

Pulmonary health risks of working at a cement plant in Khyber Pakhtunkhwa province of Pakistan

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Abstract

Objective: To examine the risk and preventive factors of working in a cement plant.

Methods: The cross-sectional study was conducted from July to September, 2016, at a leading cement manufacturing plant in the Khyber Pakhtunkhwa province of Pakistan. An interviewer-administered questionnaire was used to collect data about characteristics of exposed and unexposed subjects. The characteristics and occupational illnesses were compared between exposed and unexposed workers. Logistic regression was applied to estimate the odds ratio for risk and preventive factors associated with pulmonary illnesses linked with the profession.

Results: Of the 550 workers contacted, 260(47.3%) agreed to participate. The mean age of the sample was 30.48±6.13 years. Of the total, 80(31%) were exposed and 180(69%) were unexposed. Overall, 96(37%) workers had medical coverage facility, while 114(63%) reported very good health. All socioeconomic and working characteristics were highly significant between exposed and unexposed workers ($p < 0.05$). There were 67(25.7%) workers with pulmonary illnesses and the difference between the exposed and unexposed groups was significant ($p < 0.05$).

Conclusion: Pulmonary health among workers could be improved by implementing occupational health improving strategies.

Keywords: Cement dust, Occupational health, Logistic regression, Developing countries, Pakistan. (JPMA 69: 869 2019)

Introduction

Cement workers are highly exposed to dust from the extraction of raw material to the packing of the final product. The health risks posed by inhaled cement dust irritate the skin, the mucous membrane of eyes and the respiratory system.¹ Long-term and increasing exposure to cement dust causes decline in lung volumes along with decline in the lung function.² Exposition to airborne particular matters (fumes, dust and gases) cause different types of health hazards in developing occupational pulmonary illnesses as well as structural abnormalities.^{3,4} For certain reasons, cement workers in the developing countries do not protect themselves enough through personal protective equipment.⁵ They are often from poor socioeconomic classes and deployed at work-sites without appropriate training. Plenty of research in occupational health shows the association of lung diseases with cement dust. On the other hand, some researchers also showed the association of visual impairment and heart diseases with working in cement factory.⁵⁻⁷

Prevalence of pulmonary illnesses among workers exposed to cement dust is a major issue in the developing

countries.⁵⁻⁷ Pulmonary illnesses mainly include damaging respiratory system that causes difficulties in breathing. Cement dust is highly associated with respiratory symptoms and chronic impairment of the lung function.⁸⁻¹⁰

Prevalence of heart illnesses in the developing countries is very high and smoking is considered to be the major cause. This ailment causes greater socioeconomic losses to the workers and their families. Risks of occupational heart illnesses linked with cement plant have been rarely highlighted in literature.¹¹ Instead, by controlling the smoking status of workers, one can investigate the relation between cement dust exposure and occupational heart illnesses.

Cement workers are seen heavily powdered from hair to toes, including eye-lashes. And the powder is more likely to enter into the eyes and cause irritation. A study evidenced 97% eye irritation among workers at a cement plant.¹² The irritation leads to visual impairment that affects workers' health.

The above-mentioned occupational illnesses damage workers' health badly. They are sometimes unable to continue their jobs due to falling health. It also causes economic burden on individual, society and the government. Cement workers play an important role in infrastructural development of a country as cement is used in constructing new buildings to fulfil the needs of

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increasing population, and even for renovation. Keeping in view the sensitivity of these major occupational health problems and their importance, it is imperative to realise the significance of risk and preventive factors of working at a cement plant that may affect the health of those employed there. Occupational health research builds strong policies in reducing industrial hazards and protecting workers' health.

The current study was planned to investigate the workers' health status at a cement factory with respect to exposure time, service duration, smoking etc.

Subjects and Methods

The cross-sectional study was conducted from July to September, 2016, at a leading cement manufacturing in the Khyber Pakhtunkhwa (KP) province of Pakistan. The study site was one of the major cement plants in the province, currently producing more than 2,110,500 tons of grey and white cement annually, and it had around 1000 workers at the time of the study.

For sampling purposes, convenience and quota sampling (non-probability) methods were used as they are unrelated to specific research aims and introduce no bias in the results.¹³ After obtaining permission from the factory administration, all workers and staff members whether directly exposed or unexposed to cement dust to join the study. Objective and protocol of the study was explained and verbal consent of the workers was taken before initiating the study which was earlier approved by the COMSATS University, Islamabad, Pakistan.

