MPhil Dissertation

Determinants of Health and Healthcare Cost of Cement Workers and Community: A Case Study

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THIS THESIS IS DEDICATED TO:

MY LOVEABLE FAMILY

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List of Abbreviations

CO_2	Carbon Dioxide
ILO	International Labor Organization
ISO	International Standards Organization
NO_2	Nitrogen Dioxide
PKR	Pakistani Rupee
SMEs	Small and Medium Sized Construction Businesses
SO_2	Sulfur Dioxide
US	United States
WHO	World Health Organization

Abstract

Health status determines the quality of life of workers and the community. This study analyzes the health protection programme and the environmental impacts of cement plant on working conditions to find the frequency of occupational illnesses and associated health costs at a cement factory in Khyber Pukhtoon Khwa, Pakistan. Furthermore, this study analyzes the active factors that affect workers' health and measures to reduce the incidence. This study uses the primary data collected from the factory workers and members of neighboring community. The health protection programme, incidence rate and occupational health cost has been estimated through descriptive measures along with statistical tests like chi-square test and student t-test. Logistic regression model results have been provided to stab the effects of active factors that affect workers' health and possible socioeconomic measures that can reduce incidence. Inhalation of health hazardous gases and cement dust causes severe health disorders in terms of pulmonary, cardiovascular and eye problems and imposing additional health cost on workers. The results also concluded that health protection programme reduces the incidence rate and health expenditures.

Keywords: Healthcare Cost, Occupational illness, Logistic Regression Model, Cement Industry. Health Insurance

Jel Classification: C25, I13, L61.

CHAPTER 1

INTRODUCTION

It is customary that if workers' health is good, they can work with full capacity and efficiency. Industrial growth depends upon the workers' health that reflects upon safety measures provided by the industry. An employee spends about 8 hours at the place of work during any working day. If he is provided with such types of facilities for maintaining his health and keeps him interested in his work, it helps to minimize the job associated risks and increase the production and payoffs. Thus the employees' health, safety and welfare are correlated with each other.

Cement industry is a proven highly important segment of industrial sector and continue to play a pivotal role in the socio-economic development (Syndicate, 2012). It contributes primarily to increase greater employment opportunities, livelihood opportunities and reduce poverty (Hurley et al., 1995). As a result of economic progress and expansion of this sector, it employs 3 percent of the country's labor force (Ali, N. 2015). Besides providing job opportunities, it contributes more than Rs. 4 billion tax in the country revenue and during the year 2012-13 the industry exported 8.586 million tons cement (Ali, N. 2015). Despite all its major contributions in the economic development, cement industry lags in reducing environmental degradation inside and outside the plant due to which community and employees especially labor health are more likely to be affected. Environmental pollutants add toxic metals in the physical environment like cobalt, lead, chromium, nickel, mercury (Kumar et al., 2008; Glasson et al., 2013) and, therefore, the production of cement causes negative impacts on the environment and human health.

This study is designed to interrogate the environmental impacts of cement plant on working conditions to find the frequency of diseases like pulmonary, cardiovascular, eye, skin and nose diseases, and occupational health protection program. Next to it, this study strives to find active

factors that affect the health of workers and community. Secondly, estimating the cost of ill occupational health cost of industry workers is also the motivation for our study since medical expenditures carry tangible costs. The inspiration of this study is to aware workers and employers about these problems and to take precautionary action to cob with it, and this awareness in turns will save their health and increase their productivity. On the basis of results from the research work, suggestions will be carried for policy implications and improvement.

1.1. Research Questions:

Taking the issue of research under consideration, this study aims to investigate to the following research questions:

1. What is the vulnerability of workers towards diseases (pulmonary and cardiovascular diseases; and eye problems) due to working in the polluted environment of cement plant?
2. What is the role of health and safety instruments in reduction of diseases?
3. What are the health related costs that the workers bear due to diseases caused by working in the polluted environment of cement factory?

1.2. Objectives of the Study

This study incorporates the following objectives:

1. To investigate the occupational health protection program of the cement factory
2. To find the active factors such as age, education, service duration, insurance, income and exposure time that is likely to affect the health of workers and community.
3. To estimating the cost of ill occupational health of industry workers.

Following research protocol, study questions would be investigated through following hypotheses:

1.3. Hypothesis of the study

Ho: Exposure to cement dust and chemicals is associated with an increased amount of diseases among the factory workers.

$H_{1:}$ Exposure to cement dust and chemicals is not associated with an increased amount of diseases among the factory workers.

Ho: Health and safety instruments decrease the risk of diseases among the factory workers.

H_1: Health and safety instrument doesn't decrease the risk of diseases among the factory workers.

Ho: Cement factory workers bear high health costs than those they are not directly or indirectly attached to cement plant.

H_1: Cement factory workers do not bear high health costs than those they are not directly or indirectly attached to cement plant.

