of reasonable individual defensive gear

(PPE), instruction, preparing and supervision of laborers, natural checking and wellbeing reconnaissance

- Exposure to inhalable dust should be diminished, avoidance measures incorporate trustworthy damp cutting, cleaning of the work region by clearing absent the mud by hand or with a manicured, and wetting the quarry floor and the get to the operations , particularly within the drier seasons. Amid these operations, specialists wear satisfactory individual defensive hardware gadgets to secure respiratory aviation routes and lungs. The companies ought to too offer preparing on to begin with help strategies

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APPENDIX A: INFORMED CONSENT

LETTER OF INFORMATION

Title of the Research Study : Investigation of factors contributing to occupational accidents among mine workers of dimension stone quarry mines Mutoko, Zimbabwe

Principal Investigator/s/ researcher : Kashiri Lisa, Master of Public Health

Co-Investigator/s/supervisor/s : Dr NS Mashau

Mr E Mhlongo

Brief Introduction and Purpose of the Study: The purpose of the study is to determine different factor leading to occupational accidents among quarry mine workers of dimension stones in Mutoko Zimbabwe, the study will be guided by the epidemiological triad model which seeks to outline the human, operational and environmental factors that causes accidents in workplace. The findings from this study will contribute to the existing body of knowledge regarding the findings of this study will be useful to stakeholders such as other mining companies in Zimbabwe in the development and implementation of safety in mines This research project might also assist the mine workers, mine managers to realize the importance of miner's safety through the compliance with safety regulations.

Outline of the Procedures : The researcher will be collecting data using questioners which are closed ended questioners

Risks or Discomforts to the Participant: no risks are anticipated.

Benefits: The researcher will benefit from the participants in order to finish the master's degree and publish. The participants may benefit when the research has been published, their plights might be heard. They may also benefit by completing the questionnaire, which will serve as a reminder of safety precautions at their workplace.

Reason/s why the Participant May Be Withdrawn from the Study: There will not be any adverse consequences if the participant wishes to withdraw from the study. Participants can withdraw if they no longer wish to be part of the study.

Remuneration: There will not be any monetary payment to participants for participating in this study.

Costs of the Study: Participants will not cover any of the study costs. The researcher will fund the study.

Confidentiality: Participants' names will be kept confidential, meaning that the researcher will not use participants' real names when handing out the questioners.

Research-related Injury: There are no research related injuries anticipated. The researcher will withdraw from any interview if the participant feels they want to withdraw from the study.

Persons to Contact in the Event of Any Problems or Queries:

Please contact the researcher 0737823297 , my supervisor Dr N,S Mashau 015 962 8892 or the University Research Ethics Committee Secretariat on 015 962 9058. Complaints can be reported to the Director: Research and Innovation, Prof GE Ekosse on 015 962 8313 or Georges Ivo.Ekosse@univen.ac.za

General:

Potential participants must be assured that participation is voluntary and the approximate number of participants to be included should be disclosed. A copy of the information letter should be issued to participants. The information letter and consent form must be translated and provided in the primary spoken language of the research population

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Kashiri Lisa about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number:
- I have also received, read and understood the above written information (*Participant Letter of Information*) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerized system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

Full Name of Participant Date Time Signature

I Lisa Kashiri

(*Name of researcher*) herewith confirm that the above participant has been fully

Informed about the nature, conduct and risks of the above study.

Full Name of Researcher

Kashiri Lisa

Date…….. Signature…

Full Name of Witness (If applicable)

…… Date …… Signature……..

Full Name of Legal Guardian (If applicable)

…… Date…… Signature……

APPENDIX B: QUESTIONNAIRE

Dear Respondent

I am a student at University of Venda doing Masters of Public health, Environmental and occupational health kindly request for your participation

And assistance. I am carrying out a research project entitled "*Investigation of factors contributing to occupation accidents in dimension stones quarry mineworkers of Mutoko Zimbabwe* .". All the information you disclose will be kept confidential and will not be used for any other purpose except for this Academic research.

Instruction

• Please do not write your name on the questionnaire.

• Tick the appropriate response or give a brief explanation in the spaces provided where applicable.

