KNOWLEDGE, ATTITUDE, AND PRACTICE (KAP) REGARDING PERSONAL PROTECTIVE EQUIPEMENT USE AMONG WORKERS OF STONE CRUSHING INDUSTRIES

SUBMITTED BY

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BACHELOR OF SCIENCE

IN

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DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING

SHAH JALAL UNIVERSITY OF SCIENCE & TECHNOLOGY

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*This thesis is submitted to the **DEPARTMENT OF INDUSTRIAL AND PRODUCTION ENGINEERING** in partial fulfillment of the requirement for the award of the degree of **BACHELOR OF SCIENCE IN INDUSTRIAL AND PRODUCTION ENGINEERING.***

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RECOMMENDATION OF THE BOARD OF EXAMINERS

The board of the examiners hereby recommends to the Department of **Industrial and Production Engineering**, Shahjalal University of Science and Technology (SUST), Sylhet-3114, Bangladesh, the acceptance of the thesis **"KNOWLEDGE, ATTITUDE, AND PRACTICE (KAP) REGARDING PERSONAL PROTECTIVE EQUIPEMENT USE AMONG WORKERS OF STONE CRUSHING INDUSTRIES" s**ubmitted by **Samim Reza Sumon, Reg. No. 2013334024, Md. Abdullah Hel Kafi, Reg. No. 2013334013, and Kya Zaw Thowai, Reg. No. 2013334055; Session 2013-14,** in the partial fulfillment of the requirement for the award of the degree of Bachelor of Science in **Industrial and Production Engineering.**

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THIS THESIS PAPER

IS DEDICATED

TO OUR BELOVED PARENTS,

TEACHERS & LATE FOYSAL SUMON

SAMIM REZA SUMON

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ABSTRACT

In the labor-oriented unorganized small industry - stone crushing industries, workers have been involved in several agents of injuries and health problems. Personal protective equipment (PPE) plays an important role in protection to workers' health from exposing to those agents and hazards.

The objectives of this study were: (1) to assess the prevalent work-related hazards and their associated risks of accidents or injuries faced by employees in stone crushing industries located in Sylhet region (Jaflong), (2) to assess the knowledge, attitude and practice (KAP) on the use of personal protective equipment (PPE) and examine the association among them, and (3) to assess the training need for the workers and developing an action plan for ensuring the occupational health and safety.

In this cross-sectional descriptive study, a total of 388 stone crushing workers participated and were interviewed by face to face questionnaire. Data was analyzed with the licensed SPSS software windows version 23. Pareto analysis was applied to identify potential hazards and occupational health, and injury. Chi-square test was applied to evaluate the association between knowledge and attitude, knowledge and practice, attitude and practice, between another variable deemed critical. In this analysis, 'p' value less than 0.05 was considered to be statistically significant.

The mean age of respondents was 31.16$\pm$9.68 where 58.2% were young age adult (18 to 30 years). Majority, 70.1% were male, 70.6% had no formal education and 78.9% were carrying and lifting workers. Workers were exposed to a variety of occupational hazards with injuries and accidents. The majority 56.72% of them were encountered with potential occupational health and injuries. The study explores that approximately 80.93% workers had relatively higher knowledge about the use of PPE. 67.01% workers demonstrated neutral to positive attitude towards the use of PPE. Almost, 99.23% had poor practice on PPE using. The associations between knowledge and attitude, knowledge and practice, and attitude and practice demonstrated statistical significance as p value – 0.000, 0.007, and 0.000 respectively. 84.8% workers deemed PPE is unavailable. 92.5% respondents were willing to use PPE. 96.9% of respondents were not trained. Among 51 stone crushing factories, 48 (94.11%) factories never arranged any job training.

The huge gap between knowledge and practice, and attitude and practice of PPE using can be reduced by providing proper PPE and training about PPE using.

Finally, in this paper, various work-related hazards and their associated risks prevailing in stone-crushing industries are revealed. The level of knowledge, attitude and practice regarding the personal protective equipment among the workers in this unorganized labor-oriented sector are well-understood. Mutual relationships among demographic variables, knowledge, attitude, and practice of PPE use among the workers are identified and used in assessing the training and education need and determining the necessary actions to be taken to ensure occupational health and safety.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DEFINITION OF TERMS

Personal Protective Equipment: Personal Protective Equipment or PPE is designed to protect employees from serious workplace injuries or illnesses resulting from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. Personal Protective Equipment includes face shields, safety glasses, hard hats, safety shoes, coveralls, gloves, ear protection, vests and respirators. (OSHA Fact Sheet, 2009)

Knowledge: Knowledge refers to information and understanding that is used in everyday life; it enables people to cope effectively with daily tasks. Knowledge is acquired through learning, experience and self-reflection (Mouton, 1997:8).

Attitude: Attitude is more or less a permanent state of mental organization which is a highly emotive feeling reflecting a person's state of mind towards a value such as a fear of something (Pearsall, 1999:410).

Practice: Practice, in this study, refers to emphasizing a concern; by both thought and action; that is directed towards achieving some aim. It is dependent on the resources of time, skills and material goods (Lesser et al., 2000:144).

Willingness: The quality or state of being prepared to do something, readiness. Being in the state of doing something without forcing.

Severe: Severe is defined by the extreme injury or illness, a major trauma is defined as the injury severity.

Major: A major injury is any injury that could potentially lead to death, prolonged disability or permanently diminished quality of life. The following are examples of major injuries that should receive immediate attention: compound fractures, any type of head or eye injury, deep lacerations or stab wounds, severe or extensive burns, injures accompanied by chest pain, paralysis, confusion, severe bleeding or unconsciousness.

Minor: Minor injuries can be painful, but they don't threaten your life, mobility or long-term survival. Examples of minor injuries include the following; shallow cuts or abrasions, sprains and muscle strain, bruises and skin lesions, minor burns covering only a small area of skin.

Insignificant: Insignificant something that is unimportant, especially because it is very small.

Fatal: Fatal is something that causes death or that leads to failure or disaster**.**

Total disablement: Total displacement is a condition in which an individual is no longer able to work due to injuries. The term is applied to cases in which the individual may never be able to work again.

Partial disablement: The type of disability in which the workers is unable to perform at full physical capacity, this is usually due to on the job injury or due to illness.

Occupational health and Injuries: Occupational health and injuries are all caused by preventable factors which could be eliminated by implementing measures and methods that already exist. It may be any kind of injury that results from the workplace, including illness or disease. (Alli, 2008)

Hazards: A possible source of danger is called hazard. A hazard is an agent which has the potential to cause harm to a vulnerable target.

CHAPTER ONE

INTRODUCTION

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INTRODUCTION

1.1. Introduction

In recent years, Bangladesh has achieved significant human and social development. As a fast-growing developing country, Bangladesh is progressively prospering in its commerce and industry resulting in growing demand for workers in industries and factories. Though unorganized, small industrial sector like stone-crushing factories are considered critical in Bangladesh regarding its contribution to growth and poverty reduction. In these small industries, knowledge of the workers about occupational hazards and their use of personal protective equipment is unsatisfactory. Besides, workers are unprotected from occupational hazards mostly accidents and injuries. Therefore, the knowledge, attitude, and practice regarding personal protective measures of work-related hazards among workers in these small industries have been selected as the field of this study.

This chapter reveals the background of the study, problem statement, objectives, and significance of the study.

1.2. Background of the study

Works essential to people's lives, and it is an essential condition to the survival of the family and society. Workplace environmental hazards or occupational hazards are the globally primary cause of disability and mortality among working population (WHO, 1997, (ILO, 2013). The World Health Organization (WHO) places occupational risks as the 10th leading cause of morbidity and mortality (WHO, 1999). The International Labor Organization (ILO) deems occupational health and safety issues to be so important that it has devoted about 80% of its standards and instruments either wholly or partly to it (Ali, 2008). However, currently, around 160 million people are estimated to suffer from avoidable occupational diseases. Two million people die annually as a result of work-related accidents and diseases (ILO, 2013). Workers suffer 270 million accidents and at least 335,000 fatal injuries annually (ILO, 2008). About 50-70% of the current global labor force working in the developing countries are exposed to a massive physical workload or poor working conditions, and the prevalence of

occupational injuries among blue-collar workers including laborers, machinery operators, drivers, technicians and trades workers are found to be higher in the industrial sectors (Won J et al., 2007). These numbers may translate into an approximation of nearly five percent loss of the world's GDP (Alli, B.O, 2008).

Additionally, ANZSCO (2013) cited as reduced occupational health and working capacity of workers may cause economic loss up to 10-20% of the Gross National Product of many countries for which Bangladesh is not an exception. Besides, only a small minority (5-10%) of the global workers has access to occupational health services (Aderaw et al., 2011). The scenario is much worse in developing countries like Bangladesh.

For these reasons, an assessment of the dominant occupational hazards and their associated risks of injuries faced by the people working in labor-oriented unorganized small industries like engineering workshops and stone-crushing companies are critical. The use of personal protective equipment (PPE) has to be set as a priority agenda for the afforested industries since PPE is designed to protect employees from work-related severe injuries or illnesses resulting from the exposure to chemical, physical, electrical, mechanical, or other workplace hazards. However, the usage of personal protective equipment needs behavioral changes from the worker.

Behavior again is directly associated with the knowledge, since it is the one that influences practice. Attitudes once again are interlaced with a person’s knowledge, beliefs, and values, and vacillate between positive or negative (Launiala, 2009). Thus, understanding the level of knowledge attitude and practice are needed to enable a more efficient process of awareness creation and to get insight about the need of training programs for the people working in the industrial sector to attain behavioral change (Launiala, 2009).

In these circumstances, several studies have been conducted in the knowledge, attitude, and practice (KAP) among the workers engaged in different occupations.

Troung et al. (2009) carried a cross-sectional study to assess the level of knowledge, attitude, and practice of PPE use amongst rattan artisans in Vietnam. They found that 78.2%of the respondents had low knowledge about PPE, and 4% had a positive attitude towards PPE. However, the majority of participants pointed out a fair level of practice of PPE. Ziauddin et al., (2006) studied the knowledge, attitude, and practice about the use of PPE amongst steelworkers in India. They found that 75-97 % of the employees had adequate knowledge and possessed a positive attitude. Consequently, 80% of the participants responded positively to the practice of using PPE. Taha (2000) conducted a study at Al Khobar to evaluate the

knowledge and practice of workers in a small industry about preventive measures of occupational hazards, Taha (2000) concluded that knowledge of workers about occupational hazards and the use of preventive measures were inadequate (Taha, 2000). Islam at al. (2017) conducted a cross-sectional study on occupational health hazards and safety practices among the workers of tannery industry in Bangladesh; they concluded that majority of the workers were suffering from various occupational diseases caused by multiple work-related hazards and only one-third of the respondents used the personal protective equipment (Islam at al., 2017).

As can be seen in the above literature, an unorganized and labor-oriented sector, stone-crushing companies play an essential role in our economic and social welfare. Like other industrial sectors, workers engaged in these industries are exposed to work-related hazards and are always at risks of accidents or injuries. Workplace accidents result in considerable economic and human losses. Hence, assessment of the most frequent occupational hazards and their associated risks of injuries faced by the workers are critical. Though using PPE reduces the exposure to a variety of occupational hazards, their usage is found deficient in the industrial sector and needs a behavioral change from the worker. Behavioral change again linked with knowledge, which, in turn, influences the attitude and safety practice of the workers.

Moreover, there is no systematic study on the assessment of risks of injuries caused by various occupational hazards and the understanding knowledge, attitude towards, and practice level of PPE using among the workers involved in stone-crushing factories in Bangladesh which has been reported in the literature. This study is, therefore, aimed at determining the knowledge, attitude, and practice regarding personal protective measures of work-related hazards amongst the workers of small unorganized industries like stone-crushing factories.

1.3. Statement of the problem

Occupational health services, especially health education for workers are often inadequate or non-existent. No notification or registration system for occupational hazards exist in such unorganized labor-intensive organizations as stone-crushing factories. As a consequence, there are clear indications of no use of PPE while working in the factories. It may be because of the shortage of information regarding PPE, a negative attitude towards using it, or lack of training rendered to the employees. Besides, workers might know PPE use but do not consider its use essential. As a result, the number of severe injuries and occupational diseases may be increased.

1.4. Research Questions

1. What hazards and associated risks of accident or injuries are prevalent amongst the workers of stone-crushing factories in Sylhet region?
2. What are levels of knowledge of, attitude towards and practices of personal protective equipment use prevalent amongst the workers of stone-crushing factories in Sylhet region?
3. In there any association among the workers' level of knowledge of, attitude towards, and practice of personal protective equipment use?
4. Do the workers of stone-crushing factories need any training on personal protective equipment use?

1.5. Purpose of the study

The purpose of this study was to determine the knowledge, attitude, and practice of personal protective equipment (PPE) use among workers in an unorganized industrial sector (e.g., stone-crushing factories) located in Sylhet area.

1.6. Objectives of the study

The objectives of this study were to:

1. Assess the predominant work-related hazards and their associated risks of accident or injuries faced by employees working in stone-crushing factories located in Sylhet region.
2. Evaluate the knowledge about PPE use among the employees working in stone-crushing factories placed in Sylhet region.
3. Determine attitude towards PPE use among the employees working in stone crushing factories situated in Sylhet region.
4. Explain the practices for PPE use among the employees working in stone-crushing positioned in Sylhet region.
5. Examine the relationship among the workers' knowledge, attitude, the practice of PPE use, and demographic variables deemed critical.
6. Assess the training need for the workers and develop an action plan that needs to be implemented to ensure the occupational health and safety.

1.7. The significance of the thesis

Annually, almost 12 thousand workers suffer from fatal accidents, and nearly 25 thousand dies from work-related diseases across every sector which lead to expending the US $4 per victim on each injury where 17.6% of the population lives below the lower poverty line (Tasnim et al., 2016). A study among automobile repair workers in India [Philip et al., 2014] reported that half of the employees were unaware of the health problems associated with their occupational exposures, and thereby the use of personal protection was deficient. None of them had received any formal training on workplace safety. Bangladesh Institute of Labor Studies (BILS) also reports that employees within agriculture, ready-made garments, construction, tannery, shrimp, re-rolling, jute, and shipbreaking sectors are exposed to a wide variety of occupational hazards and are always at the risk of accidents or injuries and suffering from occupational diseases (Bangladesh Institute of Labor Studies, 2015). The main reasons are reported to be low levels of education of workers: inadequate knowledge of health hazards, unavailability of preventive measures and little or no use of PPE. However, from another study (Akintayo, 2013), it is evident that encouraging PPE use among workers is dependent of their appropriate attitude towards the health risks, which associated with knowledge about the danger and harmful effects of their work characteristic.

Hence, a systematic study must be organized for the assessment of risks of injuries caused by various occupational hazards and for the understanding the level of knowledge, attitude, and practice of PPE use among the workers engaged in engineering workshops, and stone-crushing companies in Bangladesh.

This study is, therefore, designed to determine the knowledge, attitude, and practice regarding personal protective equipment of work-related hazards amongst employees working in small industries like stone-crushing companies.

1.8. Structure of the thesis

This thesis paper comprises of six chapters. Chapter one introduces the overview of the study and focuses on the background, objectives, and significance of the study. Chapter two discusses the literature review on the relevant researches and their findings, and arguments. Chapter three includes the methodology of the study. Chapter four examines the data and find out the relationship between various variables like demographic data, accidents or injury related

information and knowledge, attitude, practice level of the respondents. Chapter five discusses the findings and analysis thoroughly. Chapter six provides conclusion and recommendations to determine the necessary actions to be taken to ensure occupational health and safety, and helpful for the policymakers while formulating the policy to make the workplace safe for the workers engaged in this sector.

1.9. Conclusion

This study explores the significant issues to evaluate accidents, and injuries and the knowledge, attitude, and practice regarding personal protective equipment use in the stone crushing factories. The next chapter describes the literature review on the relevant researches.

CHAPTER TWO

LITERATURE REVIEW

CHAPTER TWO

LITERATURE REVIEW

2.1. Introduction

A review of the literature provides a clearer understanding of the problem of the study under consideration. It also exposes how a study is similar and dissimilar to previous researches. In this chapter, the authors' analysis and findings of their studies regarding knowledge, attitude, and practice of using PPE in different sectors have been summarized.

2.2. Knowledge about PPE Use

The knowledge of the personal protective equipment (PPE) and their usage can be helped workers to have a sound working environment avoiding the hazards, as it is not possible to eliminate them. Hence, assessing the workers' level knowledge of PPE use is very important. Many types of research have been conducted to measure the knowledge of workers in various fields and industries in different parts of the world.

2.2.1 Knowledge of Using PPE Amongst Employees Working in Industries

Taha (2000) in his study assessing the knowledge and practice of workers in a small industry about preventive measures of occupational hazards found that only 12% used protective clothing all the time and 60% did not use any PPE. Moreover, the knowledge of workers about occupational hazards and the use of preventive measures were unsatisfactory.

In another study investigating the knowledge, attitude, and practice about the use of PPE among the workers of Visakhapatnam steel plant, India during 2002-2003, Ziauddin et al. (2006) reported that three-fourths of the employees responded positively about knowledge and attitude, and 80% responded positively about the use of PPE. The positive response to the KAP survey was an indication of the employee having the highest degree of awareness about PPE (Ziauddin et al., 2006).

Troung et al., (2009) conducted a cross-sectional study to assess the level of knowledge, attitude, and practice of PPE use amongst rattan artisans in Vietnam. The results showed that

almost 80% of respondents had low knowledge of PPE, and the rest 20% had moderate knowledge or high knowledge. Most of responded (95.8%) had either a neutral attitude (69%) or a negative attitude (26.8%). The majority of participants indicated a fair level of practice of PPE as opposed to a more than a good level of practice (Troung et al., 2009).

In 2013, Akintayo (2013) demonstrated that only 3.7% of the traditional resist workers had a good knowledge about PPE whereas 91.6% of them knew about the risk of synthetic dyes and chemicals they're exposed. This fact indicates an alarming situation. However, another study on KAP about PPE conducted in the following year among textile dye workers exhibited a positive change. Okafoagu et al. (2017) confirmed 77.5% of the respondents knew about the use of PPEs during the dyeing process, and 39% knew that eye goggles could be used in textile dyeing. Moreover, a high proportion of the respondents (74%) had good knowledge of workplace hazards and safety practices.

2.2.2 Knowledge of Using PPE amongst Medical and Health Care Personnel

In 2009, Visentin and his co-workers conducted a cross-sectional study amongst Emergency Medical Technicians (EMT) to assess their knowledge, attitude, and prevalence of PPE use. The results demonstrated that PPE was not consistently employed as it was supposed to be used. These paramedics were acutely affected by the Severe Acute Respiratory Syndrome outbreak of 2003 (Visetin et al., 2009).

Vailaya et al. (2014) carried out a similar study on health care professionals in a Tertiary Care Hospital, Karnataka during the outbreak of Ebola virus in India. The results revealed that the knowledge about using protective equipment was highest among the registrars (71.4%) followed by consultants (60%), resident doctors (55%), nurses (45%). (Vailaya et al., 2014)

2.2.3 Knowledge of Using PPE amongst Mineworkers

A descriptive cross-sectional study was conducted at a coal and gold mine in South Africa to assess workers' knowledge about footwear and foot hygiene. Generally, the mineworkers demonstrated good knowledge about the importance of protective footwear. However, the associated complaints about being hot and causing foot problems outweighed the benefits of protective footwear for many (Schutte et al., 2005)

2.2.4 Knowledge of Using PPE amongst Agricultural Workers

In a study examining the knowledge, attitude and practice of using PPE among the chili growing farmers, Siriwong et al., (2010) demonstrated that 77.2% of respondent knew the risks and hazards caused by pesticides, whereas only 22.8% respondent knew the use of PPE to avoid the hazards. (Siriwong et al., 2010).

2.3. Attitude towards PPE Use

3.3.1. Knowledge of Using PPE Amongst Employees Working in Industries

Guseva Canu et al. (2013) conducted a study on attitude towards PPE in the French nuclear fuel industry. Three hundred participants answered a structured questionnaire. The results showed that only the question on PPE availability was responded to 100% of the time with 100% positive result. But the usage rate of PPE was varied according to workstation and kind of PPE used. Mostly (70%) used PPE was gloves. The reasons stated by the workers for not using or less using another PPE was: misplacement of PPE, perceived unnecessary, and hindrance or uncomfortable. However, a positive tendency (i.e., more systematic PPE use) was observed as exposure to chemicals increased. (Guseva Canu et al., 2013).

In 2007, Parimalam and his co-workers accomplished a cross-functional study among garment workers in Tamil Nadu. The survey found that 63.4 - 100% of workers working in different sections of the factory knew about PPE while a few workers (4%) used them. The reasons behind the non-use of PPEs were lack of availability of safety devices, high cost and not supplied by owners, and uncomfortable, work hampering (Parimalam et al., 2007).

In another study conducted amongst rattan artisans in Vietnam, Troung et al., (2009) highlighted that a few (4.2%) of respondents had a positive attitude, Majority (69.0%) of them had a neutral attitude while (26.8%) had a negative attitude. (Troung et al., 2009)

2.4. Practice regarding PPE Use

Practices of using PPE shows the actual attitude of workers that how much they are concerned about protection from different injuries which may occur during the operational time. It is, therefore, critical to assessing the practicing attitude towards using the PPE among the workers. Several kinds of literature have been published with a particular focus on the stated issue.

2.4.1 Practices of Using PPE amongst Mineworkers

Mc Aslan (2000) conducted a study about deminer injuries and their causes during 1998 – 1999. Information was gathered from Afghanistan, Angola, Bosnia, Cambodia, Lagos, Mozambique and Zimbabwe. The results demonstrated that in a vast majority of cases, victims either failed to wear PPE or were engaged in activities which contravened safety operating procedures. Most common injuries were to lower parts of the body, heads, and arms. The frequency at which the deminers was unable to wear PPE suggested that the use of equipment and clothing were inappropriate. However, it was concluded that, to reduce injuries, personal protective equipment should be considered as an integral part of the toolbox of a deminer; not just as a nice to have accessory.

2.4.2 Practices of Using PPE amongst Workers in Other Industries

Gonese et al. (2006). in their study on occupational injuries among workers in the cleaning section of a chemical industry in Bulawayo, reported that 62 out of 153 workers sustained injuries, including one that was fatal. Of these injuries, 40% involved workers who suffered cuts and 16% sustained sprained ankles and wrists. The hazards identified during the walkthrough survey included contact with chemical material and reduced use of PPE (Gonese et al. 2006).

In an observational study on the use of different protective equipment by 877 in-line skaters at four sites, Beirness et al. (2001) found that the use of protective equipment was: 25% wrist guards, 13% helmets, 14% elbow pads and 10% kneepads. About 38% of the skaters did not use any PPE. However, the study concluded that, despite the availability of inexpensive protective equipment, in-line skaters did not protect themselves (Beirness, Foss et al., 2001).

In 2006, Reed et al. (2006) surveyed PPE use and safety behavior amongst 593 adolescent high school students on Kentucky USA farms and indicated that hearing and respiratory protection was used minimally and sporadically. Of the students who operated farm tractors, half of them operated tractors with safety bars and seat belts. Sixty percent of the students reported using equipment with damaged or missing safety shields (Reed et al. 2006).

To investigate different industry for assessing the knowledge, practice, and attitude about PPE is significant for decreasing injury rate from industry and others fields. Continuously researches have been being conduct applying several measuring tools to precisely identify injury rate and

reasons of injuries. For this activity's researchers take different methodology to collect actual data from workers. Most traditional is direct interview with structured questionnaire. By reviewing the existing researches it's been seen that most researches have tried to measure knowledge, attitude, practice only about PPE. On the other hand, in our research we at first aimed to identify the most occurring injuries, most responsible agents for their occurrence in workplace and knowledge, attitude and practice about use of PPE to prevent them.

2.5. Conclusion

In this chapter, a detailed literature review on knowledge, attitude, and practice of using PPE have been presented. In the next chapter, the research methodology will be discussed thoroughly.

CHAPTER THREE

RESEARCH METHODOLOGY

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. Introduction

The methodology of research used in this study includes study site, population and sampling, data collection, reliability, data analysis, inclusion and exclusion criteria, tools and techniques applied and ethical considerations.

3.2. Study Zone

The study was conducted in stone-crushing factories located in Sylhet region. Stone-crushing factories considered for this study were placed at Ballaghat, Jaflong under Goianghat Upazila of Sylhet, the north-east zone of Bangladesh. The stone-crushing factories under investigation were selected randomly.

3.3. Population and Sampling

The population is the broader group of people to whom one's intend to generalize the results of one's study. And the sample is always a finite subset of the population to find out the characteristics of the parent set. One's specific population depend on the scope of one's study. For the survey, the selection of the sample is the first step in conducting a KAP study. The sample must be sufficiently large for the representing of the population as data collection and analysis are incredibly problematic without being large data. In choosing a sample size, proper care should be taken as some of those selected may be difficult or impossible to contact, or unwilling to participate in the study. Kaliyaperumal (2004) suggests that a sample size of approximately 200 individuals from each group suffice as long as care is taken to ensure that the response rate is reasonably high (Kaliyaperumal, 2004).

However, because of the large sizes of populations, researchers often cannot test every individual in the population since it is excessively costly and tedious. That's why researchers depend on sampling techniques.

