“IMPACT OF ENVIRONMENTAL POLLUTION ON PUBLIC HEALTH: A CASE STUDY OF STONE CRUSHING INDUSTRY OF MARGALLA HILLS, TAXILA, PAKISTAN”

Submitted by

Hafiza Sadaf Hafeez

Supervised by

Prof. Dr. Usman Mustafa

PAKISTAN INSTITUTE OF DEVELOPMENT ECONOMICS
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CERTIFICATE

This is to certify that this thesis entitled: "*Impact of Environmental Pollution on Public Health: A Case Study of Stone Crushing Industry of Margalla Hills, Taxilla, Pakistan*" submitted by Hafiza Sadaf Hafeez is accepted in its present form by the Department of Development Studies, Pakistan Institute of Development Economics (PIDE), Islamabad as satisfying the requirements for partial fulfillment of the degree in Master of Philosophy in Development Studies.

Supervisor:

Dr. Usman Mustafa
Professor
Pakistan Institute of Development Economics
Islamabad

External Examiner:

Dr. Javed Iqbal
Assistant Professor
Department of Economics
Quaid e Azam University
Islamabad

Head,
Department of Development Studies:

Dr. Zulfiqar Ali
Assistant Professor
Pakistan Institute of Development Economics
Islamabad

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Hafiza Sadaf Hafeez

ABSTRACT

The base of research work Impact of Environmental Pollution on Public Health. It was a Case Study of Stone Crushing Industry of Margalla Hills Taxila on human health and duration of workday's loss due to the sufferings from different diseases. Primary data was collected using "purposive sampling techniques." The total sample size was 50 respondents each from Stone Crushing Industry and CDA workers Non-Stone Crushing Industry. The data had equally distributed among Stone Crushing Industry and CDA workers Non-Stone Crushing Industry. Data had obtained through well-structured and pretested questionnaire. Chi-Square Test had used to carry out comparative analysis between the Stone Crushing Industry workforce and CDA workers Non-Stone Crushing Industry. Workforce for Stone Crushing Industry has direct impact of dust pollution and number of workday's loss due to illness/total direct mitigation cost. Result also revealed that there is significant number of workday's loss due to illness from dust for Stone Crushing workforce. High co-relation had also observed for prolonged working hour's consequently greater exposure to the dust particles. Results showed Stone Crushing Industry workforce more illness and workday loss as compared to CDA workers Non-Stone Crushing Industry. Although Stone Crushing Industry Workforce was aware of dust pollution, yet their negligence in adopting safety measures including non-using of dust masks was main cause of their illness whereas major factor is lack of education and awareness. Average Stone Crushing Workers and CDA workers Non-Stone Crushing Industry illness response was 65%. Policy recommendations had formulated.

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List of Acronyms

CDA	Capital Development Authority
CFA	Confirmatory Factory Analysis
CPEC	China Pakistan Economic Corridor
DARWF	Days Away of Regular Work Force
DAW	Days Away from Work
EPA	Environmental Protection Agencies
IPM	Inhalable Particulate Matter
OHSA	Occupational Health and Safety Administration
STDs	Sexually Transmitted Diseases
TB	Tuberculosis
WHO	World Health Organization

CHAPTER I

INTRODUCTION

1.1 Background

Allah has gifted Pakistan various types of natural reserves and minerals including precious stones, marble, gypsum, gravel, silica, iron ore, salt, silver, copper, coal, and even gold in Baluchistan. The foremost use of gravel is the basic for Pakistan infrastructural development such as bridges, roads, multi stories buildings and development of new cities/houses all over the country. The demand of gravel has tremendously increased in the country after implementation of China Pakistan Economic Corridor (CPEC) for construction of Motorways from Gawader to China border passing through all four provinces of Pakistan and Northern areas (Malkani *et al.,* 2017).

The environmental pollution is the phenomenon to know about the impurities contained in the atmosphere that are harmful for human being also to adhere remedial action for minimizing pollution (Rajeshwar, *et al.,* 1997).

The environmental pollution is due to the unusual growth in population, demand in natural resources, and expansion in infrastructure, energy requirements for industries, agriculture, and domestic usage. Low environmental literacy and under-evaluation of the economic and ecological aspects are damaging to basic life supporting system (Smith, Corvalan and Kjellstrom, 1999).

Pakistan Environmental Protection Agencies (PAK-EPA) are not taking serious actions to the industries polluting the environment. In addition, to estimate growth compared to reality that is resulting under nutrition and high infant mortality (Azizullah *et al*., 2011).

The environmental pollution accelerated for development of infrastructure to increase production for meeting human needs and this pollution is majorly affecting the human health. The insufficient skill and resources are main causes effecting to control environmental pollution. Western world and Japan had generated the movement for combating environment pollution at extremely high level (Vallero, 2007).

The Epidemiological studies helps the hypothesis pollution in air has detrimental effect on the respiratory tract and other human body systems majorly caused by quarries, cement industries, textile industries, bricks kilns, gas processing plants and steel melting industries. Their effect on human health depends on the nature and distance from polluted area, exposure, its concentration and duration (doses). It is prime responsibility of industrialists to maintain atmosphere by controlling dust, gases, and effluent as per guideline of Pakistan Environment Protection Agencies. Dust pollution scale is ten per cubic meter particles and its maximum safe count for human being is hundred micro gram per cubic meter (Hajime, 2003).

"Air pollution based on industrialization in world and its impact on human health during start of the 20th century. Measures have been taken by Western Countries and America as per International Standards on air pollution resulting in reduction of pollution" (Kundin, 2004).

Extreme pollution levels have recorded constantly in cities of third world countries such as Bangkok, New Delhi and South American city of Mexico. As major threat for residents, it has observed in form of smog in New Delhi in November 2016. Epidemiological studies showed that numerous casualties, tremendous amount of medical cost and loss of production in industries every year due to pollution. The poor quality of life has shown remarkable extra burden on people in these societies (Crisp *et al.*, 1998).

Industrial development has brought changes in human life but major cause of environmental damage is due to industries. Effluent waste is damaging the water streams and adjacent soil whereas smoke and dust from chimneys is polluting air and degrading it tremendously, thus industries are sources of exploitation of natural resources (McMichael, 1999).

"Environmental degradation caused by industries in developed and developing countries have major concern for people living in the vicinity during last four to five decades. Global environmental issues such as impure atmospheric air, water contamination, spillage of lubricants, toxic waste both in air and water, trend of global warming, damage to ozone layer, deforesting and soil erosion due to rain" (Blaxill, 2004).

Prominent diseases in industrial working staff and nearby community are facing such as blood pressure, ear/nose/throat diseases, diarrhea, gastro-intestinal diseases, malaria, yellow fever, chronic respiratory diseases and cancer (Sellers, 1997).

1.2 Problem Statement

Rapidly growing mining progressing areas, blasting in the mines with closed atmosphere, lack of availability of fresh air is main cause of tuberculosis (Munnik, 2010).

Beside this, water pollution in the area due to explosive and water drainage in streams are causing skin diseases for the innocent people living downstream. They are unaware of the chemicals presence in the water causing serious effect to their skins. While in some areas, people use this water for drinking and affecting their lives (Avdeev and Korchagin, 1994).

An air pollution at high level poses hazard to human health (Dockery, and Pope, 1994).

An infectious disease is spreading by mycobacterium tuberculosis. Even the human body is helpless against this co-bacterium and the lungs an essential organ come under influence of tuberculosis. Mostly this disease effects the youth and poor families. As tuberculosis spreads through air and transmits effectively in poor families due to their close interaction. Similar situation exists in workforce working in mines. Most gold mines are in South Africa where tuberculosis has considered as the third reason for human death (Ciocco and Thompson, 1961).

Population in the radius of 1000 meters has mainly affected by dust and vigor's affects in the radius of 100 meters. These dust particles can be seen on clean surfaces such as cars, windows and window lodges, even interior of the houses over furniture's , glassware, window panels etc. The process of quarrying causes negative impact on floral development (DeBarteleven, 1992).

The dust particles with crystalline silica are major effects of respiratory illness named silicosis. Approximately twelve % of earth crust has presence of silica are cause of silicosis. Quarrying causes air pollution for the people residing in the vicinity. Dust particles equally effect on the plants by making layer over the leaves of the plant-causing breakdown for

their development by decreasing day light penetration, with consequences of low and poor vegetation (Aliasgharpour and Hagani, 2005).

People working in these industries are often unaware of safety and precautionary measures for these life-threatening pollutants. Work force related to stone crushing industry with inhaling of dust has serious effect on lungs illness, cardiovascular, respiratory, and liver problems (Ashraf *et al*., 2010).

Quarry mining is less hazardous than tunnel mining. Major factor in quarry mining is dust pollution in the nearby vicinity and surrounding area. Several regulations are set up to keep away the living areas from the quarry at least 1000 meters (Gehring *et al*., 2002).

Supreme Court of Pakistan has ordered on June 4, 2016 and restricted the use of explosive for blasting at Margalla hills quarries. Furthermore, Supreme Court (SC) asked from Federal and Punjab Governments to provide detailed reply on the issue for the "protection of environment."

An overall study related to ecological harms and consequence of mining operation. About sixty % occupants are at danger limit because people of vicinity are less aware due to illiteracy and pneumonic illnesses due to respiratory infection. Beside this lack of safety measures, clinical and doctor deficiency affecting the life to these industries laborers remain permanently in air borne contamination. Hence, this study has focused on the impact of dust on work force (Weber, 2002).

1.3 Objectives

The aim of this study is to determine the effect of dust pollution on human health. Specifically the study has following objectives:

- To examine the consequences of stone crushing on human health
- To consider the impact of environmental pollution on working staff
- To estimate the mitigation cost and workdays loss due to health hazards by dust in the working staff

1.4 Research Question

Following are the research questions:

- What are the consequences of stone crushing on human health?
- What is the impact of environmental pollution on working staff?
- What type of disease occurred due to environment pollution?
- What is the mitigation cost and working days loss due to health hazards by dust in the working staff?

1.5 Hypothesis

Following are the hypothesis:

1. "Stone crushing could lead to the environmental pollution."

2. "Stone crushing might damage to the public health."

    - The impact of age of the respondents on stone crushing might damage to the health of people
    - The impact of education of the respondents on stone crushing might damage to the health of people
    - The impact of income of the respondents on stone crushing might damage to the health of people

3. "The risk of work day's loss could increase because of bad health."

    - The impact of income of the respondents on workday's loss due to illness
    - The impact of age of the respondents on workday's loss due to illness
    - The impact of education of the respondents on workday's loss due to illness

1.6 Significance of the Study

Significance of this study to elaborate and enhance health related safety measures due to dust and environmental pollution. Although atmospheric dust has not monitored in most parts of the world yet its appearance over the smooth surfaces like vehicles, window glass panels, furniture etc. is elaborated and correspondingly affecting the human health. This study will analyze the health hazards in the environmental perspective. The relationship between the environmental pollution and diseases is focus of the study and to carry out interrogation and impacts of dust during gravel production on health of working staff in comparison with CDA workers as a Non-Stone Crushing Industry was having same age, qualification, and income working in non-polluted area.

CHAPTER II

REVIEW OF LITERATURE

This chapter comprises of three parts described as literature review, contribution of the present study and research gap.

2.1 Air Pollution

According to World Health Organization pollution in the air defined as, “Air pollution is contamination of the indoor or outdoor environment by any chemical, physical, or biological agent that modifies the natural characteristics of the atmosphere. Household combustion devices, exhaust from motor vehicles, industrial exhausts, and forest fires are common sources of air pollution. Pollutants of major public health concern include particulate matter, carbon monoxide, ozone, nitrogen dioxide, and sulfur dioxide. Outdoor and indoor air pollution causes respiratory and other diseases, which can be fatal” (WHO, 2018).

Major gases in the atmospheric air have 78% Nitrogen, 21% Oxygen, 0.03% Carbon Dioxide, and other gases. Major part of Oxygen is for human inhaling and Nitrogen for plants and trees available in this universe are gift of nature. If an air has contaminated with dust, acidic fumes, mist, odor, smoke or harmful vapors, it is basic cause of human/plant/animal life injuries or it interferes with enjoyment and comfort of human being. Air pollution is one of the unseen enemy for human/plants and called environmental evil. An air pollution generated by automobiles described as the “disease of wealth and health.” If we breathe contaminated air, it will affect our respirations, lungs and even in worst case as cancer to human. Fresh air is gift of God Almighty for human being with qualitative balance that maintains the wellbeing of human. An Encyclopedia of environment describes, “Effects of air pollution have more dire effects for infants with it tremendous enhancement during winter season even for adults because pollution reaches to peak” (Gauderman *et al.*, 2005).

Tragic death incident due to air pollution in London among year 1952, and Bhopal in India gas tragedy of 1984 that generations are still facing over there. We will present impact of dust pollution caused by quarry and gravel industry on working staff (Goodall, 1995).

According to Ghasemkhani *et al.,* (2006) workers respiratory symptoms in South Tehran to find respiratory illnesses of lungs related diseases. Eight Hundred Eighty sampling has done by stage wise random sampling technique of these workers. The sampling data has gathered through questionnaire prepared by medical research council. The available data by Chi-square test used in statistics. The worker‘s age was 19 to 70 years of male gender. The extra ordinary polluted industry is construction and spreaded around the globe. Under this study, results revealed that prevalence of the respiratory disease were high in the workers related to this industry.

Stone crushing and gravel production is basis for dust formation inhaled by the workers working in the quarry, stone crushing and segregation of different gravel grades. Laborers exposed to this dust are at extreme danger with signs of asthma, bronchitis, irritation in nose and prime effects on the lungs. The risk of determining nasal disease from zero to hundred has measured, as Inhalable Particulate Matter (IPM) is environment measurement. This is the mass fraction of airborne particles inhaled through nose and mouth. Quarry and stone crushing dust consists micro particles of sand/silica. These micro particles are main cause of occupational illnesses, silicosis Lung cancer (IARC 1997), and silicosis, irrespirable crystalline silica directly affects to immune system infection, non-harmful renal sickness and cardiovascular opestractive ailment (Kan, 2009).

The environmental health risks due to dust formation during gravel production are tremendous due to lack of knowledge in the community. The owners do not bring the rate of injuries, accidents, and even fatalities to the surface because they are using crude methods of different operations during complete cycle of this process. It remained hazardous operation in the era 1980-1989, and impact on health of the concerned staff has categorized as allergy including cough, fever, sneezing, etc. leading to cardiovascular diseases, respiratory infections, and dermatological issues respectively. Microbial infections are more in the working staff because lack of awareness, poor and un-hygienic living conditions, and food they are eating in the area (Kromm, 1973).