1.4. Contribution and Significance of the study:

This study contributes to the existing literature in the following ways:

In Pakistan fewer amount of studies like Meo et al. (2002), Shaikh et al. (2012) considered the relationship between some of the diseases and working in the polluted environment of cement plant. There is need to work on the broader extent. This study considers a wide range of diseases such as pulmonary, cardiovascular diseases and eye diseases caused due to working at the polluted environment of cement plant. Furthermore, this study computes the health expenditures that the workers bear due to diseases caused by working in the cement production plant. This study also evaluates the role of health and safety instruments in reduction of diseases.

1.5. Potential Beneficiaries:

Present study raises awareness in cement workers regarding the risks associated with their job. Furthermore, the study helps the factory management to understand inefficiency in provision of health and safety facilities to their workers. Research conclusions will increase their overall efficiency, workers health and reduce the health costs. It will also help the law enforcement bodies to understand the gaps in provision of health and safety facilities and enforcement of regulations regarding the workers' health and safety.

1.6. Organization of the Study

This study is organized in the following manner. Introduction of the study covered the statement of the problem, research question and objectives, hypothesis, contribution and significance of the study and potential beneficiaries are discussed in this first chapter. In the second chapter, relevant literature about the relationship between diseases caused due to working in the cement plant, impact of health and safety programme on worker's health and occupational illness cost is reviewed. The third chapter is comprised of the data and methodology of the study. In fourth chapter, results of the study objectives are reviewed. Last chapter include conclusion and policy recommendation. Followed by references and Anexure 1 where questionnaire used for the study is attached.

CHAPTER 2

Literature Review

Cement industry and health matters have been studied at large scale in industrialized world but far less in the developing countries. Identification of the correlation between working and health conditions especially of labor force are very important, so as to take necessary actions to reduce frequency of these problems. Numerous studies have been conducted relevant to the issue under consideration.

2.1. Cement Production and Diseases

Most of the previous studies reported that cement worker exposed to open air experienced more respiratory and pulmonary problems (Vestbo and Rasmussen., 1990; Schuhmacher et al., 2004; Ballestas and Phillip., 2010; Priyanka et al., 2013; Sana et al., 2013). Studies conducted on the topic are agreed that working in cement factory causes serious health threats like gastro and intestinal problems (Adak et.al., 2007), skin irritation problems (Ikli, 2003), cancers, eye defects and genetic problems (Iqbal et.al., 2001) visual impairment, as well as adverse effects on the cardiovascular and central nervous systems (Gilette, 1984). In turn, this situation multiplies health costs, associated with premature death and deteriorating quality of life.

Though, cement industry plays an important role in local development by providing jobs, infrastructure, sanitation and education (Kusena et al., 2012; Zambrano et.al., 2002. But, direct exposure to dust and silica also cause asthma, heart and skin problems, and dirreha (Afolabi et al. 2012). In addition to it, working in cement plant also cause noise, land and water pollution (Atmaca et al., 2005). This is reputed as one of the leaders in environmental degradation by depleting sources and consuming energy or creation of waste (Stajanvca and Estokova., 2012).

Higher concentration of nitrogen dioxide (NO_2), sulphur dioxide (SO_2), and carbon dioxide (CO_2) in the air at cement production plant site causes air pollution and ultimately cause skin infection, coughing, furunculosis, dermatitis and eczema (Oguntoke et al., 2012). Reduced air pollution also curtails bronchitis, pleurisy, high blood pressure, and heart troubling problems (Bogawatte et al., 2008). It suggests that there are significant environmental impacts of air pollution due to cement industry that can trouble the human health.

Respiratory problems like coughing, phlegm, and wheeze problems, dyspnea, bronchitis, sinusitis, shortness of breath, and bronchial asthma (Al-Neaimi et al., 2001; Shaikh et al., 2012) are considered as the most common occupational health hazards.

Chromosomal aberration is also higher in cement workers (Fatima et al., 2001). Dust during production also causes chronic cough, chronic bronchitis, bronchial asthma (Mengesha et al., 1998; Kakooei et al., 2012; Neghab et al., 2007). Comparing with white-collars, mortality rate among workers is higher due to respiratory cancers (Rachiotis et al., 2012; George et al., 2012).

Limestone crushing and production process adds environmental noise that adds disease burden of hearing loss of workers (Kumar et al., 2008). 16% of the disabilities of hearing loss are due to work station noise according to WHO (Nelson et al., 2005).

Working at plant not only affect minor diseases but some fatal cancer types are also believed due to dust exposure. In a study held in Korea (Koh et al., 2013), high concentration of hazardous chemicals such as hexavalent chromium and high incidence rate of stomach cancer at high dust exposer group were found. Rectal cancer was also found due to dust exposure.