In this study, the sample size was taken to be 388. This sample size was determined by the following formula with a 95% confidence level.

$$\boldsymbol{n = \frac{z^2 * p * (1-p)}{d^2}}$$

Where, n = Desired sample size, z = Standard normal deviate, usually considered 1.96 at 95% confidence interval (CI), α = Level of statistical significance, p = the proportion of the target population taken as 50% (0.5), d = margin of error at 5% = 0.05,

Hence, desired sample size, $n = \frac{1.96^2 * 0.5 * (1 - 0.5)}{0.05^2} = 384.$

3.4. Data Collection

The research method for data collection includes on the spot assessment for physical evaluation of safety environment or occupational hazards, semi-structured questionnaire and participatory approaches in this study. Based on the published literature on the subject of interest and physicians' expert opinions, a standardized questionnaire comprising of the open and close-ended question was developed and used. The questionnaire was prepared in English and asked directly into Bangla. Data is collected using face to face a confidential interview. Prior permission from the owners of the particular concern and verbal consent from the workers are taken. Respondents had complete liberty not in responding to any of the questions and leave the interview at any time during the study.

3.5. Instrument

The questionnaires consisted of six parts.

- The first part describes the demographic data of the respondents.
- The second part address issues on the prevalence caused by a common hazard, the probability of occurrences of an incidence caused by a common hazard, and severity of its consequence.
- The third part includes the questions on the knowledge about PPE use among the workers.
- The fourth part address the issues on the attitude of the workers towards the PPE use, and
- The fifth part deal with questions on the practices of PPE use.
- Finally, sixth part describes the PPE availability assessment and training arrangement. This part was questioned only employers (owners or managers).

3.6. Reliability Test

Reliability states that every research participant was asked to complete the same questionnaire at different times, then it should confirm the preliminary answers (Terre Blanche & Durrheim, 2004). Every repetition of the research, similar results must be achieved when related to the original results.

A pilot study was conducted to assess the validity (internal consistency) and reliability of the questionnaire to enhance its accuracy for evaluation. About 15 participants for the pilot study was selected from each category of the companies of interest.

The reliability of the questionnaire, which is concerned with its ability to measure consistently, was established using the Cronbach's alpha coefficient. Respondents had answered 16 questions for knowledge about PPE use, 9 questions for attitude towards PPE use, 8 questions for practice PPE use. The Cronbach's Alpha values for all of them have been found satisfactory.

Table 3.6. 1: Reliability Test: Statistics

Categories	*Cronbach's Alpha*	*N of Items*
Knowledge about PPE use	0.957	16
Attitude toward PPE use	0.656	9
Practice for PPE use	0.726	8
All items	0.878	156

From the table 3.6.1, for the all items Cronbach's alpha value is 0.878, which indicates a high level of internal consistency for the sample. The reliability test of the data reveals that all dataset entered in the analysis is reliable, and further tests can be applied to the data to conclude the results (Mehboob et al., 2011).

3.7. Inclusion and Exclusion Criteria

The study population consisted of the employees working in engineering stone-crushing factories located in Sylhet region. The workers, who worked for less than six months in these small industries aren't eligible to participate in the study. The administrative workers (not directly involved in the process) are excluded from the study.

3.8. Data Analysis

The Statistical Package for Social Sciences (SPSS) software for windows version 23 was used to analyze the data. Frequency tables of demographic characteristics, knowledge attitudes and practices were formulated. Normality test was performed before analyzing the inferential statistic. Chi-square test was applied to evaluate the association between knowledge and attitude, knowledge and practice, attitude and practice, between another variable, deemed critical. In the analysis, a p-value of less than 0.05 was considered to be statistically significant. Statistically significant means that the variability of means and samples sizes do not affect the results of the respective data. And not statistically significant (when p value more than 0.05) means that the results of the particular data is biased by variability of means and sample sizes. Knowledge, attitude, and practice are categorized into three level by using Bloom's cut points as several author used their study (Kralam et al., 2015; Yimer et al., 2014; John, 2011; Nahida, 2007).

Bloom's Cut Off Points:
80 – 100% as Good level,
60- 79% as Moderate level and
Less than 60% as Poor level.

3.8.1. Assessment of Knowledge Level

The term 'Knowledge' in this study implied the workers' understanding of PPE use. Knowledge was measured by 16 questions put on Likert's scale as strongly agree scored 5, agree 4, neither agree nor disagree 3, disagree 2, strongly disagree 1. The responses were summed up, and a total score was obtained for each respondent. The highest score was expected to be 80 and the lowest score to be 16.

By using Bloom's Cut Points, total scores (80 scores) were classified into 3 levels as Good knowledge: 65-80 scores (80-100%), Moderate knowledge: 48-64 scores (60-80%), and Poor knowledge: 0-47 scores (less than 60%).

3.8.2. Assessment of Attitude Level

The attitude was assessed by nine questions put on Likert's scale. The questions on Likert's scale had positive and negative responses that ranged from strongly agree, agree, neither agree nor disagree, disagree and strongly disagree. The scoring system used with respects to respondents' answers was as follows:
For positive statement: strongly agree scored 5, agree 4, neither agree nor disagree 3, disagree 2, strongly disagree 1.
For negative statement: strongly agree scored 1, agree 2, neither agree nor disagree 3, disagree 4, strongly disagree 5.

The responses were summed up, and a total score was obtained for each respondent. The highest score was expected to be 45 and the lowest score to be 9. The scores will be classified into three levels: Positive attitude 36-45 scores (80%-100%), Neutral attitude 27-35 scores (60%-80%), and Negative attitude 0-26 scores (less than 60%).

3.8.3. Assessment of Practice Level

Practices of the individuals towards PPE use has eight questions. The rating scale was measured (Likert's scale) as follows: Always scored 5, Frequently scored 4, Sometimes scored 3, Not too often scored 2, and Never scored 1.

The scores ranged from 8 to 40 and were classified into three levels as Good practice: 33-40 scores (80%-100%), Fair practice: 24-32 scores (60%-80%), and Poor practice: 0-23 scores (Less than 60%).

3.9. Ethical Considerations

According to Katzenellenbogen et al. (1997), ethical issues usually were more complicated in occupational epidemiology than in general epidemiology. The purpose, content, and significance of the study were adequately explained to the respondents after which verbal consent was taken from each of them. Participation was entirely voluntary. No names or shop numbers were used to ensure confidentiality.

3.10. Conclusion

In this chapter, study site, population and sampling, data collection, data analysis, inclusion and exclusion criteria, tools and techniques used and ethical considerations. Results obtained from the survey and data analyses will be present in the next chapter.

CHAPTER FOUR

FINDINGS AND ANALYSIS

CHAPTER FOUR

FINDINGS AND ANALYSIS

4.1. Introduction

In this chapter, the information as well as data gathered from stone crushing companies through the questionnaire are presented and analyzed. The demographic information, accidents and injury related information of the respondents are discussed. After that, knowledge level, attitude level, and practice level towards personal protective equipment use are measured. The association between demographic variable and KAP level also examined. Then the relationship among knowledge, attitude and practice for PPE use are investigated. The training need assessment for the workers also are explored in these chapter.

4.2. Demographic characteristics of the respondents

Table 4.2.1: Demographic information of the respondents

Demographic Characteristics	Frequency (n = 388)	Percentage (%)
Age Group (years)		
Young age (18-30 yrs.)	226	58.2
Early middle age (26-40 yrs.)	131	33.8
Late middle age and above (46+ yrs.)	31	8.0
Range = 14 to 70; Mean $\pm$ SD = 31.16 $\pm$ 9.68; Median = 29, Mode = 35.		
Gender		
Male	272	70.1
Female	116	29.9
Marital status		
Married	313	80.7
Unmarried	70	18.0
Widowed	3	0.8
Divorced	2	0.5

Demographic Characteristics	Frequency (n = 388)	Percentage (%)
Level of education		
No formal education	274	70.6
Primary (Up to class V)	89	22.9
Secondary (Class VI - X)	25	6.4
Employment		
Fulltime	361	93.0
Part-time	23	5.9
Self-employed	3	0.8
Replacement worker	1	0.3
Occupation		
Carrying and lifting personnel	304	78.4
Machine operator	28	7.2
Welder	11	2.8
Supervisor	10	2.6
Maintenance personnel	6	1.5
Assistant to machine operator	2	0.5
Others	27	7.0
Length of service in the current organization/job (in year)		
0.5 - 3 yrs.	70	18.0
3 - 5 yrs.	84	21.6
5 - 8 yrs.	95	24.5
8+ yrs.	139	35.8
Number of hours worked per day		
6-8 hrs.	139	35.8
9-12 hrs.	222	57.2
12+ hrs.	27	7.0
Monthly income (in taka)		
Less than 8000tk	64	16.5
8000-10000tk	158	40.7
10000-12000tk	56	14.4
12000-15000tk	62	16.0
15000+tk	48	12.4

Demographic characteristics of the respondents are presented in Table 4.2.1. Three hundred and eighty-eight (388) stone crushing workers had participated in this study. Among 388 participants, the majority of the workers were male 272 (70.1%). Number of female workers were 116 (29.9%). The mean age of the respondents was 31.16 years with standard deviation of 9.68. The ages of the respondents ranged from 14 to 70 years where 58.2 % (226) respondents were young adults (18-30 yrs.). The greater part 313 (80.7%) of respondents were married. Approximately, 70.6% (274) of the respondents had no formal education, 22.9% (89) had completed primary level and only 25 (6.4%) had completed secondary level education. The table showed that 78.4% (304) respondents were carrying and lifting personnel, 7.2% worker were machine operators. The study demonstrated that, job duration of35.8% stone crushing workers was more than 8 years, 24.5% was 5 to 8 years, 21.6% was 3 to 5 years, and 18% was more than six months to three years. Most of them around 57.2% of them worked for 9 to 12 hours per day. The majority workers earned 8000-10000tk (40.7%) per month.

Table 4.2.2: Level of Education with Age group of the respondents

Age Group	*Level of education*			*Total (%)*
	No formal education (%)	Primary (Up to class V) (%)	Secondary (class VI - X) (%)	
Young Adults (18-30 yrs.)	144 (63.7)	63 (27.9)	19 (8.4)	226 (100)
Early middle age (31-45 yrs.)	100 (76.3)	26 (19.8)	5 (3.8)	131 (100)
Late middle age and above (46+ yrs.)	30 (96.8)	0 (0.0)	1 (3.2)	31 (100)
Total	274 (70.6)	89 (22.9)	25 (6.4)	388 (100)
				χ^2= 18.446, p = 0.001

Table 4.2.2 presents that the majority (63.7%) of the young adults had no formal education where 27.9% of them completed primary level of education.76.3% of the early middle age adults also had no formal education. Only 8.4% of the young age adults completed secondary level of education. Most of late middle age adults (96.8%) had no formal education. The chi-square test has been found statistically significant association between age group and education level. Therefore, the variability of means and sample sizes does not affect the result in table 4.2.2.

4.3. Accidents and injury related information of the respondents

Table 4.3.1: Types of accident encountered by respondents

Type of accident encountered	*Frequency*	*Percentage (%)*
Severe	16	4.1
Major	58	14.9
Minor	158	40.7
Insignificant	156	40.2
Total	388	100

The table 4.3.1 exhibited that, around 80% of the respondents had suffered either from minor or insignificant level of injuries during work. 4.1% respondents have faced severe type of injuries and 14.9% faced major type of injuries from during work.

Table 4.3.2: Consequence of the accidents

Consequence of the accidents	*Frequency*	*Percentage (%)*
Absence for two hours to a day	165	42.5
Absence for a day to a week	127	32.7
Absence for a week to a month	51	13.1
Absence for more than a month	34	8.8
Partial disablement	11	2.8
Total disablement	0	0.0
Total	388	100

*Fatality - 4 workers, three years before

Table 4.3.2 indicates that, Among the 388 respondents,42.5% were absent for two hours to a day, 32.7% were absent for a day to a week, 13.1% were absent for a week to month, 8.8% were absent for more than a month. Among the respondents 2.8% were partially disabled and none of the respondents were totally disabled from the accidents. Four fatality has been found in this study from the respondents.

Table 4.3.3: Time of occurrence of the accident (24-hr clock)		
Time of occurrence of the accident (24-hr clock)	*Frequency*	*Percentage (%)*
8 - 10 hr.	7	1.8%
10 - 12 hr.	49	12.6%
12 - 14 hr.	104	26.8%
14 - 16 hr.	145	37.4%
16 - 18 hr.	71	18.3%
After 18 hr.	12	3.1%

The table 4.3.3 represents time of occurrence of the accidents. For 1.8% of respondent, time of occurrence of accidents was between 8- 10hr., for 12.6% respondents time was between 10-12 hr., for 26.8% respondents time was between 12-14hr., for 37.4% respondents time was between 14-16 hr., for 18.3% respondents time was between 16-18 hr. and rest of them experienced it after 18 hr. of a 24-hr. clock.

Table 4.3.4: Distribution of accident types by age group					
Age group	*Type of accident encountered*				*Total (%)*
	Severe (%)	*Major (%)*	*Minor (%)*	*Insignificant (%)*	
Young age (18-30 yrs.)	9(2.3)	31(8)	88(22.7)	98(25.3)	226(58.2)
Early middle age (31-45yrs.)	6(1.5)	21(5.4)	62(16)	42(10.8)	131(33.8)
Late middle age and above (46+ yrs.)	1(0.3)	6(1.5)	6(2.1)	16(4.1)	31(8)
Total	16(4.1)	58(14.9)	158(40.7)	156(40.2)	388(100)
					χ^2 = 7.871, p = 0.248

Table 4.3.4 shows that, among the three groups young age (18-30 yrs.) have experienced with minor and insignificant type of accident cumulatively of 48% and of 10.3% of severe and major type of accident, cumulatively for early middle age (31-45 yrs.) it is of 26.8% and 6.9% respectively and for late middle age and above (46+ yrs.) we get, cumulatively 6.2% and 1.8% for minor and insignificant and severe and major type of accident. However, this result is not reliable because it is biased by the variability of means as the chi-square test result (χ^2 = 7.871 and p = 0.248) has not been found statistically significant.

Table 4.3.5: Distribution of accident types by Gender

Gender	*Type of accident encountered*				*Total (%)*
	Severe (%)	*Major (%)*	*Minor (%)*	*Insignificant (%)*	
Male	9 (2.3)	39 (10.1)	116 (29.9)	108 (27.8)	272 (70.1)
Female	7 (1.8)	19 (4.9)	42 (10.8)	48 (12.4)	116 (29.9)
Total	16 (4.1)	58 (14.9)	158 (40.7)	156 (40.2)	388 (100.0)
					χ^2 = 2.577, p = 0.462

Table 4.3.5 presents that, 12.4% of male respondents are affected by severe and major type of accident where the female is 6.7%. Most of the accident type for male and female was minor and insignificant type cumulatively 57.7% and 23.2% respectively. Since, the chi-square test (χ^2 = 2.577 and p = 0.462) have not been found statistically significant because it is biased by the variability of means.

Table 4.3.6: Distribution of accident types by level of education

Level of education	*Type of accident encountered*				*Total (%)*
	Severe (%)	*Major (%)*	*Minor (%)*	*Insignificant (%)*	
No formal education	11(2.8)	40(10.3)	103(26.5)	120(30.9)	274(70.6)
Primary (Up to class V)	4(1)	16(4.1)	46(11.9)	23(5.9)	89(22.9)
Secondary (Class VI - X)	1(0.3)	2 (0.5)	9 (2.3)	13 (3.4)	25 (6.4)
Total	16(4.1)	58(14.9)	158(40.7)	156(40.2)	388(100)
					Fisher's Exact Test = 11.502, p = 0.061

Table 4.3.6 presents that, 13.1% of the respondents with no formal educated are affected by severe and major type of accident where the primary level respondentsare5.1%. Most of the accident type for no formal education and primary level respondent was minor and insignificant type cumulatively 57.4% and 17.8% respectively. With the increasing of education level, the percentage of accident decrease. For no formal education to Secondary (Class VI - X) the severity decreases from 2.8% to 0.3%, for major 10.3% to 0.5%, for minor 26.5% to 2.3%, for insignificant 30.9% to 3.4% respectively. However, the Fisher's Exact test (fisher's exact test value = 11.502 and p = 0.061) have not been found statistically significant. Therefore, the conclusion drawn from table 4.3.6 is biased by variability of means.

Table 4.3.7: Distribution of accident types by employment

Employment	Type of accident encountered				Total (%)
	Severe (%)	*Major (%)*	*Minor (%)*	*Insignificant (%)*	
Fulltime	15(3.9)	51(13.1)	152(39.2)	143(36.9)	361(93)
Part-time	1(.3)	7(1.8)	5(1.3)	10(2.6)	23(5.9)
Self-employed	0(0)	0(0)	0(0)	3(.8)	3(.8)
Replacement worker	0(0)	0(0)	1(.3)	0(0)	1(.3)
Total	16(4.1)	58(14.9)	158(40.7)	156(40.2)	388(100)

Fisher's Exact Test = 12.866, p = 0.119

From the Table 4.3.7 we can see that, among the 388 respondents 361 respondents of the fulltime workers are having the experience of severe, major, minor, insignificant type of accident of 3.95%, 13.1%, 39.2%, 36.9% comparatively to the part-time workers of 0.3%, 1.8%, 1.3%, 2.6% respectively. 17% of fulltime respondents are affected by severe and major type of accident where the part-time is 2.1%. However, the Fisher's Exact test (fisher's exact test value = 12.866 and p = 0.119) have not been found statistically significant because it is biased by the variability of means.

Table 4.3.8: Distribution of accident types by occupation

Occupation	Type of accident encountered				Total (%)
	Severe (%)	*Major (%)*	*Minor (%)*	*Insignificant (%)*	
Carrying and lifting personnel	15 (3.9)	47 (12.1)	126 (32.5)	116 (29.9)	304 (78.4)
Machine operator	1 (0.3)	4 (1.0)	14 (3.6)	9 (2.3)	28 (7.2)
Welder	0 (0.0)	0 (0.0)	5 (1.3)	6 (1.5)	11 (2.8)
Supervisor	0 (0.0)	1 (0.3)	1 (0.3)	8 (2.1)	10 (2.6)
Maintenance personnel	0 (0.0)	1 (0.3)	3 (0.8)	2 (0.5)	6 (1.5)
Assistant to machine operator	0 (0.0)	0 (0.0)	1 (0.3)	1 (0.3)	2 (0.5)
Others	0 (0.0)	5 (1.3)	8 (2.1)	14 (3.6)	27 (7.0)
Total	16 (4.1)	58 (14.9)	158 (40.7)	156 (40.2)	388 (100.0)

Fisher's Exact Test = 14.267, p = 0.649

Table 4.3.8 shows that, among the 388 respondents 304 are involved in Carrying and lifting personnel, among them 16% have experienced severe and major, 62,4%% of minor and insignificant type cumulatively whereas cumulatively1.3% of the machine operator experienced severe and major and 5.9% of minor and insignificant type respectively. However, this result is not reliable because it is biased by the variability of means as the Fisher's Exact test (fisher's exact test value = 14.267 and p = 0.649) has not been found statistically significant.

Table 4.3.9: Distribution of accident types by Length of service in the current organization/job (in year)

Length of service in the current organization/job (in year)	Type of accident encountered				Total (%)
	Severe (%)	Major (%)	Minor (%)	Insignificant (%)	
0.5 - 3 yrs.	1 (0.3)	8 (2.1)	27 (7.0)	34 (8.8)	70 (18.0)
3 - 5 yrs.	2 (0.5)	9 (2.3)	33 (8.5)	40 (10.3)	84 (21.6)
5 - 8 yrs.	6 (1.5)	12 (3.1)	43 (11.1)	34 (8.8)	95 (24.5)
8+ yrs.	7 (1.8)	29 (7.5)	55 (14.2)	48 (12.4)	139 (35.8)
Total	16 (4.1)	58 (14.9)	158 (40.7)	156 (40.2)	388 (100.0)
					χ^2= 13.010, p = 0.162

Table 4.3.9 presents that cumulatively 2.4% of the respondents had suffered from severe to major type accidents at the 0.5-3 years' service length whereas 7% of them had suffered from minor accidents. At 3-5 years' service length, cumulatively 2.8% of the respondents had experienced with severe to major accidents where 8.5% of the respondents had experienced with minor type accidents. Cumulatively 4.6% of the respondents had faced with severe to major type accident while 11.1% of the respondents had faced minor type accidents. More than 8 years experienced respondents, cumulatively 9.3% of them had encountered with severe to major type accident whereas 14.2% of the respondents had encountered minor type accidents. However, the chi-square test (χ^2 = 13.010 and p = 0.162) have not been found statistically significant. Therefore, the conclusion drawn from table 4.3.9 is biased by variability of means.

Table 4.3.10: Distribution of accident types by body parts

Injury by body parts	*Type of accident encountered*				*Chi-square test*	
	Severe (%)	*Major (%)*	*Minor (%)*	*Insignificant (%)*	χ^2	*P*
Neck and head	15 (12.7)	30 (25.4)	35 (29.7)	38 (32.2)	*50.572*	*0.000*
Shoulder	8 (9.6)	9 (10.8)	16 (19.3)	50 (60.2)	*31.443*	*0.000*
Face	8 (11.4)	24 (34.3)	15 (21.4)	23 (32.9)	*41.371*	*0.000*
Eye	14 (7.2)	33 (17.0)	85 (43.8)	62 (32.0)	*17.579*	*0.001*
Wrist and hand/fingers	16 (4.4)	56 (15.3)	149 (40.7)	145 (39.6)	*2.054*	*0.561*
Arm	10 (6.9)	33 (22.8)	43 (29.7)	59 (40.7)	*20.741*	*0.000*
Abdomen and chest	5 (7.7)	19 (29.2)	22 (33.8)	19 (29.2)	*16.312*	*0.001*
Back and low back	14 (4.9)	37 (13.1)	117 (41.3)	115 (40.6)	*4.323*	*0.229*
Knee	13 (7.1)	21 (11.5)	83 (45.6)	65 (35.7)	*19.971*	*0.003*
Feet/Toe	14 (5.7)	37 (15.0)	110 (44.5)	86 (34.8)	*11.266*	*0.010*
Ankle	10 (9.8)	16 (15.7)	40 (39.2)	36 (35.3)	*11.785*	*0.008*
Hip/Leg	7 (7.9)	27 (30.3)	27 (30.3)	28 (31.5)	*27.472*	*0.000*

Table 4.3.10 shows the relation between most significant body parts and type of accident encountered. We observe that most of the accident by the body parts are insignificant. Cumulatively 38.1% of the respondents are suffering from severe and major type of accident for neck and head. Cumulatively 20.4%, 45.7%, of the respondents are suffering from severe and major type of accident for shoulder and face respectively. For hip/Leg, abdomen and chest, arm the percentage of suffering workers are 38.2%, 36.9%, 29.7% cumulatively for severe and major type of accidents respectively. However, the chi-square test is statistically significant (when p value more less 0.05) means that the variability of means and samples sizes do not affect the results of the respective data. And not statistically significant (when p value more than 0.05) means that the results of the particular data is biased by variability of means and sample sizes.

Table 4.3.11: Distribution of location of injury by body part

Location of injury by body part	*Frequency*	*Percentage (%)*	*Cumulative Percentage (%)*
Wrist and hand/fingers	366	18.83%	18.83%
Back and low back	283	14.56%	33.38%
Feet/Toe	247	12.71%	46.09%
Eye	194	9.98%	56.07%
Knee	182	9.36%	65.43%
Arm	145	7.46%	72.89%
Neck and head	118	6.07%	78.96%

*full table in Appendix [1]

In the table 4.3.11, Most significant location of injury by body part are observed. 78.96% injury was encountered in these seven body parts which found by using Pareto analysis. Almost half of the injury of the respondents (46.1%) are found affected in wrist and hand/fingers, back and low back, feet/toe cumulatively. For eye and knee, arm and neck and head it is observed cumulatively 19.34% and 13.53% respectively are affected of the 388 respondents.

Table 4.3.12: Distribution of Occupational health and injuries

Occupational health and injuries	*Frequency*	*Percentage (%)*	*Cumulative Percentage (%)*
Lacerations/ irregular tear of skin	340	8.72%	8.72%
Back and low back pain	317	8.13%	16.85%
Contusion/bruise	289	7.41%	24.26%
Eye irritation and red eye	277	7.10%	31.36%
Crushed hand/ fingers/toes	265	6.79%	38.15%
Headache	249	6.38%	44.54%
Sharp and deep cuts or indent	241	6.18%	50.72%
Restriction of joint movement	234	6.00%	56.72%
Cough	228	5.85%	62.56%
Difficulties in breathing	202	5.18%	67.74%
Skin irritation and Dermatitis	197	5.05%	72.79%
Abrasions	196	5.03%	77.82%

*full table in Appendix [1]

In the table 4.3.12, the most frequent occupational health and injuries are observed. These twelve occupational health and injuries were encountered in workplace at 77.82% of total which found by using Pareto analysis. Lacerations or irregular tear of skin, back and low back pain, contusion, eye irritation and red eye have been faced by 31.36% of the respondents cumulatively. Crushed hand or fingers or toes, headache, sharp and deep cuts or indent, restriction of joint movement is caused cumulatively by 25.35% of the respondents. Cough, difficulties in breathing, skin irritation and dermatitis, abrasions are faced by 21.11% of workers cumulatively of the stone crusher.