The effect of air pollution on the work force is mainly by the dust generated by mining and stone crushing activities. This is obligation of owner and concerned authority to envisage the well-being of the people especially, those living close to quarry and operational areas. They are often suffering with headache, skin rashes, diarrhea and sometimes vomiting, etc. Quarry and stone crushing usually damage water reservoirs creating obstructions for nearby residents for obtaining clean potable water for drinking, cooking, washing, bathing etc. Another major impact in stone crushing areas has a tendency for prostitution, sexual abuse, and drug addiction effecting health of the working people. Major causes of HIV/AIDs in these areas are due to sexual abuse including Sexually Transmitted Diseases (STDs). People all over the world are in influence of negative social, environmental and health impact due to quarries and stone crushing, with poor or negligible environmental health and safety standards. Quarries owners in these communities are not managing effective measures to curtail above-mentioned difficulties. Often perspective offences against individuals are an optional concern (Kimani, 2007).

Working hours for the worker are 10 to 12 per day. Staff consists of male workers with age of 21 to 58 years and mean duration of the work was 5 to 10 years. Prolonged working hours in gravel manufacturing is major cause of respiratory illnesses among the workers. Working staff was almost illiterate/primary education. Due to lack of education, they are not following the precautionary measures causing respiratory illness. There was less incident of illness in educated workers because they were following safety instructions. It has suggested that mandatory used of safety awareness and safety gadgets by working staff must be implemented (Harvath and Hegedus, 1994).

Study covers for monetary benefit due to health and payment to residents of 3122 persons in the urban industrial city of Kanpur in India. This study has analyzed for the health using the Poisson Regression used in Tobit Regression Model. The monetary benefits were calculated using two components of health (Heinrich and Wichmann, 2004).

Both primary and secondary data has used during the study. Questionnaire was prepared for collection of primary data on week wise health register of four seasons. The air quality data used as secondary has collected from Department of Meteorology. Results showed that air pollution was the basis of related illness such as cough, eye irritation, asthma etc.

and it decreased the output. Monitory calculation was Rupees 165 per year per person gain for Kanpur residents by keeping air pollution in safe level (Holland *et al.,* 1979).

2.1.2 Environment and Industry

In the present era due to industrialization, we have many benefits including tremendous challenges. Large numbers of vehicles have used for easiness and fast travelling but these vehicles are emitting considerable Carbon Mono Oxide (CO) in fractions of second with healthy engines. Beside this if, vehicle engine is not proper lot of smoke is also becoming from exhaust polluting the atmosphere (Huppert and Sparks, 2006).

"Hence it is responsibility of current age human being to consider environmental protection with sustainable development." Now day's industries are basis of economic development of countries but this development paying serious damage to environment. It is responsibility of Environmental Protection Agencies to provide license for operating any industry meeting the requirement of environmental conditions. There must be authorized Environmental Inspector for each industrial zone and has authority to cancel the license of the industry with poor environmental performance (Jacquemin *et al.,* 2009).

2.1.3 Pollution due to Gravel Industry

Gravel industry has considered as basic asset for infrastructure development in Pakistan contributing from small house to the multi stories buildings, paved roads to the motorways, causeway to modern bridges etc. The world economic development depends largely upon the size and lengths of modern roads network thus enhancing the economy for fast track movement of goods within the country and sending/receiving from abroad. The other phase of economy is saving in time and fuel energy reducing impact on revenues (Anwar, 2014).

The Environmental Protection Agency (EPA) must check and verify accomplishment of regulations and industries not maintaining rules be punished and even closed by repeating similar offence. An example of this is available in Fecto Cement Industry Islamabad where no atmospheric pollution due to strong regulation and implementation of PAK-EPA rules because its existence in Islamabad Capital Territory.

International Environmental Protection Agency allows noise pollution limit of industrial Zone to maximum eighty dB, this limit has to be meet in Diesel Generating Power Plants, Forging Industries, and Sheet Metal Industries etc. Proper ear protecting devices such as earmuffs is mandatory for all individuals working in these industries otherwise prolonged noise pollution effects the hearing capabilities of the working staff. In fact, location of these industries must be far away from the local community to minimize noise pollution in the surrounding areas (Künzli *et al.,* 2000).

Continuous safety training has maintained in these industries to transfer the knowledge and safety awareness in the staff for betterment of the individuals. These trainings minimize the possibility of worker's illness/industrial accidents causing days away from work and enhances productivity. The Occupational Health and Safety Administration (OHSA) maintain and adhere through administration as guideline of International Organization of Health and Safety. An appropriate measure is prime responsibility of owner to minimize inhaling of silica dust by the working staff (Landrigan *et al.,* 2002).

In Pakistan, occupational health and safety issues of working staff is least due to inattention of respective government department. Exceptional care is required for small-scale commercial enterprises still not registered in Government Social Security. Current study especially focusing on the workers employed in quarry and stone crushing/gravel manufacturing where working staff are critically exposed to occupational health related risks. Suggestions for lessening the related dangers because workers of quarry and stone crushing industry are least equipped with the personal protective equipment's (PPE's) and risk of various occupational health and safety hazards and their mitigation (Lenkova, and Vargova, 1994).

2.3 Research Gap

The impact of air pollution by gravel industry on social aspects of Pakistan consequently over the health of working staff and people living in surrounding areas is still under debate. In Pakistan, there is no specific study to examine social perspective in context of air pollution from stone crushing industry in Margalla Hills and its impact on health. We were

also unable to find any econometric models used in the previous studies, that examines socio-economic factors and diseases with the dependent variable.

The impact of gravel industry on staff working in quarry/gravel industry has undertaken on the basis Days Away of Regular Work Force (DARWF) due to health or physical grounds. Total working day loss caused by polluted air diseases have taken into consideration by Chi-Square Test.

CHAPTER III

DATA DESCRIPTION AND METHODOLOGY

This chapter comprises of three parts described as data collection, methodology, and empirical specification of the study. This study emphasized about the health and medical status of quarry workers, their respiratory diseases, socio-economic factors in Pakistan for mitigation as better as possible.

3.1 Data Collection

Primary data has collected to achieve goal of study by establishing well-structured questionnaire. Study described the impact of dust pollution on health of the workers and financial impact of illness. Thus to collect data on personal and socio economic characteristics of workers, information on respiratory diseases, expenses born by worker for medical treatment and days away from work (DAW).

Health cost means medical expenses that include the expenditure on medicines, hospitalization, X-rays, pathological tests, travel cost, doctor fees, and cost of food and stay for accompanying person etc. Another opportunity cost comprises in loss of wages or income of the relevant worker which he tolerated due to DAW (Gupta, 2006; Chowdhury and Imran, 2010; Adhikari, 2012; Chowdhury and Imran, 2010; Bogahwatte and Herath, 2008).

The data is collected from both quarry and non-quarry workers.

- The workers working in the Stone crushing industry of Margalla Hills Taxila; “Haji Iqbal Stone Crushing Plant”
- For non-quarry part we choosed the Capital Development Authority (CDA) workers Non-Stone Crushing Industry of same qualification and age as stone crushing industrial workers.

Since total number of employees were 50 in the stone crushing industry, therefore we interviewed all the fifty workers which was total population of this industry. Nevertheless,

we also interviewed 50 other non-quarry workers selected randomly. Since non-quarry workers were taken as control group thus 50 non-quarry workers were selected from outside the gravel industry.

3.1.1 Survey Design

The objective of the study was to measure the impact of dust pollution on worker health and performance. To achieve this objective collection of primary data was mandatory. The primary data collected through questionnaires of quarry workers. The development of questionnaire was based on health cost and respiratory symptoms studies (Gupta, 2006; Murty *et al.*, 2003; Adhikari, 2012; Chowdhury and Imran, 2010; Bogahwatte and Herath, 2008; Memon *et al.*, 2008; Farooque *et al.*, 2008; Nafees *et al.*, 2013; Hinson *et al.*,2014).

The questionnaires comprising in two parts: The general workers survey questionnaire comprise of information on work characteristics and socio-economic factors. There are variable in socio-economic characteristics such as age, education, and monthly income, duration of employment and smoking history of workers in quarry industry including use of mask during working hours, Socio-Economic Characteristics of workers and Health Diary Questionnaire (Kamat and Doshi, 1987; Gupta, 2006; Chowdhury and Imran, 2010; Bogahwatte and Herath, 2008).

The second part of the questionnaire was health diary questionnaire comprising the detail information on respiratory illnesses and symptoms of quarry workers. The data collected from Health Diaries on respiratory diseases and symptoms, dust level, health cost, work performance, opportunity cost and data on days away from work in coming two weeks. Gupta, (2006); Adhikari, (2012); Chowdhury and Imran, (2010); Bogahwatte and Herath, (2008) used the similar health diary technique to collected the data on health and medical status of the respondents including associated cost.

Health cost data consisted doctor fee, expenditure on medicines, hospital stay, pathological tests, and accompanying person cost. The opportunity cost included the cost of the workdays away from work during past two weeks. The study was single stage sampling technique to select workers in Margalla Hills quarry. The study probably showed that level of dust is much higher than normal in quarry area.

The data has collected after getting permission of the quarry administration. The measurement of dust pollution in quarry is very costly and monotonous job. Further, they do not allow outsider to do this kind of activity as it shows negative impact on environmental condition of this industry.

3.2.1 Theoretical Framework

The researcher focus was economic, social and environmental impact of marble and stone crushing in the regions of North Africa and Middle East specifically Palestine. A case study for efficient use of energy, water, and natural stone during production process and minimizing the waste and improve efficiency (Hanieh *et al*., 2013).

Although Margalla Hill quarries are near to Capital Islamabad yet still some old methods of crushing system have used due to lack of awareness, unavailability of modern resources, financial aspects, and technical expertise. Locally manufactured machinery has used for getting the required output for which maintenance cost of equipment's are considerable as compared to imported machinery. Figure No.1 describes the workflow of Gravel industry from quarry to the final product including process, environmental and health impacts.

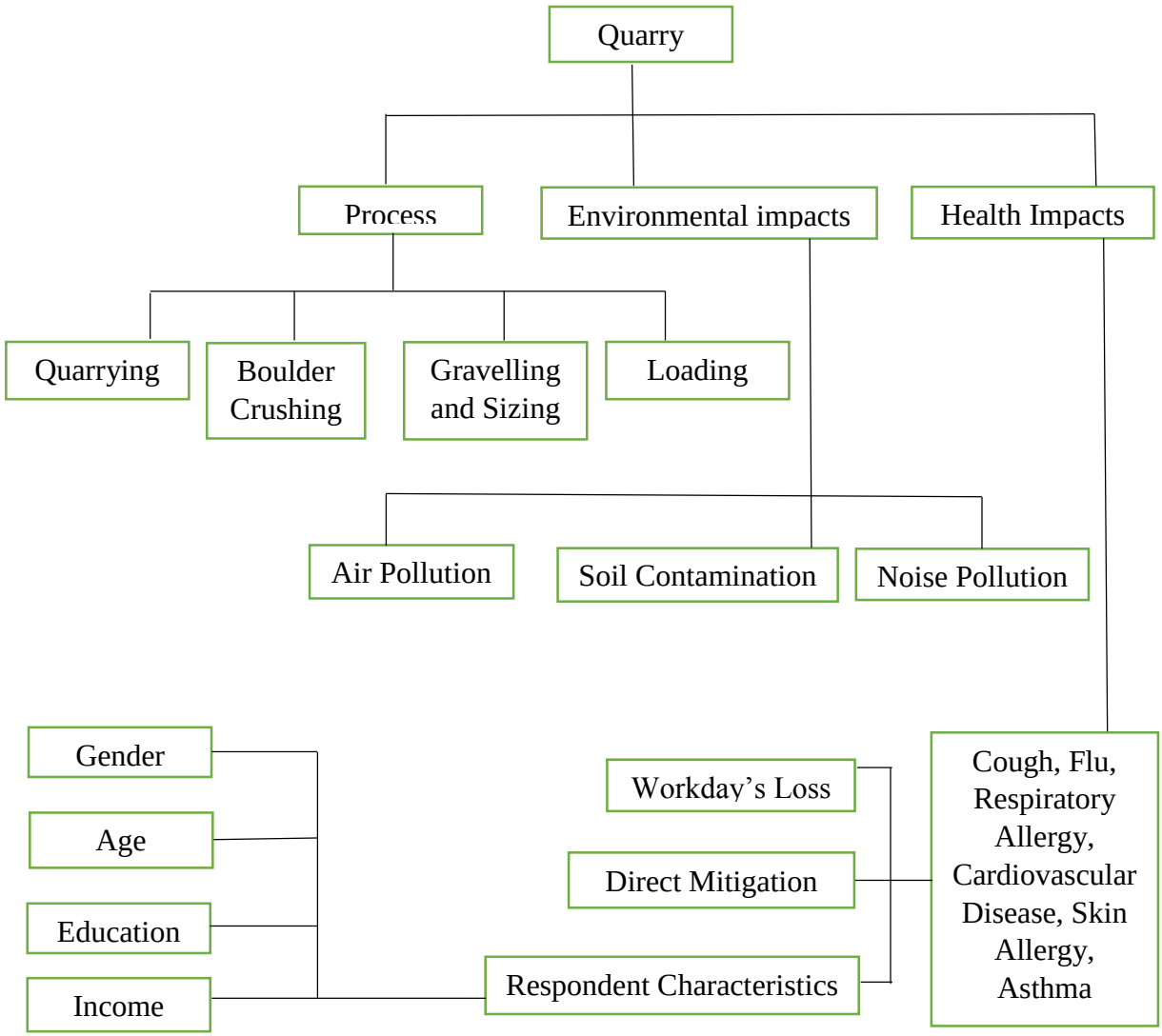
Accidents occur in quarries, during transportation of boulders, crushing areas due to lack of safety awareness, especially not using safety shoes, hand gloves, and safety helmets.

Due to dust, pollution workers are subject to respiratory, lung diseases, asthma. Cardiovascular disease such as silicosis is main cause of hypertension and noise from quarrying and crushing.

For treatment of illness, worker had to bear direct mitigation cost that includes travel cost to hospital, number of doctor's visits, medicines expenses, and diagnostic tests. The resultant was low salaries, poverty enhancement, and illiteracy in quarry industries.

By provision of proper skill and safety environment productivity can be enhanced, also factor of increasing their salaries thus improving their living standard (PFI, 2009).

Figure.1 Diagrammatical Representation of Theoretical Framework



3.3 Model

The model has based for investigation of two major objectives i.e. worker days away from work (DAW) due to illness and costs of mitigation.