The reliability of the questionnaire was tested using Cronbach's alpha based on standardised items. The value was 0.652. Since males were in majority, only male workers were approached. Those who refused to participate due to illiteracy and lack of knowledge about the significance of the study were excluded. The unexposed workers of the same factory with similar general characteristics were matched 2.25 to 1. They were the admin and supervisory staff in the factory who were not completely unexposed to cement dust, fumes or gases but they examined machinery and working by visiting the plant. Rather, their stay at dust places was very short. A number of studies have shown that smoking is directly concerned with pulmonary illnesses.¹⁴⁻¹⁶ As such, smoking habits were also noted.

An interviewer-administrated questionnaire was developed on the basis of published literature.^{1,2,5,8,10,12-14,16-20} The characteristics noted included age (in years; range: 18-57 years), education (in schooling years: range:

2-18 years), service duration (in years; range 0-35 years), annual income (in Pak rupees: range: Rs. 10,000-600,000), self-reported occupational illnesses, smoking (yes/no), with additional questions about health insurance status (yes/no), use of health and safety instruments (gloves, dust masks, work coveralls, safety shoes and earplugs), and exposure time (in hours; range: 0-8 hours).

Questions regarding symptoms of pulmonary, cardiovascular and eye diseases had multiple choices and were asked in the light of previous studies and the healthcare manual of World Health Organisation (WHO)²¹ about these diseases. The questionnaire was prepared in English and Urdu.

Dust, noise, emission of gases and danger of accidents were more prevalent. Since every corner of the cement plant was permeated with dust, workers from every section were studied equivalently.

Basic demographic data, job-related characteristics and disease classification of subjects were noted. Means and standard deviations were calculated for basic demographic and work-related characteristics of the individuals. Percentages and frequencies were used to describe occupational illnesses among exposed and unexposed groups. Student's t-test for two independent samples with unequal variances was used to compare the workers' characteristics between exposed and unexposed. For categorical variables, like insurance status and provision of health and safety (H&S) equipment, chi-square test was performed. Similarly, chi-square test was used to assess the relationship between exposure status and illnesses. Univariate and multivariate logistic regression analyses were performed to assess pulmonary illnesses as the dependent variable, as well as independent contributions of age, education, service duration, insurance status, income, smoking status, exposure time, and H&S equipment provided by the factory to the workers. Multivariate logistic regression analysis was performed in stepwise manner keeping only those characteristics which turned statistically significant. Age and education were kept irrespective of the statistical significance. $P < 0.05$ were taken as statistically significant. The analysis was controlled by unexposed group of workers. Since the difference between exposed and unexposed groups of workers for key areas was not significant, we did not perform log it analysis for those factors. All statistical analyses were performed using STATA 12.

Results

Of the 550 workers contacted, 260(47.3%) agreed to

Table-1: Individuals' demographic, work related characteristics and prevalence of disease classification among exposed and unexposed workers.

Individual Characteristics	Exposed n = 80	Unexposed n = 180	p-value
Age (years)	(28.88±0.73)	(31.19±6.55)	<0.01
Education	(7.46±2.34)	(11.92±2.51)	<0.01
Service duration (years)	(6.81±5.25)	(5.69±4.55)	NS
Insurance status	(0.18±0.38)	(0.45±0.50)	<0.01
Income	(166000±23210.6)	(205850±110700.1)	<0.01
Smoking	(0.2±0.40)	(0.12±0.33)	NS
Exposure time	(6.51±1.04)	(0.78±1.66)	<0.01
Provision of H&S equipment	(0.29±0.45)	(0.53±0.50)	<0.01
Classification of occupational illnesses, number (%)			
Pulmonary	27 (33.7)	40 (22.2)	<0.05
Cardiovascular	11 (13.7)	25 (13.9)	NS
Visual	17 (21.3)	32 (17.8)	NS

Number (Mean ± SD); H&S= Health & Safety; NS = Not significant.

Table-2: Univariate and multivariate analyses of pulmonary illnesses among cement plant workers (logit models).

Variable	Univariate Logit OR (95%CI)	Multivariate Logit OR (95%CI)
Age	1.09(1.04-1.14)	1.06(0.99-1.14)
Education	0.87(0.80-0.95)	1.08(0.92-1.27)
Service duration	1.28(1.19-1.38)	1.22(1.11-1.34)
Insurance		
No	1	1
Yes	0.94(0.52-1.67)	1.56(0.69-3.55)
(ln)Income	1.016(0.69-1.50)	0.74(0.43-1.27)
Smoking		
No	1	1
Yes	13.14(5.90-29.25)	15.86(5.55-45.35)
Exposure time	1.27(1.16-1.40)	1.34(1.13-1.59)
Provision of H&S Equipments		
No	1	1
Yes	1.02(0.59-1.79)	1.27(0.55-2.89)

Note: OR=Odds Ratio; CI=Confidence Interval; H&S=Health and Safety.

participate. The mean age of the sample was 30.48±6.13 years. Of the total, 80(31%) were exposed and 180(69%) were unexposed. Overall, 96(37%) workers had medical coverage facility. A highly significant association was found between exposure status and insurance coverage (p<0.01).