Table 4.3.13: Distribution of agents of injuries and health problem (hazards)

Agents of injuries and health problem (hazards)	*Frequency*	*Percentage (%)*	*Cumulative Percentage (%)*
Dust	302	10.32%	10.32%
Working without PPE	292	9.98%	20.30%
Bad lifting and handling technique	289	9.88%	30.18%
Lifting & handling heavy objects	244	8.34%	38.52%
Sharp edge and swarf	213	7.28%	45.80%
Flying object	211	7.21%	53.01%
Excessive noise	207	7.07%	60.08%
Falling object	200	6.84%	66.92%
Highly repetitive actions	196	6.70%	73.62%
Stressful and awkward posture	192	6.56%	80.18%

*full table in Appendix [1]

In the table4.3.13, the most significant agents of injuries and health problems are identified by Pareto analysis. Dust, working without PPE, bad lifting and handling technique, lifting & handling heavy objects is the reason for 38.52% cumulatively. For sharp edge and swarf, flying object, excessive noise cumulatively are reasons for 21.56% of the respondents. Lifting and falling object, highly repetitive actions, stressful and awkward postureare reasons for 20.1% of respondents cumulatively of the stone crusher.

Table 4.3.14: Distribution of accident types by agents of injuries and health problem (hazards)

Agents of injuries & health problem (hazards)	*Type of accident encountered*				*Chi-square Test*	
	Severe (%)	Major (%)	Minor (%)	Insignificant (%)	χ^2	*P*
Dust	15 (5.0)	49 (16.2)	107 (35.4)	131 (43.4)	16.610	0.001
Working without PPE	14 (4.8)	47 (16.1)	112 (38.4)	119 (40.8)	4.037	0.258
Bad lifting and handling technique	14 (4.8)	44 (15.2)	115 (39.8)	116 (40.1)	1.726	0.631
Lifting & handling heavy objects	14 (5.7)	39 (16.0)	111 (45.5)	80 (32.8)	17.299	0.001
Sharp edge and swarf	11 (5.2)	40 (18.8)	74 (34.7)	88 (41.3)	10.168	0.017
Flying object	12 (5.7)	40 (19.0)	88 (41.7)	71 (33.6)	12.771	0.005
Excessive noise	13 (6.3)	28 (13.5)	63 (30.4)	103 (49.8)	27.206	0.000
Falling object	14 (7.0)	35 (17.5)	96 (48.0)	55 (27.5)	32.023	0.000
Highly repetitive actions	6 (3.1)	25 (12.8)	55 (28.1)	110 (56.1)	42.905	0.000
Stressful and awkward posture	9 (4.7)	29 (15.1)	55 (28.6)	99 (51.6)	26.106	0.000

Table 4.3.14 presents accident types of the ten potential hazards and their association. The association between accident types and dust, lifting & handling heavy objects, flying object, excessive noise, falling object, highly repetitive actions, stressful and awkward posture are statistically significant where working without PPE, bad lifting and handling technique, and sharp edge and swarf are not significant. However, the chi-square test is statistically significant (when p value more less 0.05) means that the variability of means and samples sizes do not affect the results of the respective data. And not statistically significant (when p value more than 0.05) means that the results of the particular data is biased by variability of means and sample sizes.

4.4. The Association between Occupational Health and Injuries & Agents of Injuries and Health Problem (Hazards)

Table 4.4.1: The association between occupational health, and injuries and agents of injuries (hazards)

Occupational Health and Injuries	Agents of Injuries and Health Problem (Hazards)									
	Dust	Working without PPE	Bad lifting and handling technique	Lifting & handling heavy objects	Sharp edge and swarf	Flying object	Excessive noise	Falling object	Highly repetitive actions	Stressful and awkward posture
Lacerations/ irregular tear of skin	277 χ^2 = 21.01, p = 0.000	266 χ^2 = 13.08, p = 0.000	254 χ^2 = 0.07, p = 0.7900	212 χ^2 = 0.335, p = 0.5630	202 χ^2 = 22.63, p = 0.000	197 χ^2 = 14.07, p = 0.000	197 χ^2 = 23.07, p = 0.000	196 χ^2 = 40.05, p = 0.000	182 χ^2 = 9.99, p = 0.002	178 χ^2 = 9.05, p = 0.003
Back and low back pain	253 χ^2 = 3.92, p = 0.048	257 χ^2 = 31.45, p = 0.000	256 χ^2 = 35.86, p = 0.000	212 χ^2 = 11.82, p = 0.001	169 χ^2 = 1.757, p = 0.185	165 χ^2 = 3.79, p = 0.51	191 χ^2 = 33.16, p = 0.000	158 χ^2 = 2.014, p = 0.156	174 χ^2 = 13.26, p = 0.000	176 χ^2 = 25.25, p = 0.000
Contusion/bruise	234 χ^2 = 6.45, p = 0.011	239 χ^2 = 33.68, p = 0.000	219 χ^2 = 0.99, p = 0.318	196 χ^2 = 11.81, p = 0.001	161 χ^2 = 0.30, p = 0.583	155 χ^2 = 0.26, p = 0.613	173 χ^2 = 19.29, p = 0.000	154 χ^2 = 1.37, p = 0.241	155 χ^2 = 4.40, p = 0.036	155 χ^2 = 7.79, p = 0.005
Eye irritation and red eye	236 χ^2 = 13.04, p = 0.000	237 χ^2 = 55.18, p = 0.000	210 χ^2 = 0.59, p = 0.343	170 χ^2 = 0.952, p = 0.329	151 χ^2 = 0.05, p = 0.810	153 χ^2 = 0.284, p = 0.594	185 χ^2 = 70.23, p = 0.000	141 χ^2 = 0.16, p = 0.689	165 χ^2 = 31.73, p = 0.000	162 χ^2 = 31.37, p = 0.000
Crushed hand/ fingers/toes	196 χ^2 = 7.27, p = 0.007	190 χ^2 = 5.69, p = 0.017	202 χ^2 = 1.33, p = 0.248	183 χ^2 = 13.64, p = 0.000	162 χ^2 = 13.12, p = 0.000	176 χ^2 = 48.79, p = 0.000	118 χ^2 = 26.14, p = 0.000	184 χ^2 = 107.09, p = 0.00	106 χ^2 = 36.98, p = 0.000	107 χ^2 = 27.74, p = 0.000
Headache	224 χ^2 = 59.23, p = 0.000	233 χ^2 = 125.23, p = 0.000	198 χ^2 = 9.27, p = 0.02	156 χ^2 = 0.02, p = 0.898	144 χ^2 = 2.42, p = 0.12	140 χ^2 = 0.95, p = 0.329	185 χ^2 = 122.54, p = 0.00	139 χ^2 = ,5.09 p = 0.024	165 χ^2 = 68.97, p = 0.000	161 χ^2 = 64.02, p = 0.000
Sharp and deep cuts or indent	199 χ^2 = 8.27, p = 0.004	199 χ^2 = 18.28, p = 0.000	184 χ^2 = 1.16, p = 0.281	163 χ^2 = 6.14, p = 0.013	155 χ^2 = 22.79, p = 0.000	164 χ^2 = 47.90, p = 0.000	137 χ^2 = 3.124, p = 0.077	166 χ^2 = 76.52, p = 0.00	120 χ^2 = 0.133, p = 0.715	120 χ^2 = 0.024, p = 0.877
Restriction of joint movement	183 χ^2 = 0.05, p = 0.829	193 χ^2 = 16.51, p = 0.000	191 χ^2 = 15.81, p = 0.000	160 χ^2 =7.61, p = 0.006	118 χ^2 = 4.76, p = 0.029	105 χ^2 = 21.49, p = 0.000	141 χ^2 = 11.29, p = 0.001	106 χ^2 = 9.21, p = 0.002	140 χ^2 = 20.45, p = 0.000	138 χ^2 = 21.24, p = 0.000
Cough	205 χ^2 = 46.74, p = 0.000	215 χ^2 = 107.65, p = 0.000	185 χ^2 = 12.89, p = 0.000	143 χ^2 = 0.007, p = 0.935	133 χ^2 = 2.63, p = 0.104	134 χ^2 = 4.29, p = 0.038	171 χ^2 = 104.12, p = 0.00	127 χ^2 = 3.82, p = 0.051	154 χ^2 = 64.14, p = 0.0000	151 χ^2 = 62.01, p = 0.000
Difficulties in hearing	148 χ^2 = 43.89, p = 0.000	148 χ^2 = 53.90, p = 0.000	120 χ^2 = 0.82, p = 0.367	96 χ^2 = 0.203, p = 0.652	91 χ^2 = 1.24, p = 0.265	78 χ^2 = 2.02, p = 0.155	141 χ^2 = 143.77, p = 0.00	63 χ^2 = 13.01, p = 0.000	119 χ^2 = 69.29, p = 0.000	116 χ^2 = 64.57, p = 0.000
Skin irritation and Dermatitis	175 χ^2 = 28.05, p = 0.000	181 χ^2 = 59.36, p = 0.000	160 χ^2 = 9.54, p = 0.002	124 χ^2 = 0.001, p = 0.981	111 χ^2 = 0.339, p = 0.56	116 χ^2 = 3.269, p = 0.071	145 χ^2 = 65.96, p = 0.000	108 χ^2 = 1.72, p = 0.19	132 χ^2 = 43.53, p = 0.000	130 χ^2 = 43.61, p = 0.000
Abrasions	154 χ^2 = 0.124, p = 0.724	151 χ^2 = 0.676, p = 0.411	154 χ^2 = 3.48, p = 0.062	146 χ^2 = 22.58, p = 0.000	127 χ^2 = 15.67, p = 0.000	149 χ^2 = 70.76, p = 0.000	95 χ^2 = 3.79, p = 0.052	157 χ^2 = 129.31, p = 0.00	79 χ^2 = 16.52, p = 0.000	80 χ^2 = 11.92, p = 0.001

The table 4.4.1 presents the correlation between injuries and hazards. The p value is considered as statistically significant when it is $p<0.05$ and insignificant for $p > 0.05$. However, the chi-square test is statistically significant means that the variability of means and samples sizes do not affect the results of the respective data. And not statistically significant means that the results of the particular data is biased by variability of means and sample sizes.

Lacerations caused by 277, 266, 254 respondents by the agent of dust, working without PPE, Bad lifting and handling technique respectively. In all cases p value is significant for 0.00, 0.00 and insignificant for 0.79 respectively for dust, working without PPE and bad lifting and handling technique. For lifting and handling heavy objects and sharp edge and swarf respondents is 212 and 202, where p value is insignificant for 0.563 and significant for 0.00 respectively.

For back and low back pain we find 253, 257, 256, 212 respondents affected by the dust, working without PPE, bad lifting and handling technique, lifting and handling heavy objects respectively. For all cases we find the p value significant which is 0.048, 0.00, 0.00, 0.001 for dust, working without PPE, bad lifting and handling technique, lifting and handling heavy objects respectively.

For the association between contusion/bruise we find 234, 239, 219 among 388 respondents with the significant p value of 0.011, 0.00 but insignificant 0.318 respectively for dust, working without PPE, bad lifting and handling technique.

For Eye irritation and red eye there is 236, 237, 210 respondents among total with the statistically significant p value of 0.00, 0.00 but insignificant for 0.343 for hazard name dust, working without PPE, bad lifting and handling technique respectively.

Determining the association between Crushed hand/ fingers/toes and hazards we find 196 and 202 respondents are affected by dust and bad lifting and handling technique where p value is significant for 0.007 and insignificant for 0.248.

For headache we find 224, 233, 198 respondents of 388 where p value is 0.00, 0.00, 0.02 which is statistically significant for dust, working without PPE, bad lifting and handling technique respectively. individually 199 of the respondents are affected by dust and working without PPE with the insignificant p value of 0.829 and significant 0.00 respectively for sharp and deep cuts or indent.

Restriction of joint movement is caused by 183, 193 respondents because of dust and working without PPE where p value is insignificant for 0.829 and significant for 0.00 respectively where

cough is caused by 205, 215 respondents because of dust and working without PPE and the p value is significant for 0.00, 0,00 respectively.

The rate of causing difficulties in hearing is comparatively low. Causes to 148 respondents individually as because of dust and working without PPE with the p value of 0.00 and 0.00 respectively which is statistically significant.

For skin irritation and dermatitis, we find 175 and 181 respondents affected by dust and working without PPE whose p value is significant for 0.00 and 0.00 respectively. Individually 154 respondents are reported to be affected by dust and bad lifting and handling technique with the statistically insignificant p value of 0.724, but insignificant for 0.062.

4.5. Risk Assessment of Potential Hazards

Table 4.5.1: Probability Level, Exposure and Consequences of hazards

Hazardous Event	***Probability Level***	***Exposure to Hazard***	***Consequence***
Dust	0.1032	95% (approximately 7.5 hrs of 8 hrs shift)	Severe
Working without PPE	0.0998	75% (approximately 6 hrs of 8 hrs shift)	Major
Bad lifting and handling technique	0.0988	75% (approximately 6 hrs of 8 hrs shift)	Minor
Lifting & handling heavy objects	0.0834	60% (approximately 5 hrs of 8 hrs shift)	Major
Sharp edge and swarf	0.0728	75% (approximately 6 hrs of 8 hrs shift)	Minor
Flying object	0.0721	75% (approximately 6 hrs of 8 hrs shift)	Major
Excessive noise	0.0707	75% (approximately 6 hrs of 8 hrs shift)	Severe
Falling object	0.0684	75% (approximately 6 hrs of 8 hrs shift)	Minor
Highly repetitive actions	0.0670	50% (approximately 4 hrs of 8 hrs shift)	Major
Stressful and awkward posture	0.0656	30% (approximately 2.4 hrs of 8 hrs shift)	Severe

Table 4.5.1 exhibits that most frequent injury's probability level, exposure and consequence of the hazards. From twenty-four injuries, most frequent encountered ten hazardous events were selected through Pareto analysis. Those ten hazardous events were caused more than 80% of the accidents. From 4.3.14, it was apparent that three of them had severe, four of them had major and rest of them had minor consequences. The respondents exposed to hazard at different specific period time of 8 hours shift for different hazardous event. The highest exposed hazard was dust and the time of exposing was about 95% of the working hours. The lowest exposed hazardous event was stressful and awkward posture and it exposed only 30% of the working hours. From the severe consequences, dust had the probability level of encountering was 0.1032 and for excessive noise, the probability level was 0.0707 and for stressful and awkward posture, it was 0.0684. Working without PPE had the most probability level among the major consequence and it's about 0.0998 and stressful and highly repetitive actions had the least probability level of encountering and it's about 0.0670. However, bad lifting and handling technique had the most probability level among the minor consequence and it's about 0.0988 and stressful and falling object had the least probability level of encountering and it's about 0.0684.

In the figure 1, for Risk Level Calculation, the probability level divided into four categories, one in ten was denoted as most probable, one in twenty was as frequently, one in hundred as sometimes, one in thousand denoted as remotely and one in ten thousand as improbable. For exposing to hazard within 8 hours shift, it was about percentage of the time exposing to the hazard. For injuries consequence, it was divided into four categories, they were- severe, major, minor, insignificant. If the point of probability level and the point of exposure was made a straight-line, it intersected the tie line. If the point of the tie line connected with the injury's consequence level, it gave which risk level the injury was in. The risk level was divided in to five sections and for very high-risk level, it was denoted as A, B for high risk level, C for substantial risk, D for low risk and E for low risk level. All the calculations of risk level were conducted by the Risk-ex risk score calculator. However, in determining the probability level, exposure to hazard and consequences of hazard, we have to approximate in some cases because of lack of data and time constraint.

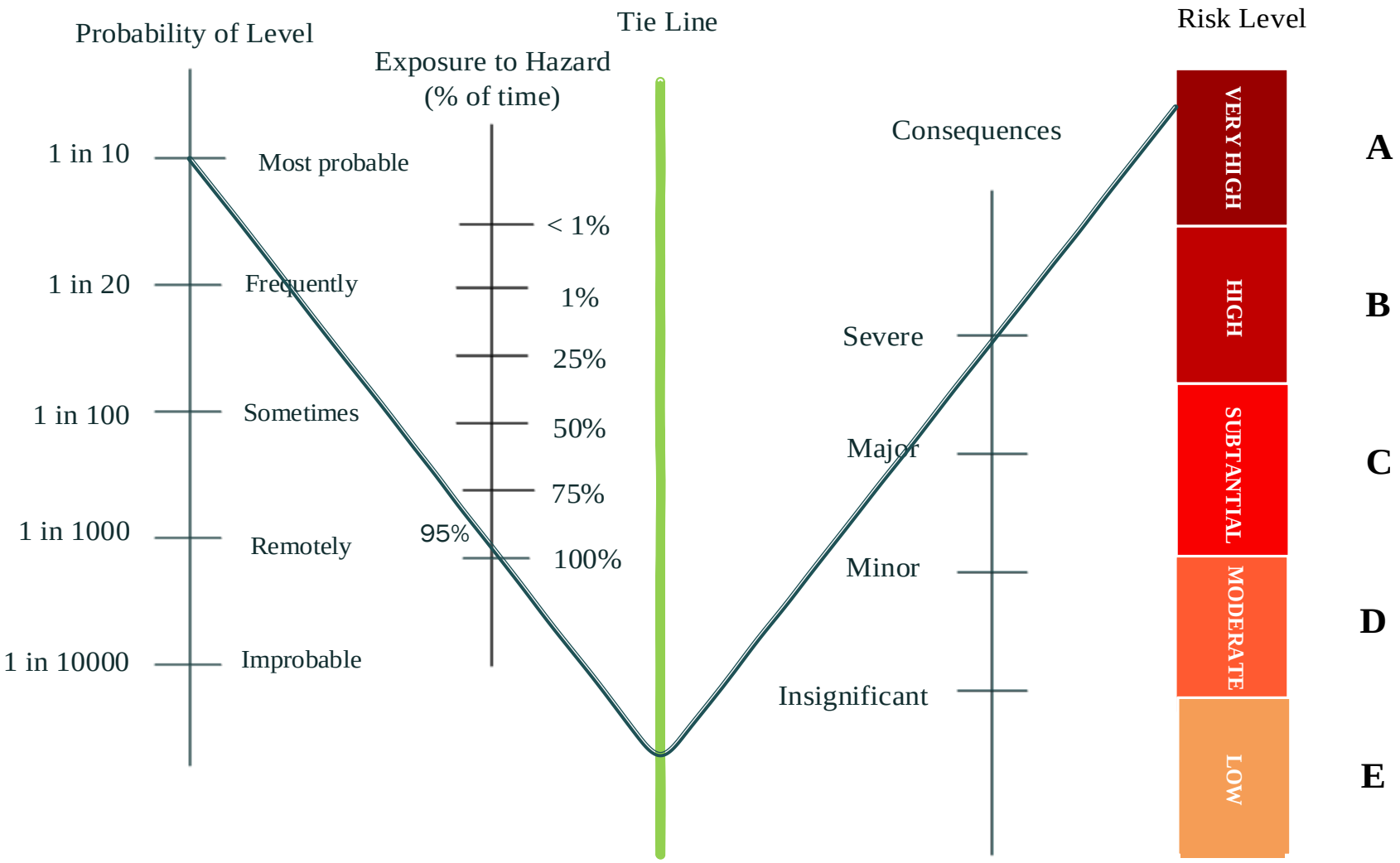

Figure 1: Sample risk level calculation for Dust.

Table 4.5.2: Hazard Identification & Analysis Work Sheet

Hazardous Events	***Possible Causes***	***Consequence***	***Risk Level***	***Control Measures***
Dust	From crushed stone	Itching, irritating or damaging skin, cough and problems in inhaling, eyes irritating	A	Avoid inhaled irritants such as dust, using mask.
Working without PPE	Ignorance, unavailability	Injury in different body parts	B	Using proper PPE.
Bad lifting and handling technique	Manual handling	Back and low back pain, musculoskeletal disorders	C	Maintain good posture, and move around during the working hours.
Lifting & handling heavy objects	Manual handling	Fatigue, back pain, musculoskeletal disorders	C	Maintain good posture, and move around during the working hours.
Sharp edge and swarf	Manual handling	Tearing skin, cut and bleeding	C	PPE, such as appropriate gloves, apron, and face shields should be worn to prevent direct contact between the substance and the skin.
Flying object	Crushed stone	Tearing skin, cut and bleeding	B	Wear proper PPE, including gloves and long sleeves.
Excessive noise	Crusher and vibrator.	Difficulties in hearing, headache	A	Using ear plug and ear muff.

Falling object	Crushed stone from belt conveyers, hopper or crusher machine	Tearing and shearing skin, cut and bleeding, crushed different body part (e.g. hand, finger, toes)	C	Wear proper PPE, including gloves, safety boot and long sleeves.
Highly repetitive actions	Manual handling	Fatigue, stress	C	Maintain good posture, and move around during the working hours or rest for a while.
Stressful and awkward posture	Less awareness	Ergonomic injuries that can affect the muscles, nerves, tendons, ligaments, joints, cartilage and spinal discs	C	Maintain good posture, and move around during the working hours or rest for a while.

From the table 4.5.2 of the experiment of Hazard Identification and Analysis, to know how to identify hazards in an organized and systematic way and analyze the potential hazards for reducing or removing the consequences of hazardous situations. It had been estimated and evaluated risks on a semi-quantitative basis as ranking risks on a comparative scale. In this study, the risk level calculation was done by using the respected probability level, exposure to hazard and consequence of hazard. For each hazardous event, the calculation of the risk level presented that it had two very high, two high and six substantial risks for encountering accidents. It was gotten that dust, excessive noise had very high-risk level among the most frequent hazardous event. Besides, working without PPE and flying object had the high level of risk and rest of the injuries had substantial level of risk. In table 4.5.2, it also suggested some control measures to mitigate the consequences.

4.6. Knowledge, Attitude, and Practice regarding PPE use of the respondents

4.6.1. Knowledge, Attitude, and Practice level assessment

Table 4.6.1: Knowledge level of the respondents about PPE use

Knowledge level	*Frequency*	*Percentage (%)*
Poor knowledge (00-47 scores)	82	21.13
Moderate knowledge (48-64 scores)	232	59.79
Good knowledge (65-80 scores)	74	19.07
Total	388	100.00

According to table 4.6.1, approximately 59.79% of the stone crushing workers had a moderate knowledge, only 19.07% respondents had a good knowledge about PPE use and 21.13% had a poor knowledge.

Table 4.6.2: Attitude level of the respondents towards PPE use

Attitude level	*Frequency*	*Percentage (%)*
Negative attitude (00-26 scores)	128	32.99
Neutral attitude (27-35 scores)	233	60.05
Positive attitude (36-45 scores)	27	6.96
Total	388	100.00

The table 4.6.2 reveals that only 6.96% respondents were positive attitude towards PPE use where 60.05% respondents showed neutral attitude, and 32.99% respondents had a negative attitude towards PPE use.

Table 4.6.3: Practice level of the respondents for PPE use

Practice level	*Frequency*	*Percentage (%)*
Poor practice (00-23 scores)	385	99.23
Fair practice (24-32 scores)	2	0.52
Good practice (33-40)	1	0.26
Total	388	100.00

The table 4.6.3 demonstrates that only one respondent (0.26%) had a good practise of PPE, two respondents (0.52%) were on fair practice of PPE, and almost all respondents 99.23% had poor practice of PPE during working.

Table 4.6.4: The reasons for not complying with PPE during working

Possible Causes	*Frequency*	*Percentage (%)*
Not available	324	84.8
Not important	29	7.6
Uncomfortable	23	6.1
Wrong size	4	1.0
Other (Not understand, Not familiar)	2	0.5
Total	382	100.0

The table 4.6.4 exhibits, 84.8% respondents never get PPE in workplace. Rest of the 15.2% respondents had a provision or availability of PPE but they did not use. Where 7.6% respondents claimed not important or no need during working, and 6.1% considered uncomfortable.

4.6.2. PPE Availability Assessment

Randomly 51 stone crushing factories was chosen to assess the PPE availability assessment. Only employers (owner or manager) responded this section of questionnaire.

Table 4.6.5: PPE availability status

Condition	*Frequency*	*Percentage (%)*
Available	7	13.73
Unavailable	44	86.27
Total	51	100.00%

Table 4.6.5 represents that, PPE was available in only 13.73% factories whereas 86.27% was unavailable among 51 stone crushing factories.

Table 4.6.6: Availability of every types of PPE

Response	Availability	Unavailability
PPE types	*Frequency (%)*	*Frequency (%)*
Nose & mouth masks	12 (23.53)	39 (76.47)
Safety boots	10 (19.61)	41 (80.39)
Helmets/hard hats	8 (15.69)	43 (84.31)
Gloves/mittens	5 (9.80)	46 (90.20)
Earplug/ear muffs	2 (3.92)	49 (96.08)
Eye shield/goggles	0 (0.0)	51 (100.0)
Face shield	0 (0.0)	51 (100.0)
Overall/apron	0 (0.0)	51 (100.0)
Total	37 (9.07%)	371 (90.93%)

Table 4.6.6 shows the availability of every types of PPE. The rate of unavailability of the PPE is much higher than the rate of availability. Availability of nose and mouth masks is 23.53% whereas the unavailability is 76.47%. The availability is only 19.61%, 15.69%, 9.8% and 3.92% for Safety boots, Helmets/hard hats, Gloves/mittens and S Earplug/ear muffs whereas the unavailability is much higher 80.39%, 84.31%, 90.20%, 96.08% for these respectively. No eye shield or goggles, face shield and overall or apron is reported by the factories.