3.3.1 Chi-Square Test

Chi-Square is an authentic test used to compare observed data with obtained data for specific hypothesis named null hypothesis**.** The data has used in calculating Chi-Square was also random from independent variables taken from samples. As the data was not normal so non-parametric test was used which is Chi-Square and through P-value we got the acceptance level. This study used the Chi-Square test whether the categorical variable are independent from each other or not.

3.4 Description of Variables

Data of several key variables have collected, however, few have mentioned below,

Number of Workday's Loss due to Illness

Chi-Square test has used to estimate the number of workday's loss due to illness. In this study, number of workday's loss due to illness and total cost of mitigation are dependent variables.

Direct Cost of Mitigation

Chi-square test has used to assess the relationship between dependent and independent variables. The dependent variable in stone crushing quarry was total mitigation cost occurred due to health hazards. Direct mitigation cost were s combination of cost on medicines, fee paid to the doctor, cost on diagnostic tests, travel cost to the doctor's clinic etc.

Diagnostic tests for detection of chronic illness/allergic rhinitis ranging from X-Rays, chest CT scan, ultra sound, ECG etc. are additional costs depending on case.

Quarry Worker and Non-Quarry Workers

To analyze relationship of workday's loss due to illness and total direct cost of mitigation with quarry and non-quarry worker have used as independent variable so, in order to compare their relationship with age, income, and education of the respondents.

Age of the Respondent

The ages of quarry worker were main factor for professional, non-professional and their residences in vicinity of quarries. They were suffering from such diseases i.e. chronic illness, allergic rhinitis, and dermatological issues.

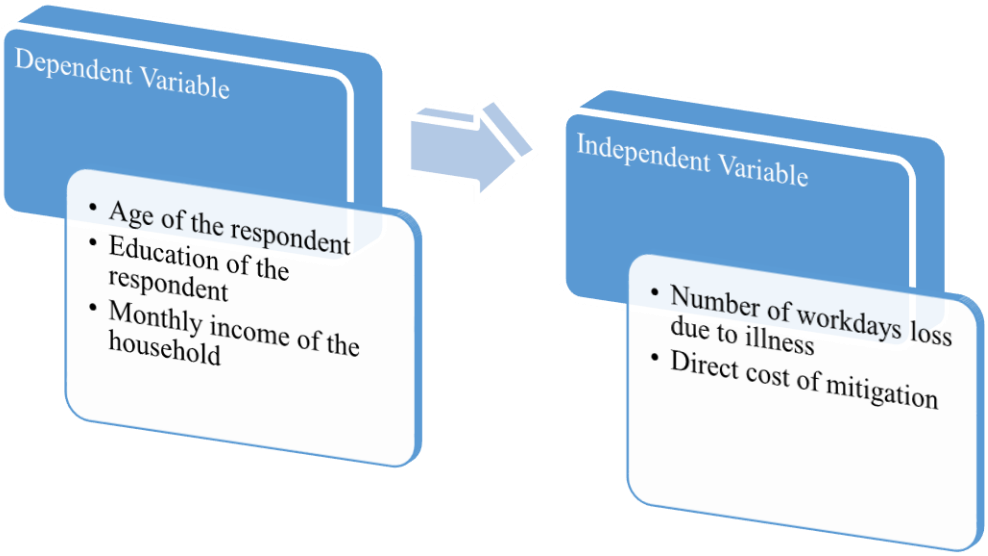
Education of the Respondent

This refers to the education of the respondent. An educated person was more vigilant for air contamination and he attempts to use safety masks for minimum health hazard. It also changes his behavior thus workday's loss decreases.

Monthly Income of the Household

The income of the respondent for household expanses is basic for our living needs and priorities changes with increase in income. Higher income households like to live in a clean environment and thus minimizing risks from ailments and workdays losses due to this.

Figure.2 Diagrammatical Representation of Independent and Dependent Variables



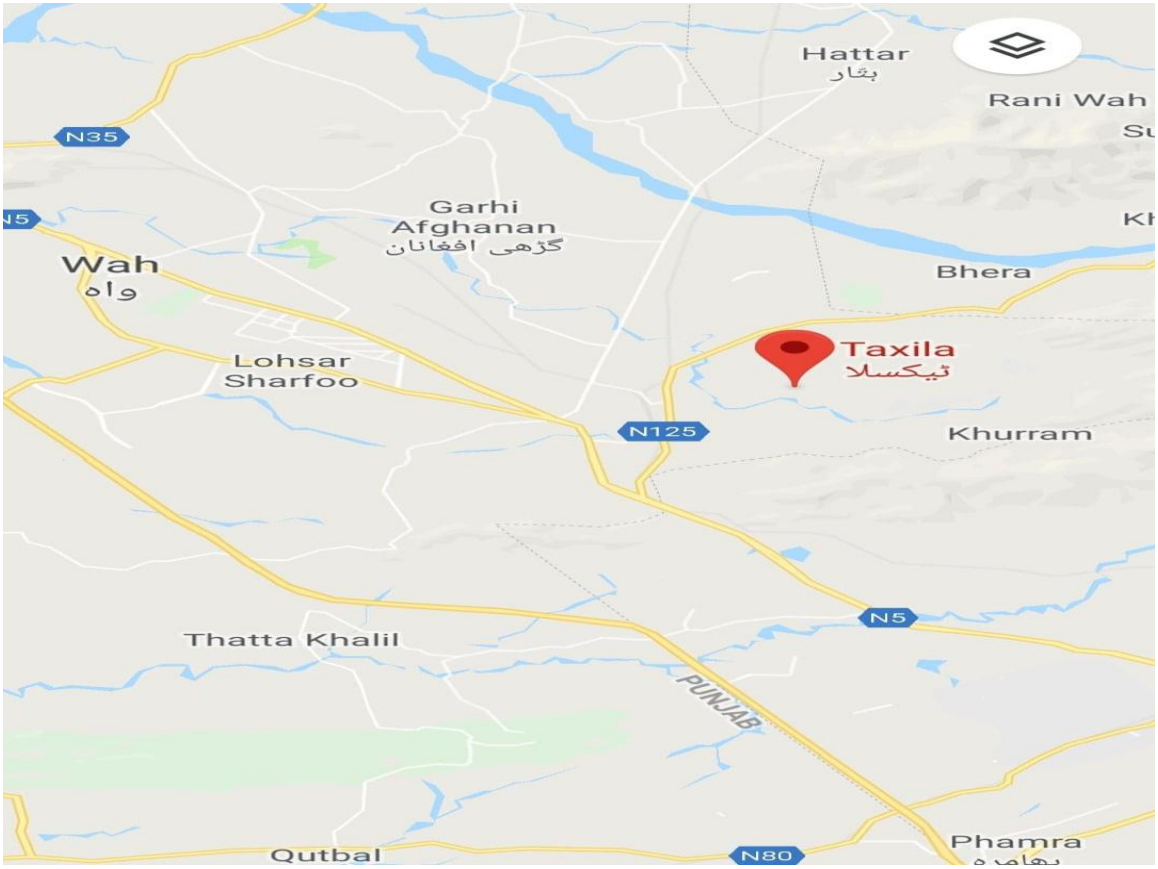
3.6 Method of Data Analysis

Collected information has coded, sequenced, and organized for information accumulation. The quantitative data have inducted in simple factual programming for analysis known as Statistical Package for the Social Sciences (SPSS).

3.7 Study Area

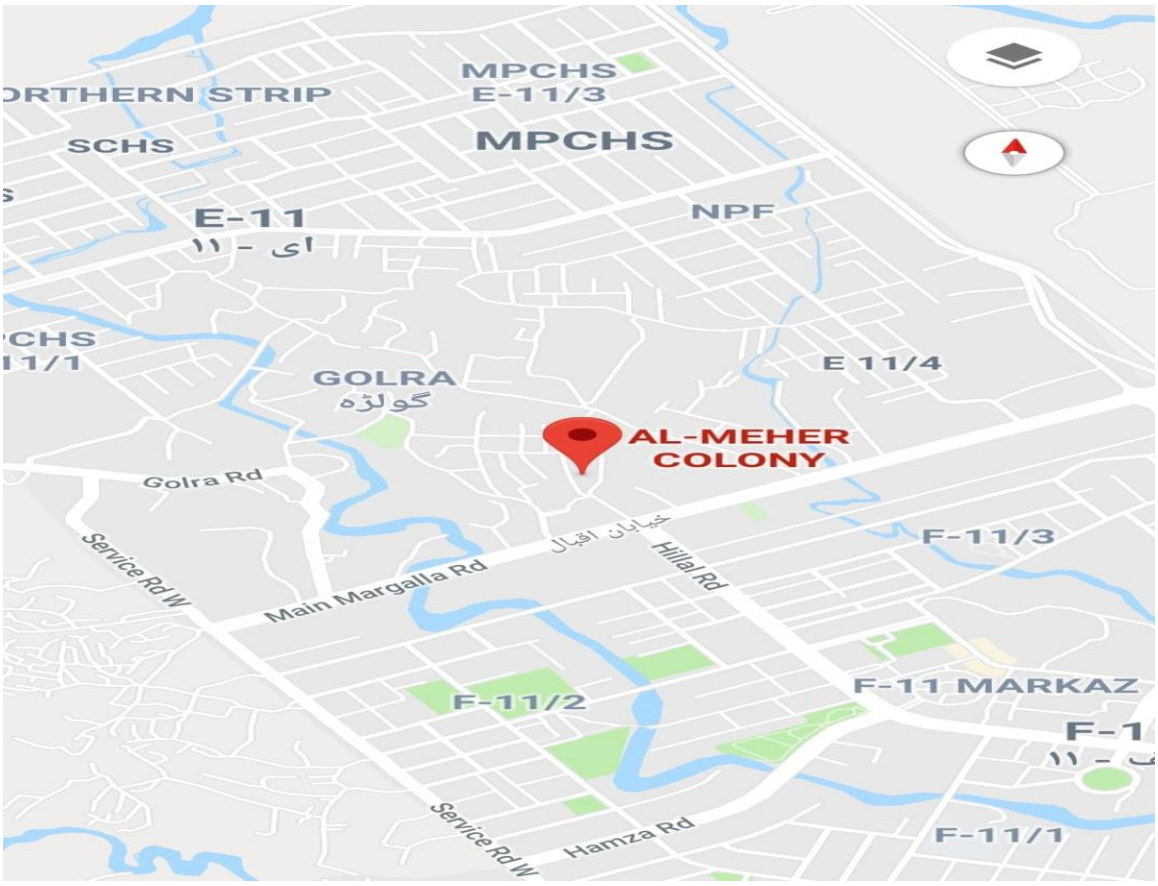
Margalla Hills quarry area covers about 12 square kilometers of total area. There are more than 140 quarries in Margalla Hill's west end side. Around 200 delivery trucks/dampers and trailers are engaged for supply of crush to all parts of the country. Our selection was Haji Iqbal Crushing Plant situated in the middle of quarries at the west end of Margalla Hills. There are eight working hours in three shifts working round the clock for production of different sizes of gravel.

Figure.3 Tehsil Map of Taxila



Sub locale were chosen from non-stone crushing workers as CDA workers working in different location like Al-Meher Colony, Christian Colony, Bheka Sydan having pollution free environment. Nature of the job and environment is different from stone-crushing area but having homogenous characteristic such as age, education, and income. We have intentionally chosen them as having different environment but similar living status/characteristics like slum "Kachi Abadi."

Figure.4 Map of Al-Meher colony



3.12 Research Design

Research designs procedures/plans for research that span the broad assumptions to detailed methods of data collection and analysis (Creswell, 2009).

The research methodology for Margalla Hills quarry industry based on investigation on ecological impact of gravel and its impact on workers.

CHAPTER IV

RESULTS AND DISCUSSION

The chapter has divided into two parts. First part deals with the descriptive analysis of the data and second part deals with the confirmative analysis using Chi-Square test.

4.1 Descriptive Statistics

In descriptive statistic the data was described meaningfully Table 1. It is very important because it provided us idea of the respective data. In descriptive statistics, simple interpretation of the data had provided without including the results. Descriptive statistics had used to describe the fundamental description of data. In descriptive statistic, we explained different socio-economic characteristic, work characteristic of the stone crushing industry workers.

4.1.1 Demographic profile of respondents

For Stone Crushing Industry none of the respondent was the age group of 16 to 20 years, 4% were of 21 to 25 years, 6% were of 26 to 30 years, 48% were of 30 to 35 years, 42% were of 36 to 40, and none of the respondent was of 41 years and above (Table 1).
For Non-Stone Crushing Industry 2% of the respondents were the age group of 16 to 20 years, 2 % were of 20 to 25 years, 32% were of 26 to 30 years, 32% were of 31 to 35 years, 24% were of 36 to 40 and 8% of the respondents were of 41 years and above (Table 1).
Although, according to Harvath and Hegedus, ages of respondents were twenty one to fifty eight years considering all male workers (1994).

For Stone Crushing Industry forty % respondents were in the category of Primary, fifty six % were in the category of Middle, none of the respondent was in the category of Matriculation and four % of the respondents were in the category of Intermediate (Table 1).

For Non-Stone Crushing Industry 42% respondents were in the category of Primary, 42% were in the category of Middle, 14% of the respondent were in the category of Matriculation and 2% of the respondents were in the category of Intermediate (Table 1).

Working staff was almost illiterate/primary education. Due to lack of education, they are not following the precautionary measures causing sickness. There was less incident of sickness in educated workers because they were following safety instructions (Harvath and Hegedus, 1994).

For Stone Crushing Industry 90% respondents were married and 10% respondents were unmarried (Table 1).

For Non-Stone Crushing Industry 92% respondents were married and 8% respondents were unmarried (Table 1).

For Stone Crushing Industry 4 % respondents were receiving PKR/- 10,001-15,000, 80% were receiving PKR/- 15,001-20,000 and 16% of the respondents were receiving PKR/- 20,001-25,000 per month (Table 1).

For Non-Stone Crushing Industry 60% respondents were receiving PKR/-. 10,001-15,000, 40% were receiving PKR/-. 15,001-20,000 and none of the respondent was receiving PKR/- 20,001-25,000 per month (Table 1).

Table 1: Demographic profile of respondents

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Age		
16-20	0	2
21-25	4	2
26-30	6	32
31-35	48	32
36-40	42	24
41 and above	0	8
Education (Years)		
Primary	40	42
Middle	56	42
Matriculation	0	14
Intermediate	4	2
Marital Status		
Married	90	92
Unmarried	10	8
Monthly Income		
10,001-15,000	4	60
15,001-20,000	80	40
20,001-25,000	16	0

Source: Survey Data

4.1.2. Work characteristics

For Stone Crushing Industry the below table described the working experience, duty hours and over time of the respondents as 14% of respondents have less than 5 years' experience, 48% have 5 to 15 years, and 28% of the respondents have 15 to 20 years' experience (Table 2).

