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Silicosis: Symptoms, Causes, Effects, Precautions & Government Schemes

(A Study of the Cases of Silicosis in the Sandstone Units in The Dholpur District of Rajasthan)

Abstract

Silicosis which is very common to the workers engaged in the mines, stone manufacturing and quarrying units and building construction industry, is a serious incurable occupational lung disease which gradually leads its victims to several severe lung diseases causing finally physical disability. It is caused by the inhalation of dust-containing silica generated during various mining activities. Silicosis is a serious global concern, and one of the main health hazards in the developing countries in particular.

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In India, mining is one of the important occupations with approximately 1.7 million workers at a high risk of exposure to respirable silica. Silicosis is incurable but preventable provided there is much of awareness about it among the concerning persons. The present study which serves as a case study of the workers sandstone mines, quarries and processing units, was conducted to assess the awareness for silicosis among the sandstone mine workers of Dholpur district of Rajasthan. It reveals the growing rate of the patients of silicosis in the workers associated with the sandstone mines, quarries and manufacturing units running successfully at the Tehsils in the district.

Keywords: Awareness, Lifestyle, Protection, Silicosis, Silica, Inhalation, Working Conditions, Government Concern, Tuberculosis, Prevention

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Introduction

The report about the victims of silicosis in Rajasthan published in India Interior on 12 July, 2019 under the head 'Silicosis: A Death Sentence for Mine Workers' reveals how hundreds of mine workers including the workers engaged in the sandstone sector in Rajasthan fall victims to silicosis every year. Given that mining activity generates sandstone, which is in great demand internationally, for tiles, slabs and cobbles, one would expect it to be a modernised, worker-friendly industry.

Silicosis is among occupational diseases enlisted by the Factories Act and Employees Compensation Act. It is an incurable, deadly and largely unnoticed and under-reported condition that develops over time when silica dust found in rock, sand quartz and other building materials is ingested. It takes about 20 years to be identified. The words of the silicosis victim Bela Ram from Bundi district of Rajasthan reveal the agony of all the people who are engaged in the sandstone sector of all the districts of Rajasthan including the ones in the Dholpur district where many of the sandstone miners and workers are lurking between tuberculosis and silicosis. In the words of Bela Ram- "We work in the very same pathetic conditions as our ancestors did, carving and processing stone manually, with hammers and chisels. The only difference is, we now know that most of us will die by the time we are 40 because we are inhaling hazardous levels of silica, which corrodes lung tissue and reduces immunity to respiratory ailments like asthma, tuberculosis and silicosis, commonly known as pathar ki bimaari. Our forefathers were ignorant of this reality."

Silicosis is an important global occupational health illness and lung disease caused by inhalation of silica over a long period of time. It is an incurable disease which causes permanent physical disability. It occurs in workers from mines, foundries, sandblasting, and glass manufacturing. Shortness of breath, cough, fever and bluish skin are some of the symptoms of silicosis. Silica is a crystal-like odourless and non-irritant mineral found in abundance in sand, rock and quartz. It affects the lungs gradually making its victims the patients of pulmonary tuberculosis, lung cancer and other severe lung diseases. The people working in the quarrying, manufacturing and building construction industries suffer most from this disease.

In India more than ten million workers associated with the stone mines and quarries are at the risk of silicosis. Gujarat, Rajasthan, Pondicherry, Haryana, Uttar Pradesh, Bihar, Chhattisgarh, Jharkhand, Orissa, West Bengal etc. are some of the states of India where silicosis is reported to affect the health of the workers associated with the quarrying, manufacturing and building construction industry.

Types of Silicosis

Acute Silicosis

The symptoms of acute silicosis are cough, weight loss, and fatigue within a few weeks or years of exposure to inhaled silica

Accelerated Silicosis

Accelerated silicosis occurs within 10 years of high-level exposure to the inhaled silica.

Chronic Silicosis

Chronic silicosis occurs from 10 to 30 years after exposure and affects upper lungs and sometimes causes extensive scarring

Symptoms of Silicosis

Some of the major symptoms of silicosis are listed as follows-

1. Dyspnea or shortness of breath
2. Persistent and severe cough
3. Fatigue and tiredness
4. Tachypnea or rapid and fast breathing
5. Weight loss and loss of appetite
6. Repeated chest pain
7. Constant fever
8. Cyanosis or bluish skin
9. Gradual dark shallow rifts in nails eventually leading to cracks
10. Heart problem and heart diseases
11. Respiratory insufficiency

Causes of Silicosis

The most prominent cause of silicosis is the exposure to crystalline silica, which comes from chipping, cutting, drilling, or grinding soil, sand, granite, or other minerals. In fact, the disturbance in the earth's crust causes this disease to those who are engaged in this work. Some of the occupations where the workers are found at the risk of having exposure to silica include various forms of mining, such as coal and hard rock mining, construction work, tunnel work, masonry, sand blasting, glass manufacturing, ceramics work, steel industry work, quarrying and stone cutting.

Results of Silicosis

Some of the results and effects of silicosis that are caused by the exposure to silica are the generation of connective tissue disease, including rheumatoid arthritis, scleroderma and systemic lupus erythematosus, lung cancer, progressive massive fibrosis, respiratory failure and tuberculosis.