Table 4.6.7: Purchasing time of PPE		
Time	*Frequency*	*Percentage (%)*
Less than 6 months	0	0.00
6 months before	3	5.88
1 year before	8	15.67
2 years before	15	29.41
5 years before	25	49.02
10 years before	0	0.00
Total	51	100.0%

Table 4.6.7 indicates the purchasing time of PPE. As we can see there is no factory who purchase PPE in less than 6 months. 5.88% and 15.67% of the factory purchases PPE respectively 6 months before and 1 year before. 29.41% and 49.02% of the factory purchases PPE 2 years before and 5 years before respectively.

Table 4.6.8: Conditions of the available PPE				***N***
Measure	*Response*	*Frequency*	*Percentage (%)*	
Are these functional conditions?	Yes	4	7.84	51
	No	47	92.16	
Do these fit all the employees/ workers sizes?	Yes	5	9.80	51
	No	47	90.20	
Do you provide them to use PPE?	Yes	6	11.76	51
	No	45	88.24	
Do you encourage them to use PPE?	Yes	9	17.65	51
	No	42	82.35	
Do they use PPE properly?	Yes	5	9.80	51
	No	47	90.20	
Do the PPE sufficient to the requirements?	Yes	1	1.96	51
	No	50	98.04	

Table 4.6.8 reflects the conditions of the available PPE. We can see that, 92.16% of the factory state that the PPE are not in functional conditions. 90.20% of the factory agree with the fact that these are not fit for all the employees or worker. 88.24% factory do not provide them to use PPE. 82.35% of the factory do not encourage them to use PPE. In 90.20% factories workers do not use them properly. 98.04% of the factory agree with the fact that PPE is insufficient to the requirements.

Table 4.6.9: The reasons for unavailability of PPE		
Possible Causes	*Frequency*	*Percentage (%)*
Not interested	11	21.57
Not important	10	19.61
Very expensive	9	17.65
Other (Deteriorate or Non-functional conditions)	21	41.18
Total	51	100.0%

Table 4.6.9 indicates the reasons for unavailability of PPE. We can see that, 21.57% of the factory says that they are not interested. 19.61% of the factory says it is not important. 17.65% says PPE is very expensive. Rest of the factory says deteriorate or non-functional conditions.

4.7. The Association among Knowledge Level and Demographic Variables regarding PPE use of the respondents

Table 4.7.1: The association between Age and Knowledge level

Age	*Knowledge level*			*Total (%)*
	Poor *(%)*	Moderate *(%)*	Good *(%)*	
Young Adult (18-30 yrs.)	54 (13.9)	125 (32.2)	47 (12.1)	226 (58.2)
Early middle age (31-45 yrs.)	16 (4.1)	92 (23.7)	23 (5.9)	131 (33.8)
Late middle age and above (46+ yrs.)	12 (3.1)	15 (3.9)	4 (1.0)	31 (8)
Total	82 (21.1)	232 (59.8)	74 (19.1)	388 (100.0)
				χ^2 = 15.227, p = 0.004

Table 4.7.1 shows that 44.3% of young adult's respondents had moderate to good knowledge level of PPE use. The 29.6% early middle age adults' workers had moderate to good knowledge. So, moderate to good knowledge level of young adults is higher than early middle and late middle age. Where the association between age and the level of knowledge with regards to PPE of the respondents was statistically significant for the p value was less than 0.05 (χ^2 = 15.227, p = 0.004). So, the variability of means and sample sizes do not affect the result shown in table 4.7.1.

Table 4.7.2: The association between Gender and Knowledge level

Gender	*Knowledge level*			*Total (%)*
	Poor *(%)*	Moderate *(%)*	Good *(%)*	
Male	42 (10.8)	176 (45.4)	54 (13.9)	272 (70.1)
Female	40 (10.3)	56 (14.4)	20 (5.2)	116 (29.9)
Total	82 (21.1)	232 (59.8)	74 (19.1)	388 (100)
				χ^2 = 17.914, p = 0.000

In Table 4.7.2, the moderate and good knowledge level of male was 59.3% of the total respondents. And 17.7% female was at the moderate to good knowledge level. There is a higher knowledge of male than female. Anyway, male knowledge level dominated than female knowledge level because of larger male number (table 4.2.1). However, there was an association between gender of the respondents and knowledge about PPE use as the chi-square test is statistically significant (χ^2 = 17.914, p = 0.000). Therefore, the variability of means and sample sizes do not affect the result shown.

Table 4.7.3: The association between Level of education and Knowledge level

Level of education	*Knowledge level*			*Total (%)*
	Poor *(%)*	Moderate *(%)*	Good *(%)*	
No formal education	69 (17.8)	164 (42.3)	41 (10.6)	274 (70.6)
Primary (Up to class V)	12 (3.1)	53 (13.7)	24 (6.2)	89 (22.9)
Secondary (class VI - X)	1 (0.3)	15 (3.9)	9 (2.3)	16 (4.1)
Total	82 (21.1)	232 (59.8)	74 (19.1)	388(100)
				χ^2 = 17.153, p = 0.002

Table 4.7.3 illustrates that almost half (52.6%) of the respondents having no formal education showed moderate to good knowledge level. 13.7% primary educated respondents perceived moderate knowledge level. Comparatively, no formal educated worker had poor (17.8%) knowledge than good level of knowledge (10.6%). There is an increasing pattern of secondary level educated respondents about knowledge of PPE use. Since, χ^2 = 17.153, p <0.05, the association between level of education and level of knowledge of the respondents was statistically significant as indicated in table 4.7.3. Hence, the results are not affected by the variability of means and sample sizes.

Table 4.7.4: The association between Employment and Knowledge level

Employment	*Knowledge level*			*Total (%)*
	Poor *(%)*	Moderate *(%)*	Good *(%)*	
Fulltime	76 (19.6)	217 (55.9)	68 (17.5)	361(93)
Part-time	6 (1.5)	15 (3.9)	2 (0.5)	23(5.9)
Self-employed	0 (0.0)	0 (0.0)	3 (0.8)	3(0.8)
Replacement worker	0(0.0)	0(0.0)	1(0.3)	1(0.3)
Total	82 (21.1)	232 (59.8)	74 (19.1)	388(100)
				Fisher's Exact Test = 12.781, p = 0.016

In the table 4.7.4, we can observe that the knowledge level for the part-time workers 1.5% is lesser than the knowledge level of the fulltime workers 19.6%. This maybe the reason behind the high frequency of the fulltime workers. However, the p value = 0,016 is lesser than 0.05 and fisher's exact test values = 12.781, it means there is statistically significant association between employment and knowledge level. Therefore, the variability of means and sample sizes do not affect the results.

Table 4.7.5: The association between Occupation and Knowledge level

Occupation	*Knowledge level*			*Total (%)*
	Poor *(%)*	Moderate *(%)*	Good *(%)*	
Carrying and lifting personnel	73(18.8)	184(47.4)	47(12.1)	304(78.4)
Machine operator	1(.3)	18(4.6)	9(2.3)	28(7.2)
Welder	0(0)	5(1.3)	6(1.5)	11(2.8)
Supervisor	0(0)	4(1)	6(1.5)	10(2.6)
Maintenance personnel	1(.3)	3(.8)	2(.5)	6(1.5)
Assistant to machine operator	1(.3)	1(.3)	0(0)	2(.5)
Others (Truck driver etc.)	6(1.5)	17(4.4)	4(1)	27(7)
Total	82(21.1)	232(59.8)	74(19.1)	388(100)
				χ^2= 33.812, p = 0.001

The table 4.7.5 presents that mostly 47.4% carrying and lifting personnel out of 304 were at moderate knowledge level. Others occupational personnel showed moderate to good knowledge level. However, there is a statistically significant association between the occupation of the respondents and the knowledge level of PPE use as χ^2 = 33.812 and p = 0.001. So, the results are not affected by the variability of means and sample sizes.

Table 4.7.6: The association between Length of service in the current organization/job (in year) and Knowledge level

Length of service in the current organization/job (in year)	*Knowledge level*			*Total (%)*
	Poor *(%)*	Moderate *(%)*	Good *(%)*	
0.5 – 3 yrs.	23(5.9)	33(8.5)	14(3.6)	70(18)
3 – 5 yrs.	16(4.1)	55(14.2)	13(3.4)	84(21.6)
5 – 8 yrs.	18(4.6)	58(14.9)	19(4.9)	95(24.5)
8+yrs.	25(6.4)	86(22.2)	28(7.2)	139(35.8)
Total	82(21.1)	232(59.8)	74(19.1)	388(100)
				χ^2= 8.772, p = 0.187

Table 4.7.6 presents that most respondents (29.4%) in servicing 8+yrs had moderate to good knowledge level. 12.1%, 17.6%, and 19.8% of workers had moderate to good knowledge in servicing 0.5-3yrs, 3-5yrs, and 5-8yrs respectively. Knowledge level was increasing with the length of service in jobs. However, the association between length of service and knowledge level is not statistically significate due to chi-square value = 8.772 and p value = 0.187.

Table 4.7.7: The association between Knowledge level and Occupation

Occupation	Knowledge level			Total *(%)*
	Poor *(%)*	Moderate *(%)*	Good *(%)*	
Machine operator	1 (3.6)	18 (64.3)	9 (32.1)	28 (100.0)
Welder	0 (0.0)	5 (45.5)	6 (54.5)	11 (100.0)
Maintenance personnel	1 (16.7)	3 (50.0)	2 (33.3)	6 (100.0)
Assistant to machine operator	1 (50.0)	1 (50.0)	0 (0.0)	2 (100.0)
Carrying and lifting personnel	73 (24.0)	184 (60.5)	47 (15.5)	304 (100.0)
Supervisor	0 (0.0)	4 (40.0)	6 (60.0)	10 (100.0)
Others	6 (22.2)	17 (63.0)	4 (14.8)	27 (100.0)
				χ^2 = 33.812, p = 0.01

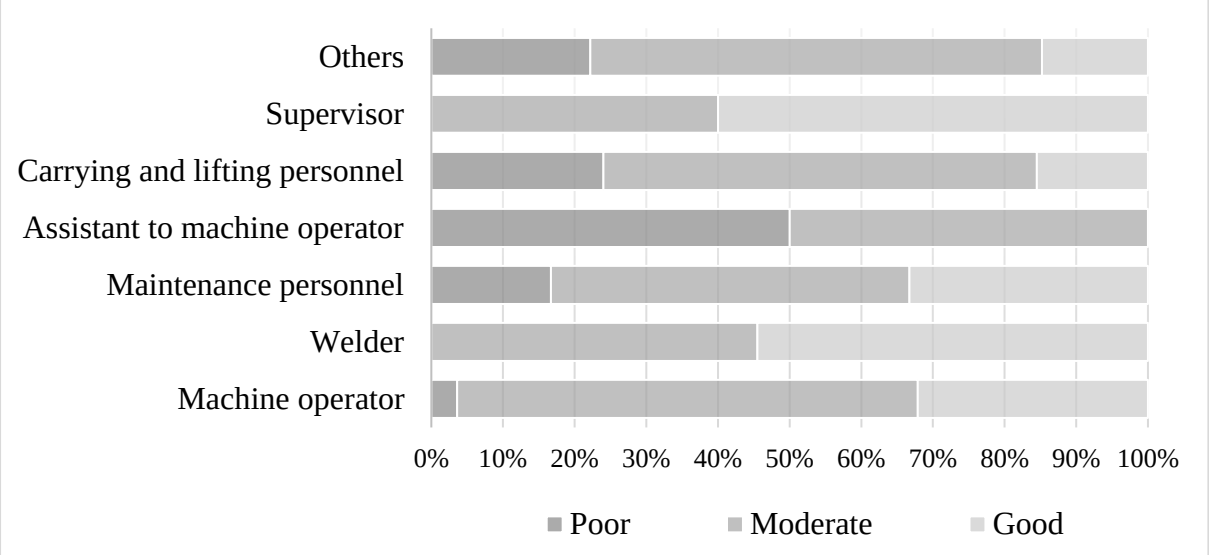

Figure 2: Knowledge Level with Occupation

A crosssectional study is conducted to explore the relationship and association of the knowledge level with the different personnel of the stone crusher. Among seven categories of occupation, supervisors had the most good level of knowledge about 60%. Beyond that, 54.5% welder had the good level of knowledge. In both occupation, poor knowledge was zero. Other types of occupational personnel had moderate level of knowledge and it's all more than 50%. Assistant to machine operator had the most poor knwledge about PPE use and it's about 50%. In total, among all occupation's personnel, 21.1% had poor knowledge, 59.8% had moderate knowledge and 19.1% had good knowledge. It was depicted that the association between occupation and types of occupation is statistically significate as χ^2 = 33.812 and p = 0.01 in table 4.7.7. Therefore, the variability of means and sample sizes do not affect the results.

4.8. The Association among Attitude Level and Demographic Variables regarding PPE use of the respondents

Table 4.8.1: The association between Age and Attitude level

Age	*Attitude level*			*Total (%)*
	Negative *(%)*	Neutral *(%)*	Positive *(%)*	
Young adults (18-30 yrs.)	85(21.9)	126(32.5)	15(3.9)	226(58.2)
Early middle age (26-40 yrs.)	36(9.3)	84(21.6)	11(2.8)	131(33.8)
Late middle age and above (46+ yrs.)	7(1.8)	23(5.9)	1(0.3)	31(8.0)
Total	128(33.0)	233(60.1)	27(7.0)	388(100.0)
				χ^2= 6.819, p = 0.146

The Table 4.8.1 shows that at the young adults negative, and positive attitude was 21.3% and 3.9% respectively about PPE use. 9.3% of early middle age worker had a negative attitude. Negative attitude towards PPE use is found higher in all age groups. However, the chi-square test (χ^2= 6.819 and p = 0.146) has not been found statistically significant association between the age and the attitude level towards PPE use. Therefore, the conclusion drawn from table 4.8.1 is biased by variability of means.

Table 4.8.2: The association between Gender and Attitude level

Gender	*Attitude level*			*Total (%)*
	Negative *(%)*	Neutral *(%)*	Positive *(%)*	
Male	76(19.6)	179(46.1)	17(4.4)	272(70.1)
Female	52(13.4)	54(13.9)	10(2.6)	116(29.9)
Total	128(33)	233(60.1)	27(7)	388(100)
				χ^2= 12.707, p = 0.002

In the table 4.8.2, most of male had neutral attitude towards PPE use. Very few (2.6%) female workers had positive attitude. Comparatively, male workers (19.6%) showed negative attitude than female (13.4%). However, the chi-square test has been found statistically significant for the p value was less than 0.05 (χ^2= 12.707 and p = 0.002). Therefore, the variability of means and sample sizes do not affect the result shown in table 4.8.2.

Table 4.8.3: The association between Level of education and Attitude level

Level of education	*Attitude level*			*Total (%)*
	Negative *(%)*	Neutral *(%)*	Positive *(%)*	
No formal education	110(28.4)	149(38.4)	15(3.9)	274(70.6)
Primary (Up to class V)	13(3.4)	67(17.3)	9(2.3)	89(22.9)
Secondary (class VI - X)	5(1.3)	17(4.4)	3(0.8)	25(6.4)
Total	128(33)	233(60.1)	27(7)	388(100)
			χ^2= 22.870, p = 0.000	

From the Table 4.8.3, we get the association between level of education level and attitude. It can be shown that among no formal education 28.4% showed negative, 38.4 % showed positive and 3.9 % showed positive attitude towards PPE use. Negative attitude decreased with the increase in level of education. Among all the level of education negative attitude was higher than positive attitude. However, the chi-square test has been found statistically significant association between level of education and attitude level as the p value was less than 0.05 (χ^2= 22.870 and p = 0.000). Therefore, the variability of means and sample sizes do not affect the result shown in table 4.8.3.

Table 4.8.4: The association between Occupation and Attitude level

Occupation	*Attitude level*			*Total (%)*
	Negative *(%)*	Neutral *(%)*	Positive *(%)*	
Carrying and lifting personnel	113(29.1)	175(45.1)	16(4.1)	304(78.4)
Machine operator	3(0.8)	22(5.7)	3(0.8)	28(7.2)
Welder	2(0.5)	5(1.3)	4(1)	11(2.8)
Maintenance personnel	1(0.3)	5(1.3)	0(0)	6(1.5)
Assistant to machine operator	1(0.3)	1(0.3)	0(0)	2(0.5)
Supervisor	1(0.3)	5(1.3)	4(1)	10(2.6)
Others	7(1.8)	20(5.2)	0(0)	27(7)
Total	128(33)	233(60.1)	27(7)	388(100)
			χ^2= 46.769, p = 0.000	

The Table 4.8.4 presented, carrying and lifting personnel were to negative attitude. Relatively, other groups had negative attitude than positive attitude towards PPE use. Here, large number of carrying and lifting personnel dominates other groups. However, the chi-square test has been found statistically significant (χ^2 = 46.769 and p = 0.000). Therefore, the variability of means and sample sizes do not affect the result.

Table 4.8.5: The association between Length of service in the current organization/job (in year) and Attitude level

Length of service in the current organization/job (in year)	*Attitude level*			*Total (%)*
	Negative *(%)*	Neutral *(%)*	Positive *(%)*	
0.5 - 3 yrs.	29(7.5)	37(9.5)	4(1.0)	70(18.0)
3 - 5 yrs.	22(5.7)	58(14.9)	4(1.0)	84(21.6)
5 - 8 yrs.	29(7.5)	58(14.9)	8(2.0)	95(24.5)
8+ yrs.	48(12.4)	80(20.6)	11(2.8)	139(35.8)
Total	128(33)	233(60.1)	27(7)	388(100)
				χ^2= 6.071, P = 0.415

Table 4.8.5 shows that 0.5-3yrs and 3-5yrs length of service had 1.0% positive attitude towards PPE use. 5-8yrs and 8+yrs service length had 2.0% and 2.8% positive attitude which showed positive attitude increasing with the length of service. Among all the group of service length had more negative attitude. However, the association between length of service in the current organization/ job (in year) and the level of attitude is not statistically significant as χ^2 = 6.071 and p = 0.415. So, the results obtained from table 4.8.5 do not reflect the true scenario and are biased by the variability of means.

Table 4.8.6: The association between Attitude level and Occupation

Occupation	Attitude level			Total *(%)*
	Negative (%)	Neutral (%)	Positive (%)	
Machine operator	3 (10.7)	22 (78.6)	3 (10.7)	28 (100.0)
Welder	2 (18.2)	5 (45.5)	4 (36.4)	11 (100.0)
Maintenance personnel	1 (16.7)	5 (45.5)	0 (0.0)	6 (100.0)
Assistant to machine operator	1 (50.0)	1 (83.3)	0 (0.0)	2 (100.0)
Carrying and lifting personnel	113 (37.2)	175 (57.6)	16 (5.3)	304 (100.0)
Supervisor	1 (10.0)	5 (50.0)	4 (40.0)	10 (100.0)
Others	7 (25.9)	20 (74.1)	0 (0.0)	27 (100.0)
				χ^2 = 46.769, p = 0.000

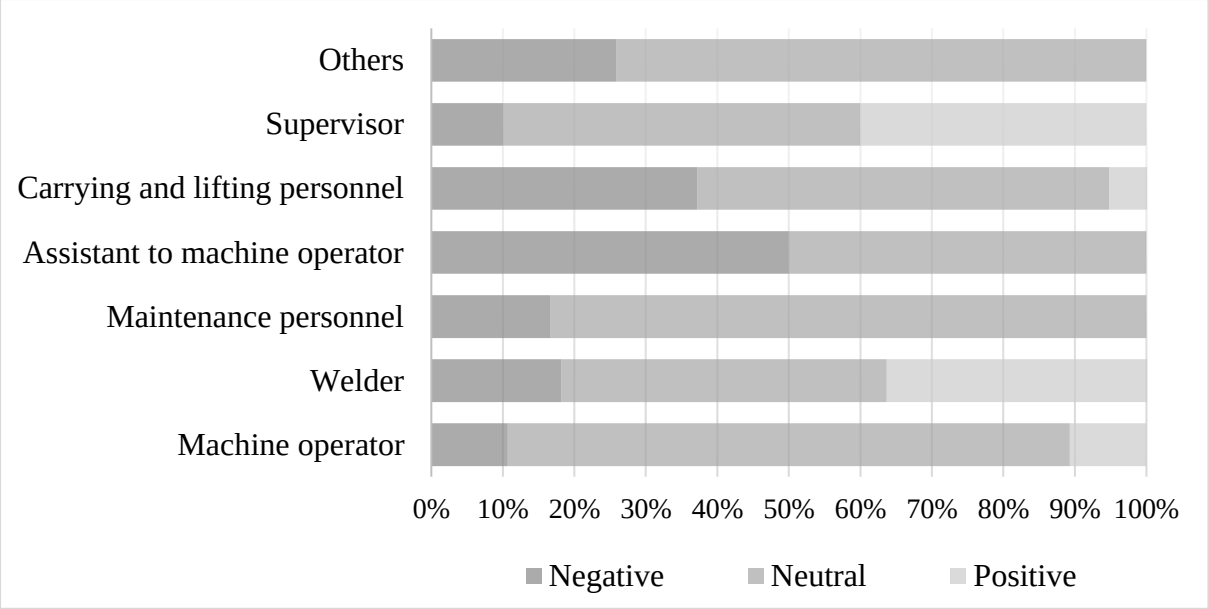

Figure 3: Attitude Level with Occupation

The findings of the above table indicate that among the seven types of occupation, only 7% had positive attitude, 33% had negative and rest had neutral attitude. Like knowledge level, supervisors had the most positive attitude & it's about 40% and beyond that 36.4% of welders had positive attitude. Machine operators and carrying & lifting personnel had a slightly little amounts of positive attitude about 10.7% & 5.3% respectively. Assistant to machine operator and carrying & lifting personnel had most negative attitude with 50% and 37.2% respectively. Apart from these occupations, most of them have neutral attitude. However, the chi-square test has been found statistically significant association between attitude level and occupation (χ^2 = 46.769 and p = 0.000). Therefore, the variability of means and sample sizes do not affect the result.

4.9. The Association among Practice Level and Demographic Variables regarding PPE use of the respondents

Table 4.9.1: The association between Age and Practice level

Age	*Practice level*			*Total (%)*
	Poor *(%)*	Fair *(%)*	Good *(%)*	
Young adults (18-30 yrs.)	225(58.0)	0(0.0)	1(0.3)	226(58.2)
Early middle age (30-45 yrs.)	129(33.2)	2(0.8)	0(0.0)	131(33.8)
Late middle age and above (46+ yrs.)	31(8.0)	0(0.0)	0(0.0)	31(8.0)
Total	385(99.2)	2(.5)	1(.3)	388(100)
				Fisher's Exact Test = 5.008, p = 0.326

Table 4.9.1 demonstrates that 58% of young adults, 33.2% of early middle age, and 8% of late middle age of workers were in poor practice of PPE use. Poor practice dominants in all the group. However, the fisher's exact test (fisher's exact test value = 5.008 and p = 0.326) has not been found statistically significant association between age and practice level. Therefore, the conclusion drawn from table 4.3.6 is biased by variability of means.

Table 4.9.2: The association between Level of education and Practice level

Level of education	*Practice level*			*Total (%)*
	Poor *(%)*	Fair *(%)*	Good *(%)*	
No formal education	274(70.6)	0(0.0)	0(0.0)	274(70.6)
Primary (Up to class V)	88(22.7)	1(0.3)	0(0.0)	89(22.9)
Secondary (class VI - X)	23(5.9)	1(0.3)	1(0.3)	16(4.1)
Total	385	2(0.5)	1(0.3)	388(100)
				Fisher's Exact Test = 12.996, p = 0.003

Table 4.9.2 provides that the majority 70.6% respondents having no formal education were in poor practice of PPE. 22.7% of primary level educated workers and 5.9% secondary level workers were also poor practices of PPE which indicates that poor practices are decreasing with the higher education level. However, the fisher's exact test has been found statistically significant association between level of education and practice level (fisher's exact test value = 12.996 and p = 0.003). Therefore, the variability of means and sample sizes do not affect the results.

Table 4.9.3: The association between Occupation and Practice level

Occupation	*Practice level*			*Total (%)*
	Poor *(%)*	Fair *(%)*	Good *(%)*	
Carrying and lifting personnel	304(78.4)	0(0)	0(0)	304(78.4)
Machine operator	28(7.2)	0(0)	0(0)	28(7.2)
Welder	10(2.6)	0(0)	1(0.3)	11(2.8)
Supervisor	8(2.1)	2(0.5)	0(0)	10(2.6)
Maintenance personnel	6(1.5)	0(0)	0(0)	6(1.5)
Assistant to machine operator	2(0.5)	0(0)	0(0)	2(0.5)
Others	27(7.0)	0(0)	0(0)	27(7.0)
Total	385(99.2)	2(.5)	1(.3)	388(100)
			Fisher's Exact Test = 40.181, p = 0.000	

From the Table 4.9.3,78.4% of carrying and lifting personnel was in poor practice of PPE. 7.2% of machine operator and 2.6% of welder also practice poor. It's clear that the association between the occupation and the practice level had significance for the p value is 0.000 (fisher exact value = 40.181). Therefore, the variability of means and sample sizes do not affect the result shown in table 4.9.3.