For Non-Stone Crushing Industry the below table described the working experience, duty hours and over time of the respondents as 60% of respondents have less than 5 years' experience, 40% have 5 to 15 years, and none of the respondent have 15 to 25 years' experience (Table 2).

For Stone Crushing Industry 100 % of the respondents were working 8 hours, none of the respondent was working 10 hours and none of the respondent was working 12 hours per day (Table 2).

For Non-Stone Crushing Industry 16% of the respondents were working 8 hours, 26% were working 10 hours and 58% of the respondents were working 12 hours per day (Table 2).

For Stone Crushing Industry none of the respondents was working overtime per day (Table 2).

For Non-Stone Crushing Industry 40% respondents were working 2 hours over time per day and 60% respondents were working 4 hours over time per day (Table 2).

Working hours for the worker were 10 to 12 hours per day. Staff consisted of male workers with age of 21 to 58 years and mean duration of the working experience was 5 to 10 years (Table2).Prolonged working period in gravel manufacturing is major cause of respiratory illnesses among the workers (Harvath and Hegedus, 1994).

Table 2: Work characteristics

	Stone Crushing Industry (%)	**Non-Stone Crushing Industry (%)**
Working Year		
<5	14	60
5-15	58	40
15-25	28	0
Duty Hours		
8 hours	100	16
10 hours	0	26
12 hours	0	58
Over-Time Work		
Yes	0	40
No	100	60

Source: Survey Data

4.1.3. Use of Personal Protection Equipment's PPE's during working hours

For Stone Crushing Industry during working hours 24% respondents were using PPE's and 26% were working without using PPE's. The use of safety helmet during working hours

by the respondents were 14% and 86% of the respondents were not using safety helmet. The 10% were using coverall and 90% of the respondents were not using coverall during working hours. The use of Safety Shoes by the respondents was 28% and 72% were not using Safety Shoes. The use of safety gloves by the respondents were 14% whereas 86% of the respondents were not using safety gloves. The use of earmuffs by the respondents was 16% whereas 84% of the respondents were not using earmuffs. The use of dust mask by the respondents was 18% and 82% of the respondents were not using dust mask. The use of specific uniform by the respondents was 6% whereas 94% of the respondents were not using uniform during working hours (Table 3).

For Non-Stone Crushing Industry use of personal protective equipment's PPE's as 38% respondents were using PPE's and 62% were working without using PPE's. None of the respondents used safety helmet and none of the respondents used coverall during working hours. The use of Safety Shoes by the respondents was 38% and 62% were not using Safety Shoes during working hours. None of the respondent used safety gloves during working hours. None of the respondent used earmuff during working hours. None of the respondent used dust mask during working hours. The use of uniform by the respondents was 92% whereas 8% of the respondents were not using uniform during working hours (Table 3).

This study especially focusing on the workers employed in quarry and stone crushing/gravel manufacturing where working staff are critically exposed to occupational health related risks. Suggestions for lessening the related dangers because workers of quarry and stone crushing industry are least equipped with the personal protective equipment's and risk of various occupational health and safety hazards and their mitigation (Lenkova, and Vargova, 1994).

Table.3 Use of Personal Protection Equipment's PPE's during working hours

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Use of safety helmet		
Yes	14	0
No	86	100
Use of Coverall		
Yes	10	0
No	90	100
Use of Safety Shoes		
Yes	28	38
No	72	62
Use of Safety Gloves		
Yes	14	0
No	86	100
Use of Ear Muffs		
Yes	16	0
No	84	100
Use of Dust Mask		
Yes	18	0
No	82	100
Use of Uniform		
Yes	6	92
No	94	8

Source: Survey Data

4.1.4. Administrative control

Stone Crushing Industry 18% of the respondents had administrative control authority whereas 82% of the respondents had not any administrative control authority. The rotation in work by the respondents showed 86% were in working rotation shifts and 14% of the respondents were working in general 8 hours duty. The work practices by the respondent's showed 94 % and 6% had not performed any work practices. The 100% respondents had given on the job training (OJT). The 88 % were keeping proper housekeeping and twelve

% of the respondents had negative response. The 78% of the respondent were engaged in equipment's maintenance and 22% of the respondents had negative response. The 78% of the respondent were engaged in personal hygiene practices and 22% of the respondents had negative response (Table 4).

For Non-Stone Crushing Industry none of the respondents had any administrative control authority. The rotation in work by the respondents showed 100% shifts. The work practices by the respondent have showed 100%. The 96% respondents had given on the job training (OJT) whereas 4% of the respondents had negative response. The 100% were keeping proper housekeeping of the area. The 100% of the respondent were engaged in equipment's maintenance. The 100% of the respondent were engaged in personal hygiene practices (Table 4).

The Occupational Health and Safety Administration (OHSA) maintain and adhere through administration as guideline of International Organization of Health and Safety (IOHS). An appropriate measure is prime responsibility of owner to minimize inhaling of dust by the working staff (Landrigan *et al.*, 2002).

Table.4 Administrative control

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Rotation in work		
Yes	86	100
No	14	0
Work practices		
Yes	94	100
No	6	0
Training on the job		
Yes	100	96
No	0	4
Housekeeping of area		
Yes	88	100
No	12	0
Equipment's Maintenance		
Yes	78	100
No	22	0
Personal hygiene practices		
Yes	78	100
No	22	0

Source: Survey Data

4.1.5. Type of mask under use if PPE's not available

For Stone Crushing Industry the alternate if proper mask is not available to the respondents, 46 % of the respondents were using turban cloth on mouth and nose whereas 54% of the respondents were using 36"x36" square cloth (Parna) to cover mouth (Table 5).

For Non-Stone Crushing Industry the alternate if proper mask is not available to the respondents. None of the respondent was using turban cloth whereas none of the respondents was using 36"x36" square cloth (Parna) to cover mouth/nose (Table 5).

Suggestions for lessening the related dangers because workers of quarry and stone crushing industry are least equipped with the personal protective equipment's and risk of various occupational health and safety hazards and their mitigation (Lenkova, and Vargova, 1994).

Table.5 Type of mask under use if PPE's not available

	Stone Crushing Industry (%)	**Non-Stone Crushing Industry (%)**
What type of mask under use if PPE's not available		
Use of turban cloth on mouth and nose	46	0
Use of square cotton cloth 36X36 (Parna) to cover mouth and nose	54	0

Source: Survey Data

4.1.6. Health diary

For stone crushing industry, 100% respondents answered positive that they know about pollution, 100% answered positive that they know about "Environmental Pollution," 100 % answered positive that stone crushing cause's environmental pollution, 100% answered positive that environmental pollution from gravel industry has impact on individual's health (Table 6).

For Non-Stone Crushing Industry 100% respondents answered positive that they know about pollution, 100% answered positive that they know about "Environmental Pollution," 100% answered positive that stone crushing cause's environmental pollution. Hundred % answered positive that environmental pollution from gravel industry has impact on individual's health (Table 6).

The environmental health risks due to dust formation during gravel production, rate of injuries, accidents, and even fatalities have not brought to the surface because they are using crude methods of different operations during complete cycle of this process. Impact on health of the concerned staff has categorized as allergy including cough, fever, sneezing,

etc. leading to cardiovascular diseases, respiratory infections, and dermatological issues respectively (Kromm, 1973).

Table 6.Health diary

	Stone Crushing Industry (%)	**Non-Stone Crushing Industry (%)**
Do you know about "Pollution"? Yes	100	100
Do you know about "Environmental Pollution"? Yes	100	100
Do you think "Stone Crushing" causes "Environmental Pollution? Yes	100	100
Do you think that environmental pollution from gravel industry has impact on your health? Yes	100	100

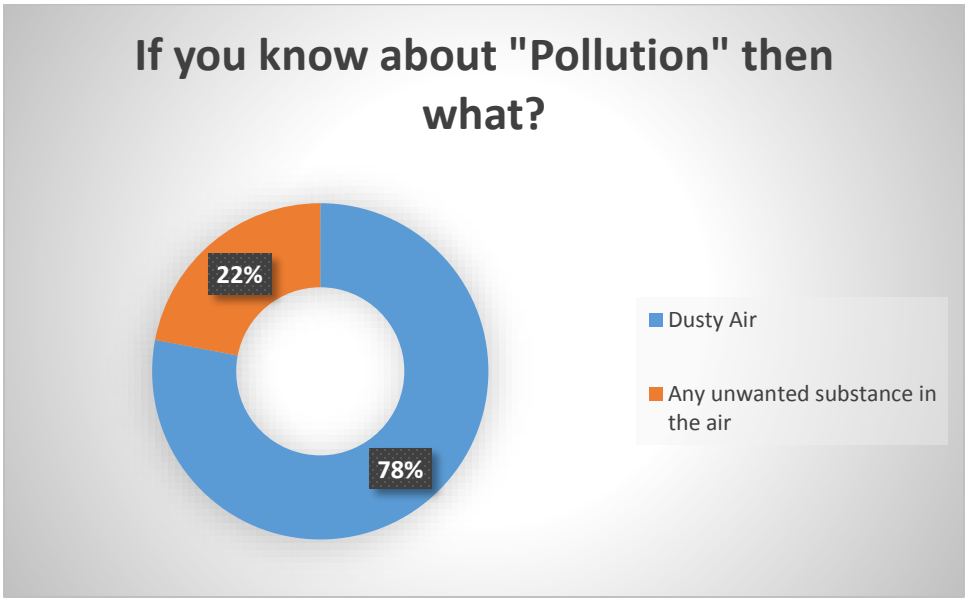
Source: Survey Data

4.1.7. If you know about "Pollution" then what:

Of the knowledge of pollution by the respondents, the 78% answered dusty air and 22 % of the respondents described as unwanted substances in the air (Figure 5).

Air pollution is one of the unseen enemy for human and plants and called environmental evil. If we breathe contaminated air, it will affect our respirations (Gauderman *et al.*, 2005).

Figure.5 if you know about "Pollution" then what?



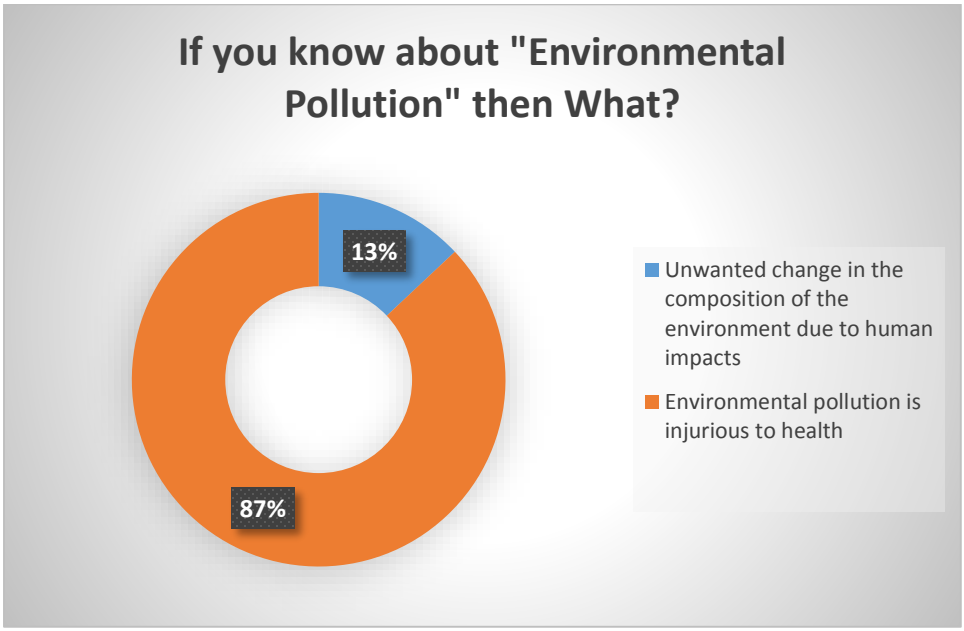
Source: Survey Data

4.1.8. If you know about "Environmental Pollution" then what

For the Environmental Pollution the 13 % respondents described as unwanted change in the composition of environment due to human impact and 87 % described Environment Pollution is injurious to health (Figure 6).

If an air has contaminated with dust, it is basic cause of human/plant/animal life injuries. Air pollution is one of the unseen enemy for human and plants and called environmental evil. If we breathe contaminated air, it will affect our respirations, lungs and even in worst case as cancer to human. Fresh air is gift of God Almighty for human being with qualitative balance that maintains the wellbeing of human (Gauderman *et al.*, 2005).

Figure.6 if you know about "Environmental Pollution" then what



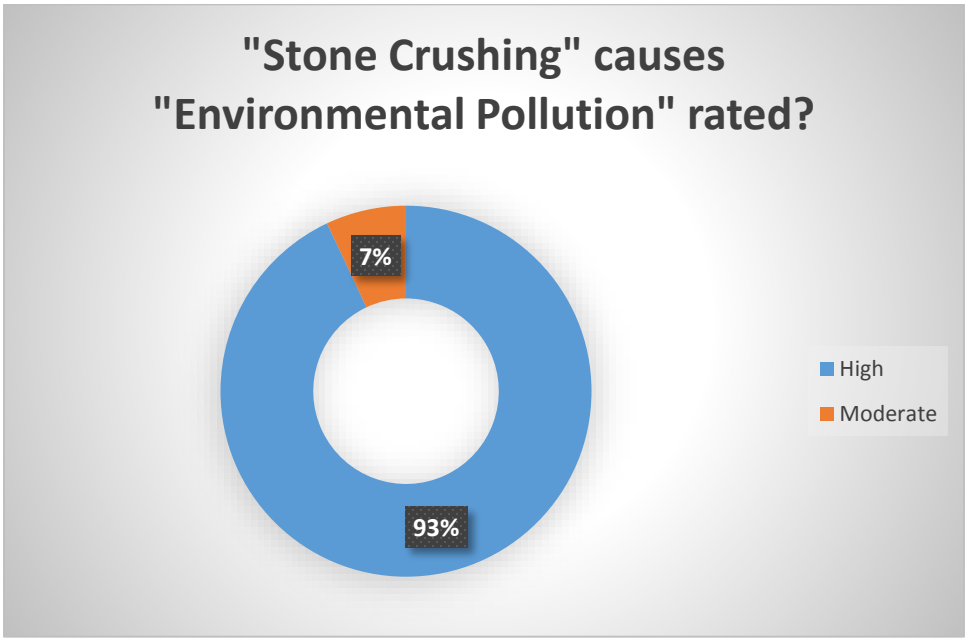
Source: Survey Data

4.1.9. "Stone Crushing" causes "Environmental Pollution" rated

The rate of pollution by the stone crushing respondents, 93% rated as high and 7% considered as moderate (Figure 7).