Precautions and Measures of Prevention

The following suggestions can be helpful in the prevention of silicosis-

1. There should be seasonal and occasional campaigns aiming at making the miners aware of the dangers of breathing in crystalline silica dust
2. The working near dust should be avoided
3. The water spray system and proper ventilation should be used particularly in the confined spaces
4. The respirators specifically designed to protect the workers from crystalline should be provided to all the workers working in the mines
5. The regular check up by the medical experts must be mandatory to all the workers
6. The workers should eat or drink nothing without washing hands
7. They must wear clean clothes.

The Rajasthan Silicosis Rules, 1955 guarantees the victims of silicosis compensation to be provided both by the government and the mine and factory owners.

The Dholpur Sandstone at A Glance

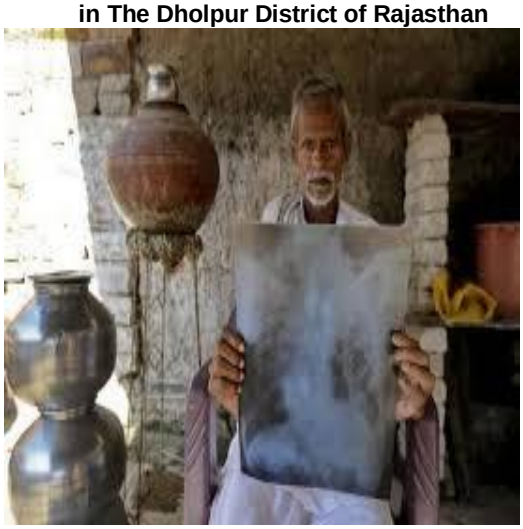
The Dholpur sandstone which contains 98.20% SiO_2, 0.840% Fe_2O_3, 0.32% Al_2O_3, 0.28% CaO, and which has 2.40 kg/m3 density, 1.20% water absorption, 208 kg/cm2 modulus of rupture and 460 kg/cm2 compressive strength is very useful, but provides a risky working to all its workers. With the exception of few, all the tehsils in the district ensure hundreds of sandstone mines where the workers can be seen working hard and risking their health and life. The scenario is so touching that it can move any person whosoever he or she it. Destined to work in the mines and other processing units, they keep on working till their health allows them to work there.

Popular Sandstone Mining and Quarrying Localities

Bari	Kankrai, Dhimri, Tanoti, Totpur, Naksonda, Richhai, Chilaghund, Bhola Ka Pura, Birpur, Basai, Dang, Khanpur Gurjar, Bijauli, Maidana, Barauli Ka Pura, Talab Sahi, Janura
Baseri	Kachchhanpura, Khidarpur, Angai, Thawa, Dhond, Bidarpur, Tilawa, Birja, Dhor, Nandanpur, Tajpur, Sarmathura, Badarea, Chand, Kharagpura
Dholpur	Chandpura, Narpura, Bhilgaon, Surajpura, Bishnoda, Kotra, Panch Gaon, Purani Chhawani
Rajakhera	Pahari and Marena
Saipau	Rundh and Rajaura

It is worth mentioning here that of the total more than 64 operational leases of sandstone in the district, more than 22 working leases for masonry stone are working successfully making available splittable and blockable sandstone. The blocks of 8'x4'x3' and even bigger size are excavated here. The leases of Khanda, Gitty, boulders & Bajari are distributed all over the district.

Silicosis in the Workers of Sandstone Mines in The Dholpur District of Rajasthan



1. It was only in 2009 when on the complaint of MLPC, NHRC acted allowed the families of 21 deceased mine workers 300,000 compensation. However, the state government didn't give any compensation or help to the other 52 silicosis patients whose names were also sent by NHRC.
2. The report of National Institute of Miners (Ministry of Mines, Govt. of India) on Detection of Silicosis Among Stone Mine Workers From Dholpur District, submitted in February, 2014 says that out of the 138 x-rays evaluated, 53 (38.4 %) had evidence of silicosis of which 4 (7.5 %) developed large opacities suggestive of Progressive Massive Fibrosis (PMF). X-rays of 74 (53.6%) persons were Normal and x-rays of 11 persons (8 %) showed radiological evidence of Pulmonary Tuberculosis. The report also says that the x-rays of the persons having work exposure of less than 10 yrs did not show evidence of silicosis. The prevalence of silicosis in persons having work exposure between 11 to 20 yrs, 21 to 30 years and more than 30 years showed increasing trend of 29 %, 45.5 % & 56.5 % respectively. The occurrence and profusion of pneumoconiotic opacities due to silicosis was directly related to the number of years of work in stone mines.
3. CJP in Sabrang reports that more than 15,000 labourers working in various mines across 16 districts in Rajasthan have been diagnosed with silicosis, a disease they caught on the job and

more than 200 have lost their lives in the past three years.

4. Aarti Dhar in the Hindu on 2nd December 2014 confirms the report of National Institute of Miners saying that there is a high incidence of silicosis in Rajasthan's Dholpur.
5. The CAG report of state government says 7,959 silicosis patients were detected between January 2015 and February 2017.