Table 4.9.4: The association between Length of service in the current organization/job and Practice level

Length of service in the current organization/job (in year)	*Practice level*			*Total (%)*
	Poor *(%)*	Fair *(%)*	Good *(%)*	
0.5 - 3 yrs.	70(18.0)	0(0.0)	0(0.0)	70(18.0)
3 - 5 yrs.	84(21.6)	0(0.0)	0(0.0)	84(21.6)
5 - 8 yrs.	95(24.5)	0(0.0)	0(0.0)	95(24.5)
8+ yrs.	136(35.1)	2(0.5)	1(0.3)	139(35.8)
Total	385(99.2)	2(0.5)	1(0.3)	388(100)
			Fisher's Exact Test = 4.456, p = 0.835	

Table 4.9.4 shows that 35.1% of 8+yrs service length workers were in poor practice. Poor practice increased with the increasing the length of service. However, the fisher's exact test (fisher's exact test value = 4.456 and p = 0.835) has not been found statistically significant. Therefore, the conclusion drawn from table 4.9.4 is biased by variability of means.

Table 4.9.5: The association between Practice level and Occupation

Occupation	Practice level			Total *(%)*
	Poor (%)	Fair (%)	Good (%)	
Machine operator	28 (100.0)	0 (0.0)	0 (0.0)	28 (100.0)
Welder	10 (90.9)	0 (0.0)	1 (9.1)	11 (100.0)
Maintenance personnel	6 (100.0)	0 (0.0)	0 (0.0)	6 (100.0)
Assistant to machine operator	2 (100.0)	0 (0.0)	0 (0.0)	2 (100.0)
Carrying and lifting personnel	304 (100.0)	0 (0.0)	0 (0.0)	304 (100.0)
Supervisor	8 (80.0)	2 (20.0)	0 (0.0)	10 (100.0)
Others	27 (100.0)	0 (0.0)	0 (0.0)	27 (100.0)
			Fisher's Exact Test Value = 40.181, p = 0.000	

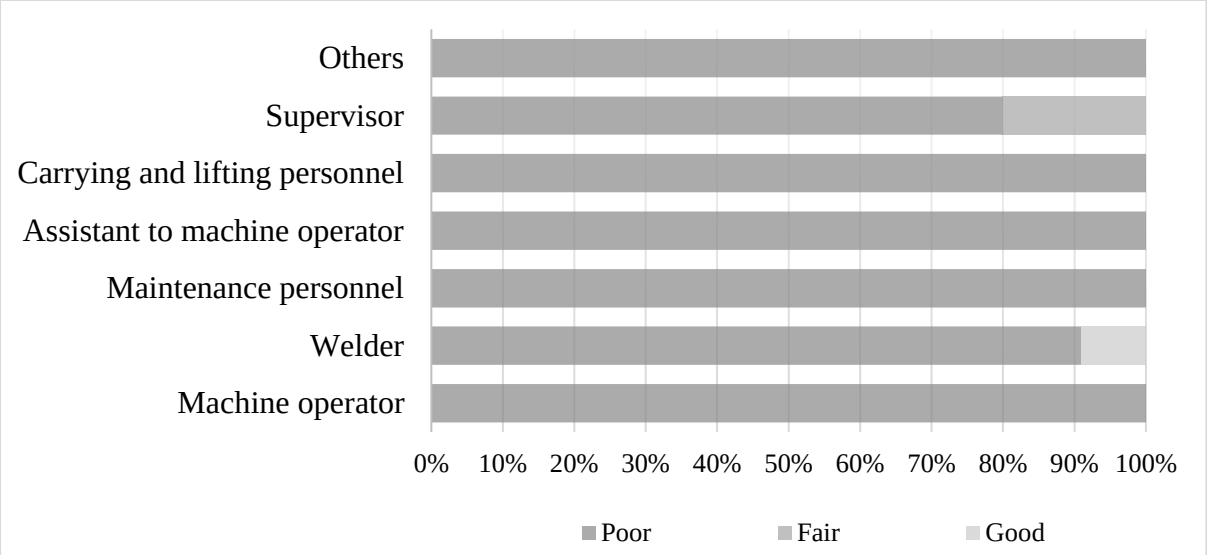

Figure 4: Practice Level with Occupation

From the table 4.9.5, it was found that only one welder had a good practice of PPE, two supervisors were on fair practice of PPE and rest of the respondents had poor practice. All the machine operators, maintenance personnel, assistant to machine operators, carrying and lifting personnel, others (truck drivers and their helpers) had poor practice of PPE. Among welders, 90.9% had poor practice, where among supervisors the percentage was slightly less and it's 80%. Good practiced respondents used almost all the PPE and fair practiced respondents used some of the PPE during their working hours. However, the association between the occupation and the practice level is statistically significance as the p value is 0.000 and fisher exact value = 40.181. Therefore, the variability of means and sample sizes do not affect the result shown.

4.10. The Association among Knowledge, Attitude, and Practice regarding PPE use of the respondents

Table 4.10.1: The association between knowledge and attitude regarding PPE use of the respondents

Knowledge level	*Attitude level*			*Total (%)*
	Negative *(%)*	Neutral *(%)*	Positive *(%)*	
Poor	53 (13.7)	28 (7.2)	1 (0.3)	82 (21.1)
Moderate	65 (16.8)	165 (42.5)	2 (0.5)	232 (59.8)
Good	10 (2.6)	40(10.3)	24 (6.2)	74 (19.1)
Total	128 (33.0)	233 (60.1)	27 (7.0)	388 (100.0)
			χ^2= 134.757, p = 0.000	

Table 4.10.1 demonstrates that among the 21.1% poor knowledge level respondents, 13.7% had shown negative attitude where cumulatively 7.5% of the respondents had shown neutral to positive attitude. Among 59.8% moderate knowledge level respondents, 16.8% of them had demonstrated negative attitude whereas 43.0% of them had shown neutral to positive attitude cumulatively. Amid 19.1% good knowledge level respondents, 2.6% of them had negative attitude and 16.5% of them had neutral to positive attitude. However, the association between knowledge level and attitude level is statistically significance as p value less than 0.05 and χ^2= 134.757. Therefore, the variability of means and sample sizes do not affect the results.

Table 4.10.2: The association between knowledge and practice regarding PPE use of the respondents

Knowledge level	*Practice level*			*Total (%)*
	Poor *(%)*	Fair *(%)*	Good *(%)*	
Poor	82 (21.1)	0 (0.0)	0 (0.0)	82 (21.1)
Moderate	232 (59.8)	0 (0.0)	0 (0.0)	232 (59.8)
Good	71 (18.3)	2 (0.5)	1 (0.3)	74 (19.1)
Total	385 (99.2)	2 (0.5)	1 (0.3)	388 (100.0)
			Fisher's Exact Test = 8.737, p = 0.007	

Table 4.10.2 presents that 21.1% of respondents were in poor practice of PPE among all the poor knowledge level respondents. Among all the moderate knowledge level respondents were also in poor practice (59.8%). Although having good knowledge level about PPE use, 18.3% respondents were in poor practices where very few (0.8%) of the were in fair and good practice. However, the fisher's exact test has been found statistically significant association between knowledge level and practice level regarding PPE use of the respondents as the p value was less than 0.05 (fisher's exact test = 8.737 and p = 0.007). Therefore, the variability of means and sample sizes do not affect the result shown in table 4.10.2.

Table 4.10.3: The association between attitude and practice regarding PPE use of the respondents

Attitude level	*Practice level*			*Total (%)*
	Poor *(%)*	Fair *(%)*	Good *(%)*	
Negative	128 (33.0)	0 (0.0)	0 (0.0)	128 (33.0)
Neutral	233 (60.1)	0 (0.0)	0 (0.0)	233 (60.1))
Positive	24 (6.2)	2 (0.5)	1 (0.3)	27 (7.0)
Total	385 (99.2)	2 (0.5)	1 (0.3)	388 (100.0)
				Fisher's Exact Test = 16.051, p = 0.000

It is visible in table 4.10.3 that 33.0% of respondents were in the poor practice level all the negative attitude respondents towards PPE use. Amid all neutral attitude respondents were also in poor practice of PPE. Conversely, comparatively lower number of them (6.2%) practiced poor level where they had positive attitude. Besides, 0.8% respondents practiced fair to good level. However, the association between attitude and practice regarding PPE use of the respondent had a statistically significant due to p value less than 0.05 (fisher's exact test = 16.051, p = 0.000). Therefore, the variability of means and sample sizes do not affect the result.

Table 4.10.4: The association between attitude and willingness regarding PPE use of the respondents

Attitude level	*Willingness*		*Total (%)*
	Willingness *(%)*	Not Willingness *(%)*	
Negative	108 (27.8)	20 (5.2)	128 (33.0)
Neutral	224 (57.7)	9 (2.3)	233 (60.1)
Positive	27 (6.9)	0 (0.0)	27 (7.0)
Total	359 (92.5)	29 (7.5)	388 (100.0)
			χ^2 = 71.632, p = 0.000

In the table 4.10.4, it is obvious that almost 92.5% of total respondents had willingness to use PPE. 6.9% of respondents had willingness to use PPE during working among all the positive attitude respondents. Majority (57.7%) of the respondents in neutral attitude level also had willingness to use PPE. 27.8% also showed wiliness to use PPE where 5.2% were not willing among negative attitude respondents towards PPE use. However, the chi-square test has been found statistically significant association between attitude and willingness of PPE use because of the p value was less than 0.05 (χ^2 = 71.632 and p = 0.000). Therefore, the variability of means and sample sizes do not affect the result shown in table 4.10.4.

4.11. Training Need Assessment

4.11.1. Training receiving status among employees

Table 4.11.1: Distribution of training received status among the respondents (employees)

	Response	*Frequency*	*Percentage (%)*
Have you ever received any training on PPE?	Yes	12	3.1
	No	376	96.9
	Total	388	100.0

From Table 4.11.1, the majority of 96.9% (376) respondents never received training on the use of PPE where very few workers 3.1% (12) of stone crushing had received the training.

Table 4.11.2: **Time of the received training**

	Time	*Frequency*	*Percentage (%)*
When have you received the training***?***	2 years before	12	100.0
	Last year	0	0
	6 months before	0	0
	3 months before	0	0
	Total	12	100.0

Table 4.11.2 present that only 12 out of 388 workers received training about PPE using before two years ago from now. In recent two years, no workers had got the opportunity of receiving training.

Table 4.11.3: **Reasons for not receiving training**

Cause	*Frequency*	*Percent*
No training is arranged	367	94.6
Not interested in training	8	2.1
Not allowed to attend	0	0.0
Others (Not important)	1	0.3
Total	388	100.0

In table 4.11.3, Most of the workers 94.6% didn't receive any training due to not arranging any training on PPE. Besides, 2.1% respondents showed no interesting to receive training.

4.11.2. Training arrangement by employers

Randomly 51 stone crushing factories was chosen to assess the training arrangement. Only employers (owner or manager) responded this section of questionnaire.

Table 4.11.4: Distribution of training arrangement status among the respondents

	Response	*Frequency*	*Percentage (%)*
Have you ever arranged any training on PPE for workers?	Yes	3	5.89
	No	48	94.11
	Total	51	100.0

From Table 4.11.4, the majority of 94.11% (48) respondents never arranged any training on the use of PPE for workers. Only 5.89% (3) of employers of the stone crushing factories had arranged training.

Table 4.11.5: Reasons of not arranging training

Response	*Frequency*	*Percentage (%)*
Not interested	10	20.83
Not important	28	58.34
Expensive and time consuming	10	20.83
Total	48	100

The table 4.11.5 demonstrate that majority of the respondents (58.34%) perceived as not important to arrange training. Where 20.83% of the respondents were not interested, and 20.83% respondents thought as expensive and time consuming for arranging training.

Table 4.11.6: Status of the arranged training		*Frequency (%)*
Arrangement time of the training:	5 years before	3 (100%)
Duration of the arranged training:	One day	3 (100%)
Types of the arranged training:	On job training	3 (100%)
Effectiveness of the arranged training:	Not sufficient to the requirements	3 (100%)

Table 4.11.6 exhibits that only three respondents among 51 (the owners or manager of the stone crushing factories) as they had arranged training. These three respondents stated that they had arranged on job training. That was five years ago and one day training. They also stated that it was not sufficient to the requirement of the training.

4.12. Conclusion

In these analyses, investigation of the different variables on KAP study regarding PPE use has been carried out. The findings reveal that there are significant issues and associations with the knowledge, attitude, and practice regarding personal protective equipment use in unorganized industries. In the next chapter, these findings and analysis have been discussed thoroughly.

CHAPTER FIVE
DISCUSSION OF THE FINDINGS AND ANALYSIS

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5.1. Introduction

In this chapter, the outcomes of the previous chapter have been discussed. The information gathered from different analyses has been used to make decisions. This chapter confers accidents and injury, risk of hazards, and KAP regarding PPE use of the respondents. In this study, p-value of less than 0.05 was considered to be statistically significant. Statistically significant means that the variability of means and samples sizes do not affect the results of the respective data. And not statistically significant (when p value more than 0.05) means that the results of the particular data is biased by variability of means and sample sizes.

5.2. Demographic information of the respondents

In the table 4.2.1, the age range of the respondents was 14 to 70 years. Most of the respondents (58.2%) are at the young age (18-30 years) age group, and 33.8% are the early middle age (26-40 years.) group. This scenario may be after working several years in stone crushing, they switched the jobs or got injured. However, almost 7:3 is the male and female ratio of the respondents. Among 388 respondents 80.7% were married and 18% were unmarried among the 388 respondents.

The table also demonstrated that, 70.6% respondents had no formal education, and 22.9% respondents had primary education. It may be because of the type of occupation required less education qualification. The education level among the respondents are very low as a result this factor might affect their knowledge, attitude and practice level regarding PPE use.

From the table, it's visible that 93% of the workers worked fulltime job. The part-time, self-employed and replacement workers had the lower number of 5.9%, 0.8%, 0.3% respectively among the total number of workers.

The majority 78.4% of the respondents were carrying and lifting personnel, and 7.2% respondents were stone crusher machine operator.

Majority of the workers 35.8% work for more than 8 years, 24.5% of them working for more than 5 years. Majority, 57.22% respondents worked for 9-12 hrs. per day. Monthly income of the 40.7% respondents were 8000-10000 BDT, 14.4% and 16.0% respondents earned 10000-12000 BDT and 12000-15000 BDT respectively. Only 12.4% respondents' monthly income were 15000+ BDT, they either the supervisor or the employers of the stone crusher.

5.3. Assessment of the hazards and their risks of accident or injuries

5.3.1. Occupational health and injury or accident

This cross-sectional study was conducted to explore occupational health and injury, and their risk assessment. In this study, p-value of less than 0.05 was considered to be statistically significant. Statistically significant means that the variability of means and samples sizes do not affect the results of the respective data. And not statistically significant (when p value more than 0.05) means that the results of the particular data is biased by variability of means and sample sizes.

In the table 4.3.1, the majority people encountered minor and insignificant accidents about 40.7% and 40.2 % respectively. Only 4% respondents faced severe types and 14.9% major types of injury in the stone crushing industries.

It is apparent from the table 4.3.2 that 4 workers were encountered fatal accidents 3 years ago. Total disablement wasn't found on the study. But 2.8% were partial disablement and most of workers (42.5%) were absent for two hours to a day where 32.7% - a day to a week, 13.1% - a week to month and 8.8% - more than a month. The time of occurrence of the accident which was measured with 24-hr clock indicated in table 4.3.3, The most (37.4%) occurrence of accidents in 14-16 hr. In morning and evening, the percentage of occurring the accident was very low. From the table 4.3.4, distribution of accident types by three age group, young age (18-30 yrs.) group had the maximum encounter with the accident with 58.2%. The less (8%) encounter with the accident were the late middle age and above (46+ yrs.) group. The severe injury became less by the age increases. However, $\chi^2 = 7.871$, $p = 0.248$, there is no influence between the ages and the accidents.

Table 4.3.5 provides the distribution of accident types by gender where male faced more injuries in all types of accidents than female. Because, male workers were more in number than

the female worker. From table 4.3.6, the distribution of accident types by marital status shows married workers faced injuries more frequently because of their number is dominant. Distribution of accident types by level of education as illustrated in table 4.3.6, the level of education has no influence on the distribution of accidents, though the educational level of primary (Up to class V) faced more minor accidents that insignificant. It doesn't matter the types of employment either fulltime or part-time, they, all encountered with all types of accidents. There is also no influence of level of employment with the distribution of the accidents. Though the number of machine operator and welder was small, but they also encountered with accidents and as always, the carrying and lifting personnel were dominated in numbers, they faced more accidents due to lack of practices of PPE which is presented in table 4.3.8 and it also depicted that the association between occupation and types of accident is not significate due to fisher's exact test value = 14.267, $p = 0.649 > 0.05$. As table 4.3.9 indicates that the distribution of accident types by length of service in the current organization which represents that by the increasing of length of services the respondents encountered with more accidents. Though the association between the distribution of the accidents and the length of service is insignificance. The table 4.3.9 shows that the severe accident was more for 9-12 hrs as it is not statistically significance.

5.3.2. The Association between Occupational Health and Injuries & Agents of Injuries and Health Problem (Hazards)

In determining the association between injuries and hazards in table from table 4.4.1, the most significant hazards and injuries are considered. Among each 24 injuries, and hazards, 12 critical injuries and 10 prevalent hazards are revealed by pareto analysis. Finally, the association between occupational health, and injuries and agents of injuries and health problem (hazards) is obtained by chi-square test and consider p value less than 0.05 is a statistically significant association. Statistically significant means that the variability of means and samples sizes do not affect the results of the respective data. And not statistically significant (when p value more than 0.05) means that the results of the particular data is biased by variability of means and sample sizes.

This study finds out statistically significant association between:

- Laceration with Dust, Working without PPE, Sharp edge and swarf, Falling object, and Highly repetitive actions.

- Back and low back pain with Bad lifting and handling technique, Lifting and handling heavy objects, Highly repetitive actions, and Stressful and awkward posture.
- Contusion or bruise with
- Eye irritation and red eye with Dust, and Working without PPE.
- Crushed hand/fingers/toes with Lifting and handling heavy objects, Sharp edge and swarf, Falling object, and Highly repetitive actions.
- Headache with Dust, Excessive noise, and Highly repetitive actions.
- Sharp and deep cuts or indent with Working without PPE, Lifting and handling heavy objects, Sharp edge and swarf, Flying object, and Falling object.
- Restriction of joint movement with Working without PPE, Bad lifting and handling technique, Lifting and handling heavy objects, Highly repetitive actions, and Stressful and awkward posture.
- Cough with Dust, Working without PPE, and Flying object.
- Difficulties in hearing with Dust, Working without PPE, and Excessive noise.
- Skin irritation and dermatitis with Dust, and Working without PPE.
- Abrasions with Lifting and handling heavy objects, and Highly repetitive actions

5.3.3. Risk Assessment of Potential Hazards

From table 4.5.1, it was apparent that three severe, four major and three minor consequences among ten hazardous events which was found by Pareto Analysis (table 4.3.13). These analyses were conducted to find out the hazards that was responsible for the most encountered accident and out of twenty-four, ten hazards were responsible for those most frequently occurred accidents. The respondents exposed to hazard at different specific period time of 8 hours shift in hazardous environment where the highest exposed hazard was dust and the lowest exposed hazardous event was stressful and awkward posture. From the severe consequences, dust had the highest probability level of encountering and stressful and awkward posture had the lowest probability level of encountering. Working without PPE had the most probability level among the major consequence and stressful and highly repetitive actions had the least probability level of encountering. However, bad lifting and handling technique had the most probability level among the minor consequence and stressful and falling object had the least probability level of encountering. In table 4.5.2, the risk level calculation was done by using the respected probability level, exposure to hazard and consequence of hazard and all the calculations of risk level were conducted by the *Riskex Risk Score Calculator*. For each hazardous event, the

calculation of the risk level presented that it had three substantial, five moderate and two low risks for encountering accidents. From those hazardous events, dust, flying object, falling object had substantial risk level, highly repetitive actions, stressful and awkward posture had the low level of risk and rest of the injuries had moderate level of risk among the most frequent hazardous events. That table also suggested some control measures to mitigate the consequences for betterment for who are working in the hazard exposing areas.

5.4. Evaluation of the knowledge of the respondents about PPE use

"Bloom's cut-off point" technique was applied to assess knowledge level of the respondents. However, this procedure is described in section 3.8.1. In the table 4.6.1, 21.13% had poor knowledge, 59.79% had moderate knowledge and 19.07% had good knowledge about PPE use among 388 respondents. In similar research, very low knowledge (more than 75%) was found by Troung et al. (2009) and Siriwong et al. (2010). The association between age and the knowledge level of the respondents was statistically significant (table 4.7.1). The value of P = 0.004 which is less than 0.05. Knowledge level have an influence of what is the age of the respondents. In the table 4.7.2, male had higher knowledge level than female. The association between gender and knowledge level was also significant (p = 0.000). Besides, the level of education was also statistically significant (p = 0.002). That's why it had an impact on the knowledge about PPE use. There is an increasing pattern of highly educated respondents about knowledge of PPE use. In the table 4.7.6, moderate to good knowledge level was increasing with the length of service in jobs. However, it is not statistically significate as $p = 0.187$. Statistically significant means that the variability of means and samples sizes do not affect the results of the respective data. And not statistically significant (when p value more than 0.05) means that the results of the particular data is biased by variability of means and sample sizes.

5.5. Determining the attitude of the respondents towards PPE use

"Bloom's cut-off point" was applied to evaluate attitude level of the respondents which is defined in section 3.8.2. The findings of this study indicate that only 6.96% respondents were positive attitude towards PPE use where 60.05% respondents showed neutral attitude, and 32.99% respondents had a negative attitude towards PPE use in the table 4.6.2. Akintayo (2013) examined almost similar findings. Ziauddin (2006) found more than 75% positive attitude among employees. For the P value (0.146), there is no impact of attitude whether respondents

in age group in table 4.8.1. But there is an association between attitude level and gender (table 4.8.2) for the p value (0.002). The study shows that there is an association between attitude and level of education as p = 0.000 in table 4.8.3. Besides, the negative attitude of the respondents becomes low with the education level. In table 4.8.5, Positive attitude is increasing with the length of service. However, it is not statistically significant as P = 0.415. Conversely, different occupation related to stone crushing have a significant association with attitude towards PPE use in table 4.8.6. Most of them have neutral attitude towards the use of PPE. Statistically significant means that the variability of means and samples sizes do not affect the results of the respective data. And not statistically significant (when p value more than 0.05) means that the results of the particular data is biased by variability of means and sample sizes.

5.6. Explanation of the practices of the respondents for PPE use

The procedure of measuring practice level of the respondents is well-defined in the section 3.8.3. The objective of explaining the practices of the respondents with regarding PPE use was achieved. The use of PPE makes a barrier between worker and hazards. But the table 4.6.3 demonstrates that only 0.26% respondent had a good practice of PPE, 0.52% respondents were on fair practice of PPE. And almost all respondents 99.23% had poor practice of PPE during working. In similar research, Kralam (2015) found that 31.2% were poor practice where only 21.4% good level practice. There was no significant association with the different age groups, gender, length of service in the current organization/job because P value more than 0.05 in the table 4.9.1 and 4.9.4 respectfully. However, it's visible in the table 4.9.2 that practice level becomes higher with the level of education. In the table 4.9.4., Good and fair practice found only 8+yrs experienced respondents. Statistically significant means that the variability of means and samples sizes do not affect the results of the respective data. And not statistically significant (when p value more than 0.05) means that the results of the particular data is biased by variability of means and sample sizes.

5.7. Association among knowledge, attitude, practice for PPE use

Knowledge level of PPE use was associated with attitude level, and also with practice for PPE use. Knowledge, attitude, practice, all are connected and associated with each other. However, most of the respondents lies in the moderate knowledge level and neutral attitude level. In the table 4.10.1 and 4.10.2, the poor knowledge conducted negative attitude and poor practice of

PPE use. For the association between knowledge and attitude regarding PPE use of the respondents, χ^2 = 134.757, P = 0.000 which lies in the expected value. For the association between knowledge and practice regarding PPE use of the respondents, Fisher's Exact Test = 8.737, P = 0.007, it's also within the expected value, P=0.05. The association between attitude and practice regarding PPE use of the respondents is also statistically significant because the value of Fisher's Exact Test = 16.051, P = 0.000. However, positive attitude rises with the higher knowledge level (table 4.10.1). Although having good knowledge level of PPE, 18.3% workers were in poor practices. Very few of the were in fair and good practice because of lower number use PPE. Statistically significant means that the variability of means and samples sizes do not affect the results of the respective data. And not statistically significant (when p value more than 0.05) means that the results of the particular data is biased by variability of means and sample sizes.

5.8. Training need assessment

Training is necessary to improve the knowledge, and awareness about the PPE use. In the table 4.11.1, 96.9% respondents did not receive any formal training about PPE use due to the unviability of training. Almost 94.6% respondents claimed that no training programmed was arranged for them in table 4.11.3. Where only 12 had received training more than two years before in table 4.11.2. It is the possible reasons for lack of knowledge level about and poor practice.

The training arrangement by employers, table 4.11.4 and 4.11.5 reveals that, majority of 94.11% respondents never arranged any training on the use of PPE for workers and only 5.89% of employers of the stone crushing factories among 51 had arranged training. The reasons behind not arranged training was because of 58.34% respondents thought that training was not important, 20.83% respondents responded as not interested, the other 20.83% respondents responded as expensive and time consuming. However, table 4.11.6 represents that, from those 51 respondents of the owners and supervisors of the stone crusher, only three respondents said that training was arranged and it was five years ago, duration of one day on job training and the owners & supervisors agreed that there was not sufficient to the requirement of the effectiveness of the arranged training.