The mean age of workers exposed directly to dust particles was 28.88±0.73 years and that in the unexposed group was 31.19±6.55 years with a standard deviation of 6.55 years (p<0.01).

All variables, except service duration and smoking, showed highly significant difference between exposed

and unexposed workers (p<0.05). Besides, 162(63%) reported very good health status. The most common occupational illness noted in 67(25.8%) participants was related to pulmonary, and the difference between the groups was significant in this regard (p>0.050) (Table-1).

To account for potential confounders, smoking status of the workers was not found to be statistically significant (p>0.05) with exposure status.

Univariate as well as multivariate logistic regression of self-reported pulmonary illnesses Showed that service duration badly affect the health of the workers, and that increasing years of working at the factory increased the risk of pulmonary illnesses (p<0.01). The mean employment duration was 3.2±5.1 years. Ageing also increased the risk of pulmonary illnesses among the workers (p<0.05). Exposure time was also a responsible risk factor (p < 0.01).

Smoking also increased the likelihood of having pulmonary illnesses (p<0.01) (Table-2).

Discussion

The cross-sectional study confirms that there are significant relationships between pulmonary illnesses, service duration, income, smoking and exposure to cement dust. The findings are consistent with previous studies.^{17,22-23} Health risks are predominating for Pakistani poor²⁴ and workers with dust exposure are more prone to occupational illnesses.

Our study revealed that older workers were at higher risk for pulmonary illnesses which is similar to literature.^{18,25} The likely reason why ageing is a risk factor is thought to be because older age groups tend to have passed more time in dust and gas inhalation, whereas younger age groups have experienced less inhalation of hazardous particles. Alternatively, all study participants reported that noise and dust were major hazards at work, as has been reported earlier.²⁶

The exposed workers had a higher prevalence of pulmonary ill-health profile in comparison with unexposed workers of comparable age. These findings are conforming to the previous observations.²⁷ Occupational exposure to cement dust and gases has been reported to lead to a greater prevalence of occupational health issues found by others as well.^{5,19} These studies have also submitted that the inhalation of cement dust along with smoking aggravates this effect.

Dust control measures were not sufficiently installed in the factory, and dust was all-pervasive. Cement manufacturing plants should also be required to install

and operate dust and noise abatement systems in the plant process area.

In our study, the most common risk factor was 'duration of working' which showed greater likelihood of causing pulmonary illnesses. This result also complements the risks of having occupational illnesses in the absence/lack of safety equipment.

Our study showed significant association between education and likelihood of occupational illnesses. Some studies have emphasised the need of indoor education that is relevant to the working and H&S.²⁰ In this way, workers enhance their productivity and have better occupational health. Thus, better awareness of working and health education to take preventive measures and factors is necessary.

The current study had some limitations. Questions of medical history or drug use of the workers were not included in the questionnaire even though they are reported to be the risk factors associated with occupational illnesses.¹⁴ Questions concerning workplace were also not included whereas workers at the cement plant were exposed to cement dust during extraction, crushing, grinding, calcination, baking and packing of the final product. In developing countries only a minority of workers are employed in the formal sector, but even here occupational health reporting systems are highly deficient and are largely non-existent.

Despite all these limitations, we believe that the study will help improve occupational health management not only for the participants, but for all others who did not participate as new health standards will be effective across the board. The cement plant in the study was situated at an isolated place far from the city. Lesser income for exposed workers and deprivation from medical coverage could push them into the poverty trap that ultimately causes major health damages. Though the plant is investing a handsome amount on infrastructural development of the community, projects to enhance income of local people can be substantial in improving occupational as well as general health conditions. Employees' social security should also be secured in order to get them medical coverage through social security hospitals.

Conclusion

Age, service duration, years of smoking and exposure time aggravated the risk of occupational illnesses. Increasing income was important in preventing these illnesses. Employers should consider not only the employees' working conditions, but also implementing

occupational health improving strategies to prevent these illnesses. Provision of H&S equipment was also very low among the exposed workers and that underlines the significantly different disease profile between the exposed and the unexposed groups.

Disclaimer: The study is a modified version of an M.Phil thesis.

Conflict of Interest: None.

Source of Funding: None.

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