Objectives of The Study

1. Making a detailed study of the Dholpur sandstone and the localities in the district where it is quarried, manufactured, marketed, shaped, polished and processed
2. Having a sufficient idea of the workers in the sandstone mines and the working conditions under which they have to work
3. Observing and making a study of the health status of the mine and processing units workers
4. Detecting the various diseases the workers in the sandstone mines generally suffer from
5. Making a special focus on their suffering from silicosis
6. Enumerating, enlisting and analyzing the various symptoms, causes, effects and precautions of silicosis
7. Highlighting the reports of the patients of silicosis in the mines and quarries in the district
8. Reviewing the efforts made by the state government for the prevention of silicosis

Review of Literature

Michael D. Shaw (2004) in the study Respiratory Diseases And Their Prevention: A Look At Industrial Dust And Its Control quotes the recommendations made by NIOSH which suggests that respirators should not be used as the primary means of preventing or minimizing exposures to airborne contaminants. Instead, use of effective dust source controls such as substitution, automation, enclosed systems, local exhaust ventilation, wet methods, and good work practices should serve as the primary means to protect workers. Use of respirators should only occur when dust source controls cannot maintain exposure below the NIOSH recommended levels.

G. K. Kulkarni (2007) in the study Prevention and control of silicosis: A national challenge suggests the identification of nationwide population at risk in the unorganized sector, criteria of what constitutes silicosis, frequent sample surveys in the high risk sectors, assigning the task of consolidation of data on silicosis to the central nodal agency, awareness among the stake holders for silicosis, activeness of media and NGOs to make pressure on the concerning authorities, strict implementation of the control measures etc.

Mohammad Shamim , Dr Waheeb D.M. Alharbi , Dr Tariq Sultan Pasha and Dr Mohamed Osama Mustafa Nour (2017) in their study on the issue entitled Silicosis, A Monumental Occupational Health Crisis in Rajasthan- An Epidemiological Survey observe that silicosis is caused by inhalation of the silica dust; marked by inflammation and scaring of the lungs resulting in nodular lesions in the upper lobes of the lungs. The study finds that it is a fatal fibrotic pulmonary disease, which is irreversible in nature. In India, epidemiological surveys conducted time-to-time show that the problem is more severe in unorganized sector. Silicosis has emerged at epidemic level in Rajasthan due to exponential growth in the mining sector, inadequate Governmental policies, and poor implementation of the laws of the land.

Rishi K. Sharma, Atul Luhadia, Shanti K. Luhadia, Yash Mathur, Harshil Pandya, Prithviraj Methe (2017) in the paper Pneumothorax in the cases of silicosis in southern part of Rajasthan find out that among 50 patients of silicosis with increased dyspnoea, Chest X ray showed pneumothorax in 20 patients of which 4 had bilateral pneumothorax, 7 had right pneumothorax and 9 had left pneumothorax. The mean duration of exposure to silica particles was 10 years (5 to 15 years). All the patients had various degrees of dyspnoea and chest pain. Tube thoracostomy was performed in 15 patients while 5 patients were managed conservatively with oxygen and bronchodilators. The study showed an increased incidence of secondary pneumothorax in silicosis patients. The occurrence of pneumothorax, though rare in silicosis is a potentially life-threatening complication and may cause serious morbidity and mortality. The patients of silicosis who develop sudden onset of dyspnoea should be promptly investigated for this complication.

Subroto Nandi, Nishant Burnase, Anand Barapatre, Pallavi Gulhane, and Sarang Dhatrak (May-August, 2018) in their study hold the idea that silicosis is an occupational lung disease prevalent among stone mine workers all over the world, and which is characterized by cough and shortening of breath, and is occasionally associated with tuberculosis and lung carcinogenicity. It is one of the major occupational diseases and poses detrimental health effects to the workers in developing countries like India. The results of the study revealed that education or literacy highly affects the knowledge about silicosis among stone mine workers. The awareness index was found nonsignificant for the alertness of silicosis in contrast to regions, age groups, and habit of two regions and was significant for literacy in two regions. The education level of mine workers affected the knowledge of silicosis. Free seminars, symposiums, and medical camps should be organized to make miners more aware of silicosis.

Hypothesis

1. Silicosis is a global disease, but Rajasthan in India has a large number of cases of silicosis
2. The state government of Rajasthan has a serious concern for silicosis
3. Silicosis is one of the major diseases found in the workers of the sandstone mines
4. Silicosis is an incurable lung disease, and disables the sandstone mine workers in particular
5. The main cause of silicosis is the inhalation of silica during the course of work
6. Any worker can be a victim to silicosis, but it is the mine workers who have long been working in the stone mines fall prey to silicosis

7. Diagnosis of silicosis is very difficult
8. At the initial stage the patient of silicosis is found suffering from tuberculosis
9. The patient with prolonged tuberculosis is suspected to be suffering from silicosis
10. Precautions can help the mine workers be free from silicosis

Method

The present study was conducted on 500 units associated with sandstone mines and quarries of the Dholpur district of Rajasthan for assessing working conditions and awareness of the workers regarding silicosis. The units of information who participated in this study were aged >30 years, and the data were collected through the schedule technique. The schedule was divided into ten different sections covering the various aspects of the issue in question. Section 1of the schedule included basic information such as name, age, mine address, etc.; section 2 included work details like work history of the workers, present working status, working role, working hours and use of safety equipments during work; section 3 covered details regarding the awareness and knowledge of silicosis, and included five questions regarding the awareness, symptoms, causes, precautions that are taken to prevent silicosis, and knowledge about the other related lung diseases, and section 4 contained information about the unit's medical history and education status, and the remaining sections included questions about the other major aspects of the sandstone industry in the study area.