5.9. Conclusion

In this chapter, result obtained from the analysis have been interpreted. The significant findings of this study are emerged in the next chapter and prepared recommendations.

CHAPTER SIX

CONCLUSSION AND RECOMMENDATION

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CONCLUSSION AND RECOMMENDATION

6.1. Conclusion

This study has been conducted taking several variables into considerations. First one is to get an overall picture of occupational health and injury among workers and to enhance safety conditions of the stone crushing factories. Second one is to get an overall scenario of the knowledge level, attitude level, and practice level of PPE using among workers and their relations in stone crushing factories. The following conclusions can be drawn from the present study.

6.1.1. Accidents and injury related

This study concludes the following about accident and injury.

- More than half of respondents encountered by major and minor accident and injury around launch break (1 pm - 3 pm). Consequence of this accident was absence for more than a few hours to several days from works.
- The accident and injury were encountered by most of the respondents are from the age group 18 to 30 yrs. and male.
- Mostly the carrying and lifting personnel are suffered from accidents and injury who have more than 8 years working experience.
- Most of accident and injury was occurred in wrist and hand/finger, feet/toe, and back body parts.
- Dust, noise, working without PPE, bad lifting and handling technique, lifting and handling heavy object, sharp edge, and flying object hazards are predominating hazards.
- Predominant occupational health and injury are laceration, back pain, contusion, eye irritation, crushed finger/toe, difficulties in hearing, skin irritation, abrasions.
- However, preventive measures (e.g. proper use of PPE) must be implemented and maintained carefully to keep employees safe and sound both physically and economically, and to prevent loss of production time causing loss to employers.

6.1.2. Knowledge, attitude, and practice of PPE using related

This study concludes the following about knowledge, attitude, and practice of PPE using.

- Relatively high knowledge was found in a good number of participants in this study.
- Appropriate attitude was also found in relatively a good number of workers in stone crushing factories.
- But there was insignificant practice of PPE despite of a relatively high knowledge and attitude due to unavailability of proper PPE.
- Workers are aware of PPE using for their relatively high knowledge level and significant attitude level.
- Training about PPE using was also very low because of not arranging any training for workers.
- In this circumstance, PPE practice can be developed by providing proper PPE and training about PPE using.

6.1.3. Demographic variable related

This study concludes the following about demographic variable related.

- The majority of respondents were young age (18-30 years) male and have no any formal education. Most of them were carrying and lifting worker.
- There is an increasing pattern of highly educated respondents about knowledge of PPE use. Negative attitude is decreased with age.

6.2. Recommendations

Based on analysis, the following recommendations have been made.

- Authority must provide adequate occupational health and formal safety education.
- Authority should arrange proper training about PPE using.
- PPE practicing and safety awareness should be developed among workers.
- Enforcing safety and health provisions of the acts and rules.
- Hazards (e.g. dust, noise) must be control.
- Authority must supply and regular cleaning of PPE.
- Provision of proper safety guards against working agents or injury agents e.g. crusher, vibrator, belt conveyors, carrying and lifting.

- Provision of leisure during a shift to reduce fatigue and boredom.
- Motivating workers to use PPE.
- The use of gloves and shoes while working and engaging in carrying and lifting; goggles, masks, and helmets during maintenance and heavy dusty environment; face shields while welding any machine parts;

6.3. Limitations

- Some of the participants did not answer all the questions.
- Many participants were influenced by their co-workers while responding questionnaire.
- Some of the participants get bother while responding questionnaire.
- Many of them got difficulty to understand the questionnaire.
- The researchers checked questions on the basis of the respondent's emphasis.
- Some of them concerned to answer about accident and injury or fatality related information due to insecurity.
- Several stone crushing factories did not provide proper information concerning security.

6.4. Scope for the future study

There are a number of dimensions that deserves further research individually.

- Occupational health and safety practices among the workers of stone crushing industries can be conducted for future reteach.
- Awareness about occupational health and injuries in stone crushing factories can also be conducted for research.
- Knowledge of occupational hazards among the workers of stone crushing factories can be conducted for future research.

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APPENDICES

Appendix [1]: Accidents and injury related information of the respondents

Table 1.1: Distribution of accident types by marital status

Marital status	*Type of accident encountered*				*Total*
	Severe	*Major*	*Minor*	*Insignificant*	
Unmarried	2(.5)	6(1.5)	25(6.4)	37(9.5)	70(18)
Married	13(3.4)	52(13.4)	129(33.2)	119(30.7)	313(80.7)
Widowed	1(.3)	0(0)	2(.5)	0(0)	3(.8)
Divorced	0(0)	0(0)	2(.5)	0(0)	2(.2)
Total	16(4.1)	58(14.9)	158(40.7)	156(40.2)	388(100)

Fisher's Exact Test = 14.673, p = .053

Table 1.2: Distribution of accident types by working hours per day

Number of hours worked per day	Type of accident encountered				Total
	Severe	Major	Minor	Insignificant	
6-8 hrs	2 (0.5)	22 (5.7)	60 (15.5)	55 (14.2)	139 (35.8)
9-12 hrs	13 (3.4)	30 (7.7)	88 (22.7)	91 (23.5)	222 (57.2)
others	1 (0.3)	6 (1.5)	10 (2.6)	10 (2.6)	27 (7.0)
Total	16 (4.1)	58 (14.9)	158 (40.7)	156 (40.2)	388 (100.0)

χ^2 = 5.863, p = 0.439

Table 1.3: ***Distribution of location of injury by body part***

Location of injury by body part	*Frequency*	*Relative Percentage (%)*	*Cumulative Percentage (%)*
Wrist and hand/fingers	366	18.83%	18.83%
Back and low back	283	14.56%	33.38%
Feet/Toe	247	12.71%	46.09%
Eye	194	9.98%	56.07%
Knee	182	9.36%	65.43%
Arm	145	7.46%	72.89%
Neck and head	118	6.07%	78.96%
Ankle	102	5.25%	84.21%
Hip/Leg	89	4.58%	88.79%
Shoulder	83	4.27%	93.06%
Face	70	3.60%	96.66%
Abdomen and chest	65	3.34%	100.00%
	1944		

Table 1.4: Distribution of Occupational health and injuries

Occupational health and injuries	*Frequency*	*Percentage (%)*	*Cumulative Percentage (%)*
Lacerations/ irregular tear of skin	340	8.72%	8.72%
Back and low back pain	317	8.13%	16.85%
Contusion/bruise	289	7.41%	24.26%
Eye irritation and red eye	277	7.10%	31.36%
Crushed hand/ fingers/toes	265	6.79%	38.15%
Headache	249	6.38%	44.54%
Sharp and deep cuts or indent	241	6.18%	50.72%
Restriction of joint movement	234	6.00%	56.72%
Cough	228	5.85%	62.56%
Difficulties in breathing	202	5.18%	67.74%
Skin irritation and Dermatitis	197	5.05%	72.79%
Abrasions	196	5.03%	77.82%
Nose irritation	164	4.21%	82.03%
Difficulties in hearing	156	4.00%	86.03%
Throat irritation	149	3.82%	89.85%
Ear irritation	135	3.46%	93.31%
Visual fatigue/Eye strain	68	1.74%	95.05%
Amputations of fingers and hand	50	1.28%	96.33%
Burning: electric shock/fire, hot workpiece, spatter	32	0.82%	97.15%
Bone Fracture and dislocations	32	0.82%	97.97%
Skull Fracture	29	0.74%	98.72%
Infected wounds	24	0.62%	99.33%
Vibration white fingers	19	0.49%	99.82%
Electrocution	7	0.18%	100.00%
	Total = 3900	100%	

Table 1.5: Distribution of agents of injuries and health problem (hazards)

Agents of injuries and health problem (hazards)	*Frequency*	*Percentage (%)*	*Cumulative Percentage (%)*
Dust	302	10.32%	10.32%
Working without PPE	292	9.98%	20.30%
Bad lifting and handling technique	289	9.88%	30.18%
Lifting & handling heavy objects	244	8.34%	38.52%
Sharp edge and swarf	213	7.28%	45.80%
Flying object	211	7.21%	53.01%
Excessive noise	207	7.07%	60.08%
Falling object	200	6.84%	66.92%
Highly repetitive actions	196	6.70%	73.62%
Stressful and awkward posture	192	6.56%	80.18%
Being struck by falling object	185	6.32%	86.50%
Fallen from height	115	3.93%	90.43%
Being struck by moving machinery	91	3.11%	93.54%
Slipping and tripping	52	1.78%	95.32%
Entanglement with rotating/moving parts	46	1.57%	96.89%
Trapping	28	0.96%	97.85%
Poor lighting	19	0.65%	98.50%
Direct contact with wires/electrified equipment	16	0.55%	99.04%
Extended exposure to sunlight	14	0.48%	99.52%
Electric short circuit/overload	9	0.31%	99.83%
Aerosol, mist, and fume from the fluid	2	0.07%	99.90%
Direct contact with cutting tools	2	0.07%	99.97%
Direct contact with cutting fluids	1	0.03%	100.00%
Vibration: Hand grinding	0	0.00%	100.00%
	Total = 2926		

Table 1.6: The association between occupational health, and injuries and agents of injuries

	Lifting & handling heavy objects	Falling object	Flying object	Bad lifting and handling technique	Sharp edge and swarf	Dust	Excessive noise	Highly repetitive actions	Stressful and awkward posture	Working without PPE
Sharp and deep cuts or indent	163 (66.8)	166 (83.0)	164 (77.7)	184 (63.7)	155 (72.8)	199 (65.9)	137 (66.2)	120 (61.2)	120 (62.5)	199 (68.2)
Crushed hand/ fingers/toes	183 (75.0)	184 (92.0)	176 (83.4)	202 (69.9)	162 (76.1)	196 (64.9)	118 (57.0)	106 (54.1)	107 (55.7)	190 (65.1)
Laceration/ irregular tear of skin	212 (86.9)	196 (98.0)	197 (93.4)	254 (87.9)	202 (94.8)	277 (91.7)	197 (95.2)	182 (92.9)	178 (92.7)	266 (91.1)
Abrasions	146 (59.8)	157 (78.5)	149 (70.6)	154 (53.3)	127 (59.6)	154 (51.0)	95 (45.9)	79 (40.3)	80 (41.7)	151 (51.7)
Contusion/bruise	196 (80.3)	154 (77.0)	155 (73.5)	219 (75.8)	161 (75.6)	234 (77.5)	173 (83.6)	155 (79.1)	155 (80.7)	239 (81.8)
Eye irritation and red eye	170 (69.7)	141 (70.5)	153 (72.5)	210 (72.7)	151 (70.9)	236 (78.1)	185 (89.4)	165 (84.2)	162 (84.4)	237 (81.2)
Skin irritation and Dermatitis	124 (50.8)	108 (54.0)	116 (55.0)	160 (55.4)	111 (52.1)	175 (57.9)	145 (70.0)	132 (67.3)	130 (67.7)	181 (62.0)
Back and low back pain	212 (86.9)	158 (79.0)	165 (78.2)	256 (88.6)	169 (79.3)	253 (83.8)	191 (92.3)	174 (88.8)	176 (91.7)	257 (88.0)
Restriction of joint movement	160 (65.6)	106 (53.0)	105 (49.8)	191 (66.1)	118 (55.4)	183 (60.6)	141 (68.1)	140 (71.4)	138 (71.9)	193 (66.1)
Difficulties in breathing	132 (54.1)	98 (49.0)	107 (50.7)	162 (56.1)	114 (53.5)	186 (61.6)	159 (76.8)	141 (71.9)	139 (72.4)	182 (62.3)
Cough	143 (58.6)	127 (63.5)	134 (63.5)	185 (64.0)	133 (62.4)	205 (67.9)	171 (82.6)	154 (78.6)	151 (78.6)	215 (73.6)
Headache	156 (63.9)	139 (69.5)	140 (66.4)	198 (68.5)	144 (67.6)	224 (74.2)	185 (89.4)	165 (84.2)	161 (83.9)	233 (79.8)

Appendix [2]: Risk Assessment of Potential Hazards

Table 2.1: Occurrence of occupational health and injury (frequency)

Occupational health and injuries	*Always (%)*	*Frequently (%)*	*Sometimes (%)*	*Not too often (%)*	*Never (%)*
Sharp and deep cut or indent	30 (7.7)	36 (9.3)	91 (23.5)	109 (28.1)	122 (31.4)
Amputations of fingers and hand	4 (1.0)	4 (1.0)	6 (1.5)	44 (11.3)	330 (85.1)
Crushed hand/ fingers/toes	18 (4.6)	66 (17.0)	109 (28.1)	81 (20.9)	114 (29.4)
Lacerations/irregular tear of skin	37 (9.5)	99 (25.5)	176 (45.4)	46 (11.9)	30 (7.7)
Abrasions	31 (8.0)	38 (9.8)	114 (29.4)	33 (8.5)	172 (44.3)
Contusion/bruise	10 (2.6)	86 (22.2)	141 (36.3)	64 (16.5)	87 (22.4)
Burning: electric shock/ fire, hot workpiece, spatter	2 (0.5)	10 (2.6)	10 (2.6)	21 (5.4)	345 (88.9)
Eye irritation & red eye	33 (8.5)	107 (27.6)	118 (30.4)	26 (6.7)	104 (26.8)
Ear irritation	9 (2.3)	17 (4.4)	76 (19.6)	44 (11.3)	242 (62.4)
Throat irritation	10 (2.6)	26 (6.7)	88 (22.7)	36 (9.3)	228 (58.8)
Nose irritation	12 (3.1)	29 (7.5)	92 (23.7)	43 (11.1)	212 (54.6)
Skin irritation and Dermatitis	21 (5.4)	43 (11.1)	104 (26.8)	41 (10.6)	179 (46.1)
Back and low back pain	34 (8.8)	133 (34.3)	146 (37.6)	13 (3.4)	62 (16.0)
Restriction of joint movement	11 (2.8)	102 (26.3)	122 (31.4)	32 (8.2)	121 (31.2)
Bone fracture and dislocations	1 (0.3)	3 (0.8)	10 (2.6)	17 (4.4)	357 (92.0)
Skull fracture	0 (0.0)	2 (0.5)	10 (2.6)	20 (5.2)	356 (91.8)
Electrocution	0 (0.0)	0 (0.0)	3 (0.8)	1 (0.3)	384 (99.0)
Vibration white fingers	1 (0.3)	6 (1.5)	16 (4.1)	4 (1.0)	361 (93.0)
Difficulties in hearing	9 (2.3)	25 (6.4)	83 (21.4)	47 (12.1)	224 (57.7)
Difficulties in breathing	16 (4.1)	63 (16.2)	111 (28.6)	22 (5.7)	176 (45.4)
Visual fatigue/Eye strain	4 (1.0)	18 (4.6)	58 (14.9)	20 (5.2)	288 (74.2)
Cough	12 (3.1)	37 (9.5)	152 (39.2)	34 (8.8)	153 (39.4)
Headache	20 (5.2)	48 (12.4)	159 (41.0)	29 (7.5)	132 (34.0)
Infected wounds	2 (0.5)	1 (0.3)	9 (2.3)	26 (6.7)	350 (90.2)

Table 2.2: Occurrence of occupational health and injury (frequency)

Occupational health and injuries	*Always (%)*	*Frequently (%)*	*Sometimes (%)*	*Not too often (%)*	*Never (%)*
Lacerations/irregular tear of skin	37 (9.5)	99 (25.5)	176 (45.4)	46 (11.9)	30 (7.7)
Back and low back pain	34 (8.8)	133 (34.3)	146 (37.6)	13 (3.4)	62 (16.0)
Contusion/bruise	10 (2.6)	86 (22.2)	141 (36.3)	64 (16.5)	87 (22.4)
Eye irritation & red eye	33 (8.5)	107 (27.6)	118 (30.4)	26 (6.7)	104 (26.8)
Crushed hand/ fingers/toes	18 (4.6)	66 (17.0)	109 (28.1)	81 (20.9)	114 (29.4)
Headache	20 (5.2)	48 (12.4)	159 (41.0)	29 (7.5)	132 (34.0)
Sharp and deep cut or indent	30 (7.7)	36 (9.3)	91 (23.5)	109 (28.1)	122 (31.4)
Restriction of joint movement	11 (2.8)	102 (26.3)	122 (31.4)	32 (8.2)	121 (31.2)
Cough	12 (3.1)	37 (9.5)	152 (39.2)	34 (8.8)	153 (39.4)
Difficulties in hearing	9 (2.3)	25 (6.4)	83 (21.4)	47 (12.1)	224 (57.7)
Skin irritation and Dermatitis	21 (5.4)	43 (11.1)	104 (26.8)	41 (10.6)	179 (46.1)
Abrasions	31 (8.0)	38 (9.8)	114 (29.4)	33 (8.5)	172 (44.3)

From Table 2.2 we observe most frequent type of occupational health and injuries. Lacerations/ irregular tear of skin occurs to 80.4% of the respondent cumulatively for always, frequently and sometimes. For back and low back pain, contusion/bruise, eye irritation & red eye, headache, restriction of joint movement of always, frequently and sometimes are cumulatively occurs to 80.7%, 61.1%, 66.5%, 58.6%, 60.5% of the 388 respondents. We can also observe that the percentage of most of the health issue and injury of the respondents for not too often and never is also high