Stone crushing and gravel production is basis for dust formation inhaled by the workers working in the quarry, stone crushing, segregation of different grades of gravel (Kan, 2009).

Figure.7 "Stone Crushing" causes "Environmental Pollution" rated



Source: Survey Data

4.1.10. Type of disease caused

For Stone Crushing Industry the diseases caused by pollution, none of the respondents reported runny nose/cold, 8% reported headache, 8% reported flu/fever, 10% reported respiratory allergy, 4% reported cough, 4% reported asthma, 12% bronchitis, 18% cardiovascular diseases, 30% lung diseases, 6% tuberculosis, none reported high blood pressure, none reported pollen allergy and none described above disease (Table 7).

For Non-Stone Crushing Industry the diseases caused by pollution, 4% respondents reported runny nose/cold, none reported headache, 12% reported flu/fever, 2% reported respiratory allergy, 2% reported cough, none reported asthma, bronchitis, cardiovascular diseases, lung diseases, tuberculosis, 4% reported high blood pressure, 6% pollen allergy and 70% described as none of the above disease (Table 7).

Stone crushing and gravel production is basis for dust formation inhaled by the workers working in the query, stone crushing and segregation of different grades. Laborers exposed to this dust are at extreme danger with signs of asthma, bronchitis, irritation in nose and prime effects on the lungs (Kan, 2009).

Table.7 Type of disease caused

Type of disease	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Runny nose/ Cold	0	4
Headache (Migraine)	8	0
Flu/Fever	8	12
Respiratory Allergy	10	2
Cough	4	2
Asthma	4	0
Bronchitis	12	0
Cardiovascular Diseases	18	0
Lung Diseases	30	0
Tuberculosis	6	0
High blood pressure	0	4
Pollen Allergy	0	6
None of the above diseases	0	70

Source: Survey Data

4.1.11. Source of information

For Stone Crushing Industry the source of information about respondents got from self-diagnosis was none of the respondent, 92% got from health workers and 8% got the information from other (Table 8).

For Non-Stone Crushing Industry the source of information about respondents got from self-diagnosis were 70%, 28% got from health workers and 2% got the information from other (Table 8).

Safety training has maintained in these industries to transfer the knowledge and safety awareness in the staff for betterment of the individuals (Landrigan *et al.*, 2002).

Table .8 Source of information

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Source of Information		
Self-Diagnosis	0	70
Health Workers	92	28
Others	8	2

Source: Survey Data

4.1.12 .Number of days of illness and number of workdays loss due to pollution

For stone crushing industry the respondents that how many days they became ill last month, 20% become ill for one day, 36% become ill for two days, 24% become ill for three days, 14% become ill for four days, 6% of the respondents became ill for seven days, and none of the respondents became ill for whole month (Table 9).

For Non-Stone Crushing Industry how many respondents became ill last month? 24% became ill for one day, none of the respondent became ill for two days, 6% became ill for three days, none of the respondent became ill for four days, none of the respondent became ill for seven days, and 70% of the respondents did not became ill (Table 9).

To minimize the possibility of worker's illness/industrial accidents causing days away from work and enhances productivity training is mandatory (Landrigan *et al.*, 2002).

Table 9 .Number of days of illness and number of workday's loss due to pollution

	Stone Crushing Industry (%)	**Non-Stone Crushing Industry (%)**
How many days did you become ill last month?		
1	20	24
2	36	0
3	24	6
4	14	0
7	6	0
0	0	70

Source: Survey Data

4.1.13. Respondents who missed work due to illness

For stone crushing industry 92%, responded positive who missed work due to illness and 8% of the respondents did not miss the work (Table 10).

For Non-Stone Crushing Industry 14% responded positive who missed work due to illness and 86 % of the respondents did not miss the work (Table 10).

The necessary trainings minimize the possibility of worker's illness/industrial accidents causing days away from work and loose productivity (Landrigan *et al.*, 2002).

Table.10 Respondents who missed work due to illness

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Missed work due to illness		
Yes	92	14
No	8	86

Source: Survey Data

4.1.14. Respondents who were ill last month and missed the working day

For stone crushing industry 8% respondents missed one day, 42% missed two days, 12% missed three days, 4% missed four days, 6% missed five days, 6% missed six days, 6% missed seven days, and 16% of the respondents did not miss any working day (Table 11). For Non-Stone Crushing Industry 6% respondents missed one day, 4% missed two days, none of the respondent missed three days, four days, five days, six days, seven days and 90% of the respondents did not miss any working day (Table 11).

Results showed that air pollution was the basis of related illness such as cough, eye irritation, asthma etc. and it decreased the output on the cause of illness (Holland et al., 1979).

Table.11 Respondents who were ill last month and missed the working day

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
If you were ill last month but miss the working day, then how many?		
1	8	6
2	42	4
3	12	0
4	4	0
5	6	0
6	6	0
7	6	0
0	16	90

Source: Survey Data

4.1.15. Respondents who were ill last month and did not missed the working day

For stone crushing industry, the respondents who were ill last month but did not miss the working day and their performance had ranked, 24% of the respondent's performance was very poor, 36% performance was poor, and 28% satisfactory, 8% fair, and 4% of the respondent's performance were as usual (Table 12).

For Non-Stone Crushing Industry the respondent who was ill last month but did not miss the working day and their performance had ranked. None of the respondent's performance was very poor, 10% performance were poor, 6% satisfactory, none of the respondent's performance was fair and 84% of the respondent's performance was as usual (Table 12).

Impact on health of the concerned staff has categorized as allergy including cough, fever, sneezing, flu etc. for gravel industry workers leading to cardiovascular diseases, respiratory infections and dermatological issues respectively (Kromm, 1973).

Table.12 Respondents who were ill last month and did not missed the working day

	Stone Crushing Industry (%)	**Non-Stone Crushing Industry (%)**
If you were ill last month but did not miss any working day, how would you rank your work performance		
Very poor		
Poor	24	0
Satisfactory	36	10
Fair	28	6
As usual	8	0
	4	84

Source: Survey Data

4.1.16. Visit to the doctor

For stone crushing industry 30% of the respondents visited the doctor one time, 52 % visited the doctor two times, 6% visited the doctor three times, 4% visited the doctor four times and 8% of the respondents did not visited the doctor last month (Table 13).

For Non-Stone Crushing Industry 10% of the respondents visited the doctor one time, none of the respondent visited the doctor two times, 2% visited the doctor three times, none of the respondent visited the doctor four times and 88% of the respondents did not visited the doctor last month (Table 13).

It has considered that environmental health risks due to dust formation during gravel production are tremendous. Microbial infections are more in the working staff because lack of awareness, poor and un-hygienic living conditions, and food they are eating in the area (Kromm, 1973).

Table 13.Visit to the doctor

	Stone Crushing Industry (%)	**Non-Stone Crushing Industry (%)**
On how many days did you visit the doctor last month?		
1	30	10
2	52	0
3	6	2
4	4	0
0	8	88

Source: Survey Data

4.1.17. Fee paid to doctor on each visit

For stone crushing industry 8% of the respondents did not visited the doctor, 6% paid PKR/- 1-100, 6% paid PKR/- 201-300, 6% paid PKR/- 301-400 , 44% paid PKR/- 401-500, 16% paid PKR/- 501-600, and 4% paid PKR/- 601 and above (Table 14).

For Non-Stone Crushing Industry 92% of the respondents did not visited the doctor, 8% paid PKR/- 1-100, none of the respondent paid PKR/- 201-300, none of the respondent paid PKR/- 301-400, none of the respondent paid PKR/- 401-500, none of the respondent Paid PKR/- 501-600, and none of the respondent paid PKR/- 601 and above (Table 14).

Table.14 Fee paid to doctor on each visit

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Fee paid to doctor on each visit?(PKR/-)		
0	8	92
1-100	6	8
201-300	6	0
301-400	6	0
401-500	54	0
501-600	16	0
601 and above	4	0

Source: Survey Data

4.1.18. Total mitigation cost from home/workplace to the doctor's chamber

For stone crushing industry, the respondent's total mitigation cost from home/workplace to the doctor's chamber, 8% of the respondents did not pay mitigation cost, none of the respondent paid PKR/- 1-100, 48% paid PKR/- 101-200, 40% paid PKR/- 201-300, and 4% paid PKR/- 401-500 (Table 15).

For Non-Stone Crushing Industry the respondent's total mitigation cost from home/workplace to the doctor's chamber, 92% of the respondents did not pay mitigation cost, 8% paid PKR/- 1-100, none of the respondent paid PKR/- 101-200, none of the respondent paid PKR/- 201-300,and none of the respondent paid PKR/- 401-500 (Table 15).

Table.15 Total mitigation cost from home/workplace to the doctor's chamber

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
What was the total mitigation cost from your home/work place to the doctor's chamber?(PKR/-)		
0	8	92
1-100	0	8
101-200	48	0
201-300	40	0
401-500	4	0

Source: Survey Data

4.1.19. Family member accompanied the respondents

For stone crushing industry 70% had accompanied family member and 30% respondents described that no any family member was accompanied with them (Table 16).

For Non-Stone Crushing Industry 8% had accompanied family member and 92% respondents described that no any family member has accompanied with them (Table 16).

Table.16 Family member accompanied the respondents

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Family members accompanied the respondent		
Yes	70	8
No	30	92

Source: Survey Data

4.1.20. Travel and waiting time for doctor

For stone crushing industry, the time spent during travelling and waiting for doctor by the respondents, 8% respondents did not visited doctor, 6% spent one hour, 30% spent two hours, 20% spent three hours, 14% spent four hours, 6% spent five hours, 6% spent six hours, 6% spent seven hours, and 4% spent eight hours (Table 17).

For Non-Stone Crushing Industry the time spent during travelling and waiting for doctor by the respondents, 88% did not visited doctor, 4% spent one hour, 6% spent two hours, none spent three hours, 2% spent four hours, none spent five hours, none spent six hours, none spent seven hours, and none spent eight hours (Table 17).

Table.17 Travel and waiting time for doctor

	Stone Crushing Industry (%)	**Non-Stone Crushing Industry (%)**
Travel and waiting time for doctor (Hours)		
0	8	88
1	6	4
2	30	6
3	20	0
4	14	2
5	6	0
6	6	0
7	6	0
8	4	0

Source: Survey Data

4.1.21. Diagnostic test

For stone crushing industry 84%, respondents had their diagnostic test and 16% did not have any diagnostic test (Table 18).

For Non-Stone Crushing Industry 2% respondents had their diagnostic test and 98% did not have any diagnostic test (Table 18).

Table.18 Diagnostic test

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Did the doctor recommended any diagnostic test?		
Yes	84	2
No	16	98

Source: Survey Data

4.1.22. Total cost of diagnostic tests

For stone crushing industry 22% did not go for diagnostic test, 6% paid PKR/- 1-500, 42% paid PKR/- 501-1000, 16% paid PKR/- 1001-1500, and 14% paid PKR/- 1501- 2000 (Table 19).

For Non-Stone Crushing Industry 100% did not go for diagnostic test, none of the respondent paid PKR/- 1-500, none of the respondent paid PKR/- 501-1000, none of the respondent paid PKR/- 1001-1500, and none of the respondent paid PKR/- 1501- 2000 for diagnostic test (Table 19).

Table.19 Total cost of diagnostic tests

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Total cost of diagnostic tests?(PKR/-)		
0	22	100
1-500	6	0
501-1000	42	0
1001-1500	16	0
1501-2000	14	0

Source: Survey Data

4.1.23. Total transportation cost from home/workplace to the diagnostic center/laboratory

For stone crushing industry, the transportation cost from home/workplace to the diagnostic center/laboratory, 16% of the respondents didn't visited the diagnostic center/laboratory, none of the respondent paid PKR/- 1-100, 34% paid PKR/- 101-200, 42% paid PKR/- 201-300, 4% paid PKR/- 301-400, and 4% paid PKR/- 401-500 (Table 20).

For Non-Stone Crushing Industry the transportation cost from home/workplace to the diagnostic center/laboratory, 98% did not visited the diagnostic center/Laboratory, 2% paid PKR/- 1-100, none paid PKR/- 101-200, none paid PKR/- 201-300, none paid PKR/- 301-400, and none paid PKR/- 401-500 (Table 20).

Table.20 Total transportation cost from home/workplace to the diagnostic center/laboratory

	Stone Crushing Industry (%)	**Non-Stone Crushing Industry (%)**
Total transportation cost from home/workplace to the diagnostic center/laboratory?(PKR/-)		
0	16	98
1-100	0	2
101-200	34	0
201-300	42	0
301-400	4	0
401-500	4	0

Source: Survey Data

4.1.24. Travel and waiting time for the diagnostic tests

For stone crushing industry time spent during travelling and waiting for diagnostic tests, 12% respondents did not visited doctor, 4% spent two hour, 18% spent three hours, 32% spent four hours, 12% spent five hours, and 22% spent six hours (Table 21).

For Non-Stone Crushing Industry time spent during travelling and waiting for diagnostic tests, 98% respondents did not visited doctor, none of the respondent spent two hour, none

of the respondent spent three hours, none of the respondent spent four hours, 2% spent five hours, and none of the respondent spent six hours (Table 21).

Table.21 Travel and waiting time for the diagnostic tests

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Travel and waiting time for the diagnostic tests (Hours)		
0	12	98
2	4	0
3	18	0
4	32	0
5	12	2
6	22	0

Source: Survey Data

4.1.25. Doctor's prescribed medication

For stone crushing industry 92%, respondents had prescribed for medication and 8% did not have any illness (Table 22).

For Non-Stone Crushing Industry 12% respondents had prescribed for medication and 88% did not have any illness (Table 22).

Table.22 Doctor's prescribed medication

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Did the doctor prescribe any medication?		
Yes	92	12
No	8	88

Source: Survey Data

4.1.26. Any un-prescribed medication

For stone crushing industry, 18% used un-prescribed medicine and 82% did not use any un-prescribed medicine (Table 23).

For Non-Stone Crushing Industry 20% used un-prescribed medicine and 80% did not use any un-prescribed medicine (Table 23).