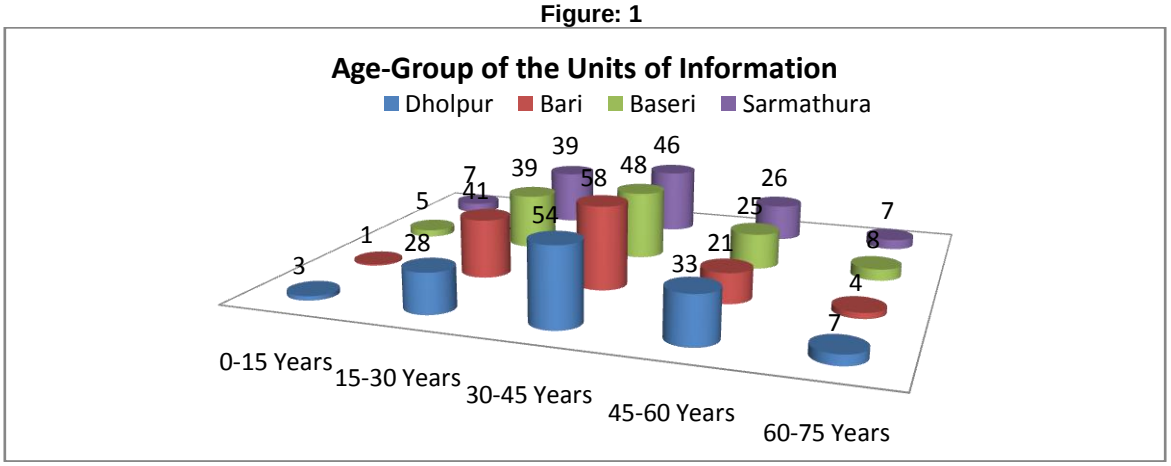
Literally, all the steps of research, such as, the review of literature; formulation of hypothesis about the study area, units of information and tools and techniques; collection, classification and analysis of data; and generalization. Maintaining objectivity throughout the study, the researcher studied in particular the working conditions in the sandstone mines responsible for silicosis, causes and effects of silicosis, and the concern of the state government for the prevention of the disease among the sandstone mine and quarry workers.

Graphical Reflection of The Collected Data

Hereunder is the graphical reflection of the collected data for the study. The varied graphs prepared for the purpose reveal the severity of the diseases among the workers engaged in the sandstone sector in the Dholpur district of Rajasthan.

1: The highest age group which the randomly selected units of information belonged to is 30-45 years, while the lowest one is 0-15 years, which is an indication that child labour is almost absent in the sandstone units in the district.

Figure: 1



2: Illiteracy prevails among the workers engaged in the sandstone and mining industry, and it is revealed by the presence of 37% of such workers