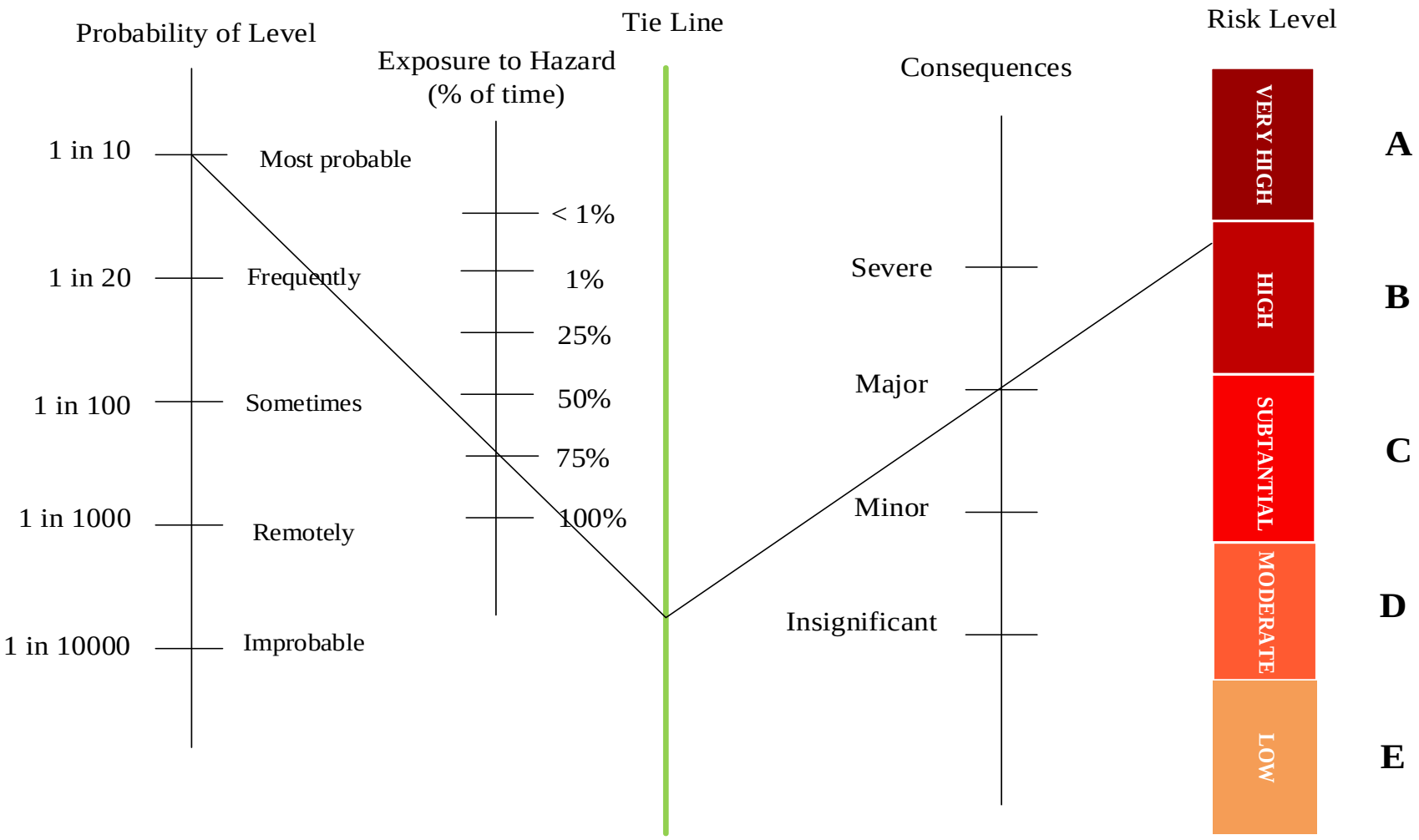

Figure 5: Sample risk level calculation for Working without PPE

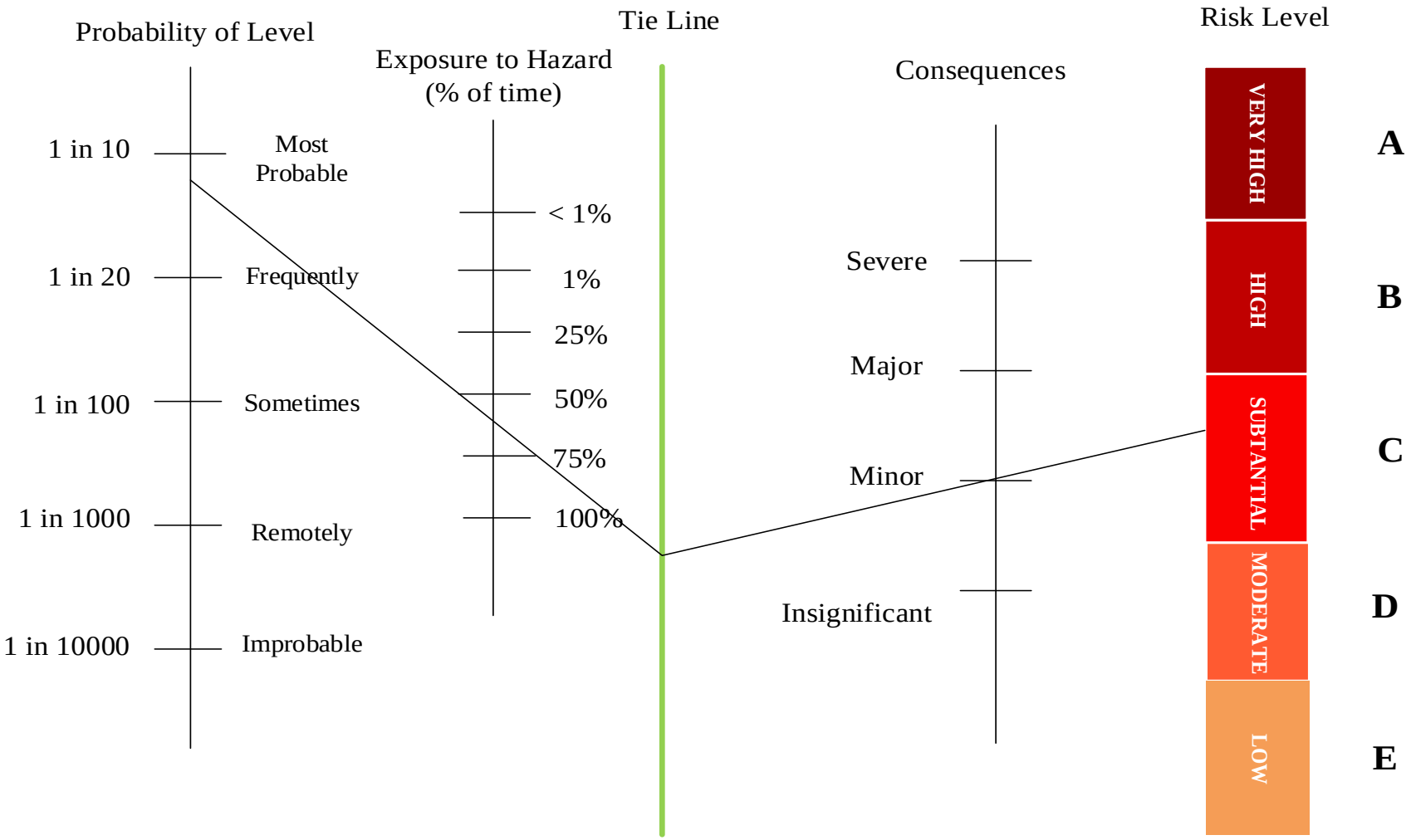

Figure 6: Sample risk level calculation for Bad lifting and handling technique

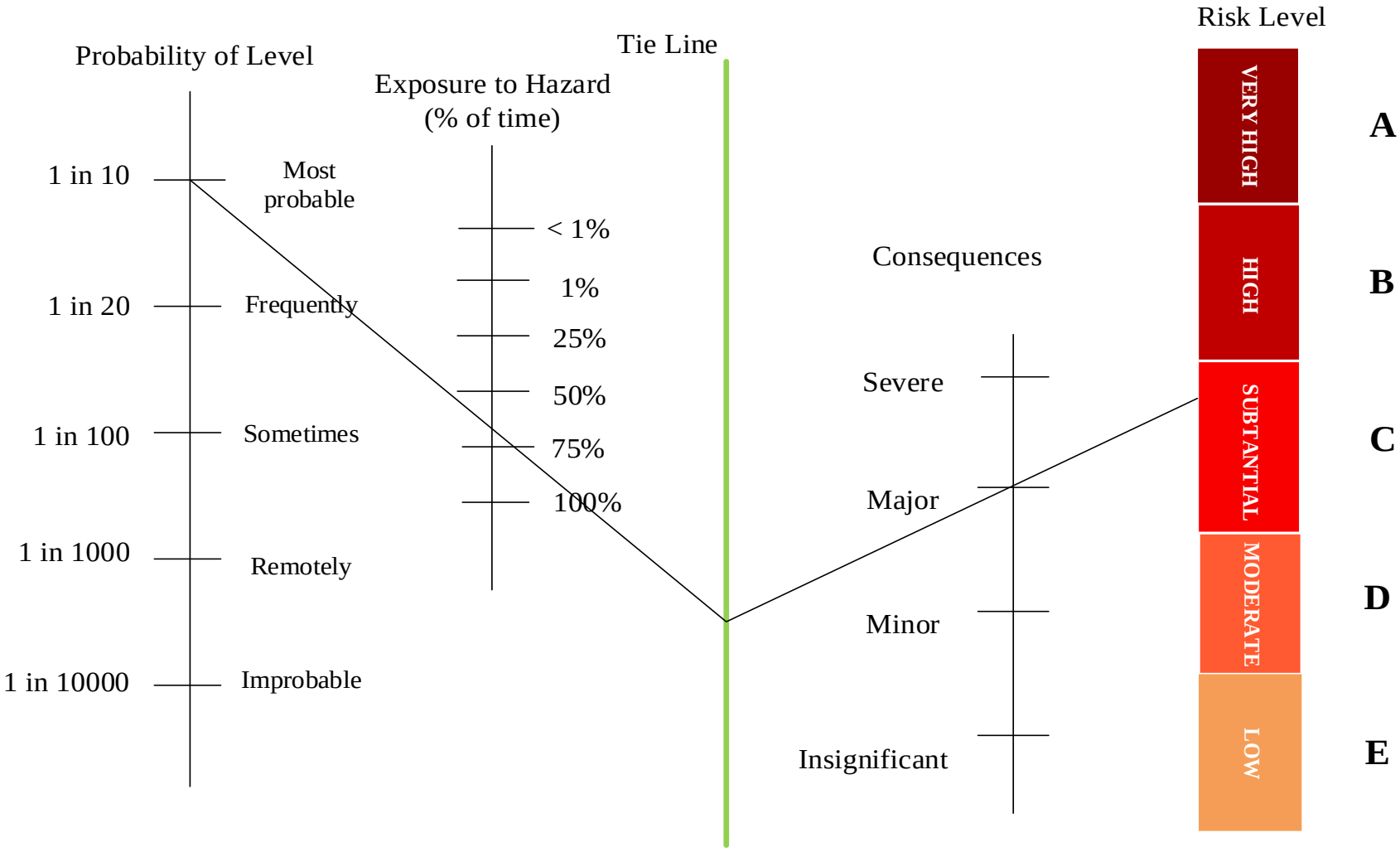

Figure 7: Sample risk level calculation for Lifting & handling heavy objects

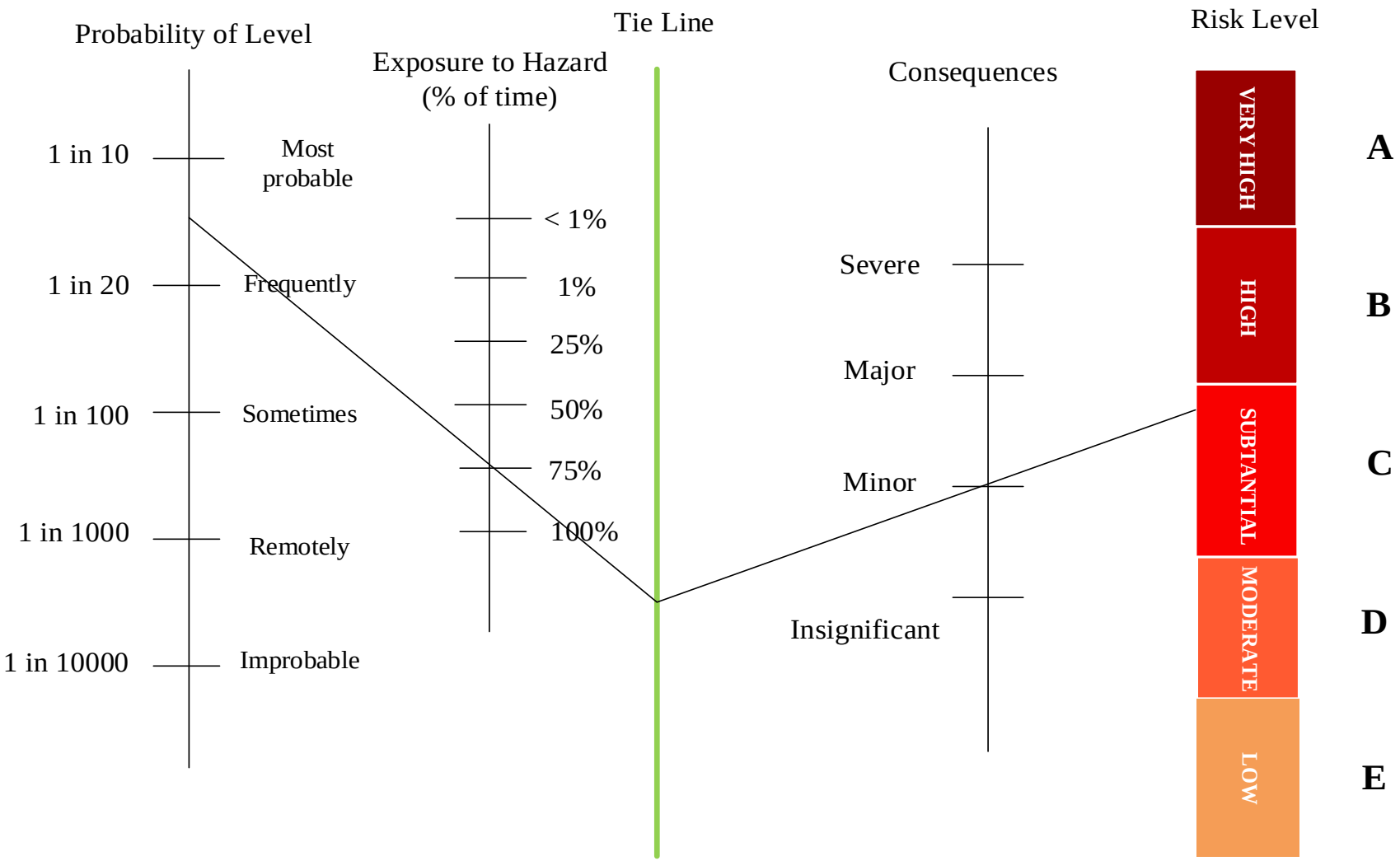

Figure 8: Sample risk level calculation for Sharp edge and swarf

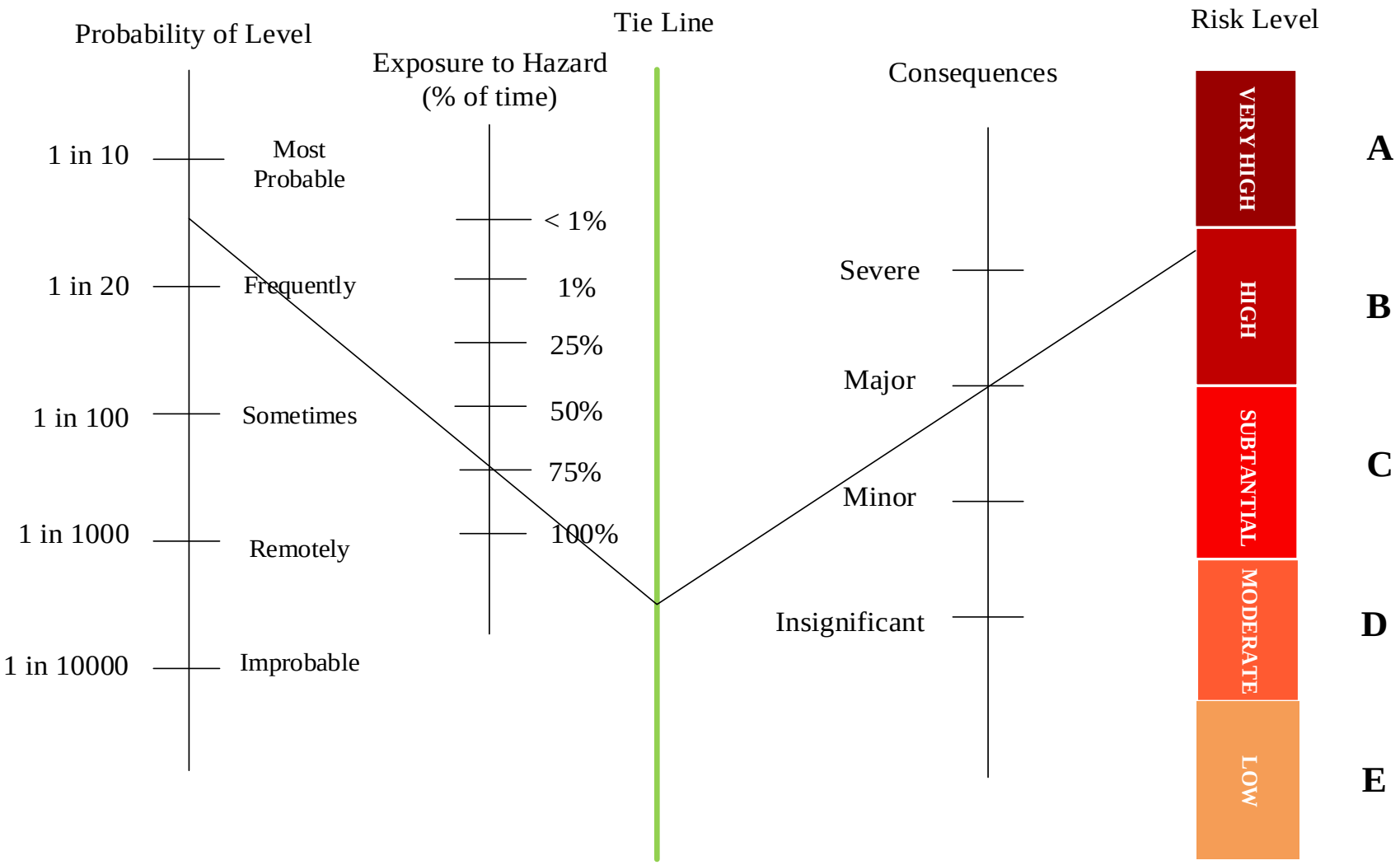

Figure 9: Sample risk level calculation for Flying object

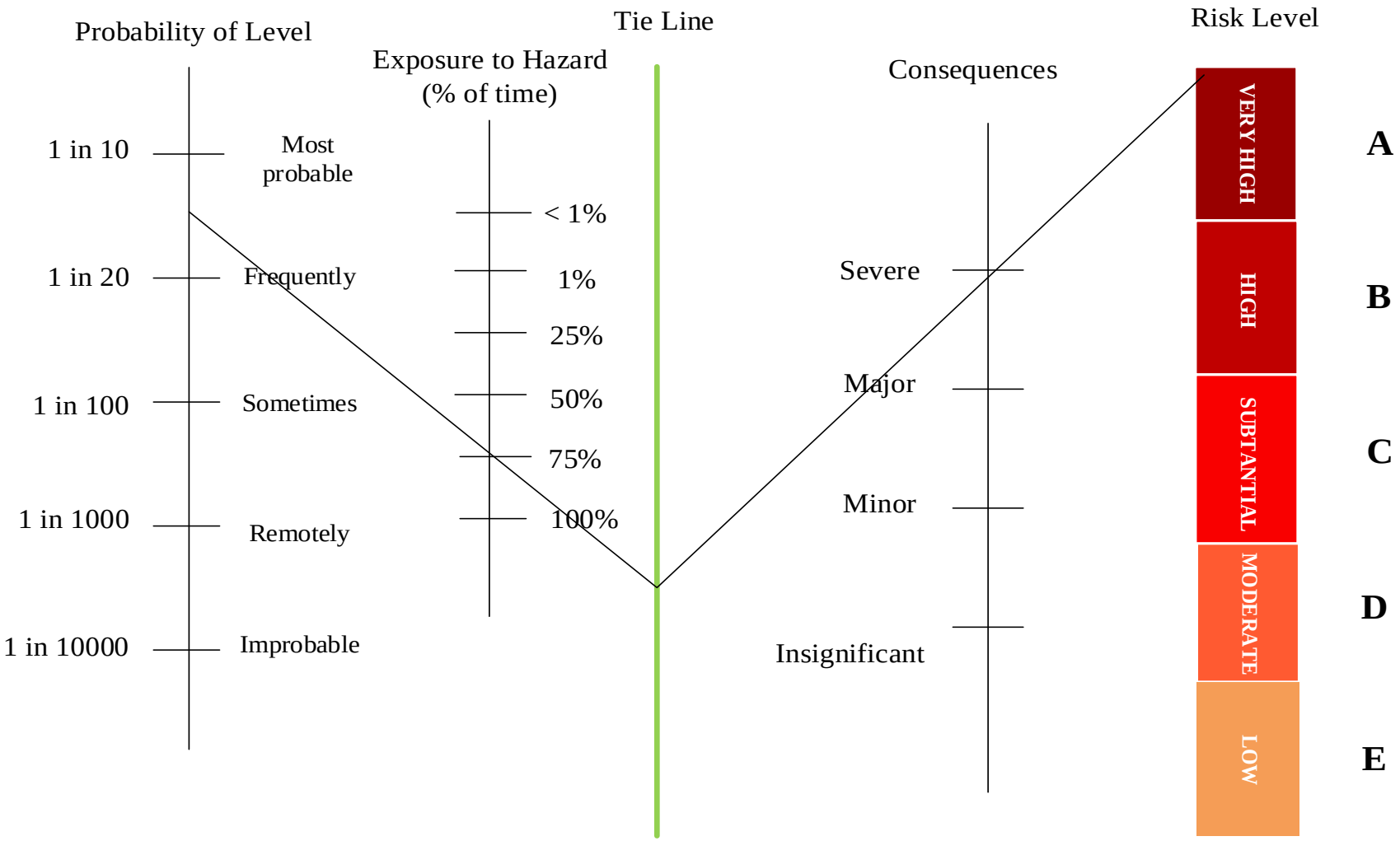

Figure 10: Sample risk level calculation for Excessive noise

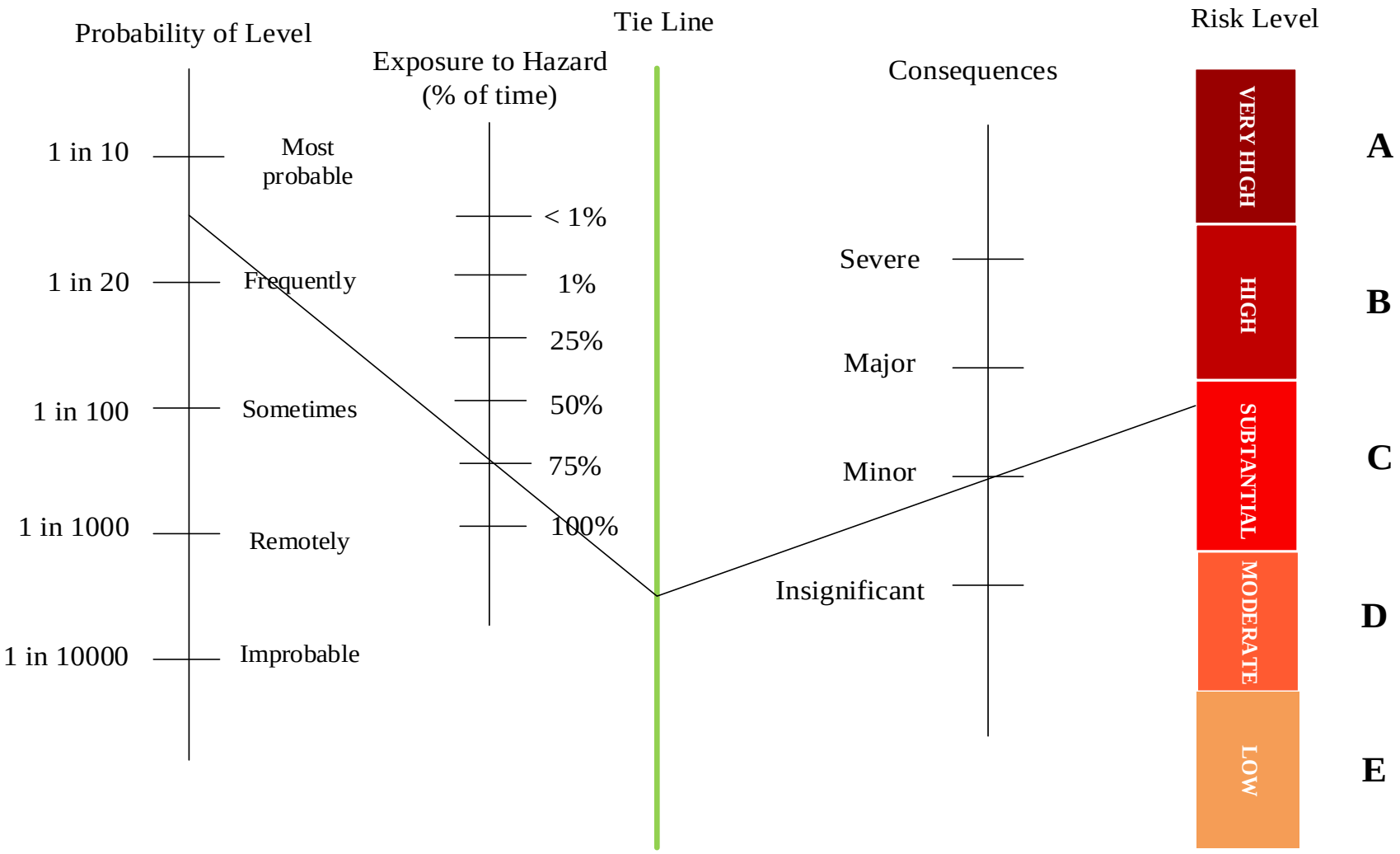

Figure 11: Sample risk level calculation for Falling object

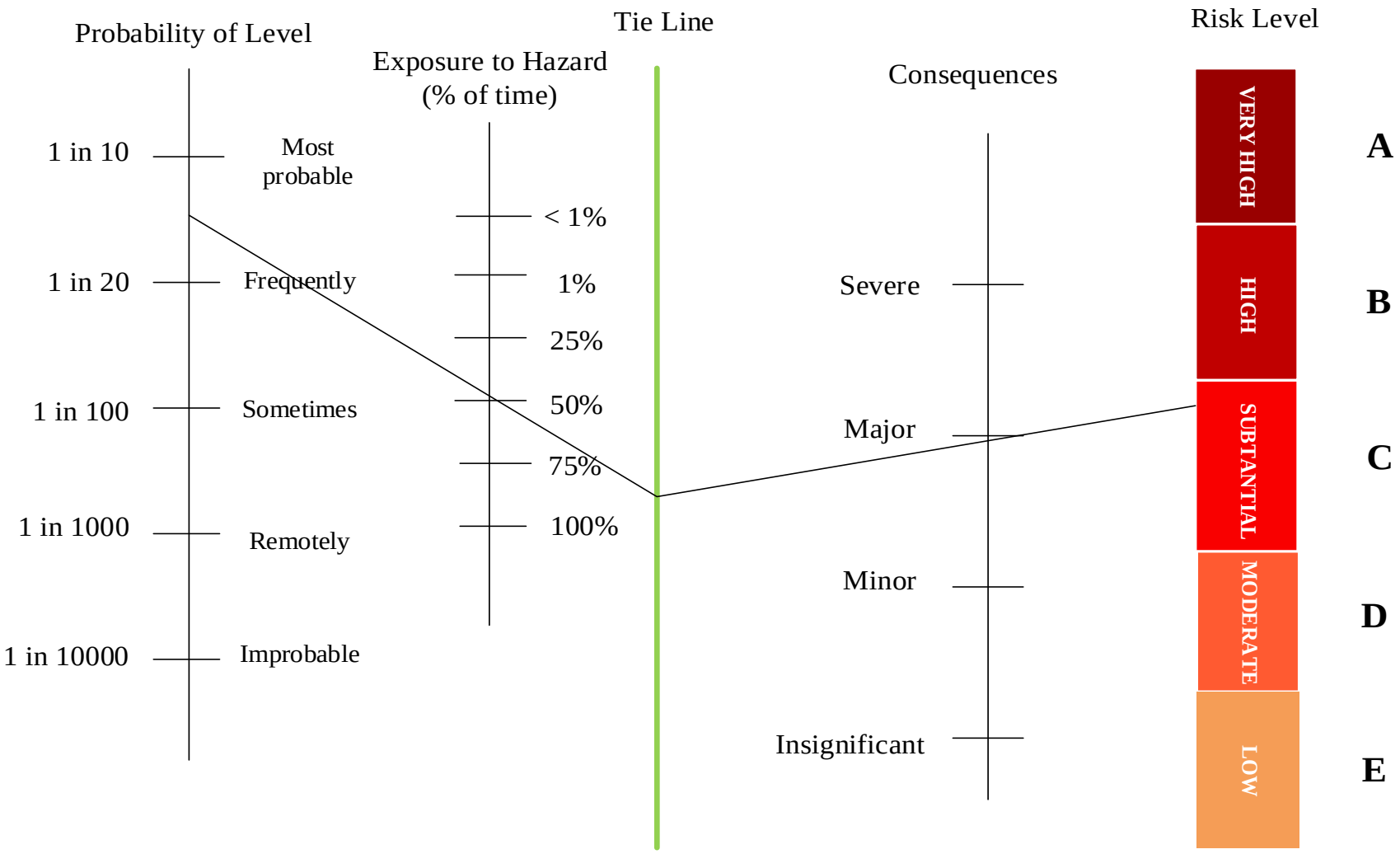

Figure 12: Sample risk level calculation for Highly repetitive actions

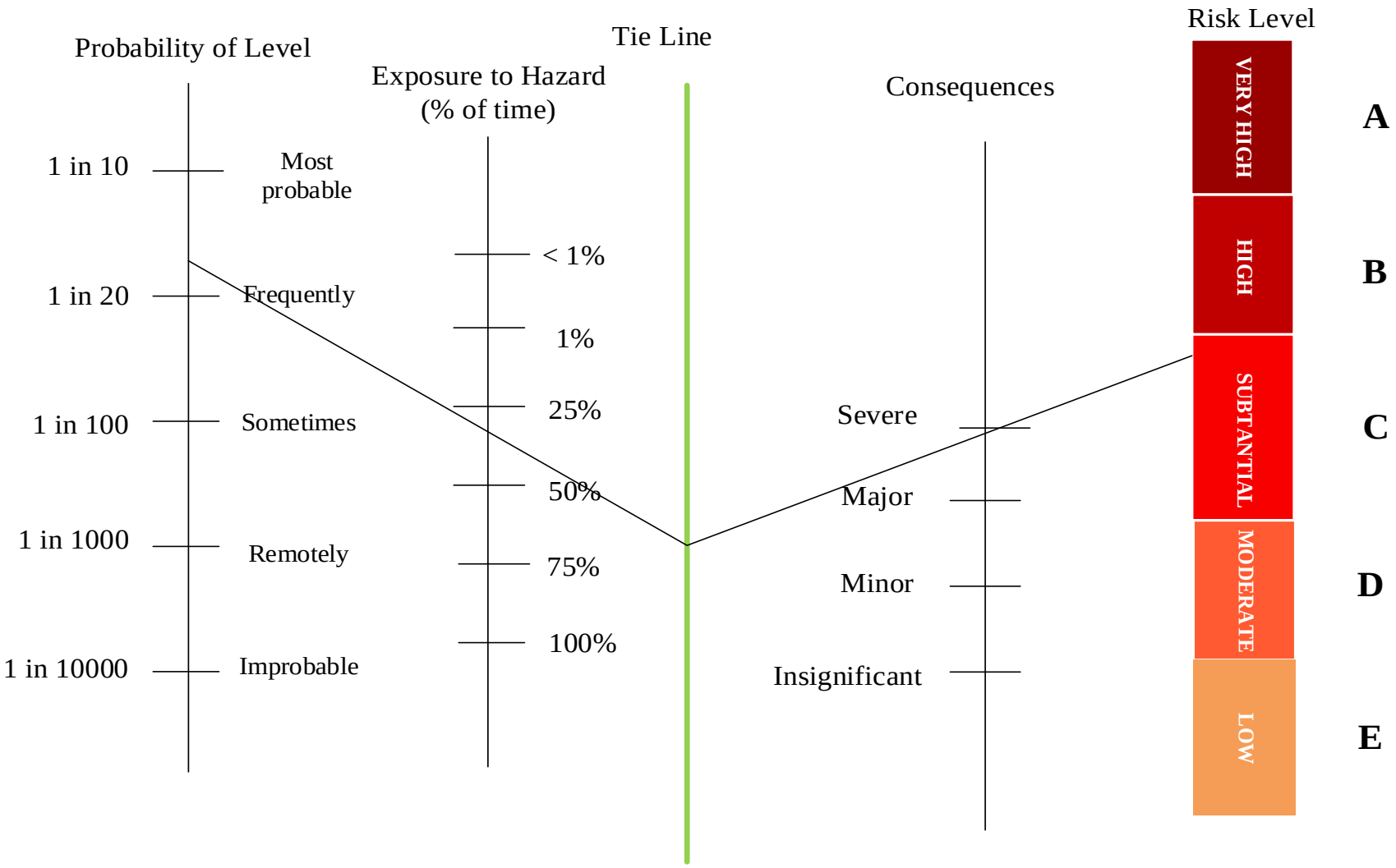

Figure 13: Sample risk level calculation for Stressful and awkward posture

Table 2.3: Probability Level, Exposure and Consequences of hazard:

Hazardous Event	Probability Level	Exposure to Hazard	Consequence
Lacerations/irregular tear of skin	0.1134	75% (approximately 6 hours of 8 hours shift)	Minor
Back and low back pain	0.1033	75% (approximately 6 hours of 8 hours shift)	Minor
Contusion/bruise	0.0954	75% (approximately 6 hours of 8 hours shift)	Minor
Eye irritation & red eye	0.0900	75% (approximately 6 hours of 8 hours shift)	Minor
Crushed hand/ fingers/toes	0.0868	75% (approximately 6 hours of 8 hours shift)	Major
Headache	0.0811	75% (approximately 6 hours of 8 hours shift)	Minor
Sharp and deep cut or indent	0.0843	75% (approximately 6 hours of 8 hours shift)	Major
Restriction of joint movement	0.0846	75% (approximately 6 hours of 8 hours shift)	Minor
Cough	0.0745	75% (approximately 6 hours of 8 hours shift)	Minor
Difficulties in hearing	0.0520	75% (approximately 6 hours of 8 hours shift)	Major
Skin irritation and Dermatitis	0.0662	75% (approximately 6 hours of 8 hours shift)	Major
Abrasions	0.0684	75% (approximately 6 hours of 8 hours shift)	Minor

Table 2.3 exhibits that most frequent injury's probability level, exposure and consequence of the hazards. From twenty-four injuries, most frequent encountered twelve injuries were selected through Pareto analysis. It was apparent that three of them had major and rest of them had minor consequences. Majority of the respondents exposed to hazard approximately 6 hours of 8 hours shift. So, they faced 75% of the time exposing to the hazard. From the major consequences, crushed hands or fingers or toes had the probability level of encountering was 0.0846. For skin irritation and dermatitis, the probability level was 0.0662 and for difficulties in hearing, it was 0.0520. Lacerations or irregular tear of skin had the most probability level among the minor consequence and it's about 0.1134 and abrasion had the least probability level of encountering and it's about 0.0684.