Blue-collars are not the only affected with pulmonary diseases but community dwellers surrounds industries are also affected with some health problems due to air pollutants. Hofmeister et al., (1992) investigated potential affects of pollutants of industrial areas on school

going children and found a large proportion with less resistance against pulmonary diseases. Chest radiology from randomly selected cement industrial workers in Pakistan concluded in higher proportion of lung diseases, pleural thickening and chronic bronchitis as compared to control group (Meo, 2003). In addition to this, more years of dust exposure also leads to increasing chances of lung diseases (Shaikh et al., 2013; Meo et al., 2002).

Adjoining agricultural areas are also affected due to cement industrial wastage. Declining yield crop patterns and downturn shift in community involvement in cultivation suggests negative association between agricultural productivity and industrial wastage (Sharma et al., 2012). It also suggests that community involves more with the industry and depend less on agriculture.

2.2. Occupational Health Cost

Every industrialized country has national laws and adheres to international convention that oblige it to protect the health and safety of its workforce. According to ILO, 4% of the global income is lost due to occupational injuries and illnesses and it is unfortunate that no corresponding policy consensus on occupational health and safety has emerged in most developing countries.

There are, of course, many important economic consequences of occupational ill-health that accumulate to workers and their households. Above all, duration of their absence from work may suffer an irretrievable loss of income. Income loss represents the starting point for measurement of economic costs borne by workers. A bigger proportion of workers in the developed world are insured under employment injury or workers compensation systems, but circumstances are entirely adverse in developing countries. Burden of payment for medical care is another direct financial cost that workers have to endure without being fully reimbursed by either the employer or employment injury insurance schemes. The burden adds up if loss of assets due to diminished

wages and unforeseen health care expenses have to be endured by the workers. Morse et al. (1998) reported that Connecticut workers who had suffered work related musculoskeletal disorders were 2.5 times more likely to have lost their car and 3.5 times more likely to have lost their home.

The above study of Morse et al. (1998) is commendable in that the researcher tried to through light on the subject that receives almost no attention. But, this study is restricted to occupational injuries only as occupational illness data are completely lacking. Contrary to this, Leigh (2001) has estimated empirically illnesses as well.

Leigh et al., (2001) carried out a study in the US to estimate cost of occupational injuries and illnesses. They estimated direct costs in terms of medical care costs that include doctor and nurse services, hospitalization charges, drug costs, rehabilitation services, etc. On the other hand, indirect costs include loss of wages due to absenteeism. Rivera et al. (2009) also assessed the direct health care costs of work related accidents in Mexico. They estimated injury rate about 2.9% and average costs to 2059$ US. Health expenditures were also estimated for underreporting.

The issue of underreporting prevails in developing countries due to which data regarding occupational injuries and illnesses are far less available, and where records do exist they are generally unreliable (ILO, 2012). These data problems restraint the estimation and plausibly to go off the path in policy making.

2.3. Health and Safety Programme

Kheni et al. (2008) investigated the health and safety practices at small and medium-sized construction businesses (SMEs) in Ghana with the aim to know whether there are any significant associations between firms' organizational characteristics (age of business, turnover, number of

employees, and type of construction work) and health and safety management practices. The findings reveal that civil contractors are better at implementing health and safety measures than building contractors. In addition to it, finding suggests positive association between annual turnover and health and safety practices by SMEs, and no positive association between the adoption of health and safety practices by the SMEs and the number of full-time employees. Furthermore, findings also shows positive correlation between the adoption of health and safety measures by construction SMEs and the type of construction works.

Heltberg and Lund, et al. (2009) conducted a study to investigate shocks, coping, outcomes, and safety nets in Pakistan. Study used logistic regression technique for analysis. Results shows high incidence of shocks (such as health shocks and others idiosyncratic shocks) and cost. On the basis of findings the average cost of coping with these shocks are 155$ US, while coping costs for idiosyncratic are higher (170$ US) than for covariate shocks (113$ US). Study revealed that private and social safety nets exist but it offers little protection to their beneficiaries and suggested the need of public action to control public health hazards and provide non-exploitative credit and more effective safety nets (Ahasan and Partanen., 2001)

Pellicer et.al (2014) conducted a study to estimate occupational health and safety costs in construction projects at Spain. Study used four types of costs: insurance costs, prevention costs, accident costs, and recovery costs. Results estimated total cost of occupational health and safety approximately 5percent of the total cost of the budget by adding the insurance, prevention and accidental cost and subtracting recovery cost.

The above literature concludes that cement production causes very harmful impacts on the workers' health in terms of the diseases like pulmonary, cardiovascular and eye diseases. The diseases that are caused by working in the polluted environment impose huge occupational

health costs. It is further concluded that the use of health and safety instruments while working in the polluted environment reduce the hazardous impacts up to a greater extent. From the literature it is an undeniable fact that cement workers are more vulnerable to diseases because of the inhalation of cement dust and chemicals. It is possible that the diseases discussed in the literature can exist in higher amount among the cement factory workers. The main contribution of this study is that it analyses the status of diseases that are very common in the factory workers like pulmonary, cardiovascular and eye diseases in Pakistan's context.