Figure: 2

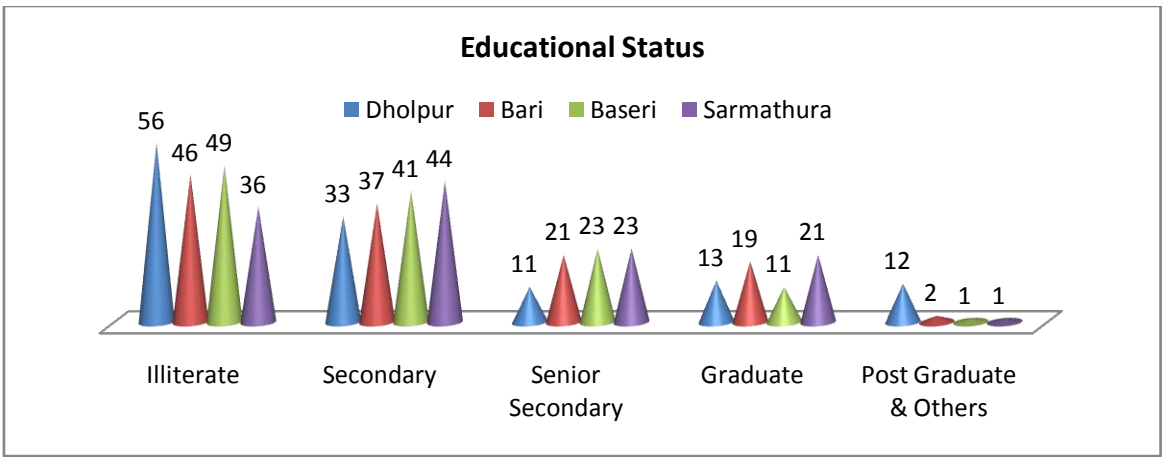
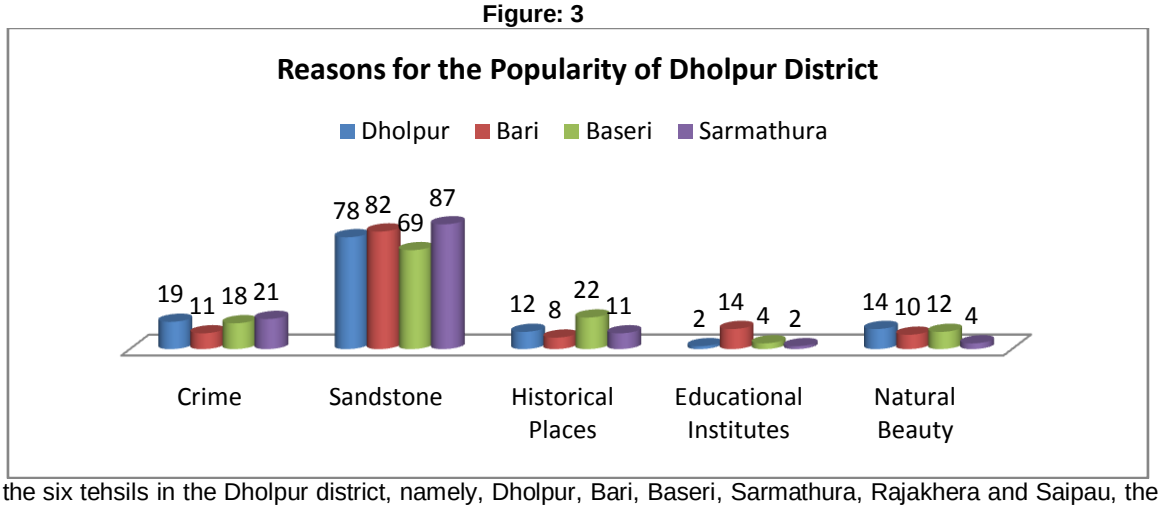
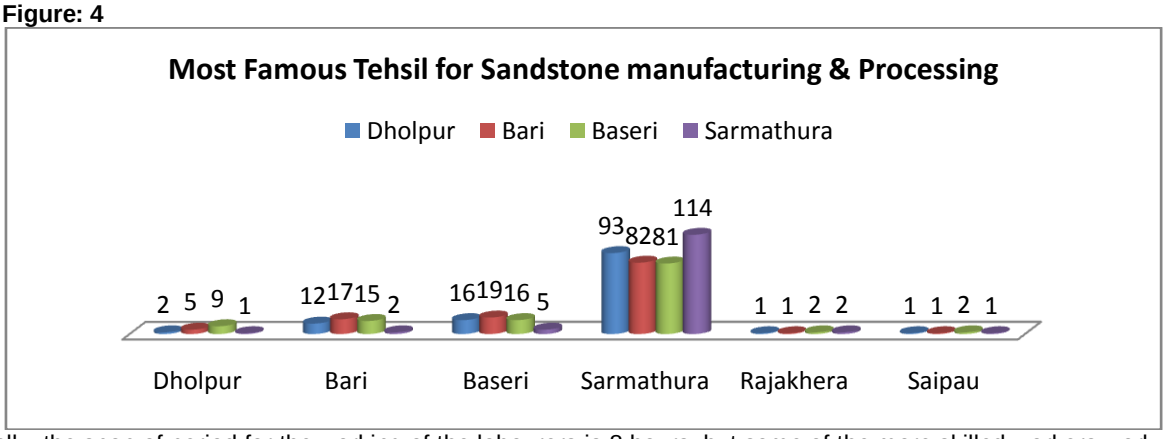


Figure: 3



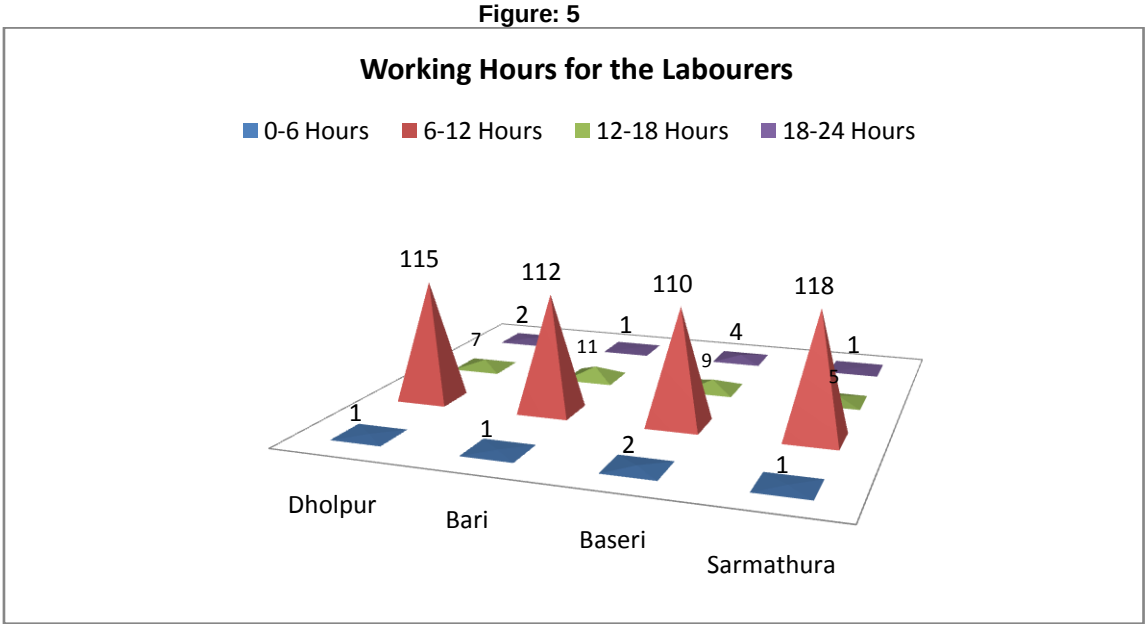
4: Of all the six tehsils in the Dholpur district, namely, Dholpur, Bari, Baseri, Sarmathura, Rajakhera and Saipau, the Sarmathura tehsil is the most popular tehsil for the sandstone mines, quarries and processing units where tons of stone is manufactured everyday (74%), while the least popular tehsil is Saipau (1%).