Table.23 any un-prescribed medication

	Stone Crushing Industry (%)	**Non-Stone Crushing Industry (%)**
Did you have any un-prescribed medication?		
Yes	18	20
No	82	80

Source: Survey Data

4.1.27. Cost of medication

For stone crushing industry 6% did not pay any money for medication, 12% paid PKR/- 1-500, 64% paid PKR/- 501-1000, none of the respondent paid PKR/- 1001-1500, 10% Paid PKR/- 1501-2000, 4% paid PKR/- 2001-2500, none of the respondent paid PKR/- 2501-3000, none of the respondent paid PKR/- 3001-3500, and 4% paid PKR/- 3501-4000 (Table 24).

For Non-Stone Crushing Industry seventy 76% did not pay any money for medication, 24% paid PKR/- 1-500, none paid PKR/- 501-1000, none paid PKR/- 1001-1500, none paid PKR/- 1501-2000, none paid PKR/- 2001-2500, none paid PKR/- 2501-3000, none paid PKR/- 3001-3500, and none paid PKR/- 3501-4000 (Table 24).

Table.24 Cost of medication

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Total cost of medication?(PKR/-)		
0	6	76
1-500	12	24
501-1000	64	0
1001-1500	0	0
1501-2000	10	0
2001-2500	4	0
2501-3000	0	0
3001-3500	0	0
3501-4000	4	0

Source: Survey Data

4.1.28. Transportation cost from home/workplace to the drug store

For stone crushing industry, the transportation cost occurred from home/workplace to the drug store. None of the respondents visited the drug store, none of the respondent paid PKR/- 1-50, 4% paid PKR/- 51-100, none of the respondent paid PKR/- 101-150, 88% paid PKR/- 151-200, 4% paid PKR/- 201-250, and 4% paid PKR/- 251-300 (Table 25).

For Non-Stone Crushing Industry the transportation cost occurred from home/workplace to the drug store, 94% did not visited the drug store, 4% paid PKR/- 1-50, 2% paid PKR/- 51-100, none paid PKR/- 101-150, none paid PKR/- 151-200, none paid PKR/- 201-250, and none of the respondent paid PKR/- 251-300 (Table 25).

Table.25 Transportation cost from home/workplace to the drug store

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Total transportation cost from home or work place to the drug store(PKR/-)		
0	0	94
1-50	0	4
51-100	4	2
101-150	0	0
151-200	88	0
201-250	4	0
251-300	4	0

Source: Survey Data

4.1.29. Hospitalization of the respondent

For stone crushing industry, 96% of the respondents hospitalized positive whereas 34% did not hospitalized for the said disease (Table 26).

For Non-Stone Crushing Industry none of the respondents responded positive whereas 100% did not hospitalized (Table 26).

Table.26 Hospitalization of the respondent

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Hospitalized for this disease		
Yes	66	0
No	34	100

Source: Survey Data

4.1.30. Type of Hospital

For stone crushing industry 76%, availed private hospital and 24% used Government Hospital (Table 27).

For Non-Stone Crushing Industry the type of hospital respondent's use for cure of their illness, 90% of the respondents did not visited any hospital, none of the respondent availed private hospital and 10% used Government Hospital (Table 27).

Table.27Type of hospital

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Type of hospital		
None of the hospital	0	90
Private	76	0
Government	24	10

Source: Survey Data

4.1.31. Number of days the respondent stayed in the hospital

For stone crushing industry 34% of the respondents did not visited any hospital. The 10% of the respondent stayed for one day, 28% stayed for two days, 6% stayed for three days, 12% stayed for four days, 4% stayed for five days, and 6% stayed for seven days (Table 28).

For Non-Stone Crushing Industry 100 % of the respondents did not visited any hospital (Table 28).

Table.28.Number of days the respondent stayed in the hospital

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
For how many days did you stay at the hospital?		
0	34	100
1	10	0
2	28	0
3	6	0
4	12	0
5	4	0
7	6	0

Source: Survey Data

4.1.32. Any family member stayed with respondent at the hospital

For stone crushing industry, the family members accompanied with respondents in the hospital, 70% have positive answer while 30% respondents described that no any family member had accompanied with them during their stay in hospital (Table 29).

For Non-Stone Crushing Industry the family members accompanied with respondents in the hospital. None of the respondent has positive answer while 100% respondents described that no any family member had accompanied with them during their stay in hospital (Table 29).

Table.29 any family member stayed with respondent at the hospital

	Stone Crushing Industry (%)	**Non-Stone Crushing Industry (%)**
Anyone from your family stay with you at the hospital?		
Yes	70	0
No	30	100

Source: Survey Data

4.1.33. Total transportation cost from home/workplace to the hospital over the period of hospitalization

For stone crushing industry, the respondent's transportation cost from home/workplace to the hospital over the entire period of the hospitalization 26% of the respondents didn't visited the hospital, 10% of the respondents paid PKR/- 1-200, 20% paid PKR/- 201-400, 38% paid PKR/- 401-600 and 6% paid PKR/- 601-800 for transportation (Table 30).

For Non-Stone Crushing Industry the respondent's transportation cost from home/workplace to the hospital over the entire period of the hospitalization, 100% of the respondents did not visited the hospital (Table 30).

Table.30 Total transportation cost from workplace to the hospital over the period of hospitalization

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Total transportation cost from home or work place to the hospital over the period of hospitalization (PKR/-)		
0	26	100
1-200	10	0
201-400	20	0
401-600	38	0
601-800	6	0

Source: Survey Data

4.1.34. Cost of Hospitalization

For stone crushing industry, the respondents total hospital bill for last stay. Thirty % respondents did not stay in hospital, 10% paid PKR/- 1-1000, 28% paid PKR/- 1001-2000, 18% paid PKR/- 2001-3000, 4% paid PKR/- 3001-4000, 6% paid PKR/- 4001-5000, and 4% paid PKR/- 5001-6000 (Table 31).

For Non-Stone Crushing Industry the respondent's total hospital bill for last stay, 100% respondents did not stay in hospital (Table 31).

Table.31 Cost of hospitalization

	Stone Crushing Industry (%)	Non-Stone Crushing Industry (%)
Total hospital bill for last stay?(PKR/-)		
0	30	100
1-1000	10	0
1001-2000	28	0
2001-3000	18	0
3001-4000	4	0
4001-5000	6	0
5001-6000	4	0

Source: Survey Data

4.1.35. Total cost of diagnostic tests inside the hospital

For stone crushing industry 40% did not pay for diagnostic test, 6% paid PKR/- 1-500, 32% paid PKR/- 501-1000, 16% paid PKR/- 1001-1500, and 6% paid PKR/- 1501-2000 (Table 32).

For Non-Stone Crushing Industry 100% respondents did not pay for diagnostic test (Table 32)

Table.32 Total cost of diagnostic tests inside the hospital

	Stone Crushing Industry (%)	**Non-Stone Crushing Industry (%)**
Total cost of diagnostic test(s) done inside the hospital?(PKR/-)		
0	40	100
1-500	6	0
501-1000	32	0
1001-1500	16	0
1501-2000	6	0

Source: Survey Data

4.1.36. Total cost of diagnostic tests outside the hospital

For stone crushing industry 96% respondents did not pay for diagnostic test outside hospital, and 4% paid PKR/- 800 (Table 33).

For Non-Stone Crushing Industry 100% respondents did not pay for diagnostic test outside hospital, and none of the respondent paid any cost (Table 33).

Table.33 Total cost of diagnostic tests outside the hospital

	Stone Crushing Industry (%)	**Non-Stone Crushing Industry (%)**
Total cost of diagnostic test(s) done outside the hospital?(PKR/-)		
0	96	100
800	4	0

Source: Survey Data

4.1.37. Total cost of medication bought during stay at hospital

For stone crushing industry the respondents total cost of medication bought during their stay at the hospital, 36% of the respondents did not pay any cost of medication, 38% paid PKR/- 1-1000, 12% paid PKR/- 1001-2000, 10% paid PKR/- 2001-3000, and 4% paid PKR/- 3001-4000 (Table 34).

For Non-Stone Crushing Industry 100% of the respondents did not pay any cost of medication (Table 34).

Table.34 Total cost of medication bought during stay at hospital

	Stone Crushing Industry (%)	**Non-Stone Crushing Industry (%)**
Total cost of medication bought during your stay at the hospital?(PKR/-)	36	100
0	38	0
1-1000	12	0
1001-2000	10	0
2001-3000	4	0
3001-4000		

Source: Survey Data

4.2 Hypothesis Testing

4.2.1 "Stone crushing" could lead to the "Environmental Pollution"

The below table described the frequency distribution of hundred respondents who answered positively that they know environmental pollution caused by stone crushing industry. Our hypothesis has proved with 100% results, as stone crushing is positively associated with environmental pollution

The effect of air pollution on the work force has mainly by the dust generated by mining and stone crushing activities. The obligation of owner and concerned authority to envisage the well-being of the people especially, those living close to quarry and operational areas. They are often suffering with headache, skin rashes, diarrhea, and sometimes vomiting, etc (Kimani, 2007).

Table.35 Stone crushing could lead to the Environmental Pollution

Category	Frequency	%
Yes	100	100

Source: Survey Data

4.2.2 The age impact of the respondents on stone crushing might damage to the health of people

Null Hypothesis

$H_{o:}$ Stone crushing might damage to the health of people irrespective of their ages.

Alternative Hypothesis

$H_{1:}$ Stone crushing might damage to the health of people related to their ages.

The below tabulated results portray a comparative relation between the age groups of the respondents showing environmental pollution from gravel industry had impact on their health. The outcomes showed that one respondents with age group 16-20 had no impact on his health. As per the respondents of 21-25 age group were concerned two of them had impact on their health whereas one had no impact on his health. Eleven respondents with age group 26-30 showed impact on health and eight of them had reverse opinion. Twenty-

eight respondents with age group 31-35 showed impact on health and twelve of them had reverse opinion. Twenty-two respondents with age group 36-40 showed impact on health and eleven of them had reverse opinion. Two respondents with age group forty-one and above showed impact on health and two of them had no effect on their health due to environmental pollution.

Count		Do you think that environmental pollution from gravel industry has impact on your health?		Total
		Yes	No	
Age	16-20	0	1	1
	21-25	2	1	3
	26-30	11	8	19
	31-35	28	12	40
	36-40	22	11	33
	41 and above	2	2	4
Total		65	35	100

Source: Survey Data

The relationship between the age group of respondents and their impact on health due to gravel industry is insignificant. The Chi-Square value is 3.158, d_f is 5 and Sig value is 0.676, therefore we accepted the null hypothesis because p-value of chi square is greater than 0.10.

Analyzed workers respiratory illness of lungs related diseases. The available data by Chi-Square test as used in statistics. The worker‘s age was 19 to 70 years of male gender. The extra ordinary polluted industry is construction and spread around the globe. Under this

study, results revealed that prevalence of the respiratory disease were high in the workers related to this industry (Ghasemkhani *et al.*, 2006).

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	3.158[a]	5	0.676
Likelihood Ratio	3.382	5	0.641
N of Valid Cases	100		

a. 6 cells (50.0%) have expected count less than 5. The minimum expected count is .35.

4.2.3 The impact of education of the respondents on stone crushing might damage health of people

Null Hypothesis

$H_{o:}$ Stone crushing might damage to the health of people irrespective of their education.

Alternative Hypothesis

$H_{1:}$ Stone crushing might damage to the health of people related to their education.

The below tabulated results portray a comparative relation between the education of the respondents showing environmental pollution from gravel industry had impact on their health. The outcomes showed that twenty-two respondents with primary education had impact on their health while eighteen respondents of the same qualification had no impact on their health. As per the respondents of Middle education are concerned thirty-one of them had impact on their health whereas sixteen had no impact on their health. Ten respondents with matriculation showed impact on health and none of them had reverse opinion. Two respondents with Intermediate education showed impact on health and one of them had no effect on their health due to environmental pollution.

Count		Do you think that environmental pollution from gravel industry has impact on your health?		Total
		Yes	No	
Education (Years)	Primary	22	18	40
	Middle	31	16	47
	Matriculation	10	0	10
	Intermediate	2	1	3
Total		65	35	100

Source: Survey Data

The relationship between the education of respondents and their impact on health due to gravel industry is significant. The Chi-Square value is 7.165, d_f is 3 and Sig value is 0.067, therefore we accepted the alternative hypothesis because p-value of chi square is smaller than 0.10.

Working staff was almost illiterate/primary education. Due to lack of education, they are not following the precautionary measures causing respiratory illness. There was less incident of illness in educated workers because they were following safety instructions. Prolonged working hours in gravel manufacturing is major cause of respiratory illnesses among the workers. It had suggested that mandatory used of safety awareness and safety gadgets by working staff must be implemented (Harvath and Hegedus, 1994).

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.165[a]	3	0.067
Likelihood Ratio	10.335	3	0.016
N of Valid Cases	100		

a. Three cells (37.5%) have expected count less than 5. The minimum expected count is 1.05.

4.2.4 The impact of income of the respondents on stone crushing might damage to the health of people

Null Hypothesis

$H_{o:}$ Stone crushing might damage to the health of people irrespective of their income.

Alternative Hypothesis

$H_{1:}$ Stone crushing might damage to the health of people related to their income.

The below tabulated results portray a comparative relation between the income of the respondents showing environmental pollution from gravel industry had impact on their health. The outcomes showed that nine respondents with income 10,000-15,000 had impact on their health while twenty-three respondents of the same income had no impact on their health. As per the respondents of income 15,001-20,000 were concerned forty-eight of them had impact on their health whereas twelve had no impact on their health. Eight respondents with income 20,001-25,000 showed impact on health and none of them had any effect on their health due to environmental pollution.

Count		Do you think that environmental pollution from gravel industry has impact on your health?		Total
		Yes	No	
Income	10,000-15,000	9	23	32
	15,001-20,000	48	12	60
	20,001-25,000	8	0	8
Total		65	35	100

Source: Survey Data

The relationship between the income of respondents and their impact on health due to gravel industry is significant. The Chi-Square value is 29.368, d_f is 2 and Sig value is 0.000, therefore we accepted the alternative hypothesis because p-value of chi square is smaller than 0.10.

Stone crushing and gravel production is basis for dust formation inhaled by the workers working in the quarry, stone crushing, segregation of different grades. Laborers exposed to this dust are at extreme danger with signs of asthma, bronchitis, irritation in nose and prime effects on the lungs and some other diseases (Kan, 2009)

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	29.368[a]	2	0.000
Likelihood Ratio	31.417	2	0.000
N of Valid Cases	100		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 2.80.

4.2.5 The impact of income of the respondents on workday's loss due to illness

Null Hypothesis

$H_{o:}$ Workday's loss could increase because of bad health irrespective of their income.