As far as statistical methodologies are concerned, most of the studies have used descriptive measures such as frequency tables, measures of central tendency and dispersion, etc. While some researchers have used inferential statistical techniques like " t-test" simple regression. Keeping in view the objective of our study, we shall use both measures to get the insight about our study.

CHAPTER 3

Data and Methodology

Study used primary one-time data collected by using a structured questionnaire through a field trip survey from a cement factory plant situated in Khyber Pukhtoon Khwa (KPK) in the year 2014-15. Data includes workers in the cement industry and residents living in near about (n=260). The staff strength of the factory according to the factory management was almost 500. Among these 130 respondents including the white and blue color workers were interviewed based on the designed questionnaire.

3.1. Sampling Technique:

The sampling technique used here is stratified random sampling because the population was heterogeneous. The population is divided into two homogeneous strata i.e., cement factory employers and the people living in the range of about 4 km of the cement factory. Now these strata are internally homogeneous and externally they differ from one another. The sample size "n" is distributed equally in the two strata by using equal allocation technique. By equal allocation we mean that from each stratum, equal number of sampling unit is selected. The total sample size "n" is distributed equally among all the k strata. Mathematically;

$ni = n/k$ for $i = 1, 2, \ldots, k$

3.2. Data and Variables:

Designed questionnaire were based on information regarding socio-economic status, demographic characteristics, working conditions, use of health & safety equipment's, insurance status, and health protection. Second, health costs include travel cost, physician fee, medicine expenditures, x-rays, diagnostic tests and others associated expenditures (Questionnaire is

attached at Annex I). For the selection of respondents from both groups, simple random sampling technique was used due to its advantages over the other sampling methodologies.

The dependent variables in the empirical model are the presence/absence of different occupational illnesses that can be caused due to cement industry working environment. These occupational illnesses include pulmonary ($OIPulm$), cardiac ($OICardio$) and eye problems($OIEye$).

Different variables may explain the causes of illnesses. The first variable is age (Age) of cement workers and community as well. Note that ageing factor may contribute in developing eye problems irrespective of working in cement industry but this variable is evenly important as other variables in the research involving environmental research. Similarly, the study have grouped the age variable into three groups to find the ageing effect exclusively on eye diseases.

Literacy means a lot of improvement in the quality of life. This study also introduced the variable education ($Education$) in the research to see whether this variable incorporates sensitivity about occupational illnesses or its detrimental hazards among workers and community.

Table 3.1: Summary Statistics

Variable	Mean	Std. Dev.	Min.	Max
Age	30.481	6.13	18	57
Education	10.55	3.209	2	18
ServDur	3.192	5.067	0	35
Insurance	0.265	0.442	0	1
Income	193588.5	94727.18	10000	600000
Yrsmoking	1.542	4.329	0	26
ExpTime	2.546	3.042	0	8
Agegroups	0.788	0.626	0	2
HSE	0.19	0.39	0	1
Exptimebinary	0.5	0.501	0	1
OIPulm	0.22	0.42	0	1
OICardio	0.12	0.32	0	1
OIEye	0.15	0.36	0	1

Working in cement industry causes inhalation of crushing material and other chemicals that weakens the internal human body with increasing the service duration. To account for the effect of service duration on occupational illnesses, the variable Service Duration ($ServDur$) is introduced in the study that contains the value 0 exclusively for the community members who have no experience in the cement industry and other natural numbers $\{n = 1,2,3,\cdots\}$ that states the number of years working at cement industry. In addition to service duration, longer working hours inside cement industry could also cause occupational illnesses. The variable exposure time ($ExpTime$) can importantly find out the effects of exposure time on the given disease. This variable has been constructed similarly to the preceding variable construction. Apart from the continuous nature of exposure time variable, we have introduced in our research a binary variable ($ExpTimeBin$) that exclusively states whether the participant is a worker or a community member. This variable helps in determining the effects of exposure of cement industry workers as compared to those who are not workers, *i.e.* community members. Service duration and exposure time variables are equally important factors in measuring environmental destruction due to cement industry and their effects on the workers in the form of occupational illnesses.

Habit of smoking is another important risk factor of pulmonary and cardiac illnesses. A larger population in developing countries smokes tobacco that causes higher prevalence of pulmonary and cardiac patients. It is interesting here to analyze the effects of years of smoking ($YrSmoking$) to see their magnitude on the disease burden.

In industrial settings, every worker is provided with insurance ($Insurnace$) so as to avoid different occupational illnesses and reduce heavy costs of medication due to working in cement

industry. Unfortunately, the data do not show evidence of any $Insurance$ for all the workers except supervisory staff. Knowing the fact that lack of $Insurance$ can cause occupational illnesses among workers, they need to be provided $Insurance$ for the health maintenance.