Figure: 4



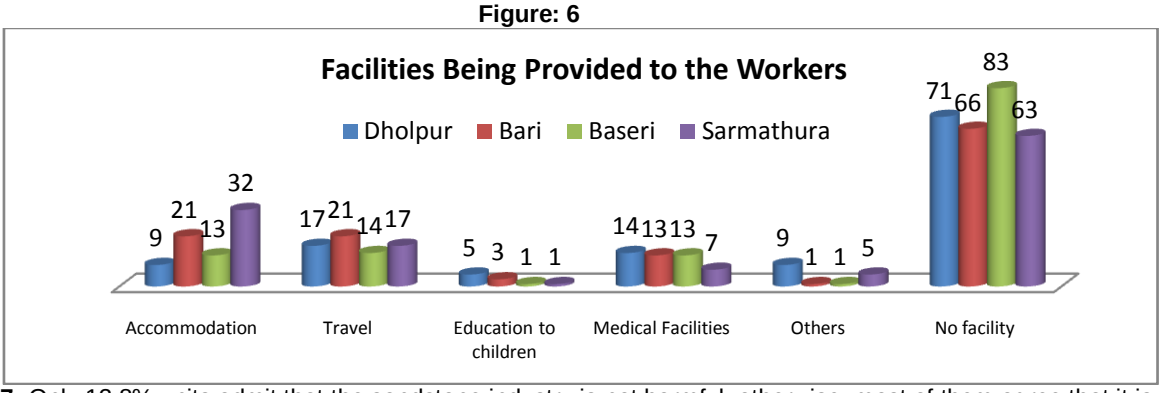
5: Normally, the span of period for the working of the labourers is 8 hours, but some of the more skilled workers work less than the others. On an average, the working hours for the labourers in the study area are 6 to 12 hours.

Figure: 5



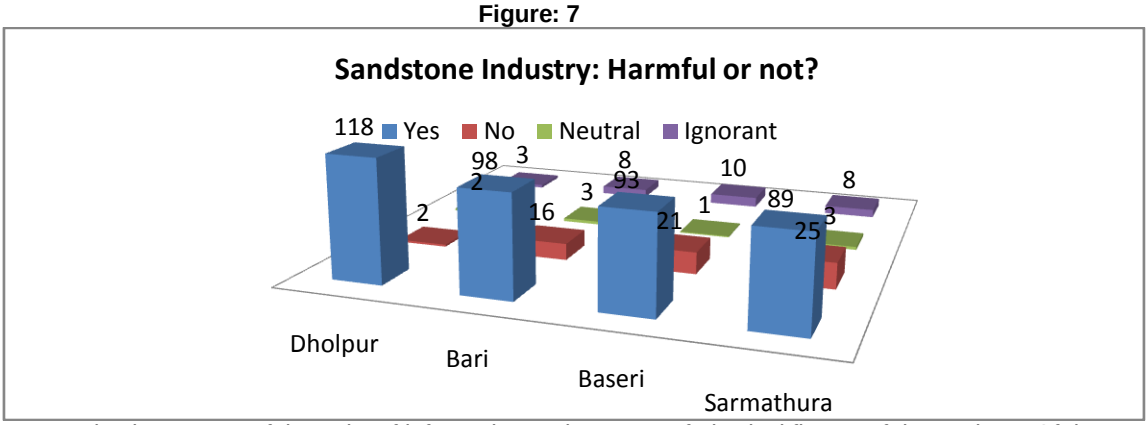
6: As reported by 56.6% units of information selected for the purpose, no facilities are provided to the workers by the mine, quarry and processing units owners. However, only very few of them provide the workers accommodation, travel, children-education, medical facilities etc, but it is only in exceptional cases.

Figure: 6



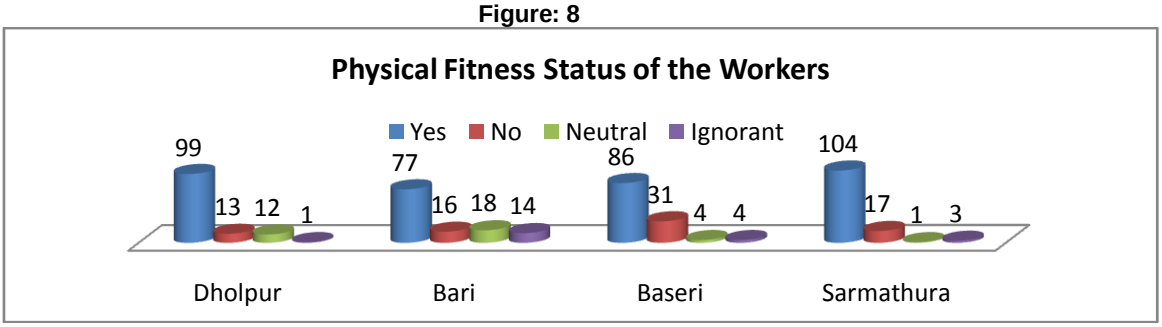
7: Only 12.8% units admit that the sandstone industry is not harmful, otherwise, most of them agree that it is harmful to the environment and public health.