Alternative Hypothesis

$H_{1:}$ Workday's loss could increase because of bad health related to their income.

The below tabulated results portray a comparative relation between the income of the respondents showing how many days they become ill last month. The outcome showed that four respondents with income 10,000-15,000 had become ill last month for one day, two respondents for two days, and three respondents for three days, while twenty-three respondents of the same qualification had not become ill last month. As per the respondents of income 15,001-20,000 are concerned sixteen of them had become ill last month for one day, ten respondents for two days, twelve respondents for three days, seven respondents for four days, three respondents for seven days, whereas twelve had not become ill last month. Two respondents with income 20,001-25,000 showed that they become ill last month for one day, and six respondents had become ill last month for two days.

Count		On how many days did this happen last month?						Total
		1	2	3	4	7	0	
Monthly Income (PKR/-)	10,001-15,000	4	2	3	0	0	23	32
	15,001-20,000	16	10	12	7	3	12	60
	20,001-25,000	2	6	0	0	0	0	8
Total		22	18	15	7	3	35	100

Source: Survey Data

The relationship between the income of respondents and they become ill last month is significant. The Chi-Square value is 47.52, d_f is 10 and Sig value is 0.000, therefore we accepted the alternative hypothesis because p-value of chi square is smaller than 0.10.

Safety training had maintained in these industries to transfer the knowledge and safety awareness in the staff for betterment of the individuals. These trainings minimize the possibility of worker's illness/industrial accidents causing days away from work and enhances productivity. The Occupational Health and Safety Administration (OHSA) maintain and adhere through administration as guideline of International Organization of Health and Safety (Landrigan *et al.*, 2002).

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	47.524[a]	10	0.000
Likelihood Ratio	47.471	10	0.000
N of Valid Cases	100		

a. 11 cells (61.1%) have expected count less than 5. The minimum expected count is .24.

4.2.6 The impact of age of the respondents on workday's loss due to illness

Null Hypothesis

$H_{o:}$ Workday's loss could increase because of bad health irrespective of their ages.

Alternative Hypothesis

$H_{1:}$ Workday's loss could increase because of bad health related to their ages.

The below tabulated results portray a comparative relation between the ages of the respondents showing how many days they became ill last month. The outcomes show that none of respondents with age 16-20 became ill last month for one day, none of the respondents for two days, none of the respondents for three days, none of the respondents for four days, none of the respondents for seven days while one respondent of same age

has not become ill last month. As per the respondents of age 21-25 are concerned none of them become ill last month for one day, two of the respondents for two days, none of the respondents for three days, none of the respondents for four days, none of the respondents for seven days, whereas one respondent did not become ill last month. Seven respondents aged 26-30 showed that they become ill last month for one day, and none of the respondents have become ill last month for two days, four of the respondents for three days, none of the respondents for four days, none of the respondents for seven days and eight of the respondents who did not become ill last month. Ten respondents aged 31-35 showed that they become ill last month for one day, seven of the respondents had become ill last month for two days, seven for three days, four for four days, none of the respondents for seven days and twelve of the respondents who did not become ill last month. Three respondents age 36-40 showed that they become ill last month for one day, nine respondents for two days, four for three days, three for four days, three for seven days and eleven of the respondents who did not become ill last month. Two respondents aged forty one and above showed that they become ill last month for one day, none of the respondents two days, none of the respondents for three days, none of the respondents for four days, none of the respondents for seven days and two of the respondents who did not become ill last month.

Count		On how many days did this happen last month?						Total
		1	2	3	4	7	0	
Age	16-20	0	0	0	0	0	1	1
	21-25	0	2	0	0	0	1	3
	26-30	7	0	4	0	0	8	19
	31-35	10	7	7	4	0	12	40
	36-40	3	9	4	3	3	11	33
	41 and above	2	0	0	0	0	2	4
Total		22	18	15	7	3	35	100

Source: Survey Data

The relationship between the ages of respondents become ill last month is insignificant. The Chi-Square value is 29.488, d_f is 25 and Sig value is 0.244, therefore we accepted the null hypothesis because p-value of chi square is greater than 0.10.

Analyzed workers respiratory illness of lungs related diseases. The available data by chi-square test as used in statistics. The worker‘s age was 19 to 70 years of male gender. The extra ordinary polluted industry is construction and spread around the globe. Under this study, results revealed that prevalence of the respiratory disease were high in the workers related to this industry (Ghasemkhani *et al.,* 2006).

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	29.488[a]	25	0.244
Likelihood Ratio	35.930	25	0.073
N of Valid Cases	100		

a. 28 cells (77.8%) have expected count less than 5. The minimum expected count is .03.

4.2.7 The impact of education of the respondents on workday’s loss due to illness

Null Hypothesis

H_o: Workday’s loss could increase because of bad health irrespective of their education.

Alternative Hypothesis

H_1: Workday’s loss could increase because of bad health related to their education.

The above-tabulated results portray a comparative relation between the educations of the respondents showing how many days they became ill last month. The outcomes showed that eight of respondents with primary education had become ill last month for one day, seven for two days, none of the respondents for three days, four for four days, and three for seven days while eighteen respondents of same qualification did not become ill during last month. As per the respondents of middle education were concerned five of them became

ill last month for one day, nine for two days, fifteen for three days, two for four days, none of the respondents for seven days, whereas sixteen did not become ill last month. Seven respondents with matriculation showed that they became ill last month for one day, two for two days, none for three days, one for four days, none for seven days and none of the respondents who did not become ill last month. Two respondents with intermediate showed that the become ill last month for one day, none became ill last month for two days, none for three days, none for four days, none for seven days and one of the respondent who did not become ill last month.

Count		On how many days did this happen last month?						Total
		1	2	3	4	7	0	
Education (Years)	Primary	8	7	0	4	3	18	40
	Middle	5	9	15	2	0	16	47
	Matriculation	7	2	0	1	0	0	10
	Intermediate	2	0	0	0	0	1	3
Total		22	18	15	7	3	35	100

Source: Survey Data

The relationship between the education, of respondents they become ill last month is significant. The Chi-Square value is 44.057, d_f is 15 and Sig value is 0.000, therefore we accepted the alternative hypothesis because p-value of chi square is smaller than 0.10.

Working staff were almost illiterate/primary education. Due to lack of education, they were not following the precautionary measures causing respiratory illness. There was less incident of illness in educated workers because they were following safety instructions. Prolonged working hours in gravel manufacturing is major cause of respiratory illnesses among the workers. It had suggested that mandatory used of safety awareness and safety gadgets by working staff must be implemented (Harvath and Hegedus, 1994).

Chi-Square Tests			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	44.057[a]	15	0.000
Likelihood Ratio	50.775	15	0.000
N of Valid Cases	100		

a. 16 cells (66.7%) have expected count less than 5. The minimum expected count is .09.

CHAPTER V
CONCLUSION AND POLICY IMPLICATIONS

5.1. Conclusion

The study had conducted in the stone crushing industry of the Margalla Hills Taxila. The primary goal of this study to assess the impact of dust pollution on working staff, daily production, and cost occurred. This study analyzes the effect of dust pollution on worker health directly effecting the production. The study tested the impact of other factors like age, education, use of safety gadgets, overtime, respiratory diseases and price workers bear due to the dust pollution illnesses.

In this study, we found the high prevalence of the respiratory diseases and symptoms among the stone crushing industry workers. These workers lose their productivity and working capacity in stone crushing industry. The 53% workers reported lack of work performance in industry. They suffered the problems during the working in stone crushing industry such as Asthma, Bronchitis, Cardiovascular Diseases, Lung Diseases, Tuberculosis, High Blood Pressure, and Pollen Allergy etc. This showed that workers had exposed to the dust pollution illnesses. Study also established the prevalence of respiratory diseases among the stone crushing workers as 2% workers had asthma, 6% bronchitis, 9% Cardio vascular disease, 15% lung diseases, 3% tuberculosis, 2% high blood pressure, and 3% had Pollen allergy.

The study analyzed the health and opportunity cost of workers by using Chi-Square method while doing comparative analysis between the stone crushing industry workers and Non-Stone Crushing Industry. The results of the Chi-Square on age, income, education, and dust pollution, number of diseases, symptoms, and workday's loss due to pollution are significant. Elaborated, as stone crushing is positively associated to environmental pollution showing 100% results. Relationship between the age group of respondents and their impact on health due to gravel industry was insignificant. Relationship between the education of respondents and their impact on health due to gravel industry was significant. Relationship between the income of respondents and their impact on health due to gravel industry was significant. Relationship between the income of respondents and they become

ill last month was significant. Relationship between the age of respondents and they become ill last month was insignificant. Lastly, the relationship between the education of respondents and they become ill last month was significant.

During this study it was observed that about 7% workers suffered the health cost (HC) ranging PKR/- 10, 3% in the range of PKR/-300, 3% in the range PKR/- 400, 27% in the range PKR/- 500, 8% in the range PKR/- 600, 2% in the range PKR/- 1000 during the last month. Workday's loss in last month 50% work force did not beard the opportunity cost.

During the survey data reported, that 53% worker lost the workday due to the respiratory illnesses in the last month as mentioned in study. It had also observed in the study that low literacy rate among the 41% in gravel industry workers. The workforce also reported that provision of the safety gadgets from management is least.

The study also provided the conclusive evidence on the opportunity and health cost. Less dust pollution had positive impact on the health and opportunity cost status of the workers. The results evidently showed that less dusty air correspondingly reduced the respiratory diseases and opportunity cost.

Study revealed that upon successfully reduction in dust pollution in stone crushing industry, the worker would gain the benefits in term of the reduction in medical cost and in terms of wages. This is because the workers would not miss their workday due to the dust pollution illnesses.

5.2 Limitation of the study

The limitation of the study had its sample size. Due to financial and policy constraints, study approached the small sample size. The study also not estimated the opportunity cost of time associated with the health care/medical care activities. According to these limitations, further study should keep these issues into account for better performance and results.

5.3 Policy Implications

The safe environmental workplace shows the indication of the good health, increase in productivity, more salary benefit of the workers and enhances the production of the industry. The Government should promote to take necessary inventiveness measure to

reduce the dust from the stone crushing industry, safe & clean environment and take such initiative to measure the dust level.

Government should consider providing the subsidy in polluted industries such as stone crushing; construction industries etc. for installing the modern technologies and make the law/policies for such type of industries to check the level of dust in these industries on the weekly or monthly basis, reporting to concerned authorities. If we provide clean working environment in our industries we will observe the positive change in the health status of the worker that correspondingly enhance the production output and economic condition of the worker.

Stone crushing plant owners must have obligations to adopt new technologies that automatically reduce the dust pollution during the work. Owner should also compensate the affected workers for their health losses in terms of the reduction in the opportunity cost that they bear due to absent from work during dust pollution sickness. Industry administration has to arrange the training workshop and safety awareness of the dust pollution among the workers.

The stone crushing industry worker should have to follow the preventive safety measures; they must wear the safety helmet, coverall, safety shoes, safety gloves, earmuffs, dust mask during working hours, and adopt such useful measures that prevent them from the dust during the work. Industry owner must provide above Personal Protective Equipment's to working staff for using during working hours. No worker should allow entering the plant without above-mentioned PPE's.

The gravel industry proprietors have the great concern on the business potentially increasing their savings in terms of the provision of the healthy work environment. When workers have the less prevalence of the diseases, more working capacity and they will increase the production level of the industry. Industry owner economic performance increases in terms of the safe provision of the working environment, this mean they are playing vital role in the sustainable development of the country. The evidences showed that safe working environment had the significant positive impact on the workers' health as well as on their social life compared to non-stone crushing industrial workers. The healthy and mentally relax workforce play the vital role in the sustainable development of the country.

The study estimated the health and opportunity costs of the workers in the last month because of this cost burden concluded that it was very easy and extremely less expensive for the stone crushing industries owners to adopt such modern technologies that abate the dust pollution. They have to adopt the workers welfare friendly technologies.

The purpose of the present study is to aware the policy makers, Government and other stakeholders about the tangible opportunity and health costs that workers bear due to the dust pollution in the stone crushing industry.

REFERENCES

Adhikari, N. (2012). Measuring the Health Benefits from Reducing Air Pollution in Kathmandu Valley: South Asian Network for Development and Environmental Economics.

Ahmed Nafees, Fatmi, Masood, and Sathiakumar, N. (2013). Pattern and predictors for respiratory illnesses and symptoms and lung function among textile workers in Karachi, Pakistan. Occupational and environmental medicine, 70(2), 101-109.

Ali, W., Abbas, S. M., Latif, K., & Turab, S. A. (2010). Land degradation assessment in the southern dry lands of Khyber Pakhtunkhwa: A case study in Pezu and Tank region of Dera Ismail Khan District, Khyber Pukhtunkhwa. *Journal of Himalayan Earth Sciences*, *43*, 12-12.

Aliasgharpour, M., & Hagani, H. (2005). Impact of occupational lead exposure on industrial workers health condition in Tehran-Iran. *Eastern Journal of Medicine*, *10*(1-2), 20-23.

Anwar, N. (2014). *Infrastructure redux: Crisis, progress in industrial Pakistan & beyond*. Springer.

Ashraf, M. A., Maah, M. J., Yusoff, I. & Mehmood, K. (2010). Effects of Polluted Water Irrigation on Environment and Health of People in Jamber, District Kasur, Pakistan, *International Journal of Basic & Applied Sciences*, 10(3), pp. 37-57.

Avdeev, O. & Korchagin, P. (1994). Organization and Implementation of Contaminated Waste Neutralization in the Ukraine - National Report II, *Central*. *European Journal* of *Public Health*, 2(suppl), pp. 51-52.

Azizullah, A., Khattak, M. N. K., Richter, P., & Häder, D. P. (2011). Water pollution in Pakistan and its impact on public health—a review. *Environment International*, *37*(2), 479-497.

Blaxill, M. F. (2004). What's going on? The Question of Time Trends in Autism. *Public Health Reports*, 119(6), pp. 536-551.

Bogahawatte, C., and Herath, J. (2008). Air Quality and Cement Production: Examining the implications of Point Source Pollution in Sri Lanka.

Carter, F. W. (1985). Pollution Problems in Post-War Czechoslovakia, *Transactions of the Institute of British Geographers*, 10(1), pp. 17-44.

Ciocco, A. & Thompson, D. J. (1961). A Follow-up on Donora Ten Years After: Methodology and Findings, *American Journal of Public Health*, 51(2), pp. 155- 164.

Creswell, J. W. (2009). Research design: Quantitative, qualitative and mixed methods.