A wider socioeconomic research reveals that socioeconomic status whether assessed by income, education or occupation is linked to disease including cardiac diseases (Alder and Newman, 2002; Link and Phelan, 1995). The variable income ($Income$) is also included in the analysis so as to know the vulnerability to occupational illnesses among workers and among community due to weaker socioeconomic status.

The Backbone Reliability test was incorporated to test the reliability of the variables. The value of the Backbone Reliability test was 0.7 which state that these variables are reliable.

This study strives for investigating the frequency of diseases that found more common in cement workers (literature witness) such as pulmonary illnesses, cardiovascular illnesses, and eye problems. To draw the associated environmental, behavioral factors and socio-economic factors with the illnesses, we have used logistic regression mechanism. To estimate occupational illness cost, we have used simple average method. In addition to it, used descriptive statistics and percentage method to investigate the health protection programs.

3.3. The Logistic Regression Model

This study follows the methodology proposed by Manddala, G.S. 1983. For setting the logistic regression model, we start with the fundamental model for any multiple regression analysis. Since the data consists of binary responses therefore using the Logit model is appropriate. First, we assume that the disease status (Y) is associated with a linear combination of a set of predictors $X_1, X_2, \cdots X_n$, we have the following:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n = \beta_0 + \sum_{i=1}^{n} \beta_i X_i + \epsilon_i \quad (1)$$

Where β_0 is the intercept, when the *X*'s are set to zero the expected value of *Y* will be β_0, β_i are the regression coefficients for each corresponding predictor variable X_i yet to be estimated and X_i are covariates which are age, smoking, exposure to cement dust, use of safety instrument, and education; and ϵ_i is the error of prediction. This multivariate model is useful only when the response variable is of continuous nature but is inappropriate for the dependent variable when it is dichotomous *i.e.* $Y \in \{0,1\}$ as in our case.

Logistic regression indirectly models the dichotomous response variable based on probabilities associated with the values of Y. We will use $\pi(x)$ to represent the probability that $Y = 1$, which is the presence of the specific disease[1]. Similarly, we will define $1 - \pi(x)$ to be the probability that $Y = 0$, which is absence of the disease. These probabilities can be written in the following form:

$$\pi(x) = p(Y = 1|X_1, X_2, \cdots X_n)$$

$$1 - \pi(x) = p(Y = 0|X_1, X_2, \cdots X_n)$$

In equation (1), we use the model for the natural logarithm of the odds to favor $Y = 1$.

$$ln\frac{p(Y = 1|X_1, X_2, \cdots X_n)}{p(Y = 0|X_1, X_2, \cdots X_n)} = ln\frac{\pi(x)}{1 - \pi(x)} = \beta_0 + \sum_{i=1}^{n} \beta_i X_i \quad (2)$$

The coefficients in a logistic regression are often difficult to interpret because the effect of increasing *X* by one unit varies depending on where *X* is. This is the essence of non-linear model. Using the inverse of the logit transformation of Eq. (2) we have:

[1] Note that the $\boldsymbol{x}$ in the expression $\pi(\boldsymbol{x})$is a vector representing the set of the independent predictor variables, that is, $X_1, X_2, \cdots X_n$.

$$p(Y = 1|X_1, X_2, \cdots X_n) = \frac{e^{\beta_0 + \sum_{i=1}^{n} \beta_i X_i}}{1 + e^{\beta_0 + \sum_{i=1}^{n} \beta_i X_i}} = \frac{1}{1 + e^{-(\beta_0 + \sum_{i=1}^{n} \beta_i X_i)}}$$

From this, we can compute the odds of disease (i.e. $\frac{p}{1-p}$). To simplify calculation of odds of disease, let $\alpha = e^{\beta_0 + \sum_{i=1}^{n} \beta_i X_i} \Rightarrow p = \frac{\alpha}{1+\alpha}$. Then it follows that:

$$odds = \frac{p}{1-p} = \frac{\frac{\alpha}{1+\alpha}}{\left(1 - \frac{\alpha}{1+\alpha}\right)}$$

$$= \alpha$$

From this it is relatively simple process to determine the odds ratio (OR) for disease that is associated with X_1:

$$OR = \frac{e^{\beta_0 + \beta_1}}{e^{\beta_0}} = e^{\beta_1}$$

Similarly, OR for the disease that is associated with kth variable will be e^{β_k}. If we increase X_i by one unit, we multiply the predicted odds by e^{β_i}. The intercept can be thought of as the predicted log-odds when X_i is zero.

More often, maximum likelihood estimation strategy is used to estimate the parameters. Likelihood function expresses the probability of the observed data as the function of the unknown parameters. Then, we will obtain the likelihood estimators of these parameters which maximize the likelihood function.

3.4. Health Cost Estimation:

The study calculates the average health cost of the workers by the following formula:

$$HC = \frac{\sum_{i=1}^{n} X_i}{n}$$

Where HC represents health cost including physician fee, travel cost, medicine expenses, diagnostic tests; $\sum_{i=1}^{n} X_i$ is sum of the heath cost of all the workers and n is the number of respondents.