Figure: 7



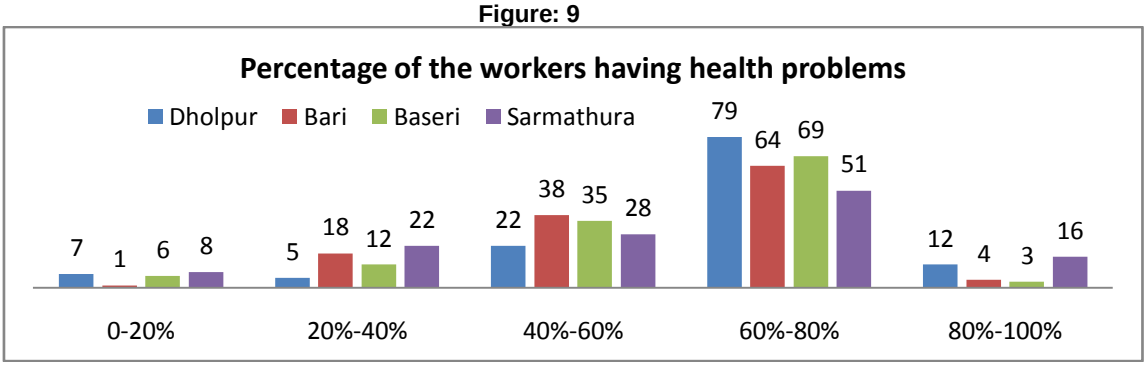
8: There was a mixed response of the units of information to the status of physical fitness of the workers. Of the total 500 units of information selected randomly for the purpose from the Dholpur, Bari, Baseri and Sarmathura tehsils of the district, 73.2 % believe that the workers are physically fit to work hard; 15.4% find that they are not physically fit for the work which is assigned to them; 7% remain neutral while 4.4 reveal their ignorance on the issue.

Figure: 8



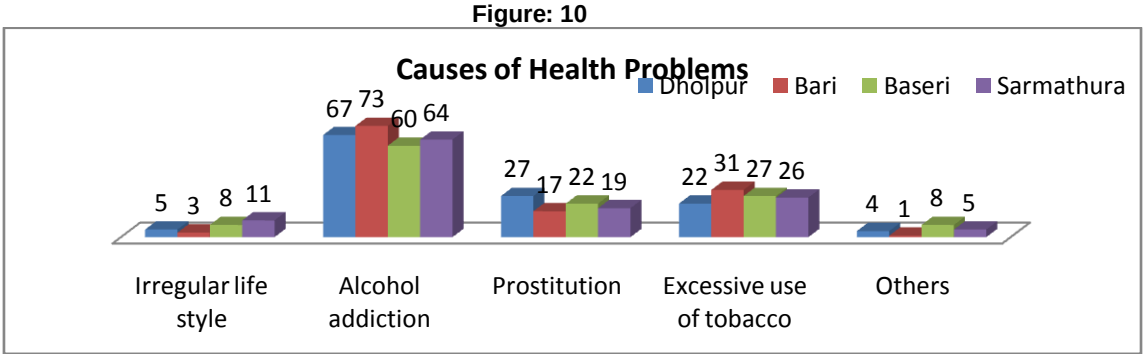
9: As reported by the units of information, 60%-80% of the workers engaged in the sandstone mines, quarries and processing units have one or the other health problem, still they continue to work taking risk to their health.

Figure: 9



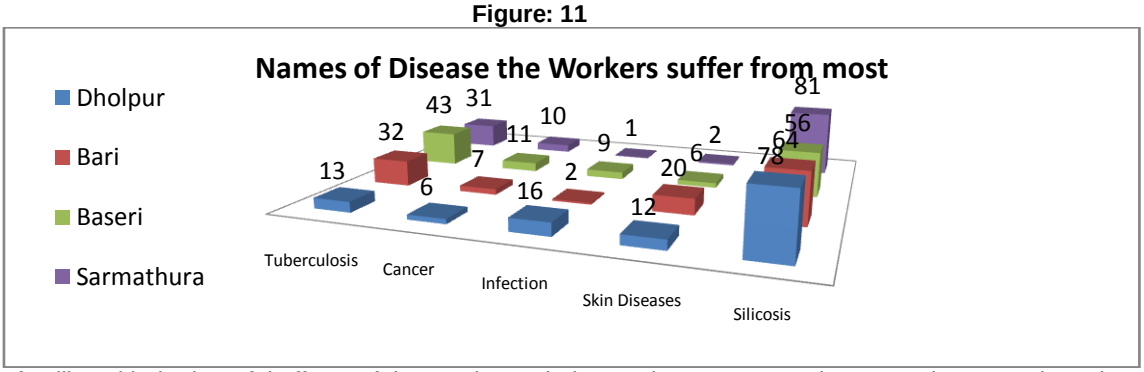
10: Irregular life style and miserable working conditions in the mines and quarries, drug and alcohol addiction, prostitution, excessive use of tobacco etc. are the causes of health problems among the workers associated with the sandstone industry in the study area.