SECTION A: Respondent's Demographic Data

1. Gender

Male	2. Female

2. Age

18-24 years	25-34 years	35-44 years	45-54 years	55-60years	

3. Marital Status

married	Single	separated	widowed	Divorced

4. If married, indicate whether wife/ husband is employed or not

Employed	Unemployed

5.What is your monthly income? (Net pay)

Below RTGS 5000	5 000 -10 000	10 00-T15 000	RTGS 20 000 and above

6 Family size

No child	1-3children	4-6	7-9	10 and above

7 Which section do you work at

Jack hammer drillers	Blasters	Dumb truck operators	Check lines	Excavator operators

8 Level of Education

No schooling	
Primary education	
Secondary education	
Tertiary education	
Post graduate	
Others specify	

9. How long have you been working in the mining industry

<1year	
1-5 years	
6-10	
11-15	

16-20	
21-25	
26-30	
31-35	

10 Have you ever been involved in a mine accident or any injury?

Yes	No

11 What time did the injury occur?

Morning	
Afternoon	
Night	

Section B: Human Factors

Psychological factors contributing to accidents

	Strongly Agree	Agree	Disagree	Strongly disagree
12 I come to work when I have stress				
13. There are social workers and psychologists who helps us with counselling if a worker is having personal problems at home				

14 I am satisfied with my salary				
15. I wear my personal protective equipment's each time I am working				
16. I sometimes come to work under the influence of alcohol				
17. We are tested for alcohol before starting with work everyday				
18 We were taught about the proper use of personal protective equipment (PPE)				

Physical factors

19.In the past three months have you been injured on the quarrying activity

(a) yes

(b) no

20 where do you seek the service from when injured ?

Self-care=1, Local health institutions=2, Tradition healers=3

Other(s), please specify ……

21. Have you been receiving regular medical examination while working at the quarry?

Yes=1, No=0

22 (a) In the last one month have you had a medical examination and physical examination?

Yes=1, No=0

Section C: Environmental factors contributing to accidents

	Strongly agree	Agree	Disagree	Strongly disagree
23 .I am able to read the instructions and any danger alerts on the walls at my working premises				

24.The noise from the machines and the drillers hinders me from hearing the warning from the sirens				
25.Do you think the dust level in the mine may be a hazard to your health				

Section D: operational factors contributing to accidents in mines

EMPLOYER'S ATTITUDE, AVAILABILITY OF PHYSICAL/MATERIAL RESOURCES AND EMPLOYEE'S ATTITUDE.

26.What do you do in your spare time?

……

27. How often do you have your performance appraised?

a) None

b) Quarterly

c) Every 6 months

d) Once every year

28. When did you last receive a bonus as a department?

a) Never

b) A month ago

c) 3 months ago

d) 6 months ago

e) Can't remember

29.Do you experience shortages of tools and machinery supplies in your Department?

a) Yes

b) No

30. Does your department provide workers with protective/safety equipment or material?

a) Yes

b) No

	Strongly agree	agree	disagree	Strongly disagree
31New employees are provided with training before working				
32We experience shortage of tools and machinery supply in our department				
33 The machineries that are used in our department are taken for servicing regularly				
34 If there is a new machine introduced, we are taken for an induction or we are taught how to use and handle it first before using it				
35 An employee who comes to work with ought a personal protective equipment be not allowed to work				

36 How many times in *a* week do you work more than 8 hours a day?

a) Never

b) Once a week

c) 2-3 times a week

d) More than three times a week

37. How often do you work over the weekend?

a) Never

b) Once a month

c) Twice a month

d) More than twice a month

38. Do you do shift work?

a) Yes

b) No

39 If the answer is 'Yes to question which type?

a) Afternoon shift

b) Night shift

c) Both/

40 How often do you do shift working a month?

a) Once a month

b) Twice a month

c) Continuous

41 When did you last go on long leave?

a) 3-7 months ago

b) 8-12 months ago

c) 2-3 years ago

d) Can't remember

END

THANK YOU

APENDIX C: ETHICAL CLEARANCE

RESEARCH AND INNOVATION
OFFICE OF THE DIRECTOR

NAME OF RESEARCHER/INVESTIGATOR:
Mrs LW Kashiri

Student No:
11634799

PROJECT TITLE: **Investigation of factors contributing to occupational accidents among mineworkers in the dimension stone quarry mine of Mutoko rural district council, Zimbabwe.**

PROJECT NO: **SHS/19/PH/29/2211**

SUPERVISORS/ CO-RESEARCHERS/ CO-INVESTIGATORS

NAME	INSTITUTION & DEPARTMENT	ROLE
Dr NS Mashau	University of Venda	Supervisor
Mr SE Mhlongo	University of Venda	Co-Supervisor
Mrs LW Kashiri	University of Venda	Investigator – Student

ISSUED BY:
UNIVERSITY OF VENDA, RESEARCH ETHICS COMMITTEE

Date Considered: November 2019
Decision by Ethical Clearance Committee Granted
Signature of Chairperson of the Committee: .....
Name of the Chairperson of the Committee: Senior Prof. G.E. Ekosse

UNIVERSITY OF VENDA
DIRECTOR
RESEARCH AND INNOVATION
2019 -12- 09
Private Bag X5050
Thohoyandou 0950

University of Venda
PRIVATE BAG X5050, THOHOYANDOU, 0950λ LIMPOPO PROVINCEλ SOUTH AFRICA
TELEPHONE (015) 962 8504/8313 FAX (015) 962 9060
"A quality driven financially sustainable, rural-based Comprehensive University"