CHAPTER 4

Results and Discussion

This chapter includes analysis of the health protection programme, diseases frequencies and the occupational health cost, and the logistic regression analysis to identify the active factors that affect respondents' health.

4.1. Health Protection Program

Factory has installed pollution control devices on chimneys to minimize the health hazardous gasses emissions that results due to cement production and provides 24 hours ambulance service to the workers, fully equipped with first aid tools in addition with the expert doctors. In addition, it provides health and safety equipment to their 39 percent workers. The disease rate was high among the factory workers un-equipped with health and safety instruments as compared to the equipped factory workers.

Table 4.1 Comparison of diseases between factory workers and community members

Community Workers Status	HSE		Total	Cardiovascular		Total	Eye		Total
	0 for No	1 for Yes		0 for No	1 for Yes		0 for No	1 for Yes	
No	163 80.69 %	39 19.31%	202 100.00%	186 81.22 %	43 18.78%	229 100.00 %	180 81.45%	41 18.55 %	221 100.00%
Yes	47 81.03 %	11 18.97%	58 100.00	24 77.42 %	7 22.58%	31 100.00 %	30 76.92%	9 23.08 %	39 100.00%
Total	210 80.77 %	50 19.23%	260 100.00%	210 80.7 %	50 19.23	260 100.00 %	210 80.77	260 100.00 %	260 100.00%
Pearson Chi^2 (1)=0.0034 Pr=0.954				Pearson Chi^2 (1)=0.2543 Pr=0.614			Pearson Chi^2 (1)=0.4370 Pr=0.509		

Source: Author's Calculation by using STATA

There is no statistical evidence that shows any significance of health and safety instruments to save from theses occupational illness. It does not mean that use of health and safety instruments plays no role in the minimization of diseases promotion, although results shows no statistical significance of health and safety instruments to save from diseases but it is fact that proper use of health and safety instruments minimizes the diseases incidence.

4.2 Disease Frequencies

The disease rate was high among the factory workers as compared to the community members.

Table.4.2. Diseases rate among equipped and un-equipped factory workers

Community Workers Status	Pulmonary		Total	Cardiovascular		Total	Eye		Total
	0	1		0	1		0	1	
No	110	20	130	117	13	130	117	13	130
Yes	92	38	130	112	18	130	104	20	130
Total	202	58	260	229	31	260	221	39	260
Pearson Chi^2 (1)=7.1902 Pr=0.007				Pearson Chi^2 (1)=0.9156 Pr=0.339			Pearson Chi^2 (1)=5.0980 Pr=0.024		

There is statistical evidence that shows significance of working in the cement plant and pulmonary and eye diseases, while there is no statistical evidence that shows any significance of working in the plant and cardiovascular disease. It is concluded that working conditions are not suitable and due to which the diseases incidence rate among factory workers are high then community members.

4.3 Workers View about Environmental Pollution

Eighty percent of the cement factory workers were agreed to the fact that cement production is polluting the environment in terms of air pollution, dust and water pollution. Furthermore, they were also agreed that working in cement factory plant results in pulmonary, cardiovascular, eye, skin and nose diseases.

4.4. Occupational Health Cost

Poor health conditions impose some tangible costs in term of physician fee, diagnostic tests, medicine expenditures and travel expenditure. There was a clear difference between the annual health expenditures of cement factory workers and community members. The average annual health cost of a community member was PKR 2808 while the average annual health cost of a cement factory worker was PKR 5164. Therefore, the average increase in the health cost of a cement factory worker was PKR 2357 annually which concludes that working in cement factory causes additional health costs. We have performed student t-test on testing continuous variables using following hypotheses:

H_1: Average health expenditure of factory workers is equal to average health expenditure of community

H_0: Average health expenditure of factory workers is not equal to average health expenditure of community

There is statistical evidence that shows significance increase in the health expenditures of factory workers then community. Now it clear from both student t-test and simple average formula that factory workers spending huge amount on health expenditures then community members

because of working in the unfavorable working condition, and it is the responsibility of factory management to compensate them in term of insurance or increase in their salaries.

Table.4.3. Comparison of health expenditures between factory workers and community members

Health expenditures	Std.Dev.	Average
Factory workers	2723.936	5164
Community	593.993	2808

4.5 Logistic Regression Model Results

The study have performed logistic regression with stepwise behavior (by retaining age and income explicitly in the model) to find those factors which are responsible in undertaking the disease among workers and the community. Other factors are added in a stepwise manner and retained only if it is likely responsible for the said occupational illnesses.

The results of the active and risk factors that are likely to play vital role in the promotion of pulmonary, cardiovascular and eye diseases are presented in Model 1, Model 2 and Model 3 respectively in the table 4.4.

Aging factor in the underdeveloped countries causes diseases mainly of which are cardiac and eye problems (Alder and Newman, 2002). The same is true for the regression results. It suggests that increasing age is not a factor that is directly responsible for cardiac and eye problems among the workers due to working in the cement industry, but these illnesses are more likely due to increasing age irrespective of working.