The figure 11 presents risk level calculation. For Risk Level Calculation, the probability level divided into four categories, one in ten was denoted as always, one in twenty was as frequently, one in fifty as sometimes and one in hundred denoted as not too often. For exposing to hazard approximately 6 hours of 8 hours shift, it was about 75% of the time exposing to the hazard. For injuries consequence, it was divided into four categories, they were- severe, major, minor, insignificant. If the point of probability level and the point of exposure was made a straight-line, it intersected the tie line. If the point of the tie line connected with the injury's consequence level, it gave which risk level the injury was in. The risk level was divided in to three sections and for high risk level, it was denoted as A, B for moderate risk level and C for low risk level. In determining the probability level, exposure to hazard and consequences of hazard, we have to approximate in some cases because of lack of data and time constraint.

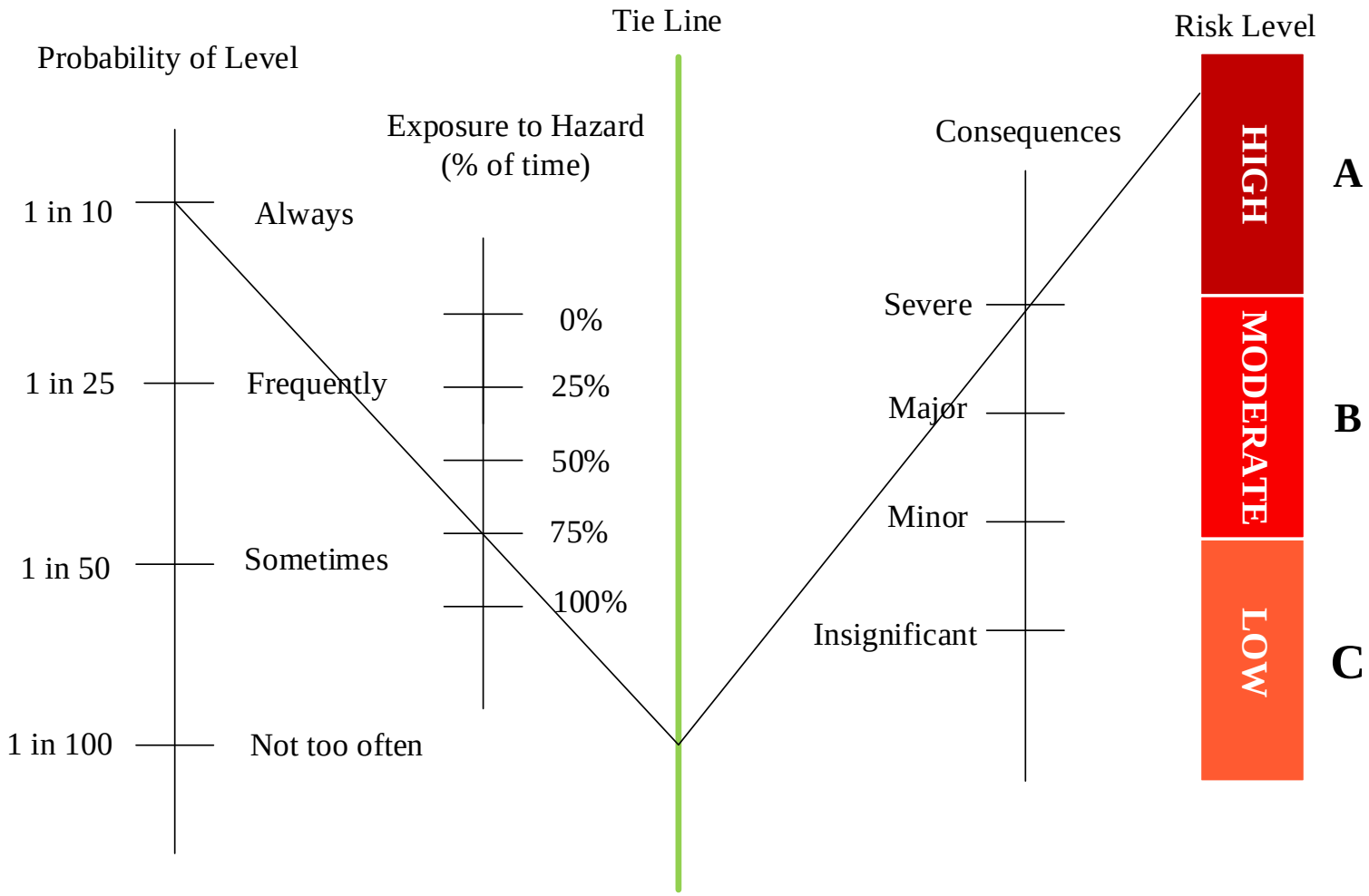

Figure 14: Sample risk level calculation

Table 2.4: Hazard Identification and Analysis Work Sheet:

Hazardous Events	Possible Causes	Consequence	Risk Level	Control Measures
Lacerations/ irregular tear of skin	Sharp edge and swarf	Tearing skin, cut and bleeding	B	Wear proper safety gear; eyewear, gloves, sleeves.
Back and low back pain	Stressful and awkward posture, Lifting and handling heavy objects, Bad lifting and handling technique	Fatigue	B	Maintain proper posture
Contusion/ bruise	Falling object, Direct contact of cutting tool	Injury	B	Taking cautions and using PPE.
Eye irritation & red eye	Dust, Flying object	Problems related to eye-vison	B	Using goggles
Crushed hand/ fingers/toes	Falling object, flying object, Direct contact of cutting tool, Entanglement with rotating/moving parts	Injury	A	Using safety boot and gloves.
Headache	Excessive noise	Feel exhausted	B	Maintain good posture, and move around during the day.
Sharp and deep cut or indent	Sharp edge and swarf, Direct contact of cutting tool	Tearing skin, cut and bleeding	A	Wear proper PPE, including eye protection, gloves, and long sleeves.
Restriction of joint movement	Lifting and handling heavy objects, Bad lifting and handling technique	Fatigue	B	Rest and Low-impact exercise
Cough	Dust	Problems in inhaling	B	Avoid inhaled irritants such as dust, using mask.

Difficulties in hearing	Excessive noise	Problems related to hearing	B	Using ear plug and ear muff.
Skin irritation and Dermatitis	Dust	Itching, irritating or damaging skin	B	PPE, such as appropriate gloves, apron, and face shields should be worn to prevent direct contact between the substance and the skin.
Abrasions	Direct contact of cutting tool	Sheared skin	C	Wear proper PPE, including eye protection, gloves, and long sleeves

From the table 2.4 of Hazard Identification and Analysis, to know how to identify hazards in an organized and systematic way and analyze the potential hazards for reducing or removing the consequences of hazardous situations. It had been estimated and evaluated risks on a semi-quantitative basis as ranking risks on a comparative scale. In this study, the risk level calculation was done by using the respected probability level, exposure to hazard and consequence of hazard. For each hazardous event, the calculation of the risk level presented that it had two high, nine moderate and one low risks for encountering accidents. It was gotten that crushed hand or fingers or toes Sharp and deep cut or indent had high risk level among the most frequent hazardous event. Besides, abrasions had the low level of risk and rest of the injuries had moderate level of risk. In table 2.4, it also suggested some control measures to mitigate the consequences.

Appendix [3]: KAP analysis regarding PPE use

Table 3.1: The association between Marital status and Knowledge level

Marital status	*Knowledge level*			*Total*
	Poor	Moderate	Good	
Unmarried	18 (4.6)	43 (11.1)	9 (2.3)	70(18)
Married	63 (16.2)	188 (48.5)	62 (16.0)	313(80.7)
Widowed	1 (0.3)	0 (0.0)	2 (0.5)	3 (0.8)
Divorced	0 (0.0)	1 (0.3)	1 (0.3)	2 (0.5)
Total	82 (21.1)	232 (59.8)	74 (19.1)	388(100)
			Fisher's Exact Test = 9.392, p = 0.086	

Table 3.2: The association between Number of hours worked per day and Knowledge level

Number of hours worked per day	*Knowledge level*			*Total*
	Poor	Moderate	Good	
6-8 hrs.	31(8)	72(18.6)	36(9.3)	139 (35.8)
9-12 hrs.	50(12.9)	147(37.9)	25(6.4)	222 (57.2)
12+ hrs.	1(.3)	13(3.4)	13(3.4)	27 (7.0)
Total	82(21.1)	232(59.8)	74(19.1)	388 (100.0)
				χ^2= 30.270, p = 0.000

Table 3.4: The association between Marital status and Attitude level

Marital status	*Attitude level*			*Total*
	Negative	Neutral	Positive	
Unmarried	26(6.7)	38(9.8)	6(1.5)	70(18)
Married	101(26)	193(49.7)	19(4.9)	313(80.7)
Widowed	0(0)	2(.5)	1(.3)	3(.8)
Divorced	0(0)	2(.5)	1(.3)	2(.5)
Total	128(33)	233(60.1)	27(7)	388(100)
			Fisher's Exact Test =10.652, P = .064	

Table 3.4: The association between Employment and Attitude level

Employment	*Attitude level*			*Total*
	Negative	Neutral	Positive	
Fulltime	121(31.2)	217(55.9)	23(5.9)	361(93)
Part-time	7(1.8)	15(3.9)	1(.3)	23(5.9)
Self-employed	0(0)	0(0)	3(.8)	3(.8)
Replacement worker	0(0)	1(.3)	0(0)	1(.3)
Total	128(33)	233(60.1)	27(7)	388(100)
			Fisher's Exact Test = 16.303, P = 0.004	

Table 3.5: The association between Number of hours worked per day and Attitude level

Number of hours worked per day	*Attitude level*			*Total*
	Negative	Neutral	Positive	
6-8 hrs.	55(14.2)	76(19.6)	8(2.1)	139(35.8)
9-12 hrs.	69(17.8)	141(36.3)	12(3.1)	222(57.2)
12+ hrs.	4(1)	16(4.1)	7(1.8)	27(7)
Total	128(33)	233(60.1)	27(7)	388(100)
			χ^2 = 20.904, P = 0.000	

Table 3.6: The association between Gender and Practice level

Gender	*Practice level*			*Total*
	Poor	Fair	Good	
Male	269(69.3)	2(.5)	1(.3)	272(70.1)
Female	116(29.9)	0(0)	0(0)	116(29.9)
Total	385(99.2)	2(.5)	1(.3)	388(100)
			Fisher's Exact Test = .902, P = 1.000	

Table 3.7: The association between Marital status and Practice level

Marital status	*Practice level*			*Total*
	Poor	Fair	Good	
Unmarried	69	0(0)	1(.3)	70(18)
Married	311	2(.5)	0(0)	313 (80.7)
Widowed	3(.8)	0(0)	0(0)	3(.8)
Divorced	2(.5)	0(0)	0(0)	2(.5)
Total	385	2(.5)	1(.3)	388(100)
	Fisher's Exact Test = 15.307, P = 0.540			

Table 3.8: The association between Employment and Practice level

Employment	*Practice level*			*Total*
	Poor	Fair	Good	
Fulltime	360(92.8)	0(0)	1(.3)	361(93)
Part-time	23(5.9)	0(0)	0(0)	23(5.9)
Self-employed	1(.3)	2(.5)	0(0)	3(.8)
Replacement worker	1(3)	0(0)	0(0)	1(.3)
Total	387(99.7)	1(.3)	0(0)	388(100)
	Fisher's Exact Test = 34.748, P = 0.000			

Table 3.9: The association between Number of hours worked per day and Practice level

Number of hours worked per day	*Practice level*			*Total*
	Poor	Fair	Good	
6-8 hrs.	138(35.6)	0(0)	1(.3)	139(35.8)
9-12 hrs.	222(57.2)	0(0)	0(0)	222(57.2)
12+ hrs.	25(6.4)	2(.5)	0(0)	27(7)
Total	385(99.2)	2(.5)	1(.3)	388(100)
	Fisher's Exact Test = 12.551, P = 0.002			

Table 3.10: The influence among knowledge, attitude, and practice of PPE use.

	N	Mean	Std. Deviation	Std. Error Mean	t	df	Sig.	Mean Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Knowledge level	388	1.9794	0.6346	0.0322	61.442	387	0.000	1.97938	1.9160	2.0427
Attitude level	388	1.7397	0.5767	0.0293	59.421	387	0.000	1.73969	1.6821	1.7973
Practice level	388	1.0103	0.1241	0.0063	160.379	387	0.000	1.01031	0.9979	1.0227

Table 3.11: The association between attitude and willingness regarding PPE use of the respondents

Attitude level	*Willingness level*			*Total*
	Poor	Moderate	Good	
Negative	20 (5.2)	89 (22.9)	19 (4.9)	128 (33.0)
Neutral	9 (2.3)	165 (42.5)	59 (15.2)	233 (60.1)
Positive	0 (0.0)	4 (1.0)	23 (5.9)	27 (7.0)
Total	29 (7.5)	258 (66.5)	101 (26.0)	388 (100.0)
				χ^2 = 71.632, P = 0.000

Appendix [4]: Training Need Assessment

Table 4.1: Time of the arranging training		
Time	*Frequency*	*Percentage (%)*
Recently (last 12 months)	0	0
1 year before	0	0
2 years before	0	0
5 years before	3	100
Total	3	100

Table 4.2: Duration of the arranged training		
Duration	*Frequency*	*Percentage (%)*
One day	3	100
One week	0	0
One month	0	0
Total	3	100

Table 4.3: Types of the arranged training		
Types	*Frequency*	*Percentage (%)*
On job training	3	100
Others	0	0
Total	3	100

Table 4.6: Effectiveness of the arranged training			
	Response	*Frequency*	*Percentage (%)*
Do the training sufficient to the requirements?	Yes	0	0
	No	3	100
	Total	3	100

Appendix [5]: Questionnaires

Questionnaire (1) for employees of stone crushing factories

SERIAL NO:

1. Demographic Data:

b) Age (in years):
c) Gender: □ Male □ Female
d) Marital status: □ Unmarried □ Married □ Widowed □ Divorced
e) Level of education □ No formal education □ Primary (Up to class V) □ Class VI – X □ S.S.C. □ Vocational school □ H.S.C □ Other
f) Employment □ Fulltime □ Part-time □ Self-employed □ Replacement worker
g) Type of Organization □ Stone crusher
h) Occupation □ Carrying and lifting personnel □ Machine operator □ Assistant to machine operator □ Supervisor □ Maintenance personnel □ Welder □ Others:
i) Length of service in the current organization/job □ 0.5+ yrs. □ 1+ yrs. □ 3+ yrs. □ 5+ yrs. □ 8+ yrs.
j) Number of hours worked per day: □ 6 – 8 hrs. □ 9 – 1 2 hrs. □ Others
k) Monthly income □ < Tk 8000 □ Tk 8000 - 10,000 □ Tk 10000 - 12000 □ Tk 12000 - 15000 □ Tk 15000+

2. Accidents / Injury related information

a) Type of accident encountered: □ Severe □ Major □ Minor □ Insignificant	
b) The consequence of the accidents:	
□ Fatal	□ Total disablement □ Partial disablement
□ Injury causing absence from the job for more than a month.	□ Injury causing absence from a job for more than a week up to a month.
□ Injury causing absence from the job for more than one day up to a week.	□ Injury causing absence from the job for more than 2 hours up to one day.
c) Time of occurrence of the accident (24-hr clock) □ 8 - 10 hr. □ 10 - 12 hr. □ 12 - 14 hr. □ 14 - 16 hr. □ 16 - 18 hr. □ after 18 hr.	

d) Location of injury by body part

□ Neck and head	□ Shoulder	□ Face	□ Eye
□ Wrist & Hand/fingers	□ Arm	□ Abdomen and chest	□ Back and low back
□ Knee	□ Feet/Toe	□ Ankle	□ Hip/Leg

e) Occupational health and Injuries

□ Sharp and deep cuts or indent	□ Amputations of fingers and hand	□ Crushed hand/ fingers/toes	□ Lacerations/ irregular tear of skin
□ Abrasions	□ Contusion/bruise	□ Burning: electric shock/fire, hot workpiece, spatter	□ Eye irritation and red eye
□ Ear irritation	□ Throat irritation	□ Nose irritation	□ Skin irritation and Dermatitis
□ Back and low back pain	□ Restriction of joint movement	□ Bone Fracture and dislocations	□ Skull Fracture
□ Electrocution	□ Vibration white fingers	□ Difficulties in hearing	□ Difficulties in breathing
□ Visual fatigue/Eye strain	□ Cough	□ Headache	□ Infected wounds

f) Agents of injuries and health problem (Hazards)

□ Lifting & handling heavy objects	□ Being struck by falling object	□ Being struck by moving machinery	□ Slipping and tripping
□ Fallen from height	□ Falling object	□ Flying object	□ Poor lighting
□ Bad lifting and handling technique	□ Sharp edge and swarf	□ Dust	□ Aerosol, mist and fume from fluid
□ Direct contact with cutting fluids	□ Excessive noise	□ Direct contact with wires/electrified equipment	□ Entanglement with rotating/moving parts
□ Vibration: Hand grinding	□ Trapping	□ Direct contact with cutting tools	□ Highly repetitive actions
□ Electric short circuit/overload	□ Stressful and awkward posture	□ Working without PPE	□ Extended exposure to sunlight

3. Occupational health and injury risk assessment

Occurrences of occupational health and injury (Frequency)					
In the last six months, how often had you have ……..	Always	Frequently	Sometimes	Not too often	Never
□ Sharp and deep cut or indent					
□ Amputations of fingers and hand					
□ Crushed hand/ fingers/toes					
□ Lacerations/irregular tear of skin					
□ Abrasions					
□ Contusion/bruise					
□ Burning: electric shock/fire, hot workpiece, spatter					
□ Eye irritation and red eye					
□ Ear irritation					
□ Throat irritation					
□ Nose irritation					
□ Skin irritation and Dermatitis					
□ Back and low back pain					
□ Restriction of joint movement					
□ Bone fracture and dislocations					
□ Skull fracture					
□ Electrocution					
□ Vibration white fingers					
□ Difficulties in hearing					
□ Difficulties in breathing					
□ Visual fatigue/Eye strain					
□ Cough					
□ Headache					
□ Infected wounds					

4. KAP study on personal protective equipment use

Knowledge about personal protective equipment (PPE) use					
Please indicate your level of agreement or disagreement with the following statements	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
□ Safety boots protect one from foot injuries.					
□ Nose and mouth masks protect one from lung problem, nose and throat irritation.					
□ Ear plugs or ear muffs prevents one from hearing loss.					
□ Overall/aprons at the workplace protect one from body injuries.					
□ Helmets or hard hats prevent one from head injuries.					
□ Eye shield or goggles protects one from eye injuries.					
□ Face shield prevents one from face injuries.					
□ Gloves or mittens protect one from hand or finger injuries.					

The use of PPE prevents one from

□ Injuries					
□ Insects					
□ Cough					
□ Disease					

The persons supposed to wear PPE

□ All the workers					
□ Workers in dangerous area					
□ Supervisors					
□ Owners/managers					

5. Attitude towards personal protective equipment (PPE) use

Please indicate your level of agreement or disagreement with the following statements.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
□ To me, the use of PPE at my workplace is very important.					
□ Employees who don't use PPE should be punished.					
□ Employees must decide themselves to use or not to use PPE.					
□ I often discuss about PPE with my coworkers.					
□ I regularly ask for the relevant PPE for my work area.					
□ I encourage my coworkers to use PPE.					
□ In my workplace, the use of PPE is absolutely necessary.					
□ PPE bothers me when I am working.					
□ PPE is a waste of money.					

6. Practice regarding personal protective equipment (PPE) use

During working, how often do you use ……?	Always	Frequently	Sometimes	Not too often	Never
□ Safety boots					
□ Nose and mouth masks.					
□ Ear plug or ear muffs.					
□ Overall/apron					
□ Helmets or hard hats					
□ Eye shield or goggles					
□ Gloves or mittens					
□ Face shield					
□ If your answer is never, mention why?	Uncomfortable	Not important	Not available	Wrong size	Other
□ If other, specify:					

7. Willingness to use personal protective equipment (PPE)

Please indicate your level of agreement or disagreement with the following statements.	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
□ During working, I am willing to use safety boots.					
□ During working, I am willing to use nose and mouth masks.					
□ During working, I am willing to use ear plugs or ear muffs.					
□ During working, I am willing to use Overall/apron.					
□ During working, I am willing to use helmets or hard hats.					
□ During working, I am willing to use eye shield or goggles.					
□ During working, I am willing to use face shield.					
□ During working, I am willing to use gloves or mittens.					

8. Training need assessment

□ Have you ever received any training on personal protective equipment (PPE)?	□ Yes			□ No
□ If yes, when did you get it?	□ 3 months before	□ 6 months before	□ 2 years before	□ Last year
□ If not, why didn't you take it?	□ No training is arranged	□ Not allowed to attend	□ Not interested in training	□ Other
□ If other, please specify:				

Questionnaire (2) for only employers of stone crushing factories

9. PPE Availability Assessment

Q1. Is there PPE available? □ Yes □ No
Q2. If no, Why PPE is not available? □ Not interested □ Not important □ Very expensive □ Other If other, please specify:
Q3. If yes, Which PPE is available? □ Safety boots □ Nose & mouth masks □ Earplug/ear muffs □ Overall/apron □ Helmets/hard hats □ Eyeshield/goggles □ Gloves/mittens □ Face shield
Q4. When did you purchase these? □ 3 months before □ 6 months before □ 1 year before □ 2 years before □ 5 years before □ 10 years before
Q5. Are these functional conditions? □ Yes □ No
Q6. Do these fit employees/workers sizes? □ Yes □ No
Q7. Do you provide them to use PPE? □ Yes □ No
Q8. Do you encourage them to use PPE? □ Yes □ No
Q9. Do they use PPE properly? □ Yes □ No
*Q10. Do the PPE sufficient to the requirements**?*** □ Yes □ No

10. Training Need Assessment: Training arrangement by employers

Q1. Have you ever arranged any training on PPE? □ Yes □ No
Q2. If not, why have not you arranged it? □ Not interested □ Not important □ Expensive & time consuming □ Other If other, please specify:
Q3. If yes, when have you arranged it? □ 3 months before □ 6 months before □ 1 year before □ 2 years before □ 5 years before □ 10 years before
Q4. What types of training have you arranged for employees? □ On job training □ Others If other, please specify:
Q5. What was the duration of training? □ One day □ One week □ One month □ Other:
*Q6. Do the training sufficient to the requirements**?*** □ Yes □ No
Q7. How many people have you trained up? □