Crisp, T. M., Clegg, E. D., Cooper, R. L., Wood, W. P., Anderson, D. G., Baetcke, K. P., Hoffmann, J. L., Morrow, M. S., Rodier, D. J., Schaeffer, J. E., Touart, L. E., Zeeman, M. G. & Patel, Y. M. (1998). Environmental Endocrine Disruption: An Effects Assessment and Analysis, *Environmental Health Perspectives*,106(1), pp. 11-56.

Daniel Vallero, 2007. Fundamentals of Air Pollution, 5. http://nier.go.ke or airemiss.nier.go.kr ACADAMIC PRESS, ISBN 10: 0-12-373615-3. 6. Seigenthaler, U. and J.L. Sarmiento, 1993.

DeBarteleven, J. (1992). *Eastern Europe's Environmental Crisis*. Baltimore, MD: Johns Hopkins Press.

Dockery, D. W., & Pope, C. A. (1994). Acute respiratory effects of particulate air pollution. *Annual review of public health*, *15*(1), 107-132.

Farooque, M. I., Khan, B., Aziz, F., Moosa, M., Raheel, M., Kumar, S., and Mansuri, F. A. (2008). Byssinosis: as seen in cotton spinning mill workers of Karachi. Journal-pakistan medical association, 58(2), 95.

Fereidoun, H., Nourddin, M. S., Rreza, N. A., Mohsen, A., Ahmad, R. & Pouria, H., (2007).The Effect of Long-Term Exposure to Particulate Pollution on the Lung Function of Teheranian and Zanjanian Students, *Pakistan Journal of Physiology*, 3(2), pp. 1-5.

Firket, J. (1931). The Cause of the Symptoms Found in the Meuse Valley during the Fog of December, *Bulletin de l'scademie Royale Medicine de Belgique*, 11, pp. 683-741.

Gauderman, W. J., Avol, E., Gilliland, F., Vora, H., Thomas, D., Berhane, K., McConnell. R., Kuenzli, N., Lurmann, F., Rappaport, E., Margolis, H., Bates, D. & Peters, J. (2005). The

Effect of Air Pollution on Lung Development from 10 to 18 Years of Age, *New England Journal of Medicine*, 352(12), pp. 1276-1286.

Gehring, U., Cyrys, J., Sedlmeir, G., Brunekreef, B., Bellander, T, & Fischer, P. (2002). Traffic Related Air Pollution and Respiratory Health during the First 2 Years of Life. *European Respiratory Journal*, 19(4), pp. 690-698.

Ghasemkhani, M., Firouzbakhsh, S., Rezaei, M., & Sadeghipour, H. R. (2006). Pulmonary function status among workers in industries of South Tehran. *J. Med. Sci*, *6*(1), 63-67

Goodall. B. (1995). Environmental Auditing: A Tool for Assessing the Environmental Performance of Tourism Firms, *The Geographical Journal*, 161(1), pp. 29-37.

Gupta, U. (2008). Valuation of urban air pollution: a case study of Kanpur City in India. Environmental and Resource Economics, 41(3), 315-326.

Harvath, A. & Hegedus, E. (1994). Hazardous Wastes in Hungary-National Report, *Central European Journal of Public Health*, 2(suppl), pp. 30-33.

Hasan, A., Abu Hanieh, A., & Abdelall, S. (2013). Sustainable development of stone and marble sector in Palestine. (PFI 2009)

Heinrich, J. & Wichmann, H. E. (2004). Traffic Related Pollutants in Europe and Their Effect on Allergic Disease, *Current Opinion* in *Allergy* & *Clinical Immunology*, 4(5), pp. 341-348.

Holland, W. W., Bennett, A. E., Cameron, I. R. , Florey, C. V., Leeder, S. R., Shilling, R. S. F., Swan, A. V. & Waller, R. E. (1979). Health Effects of Particulate Pollution: Reappraising the Evidence. Am Journal Epidemiol, 110(5), pp. 525- 659.

Huppert, H. E. & Sparks, R. S. J. (2006). Extreme Natural Hazards: Population Growth, Globalisation and Environmental Change, *Philosophical. Transactions of the Royal Society*, 364(1845), pp. 1875-1888.

Hajime A., 2003. Global Air Quality and Pollution, Atmospheric Carbon Dioxide and the Ocean, Nature, Sci., 302(5651): 1716-1719.

Jacquemin, B., Sunyer, J., Forsberg, B., Aguilera, I., Briggs, D. & Garcia-Esteban, R. (2009).Home Outdoor N02 and New Onset of Self-Reported Asthma in Adults. *Epidemiology*, 20(1), pp.119-126.

Kan, H. (2009). Environment and Health in China: Challenges and Opportunities *Environmental Health Perspectives*, 117(12), pp. A530-A531.

Kimani, N. G. (2007). *Environmental Pollution and Impacts on Public Health: Implications of the Dandora Dumping Site Municipal in Nairobi, Kenya*, United Nations Environment Programme, pp.1-31. Retrievedfromhttp://www.korogocho.org/english/index.php?option=com_docman&task=doc_download&gid=54&Itemid=73.

Kromm, D. E. (1973). Response to Air Pollution in Ljubljana, Yugoslavia, *Annals of the Association of American Geographers*, 63(2), pp. 208-217.

Krześlak, A. & Korytkowski, J. (1994). Hazardous Wastes in Poland-National Report, *Central European Journal of Public Health*, 2(suppl), pp. 44-40.

Kumar, R. (2011). *Research Methodology: a step by step guide for beginners* (3rd ed.). SAGE Publications Ltd.

Künzli N., Kaiser, R., Medina, S., Studnicka, M., Chanel, O., Filliger, P., Herry, M., Horak, F. Jr., Puybonnieux-Texier, V., Quénel, P., Schneider, J., Seethaler, R., Vergnaud, J-C. & Sommer, H. (2000). Public Health Impact of Outdoor and Traffic Related Air Pollution: A European Assessment, *The Lancet*, 356(9232), pp. 795-801.

Kundi, M., 2004. Mobile Phone and Cancer, Occup. Envirn. Med., 61: 560-570.

Landrigan, P. J., Schechter, C. B., Lipton, J. M., Fahs, M. C. & Schwartz, J. (2002). Environmental Pollutants and disease in American Children: Estimates of Morbidity, Mortality, and Costs for Lead Poisoning, Asthma, Cancer, and Developmental disabilities, *Environmental Health Perspectives*, 110(7), pp. 721-728.

Lenkova, K. & Vargova, M. (1994). Hazardous Wastes in the Slovak Republic-National Report, *Central European Journal of Public Health*, 2(suppl), pp. 43-48.

Logan, W. P. D. & Glasg, M. D. (1953). Mortality in London Fog Incident, 1952, *The Lancet*, 261(6755), pp. 336-338.

Lynn, W. R. & Metzler, D. F. (1968). Environmental Health Decision-Making, *Journal-Water Pollution Control Federation*, 40(7), pp. 1311-1313. Geneva, pp.187.

Malkani, M. S., Mahmood, Z., Somro, N., & Alyani, M. I. Cement Resources, Agrominerals, Marble, Construction, Dimension and Decor Stone Resources of Pakistan.

McGeehin, M. A., Qualters, J. R. & Niskar, A. S. (2004). National Environmental Public Health Tracking Program: Bridging the Information Gap, *Environmental Health Perspectives*, 112(14), pp. 1409-1413.

McMichael, A.J. (1999), "From Hazard to Habitat; Rethinking Environment and Health", *Epidemiology*: 460-464.

Memon, I., Panhwar, A., Rohra, D. K., Azam, S. I., and Khan, N. (2008). Prevalence of byssinosis in spinning and textile workers of Karachi, Pakistan. Archives of environmental and occupational health, 63(3), 137-142.

Munnik, V. (2010). The Social and Environmental Consequences of Coal Mining in South Africa. *A CASE STUDY. Environmental Monitoring Group*.

Rajeshwar, K., & Ibanez, J. G. (1997). *Environmental electrochemistry: Fundamentals and applications in pollution sensors and abatement*. Academic Press.

Ruwaard, D. and P.G.N. Kramers (1998), *Public Health Status and Forecasts Report 1997*, RIVM/Elsevier-de Tijdstroom, Bilthoven/Maarssen.

Sellers, C. C. (1997). *Hazards of the job: from industrial disease to environmental health science*. Univ of North Carolina Press.

Smith, R.K., *C.F.* Corvalan and T. Kjellstrom (1999), "How Much Global Ill Health Is Attributable to Environmental Factors?", *Epidemiology:* 573-584.

Su, Y.-M., Su, J.-R., Sheu, J.-Y., Loh, C.-H., and Liou, S.-H. (2003). Additive effect of smoking and cotton dust exposure on respiratory symptoms and pulmonary function of cotton textile Industrial workers.

Weber-Fahr, M. (2002). Mine Closure and Legacy Issues; World Bank Group Experiences. Global mining initiative conference, Toronto, Canada. May.

Appendix-I

Impact of Environmental Pollution on Public Health

A Case Study of Stone Crushing Industry of Margalla Hills Taxila, Pakistan

QUESTIONNAIRE

PART A

1. **Basic Information of Respondent:**

Name of Respondent	
Age of Respondent	Years
Education (Years)	Primary ☐ Secondary ☐ Matriculation ☐ Intermediate ☐
Marital Status	Married ☐ Unmarried ☐ Separated ☐
Monthly Income (PKR)	

2. **Work characteristics**

Working years	Job classification in blasting section	Duty hours
<5 5-15 15-25 >25	Production Job worker Yes | No	Over-time work Yes | No

3. **Use of Personal Protection Equipment's PPE's during working hours**

Use of safety Helmet Yes | No	Administrative controls Yes | No
Use of Coverall Yes | No	Rotation in work Yes | No
Use of Safety Shoes Yes | No	Work practices Yes | No
Use of Safety gloves Yes | No	Training on the job Yes | No
Use of year Muffs Yes | No	House Keeping of area Yes | No
Use of dust Mask Yes | No	Equipment's Maintenance Yes | No
Use of uniform Yes | No	Personal hygiene practices Yes | No

4. **What type of mask under use if PPE's not available?**
   a. Use of turban cloth on mouth and nose
   b. Use of square cotton cloth 36x36 (Parna) to cover mouth

Part B

Health Diary Questionnaire

1. **Awareness Information:**
   i. Do you know about "**Pollution**"?

      Yes ☐ No ☐

   ii. If "**Yes**", what?

      _____

   iii. Do you know about "Environmental **Pollution**"?

      Yes ☐ No ☐

   iv. If "**Yes**", what?

      _____

   v. Do you think "Stone Crushing" causes "Environmental **Pollution**"?

      Yes ☐ No ☐

   vi. If "**Yes**", then rate of pollution?

High	**Moderate**	**Low**

   vii. Do you think that Environmental Pollution from Gravel Industry has impact on your health?
      Yes ☐ No ☐

   viii. What type of disease caused?

Name of Disease	**Symptoms of Disease**	**Source of Information**
a) Runny Nose/ Cold ☐	Fever, sneezing, watery eyes	a) Television ☐
b) Headache (Migraine) ☐	Weakness, nausea, vomiting, loss of Consciousness, Fever	b) Radio ☐
c) Flu/ Fever ☐	Cough, sore throat, muscle or body aches, headache	c) Newspapers ☐
d) Respiratory Allergy ☐	Congested nose, itching, sneezing, inflammation of eyes, shortness of	d) Health Workers ☐
e) Cough ☐	breath, coughing, and tight chest.	e) Other, specify ☐
f) Asthma ☐	Cough, night sweats, sinus pressure, sore throat, runny nose.	_____
g) Bronchitis ☐	Tiredness, frequent cough, shortness of breath.	
h) Cardiovascular Disease ☐	Cough, fatigue, chest discomfort.	
i) Lungs Diseases ☐	Angina, pain in neck, jaws, upper abdomen, neck.	
j) Tuberculosis ☐	Increased mucus production, fever, chest pain, shortness of breath.	
k) High Blood Pressure ☐	Fatigue, weight loss, Chills, fever. Sweating, facial flushing.	

2. No. of Days of Illness and No. of Workdays lost due to pollution?

On how many days did this happen last month?		
You were ill one of these diseases.	You came home from work early due to illness.	You missed work due to illness.

3. If you were sick last month but did not miss any working day, how would you rank your work performance?

Days (Work Performance Scale)				
1	2	3	4	5

Working Performance Scale:

(i) Very Poor
(ii) Poor
(iii) Satisfactory
(iv) Fair
(v) As usual

5. Visit to the Doctor:

Disease Name	On how many days did you visit the doctor last month?	Fee paid to doctor on each visit? (PKRs)	What was the total mitigation cost from your home/work place to the doctor's chamber? (PKRs)	No of your family accompanied you?	Time spent (Travel time + waiting time)?	Accompanied person become ill?	If yes, then how much fee paid to the doctor for cure of his illness? (PKRs)
			(if you used your own transport, mention approximate cost of transport)	(If "**Yes**", mention member.)	(Hour's/ Minutes)	Yes ☐ No ☐	

6. Diagnostic Tests and Medication:

Disease Name	Diagnostic Test				Medication			
	Did the doctor recommend any diagnostic test? Yes ☐ No ☐	What was the total cost of diagnostic test(s)? (PKR)	What was total transportation cost from your home/ work place to the diagnostic center/Laboratory? (if you used your own transport, mention approx. Cost of transport)	What was the total time spent (Travel time + waiting time)? (Hour's/ Minutes)	Did the doctor prescribe any medication? Yes ☐ No ☐	Do you have any un prescribe medication? Yes ☐ No ☐	What was total cost of medication? (PKR)	What was total transportation cost from your home/ work place to the drugstore? (PKR) (if you used your own transport, mention approx. Cost of transport)

7. Hospitalization of Respondent:

Disease Name	Have you been hospitalized for this disease?	Type of Hospital?	For how many days did you stay at the hospital?	Did anyone from your family stay with you at the hospital?	For how many days did this person stay with you?	What was total transportation cost from your home/work place to the Hospital over the entire period of hospitalization? (PKRs)
	Yes ☐ No ☐	Private ☐ Govt. ☐		Yes ☐ (Mention Member) No ☐		(if you used your own transport, mention approx. Cost of transport)

8. Cost of Hospitalization:

Total Hospital bill for Last stay? (PKRs)	Diagnostic Tests		Medication
	What was total cost of diagnostic test(s) done inside the hospital? (PKRs)	What was total cost of diagnostic test(s) done outside the hospital? (PKRs)	What was total Cost of medication bought during your stay at the hospital? (PKRs)
	(Write 0 if no diagnostic tests were done inside the hospital)	(Write 0 if no diagnostic tests were done outside the hospital)	