Table 4.4. Factors Causing Damages to Workers and Community Health .

	Model 1	Model 2	Model 3
	OR 95% C I	OR 95% C I	OR 95% C I
Age	1.121* [1.02, 1.23]	1.085* [1.02,1.16]	
Education	0.143 [0.95, 1.38]	0.997 [0.87, 1.14]	0.890 [0.79, 1.00]
Service duration			
Community	Ref.		
Workers	1.555*** [1.34,1.80]		
Insurance	0.335* [0.12,0.97]		
Ln(Income)	0.552 [0.30,1.02]	0.518* [0.31,0.87]	0.458* [0.25,0.83]
Year smoking	1.471*** [1.24,1.75]		1.050 [0.99,1.12]
Exposure time (Continuous)			
Community		Ref.	
Workers		1.37 [0.98,1.32]	
Age groups			
(<28yrs)			Ref.
(28-37 yrs)			4.859 [1.51,15.67]
(>37 yrs)			14.780* [2.94,74.30]
Exposur Time (Binary)			
Community			Ref.
Workers			3.021** [2.94,74.39]
No of cases	260.000	260.000	260
Wald chi2	40.069	10.218	23.051
Prob¿Chi2	0.000	0.037	0.001

Read: OR (Odds Ratio)=Exponential coefficients; CI=Confidence Interval; *p < 0:10, ** p < 0:05 ,***p < 0:01
Calculated by using STATA

Although, age factor cause significantly pulmonary diseases as well but chances are there that this factor is not the only cause of pulmonary diseases. Since, service duration is concerned with increasing age; it is more likely that increasing service duration along with increasing age cause pulmonary diseases that causes deterioration in quality of life. Increasing service duration

suggests that workers whose service is greater than a year have one and a half times more chances to get the pulmonary diseases as compared to community dwellers. This also depicts the negligence or lack of using health & safety instruments by the workers, depending upon the availability and sensitivity of these instruments. Use of health & safety instruments during exposure time, workers actually curtails odds of touching pulmonary diseases. Inhalation of crush and chemicals affect not only lungs but these material affects eyes badly as well.

Work exposure causes cardiac illness among workers. It states that higher exposure time or working within the industry continuously for long hours may be harmful, likely due to continuous vibration.

Habit of smoking is showing very high probability of getting the pulmonary disease against non-smokers group. It can be suggested that the habit of smoking do not cause only pulmonary diseases among workers but in community as well. Workers with the habit of smoking might be at higher risk than smokers who are not working in the cement industry.

Insured workers and community dwellers are very less likely to get pulmonary diseases as compared to those who are not insured. This result demonstrates that insurance status provides a relief or increases the immunity among the workers and others without the fear of vulnerability of getting poor. Unfortunately, the evidence of insurance status of workers except supervisory staff was not found. Similarly, increasing income also reduce the severity of diseases among workers and community.

The results suggest that encouraging the use of health and safety instruments can reduce not only the risk of getting pulmonary diseases but also enhance the productivity as well

4.6 Conclusion and Recommendations

This study analyzed the occupational illnesses and occupational health cost of workers working in the polluted environment of cement plant. Statistical evidence shows significance of working in the cement plant and diseases i.e. pulmonary and eye, while on the other hand shows no significance with cardiovascular diseases. Furthermore, statistical evidence shows significance increase in the health expenditures of factory workers then community members. In addition to it, statistical evidence does not show any significance of health and safety instruments to save from theses occupational illness.

The results suggest that insured workers have significantly less odds of falling in pulmonary diseases. Industrial policies for workers' insurance may build confidence among workers. The insurance scheme can also be a step towards increasing productivity of the workers.

Provision of health & safety equipment is necessary in reducing the occupational illness as the data showing very less average rate of possessing any health & safety equipment. The policy implication should be the provision of health & safety equipment to every worker.

Furthermore, under the these three laws in Pakistan which pertain to the issues of sickness leaves, benefits and compensation of workers in cases of accidents or injuries namely i.e. Workmen Compensation Act, 1923 (hereby referred to as Workers Compensation Act), Provincial Employees Social Security Ordinance, 1965 and West Pakistan Industrial and Commercial Employment (Standing Orders) Ordinance, 1968, the factory owner must compensate its workers in term of insurance benefits and significance increase in their salary because there huge proportion of earning are spent on their health recovery that causes due working in the polluted factory environment.

Workers need to get frequent medical consultation about their heath especially about their occupational health. Diagnostic test could result in the form of more precise result to be concerned issue. Multiple controls can enhance the analytical value of the study.

4.7. Limitations of the Study

Although the study was being carefully prepared, however, a number of important limitations can be pointed out at this stage. In particular, there are three important limitations of the study which could have bearings on the generalizations of the study.

The study performed no medical diagnostic test for the verification of disease due to poor financial condition and questioned respondents that either they any disease or not. For more precise results, further work is needed to performed medical diagnostic test to analyze concerned issue.

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Questionnaire

This questionnaire is designed to collect data from cement workers to investigate occupational health, cost of cement workers and health protection programme at cement plant. The present questionnaire includes variables on the bases of discussed literature. Questionnaire will be filled from the workers of Kohat Cement Company limited, (kpk).

To be completed by employee

Name (please print): _____ Age: _____

Employ ID#:_____ Education: _____

No of years since working in the factory: _____ Marital status: _____

Average annual income: _____ Household size: _____

No of independent: _____

Q1. Do you smoke?	Yes	No
a. If yes, them how many cigarette per day? _____. No of smoking years _____.		
Q2. Do you have any of the following pulmonary problems? (indicate yes or no for each)		
a. Cough	Yes	No
b. Pain in chest		
c. Chest cancer		
d. Asthma		
e. Pneumonia		
Q3. Do you currently have any of these symptoms of pulmonary or lung illness?		
a. Shortness of breath	Yes	No

b. Cough that produces thick sputum or blood		
c. Any other symptoms that you may related to lung problems?		
Q4. Have you ever had any of the following cardiovascular or heart problem?		
a. Heart attack	Yes	No
b. Angina(chest pain)		
c. Irregular heart beat		
d. Swelling in your legs or feet(not caused by walking)		
e. High blood pressure		
f. Any other heart problem, If please mention		
Q5. Do you have any cardiovascular or heart symptoms?		
a. Frequently pain or tightness in your chest	Yes	No
b. In last one year have you noticed your heart skipping or missing a heart beat?		
c. Heart burn or indigestion that is not related to eating.		
d. Any other symptoms that may be related to heart or circulation problem?		
Q6. Do you have any of the following problem?	Yes	No
a. Eye problem		
b. Skin problem		
c. General weakness or fatigue		
d. Ear problem		
e. Nose problem		
f. Headache		
g. Diarrhea		
Q7. Please mention the main reason behind these problems? That is all caused due to working in the polluted environment of cement plant, or some other reason?		

Q8.Do you think that cement industry is causing any health problem? If, then please mention, such as,		
Q9.Do you use any safety devices such as masks, respirator, gloves and safety clothes?	Yes	No
Q10.Do you think that cement industry causing any kind of pollution or problems in the area?	Yes	No
a. If, then please mention		
Q11. Does the owner provide you safety devices?	Yes	No
a. If yes, then please mention equipment's names, such as,		
Q12.Are there any pollution control device installed?	Yes	No
a. If yes, are they functioning?		
b. Do u have any family history for any disease?		
Q13. Do you have burn experience due to your work?	Yes	No
Q14.How many hours do you spent plant daily?		
Q15. Expenditures on health for each disease annually? Expenditure includes physician fees, laboratory tests and any other associated medical supplies, transportation,		
a. Cough disease. Rs_____ b. Heart trouble. Rs_____ c. Eye disease. Rs_____ d. Skin disease. Rs_____ e. Pneumonia. Rs_____ f. Burn disease treatment. Rs_____ g. Respiratory diseases. Rs_____		

Q17. Does the company compensate you for health?	Yes	No
a. If yes, then, 1. full compensation		
b. If not fully ,then please mention amount of compensation Rs._____		
Q18. Do you have any health insurance policy?	Yes	No
a. If yes, then do you think that health insurance policy has positive relation with health treatment?		
Q19. From where you got health treatment mostly? Please tick on below		
a. Company provided health care centre.		
b. Private health care centre.		
c. Govt. Hospital	Yes	No
Q20. Does the company provide you better treatment in all cases of problems?		
a. In all cases		
b. Not in all cases		
c. Please mention cases name in which you think that company not provide you better treatment?		
For Severe Cases		
d. Then where you go for better treatment?		
a. Private .Hospital		
b. Govt. Hospital		
Q21. From where you got health treatment mostly?		
a. Company provided health care centre		
b. Private health care centre.		
c. Govt. Hospital		
Q22. Distance to,		
a. Govt. Hospital _____km		

b. Company health centre ____km c. Private Health Centre _____km		
Q23. .Does you think that company provided health care centre provide you better treatment then govt. hospitals?	Yes	No
Q24. If you got disabled due to any accident in your duty or die, is there any social protection programme from owner for your family?	Yes	No
Q25.Is any trained medical person available all a time in working hour for your emergency? If yes, then	Yes	No
a. Has he equipped with emergency tools/ equipment?		
b. Please mentioned the type of medical equipment's / facilities equipment?	Yes	No
Q26. Have you ever spent some time with older (retired) workers to talk about hazards they experienced during or after their working life? (To know the problems that may be faced in future)?		
a. If yes, then the most common diseases told by them?		

Employee signature: _____ Dated: _____

Thanks for your cooperation