Figure: 10



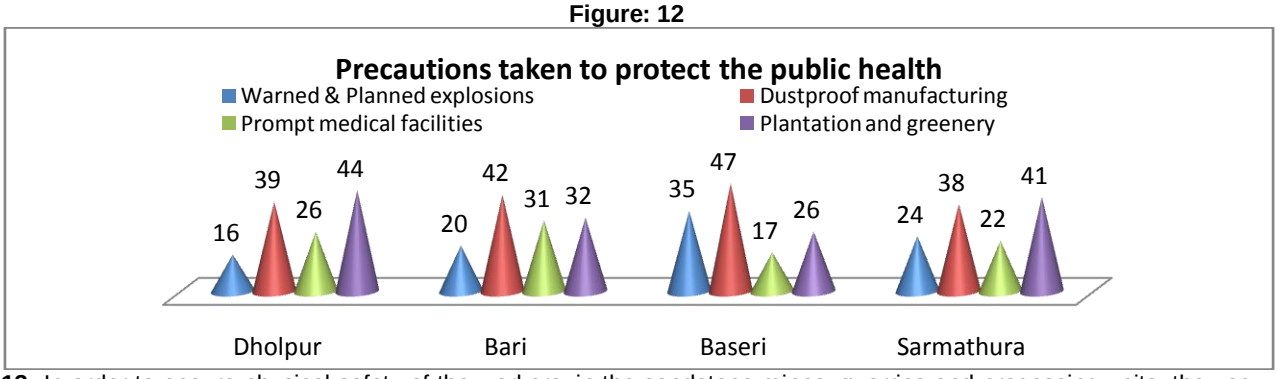
11: Tuberculosis, throat and other types of cancer, various types of body infection, skin diseases and silicosis are some of the diseases found in the workers associated with the workers. As reported by 55.8% units, silicosis is the most common disease found in them

Figure: 11



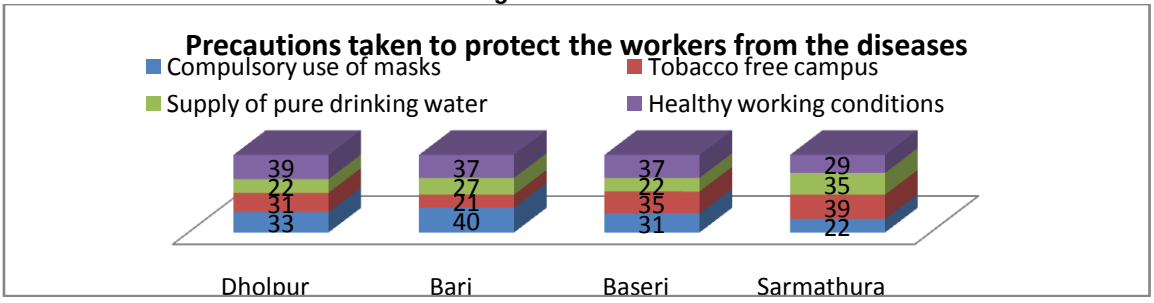
12: Being familiar with the harmful effects of the sandstone industry, the government is very serious. For the sake of public health several precautions are taken which include warned and planned mining explosions, dustproof manufacturing using advanced machines and technology, prompt and easily accessible medical facilities and plantation and greenery.

Figure: 12



13: In order to ensure physical safety of the workers, in the sandstone mines, quarries and processing units, the use of the masks has been made compulsory (25.2%); a tobacco-free campus is ensured (25.2%); pure drinking water is supplied to them (21.2%), and they are ensured healthy working conditions (28.4%).

Figure: 13



Findings

1. The state of Rajasthan produces about 90% of India's total sandstone output.
2. Some of the workers had been working with the same contractors since they began their life as mine workers.
3. The workers worked for 8 hours or more with a break of 1 hour for lunch and rest.
4. At the work place whether mines, quarries, gangsaw or processing units, there are no facilities for drinking water or restrooms, or even a shaded area where workers can relax for a short period.
5. Pneumoconiosis, Noise Induced Hearing Loss, Silicosis, Musculoskeletal problems, Heat stroke and dehydration, Cuts and bruises etc. are the major and minor diseases and health problems the workers suffer from.
6. Silicosis is a fatal respiratory illness caused by inhaling fine silica dust through prolonged exposure in sandstone mines and quarries.
7. Silicosis is one of the oldest known occupational hazards, but its patients have remained undiagnosed for years.
8. 60 % of the mine workers those diagnosed for silicosis were previously treated for tuberculosis of lungs.
9. The workers with long working duration in sandstone mines in the district, that is, from 12 years or more are found to be at risk of being victims of silicosis
10. The workers falling in the age group 30-40 and 40-50 are at risk of falling victims of silicosis
11. 10% of the total sandstone workers in the district have silicosis.
12. 30%-40% of the sandstone mine and quarry workers are the patients of tuberculosis
13. Only 0-10% sandstone mine and quarry workers in the district are aware of silicosis
14. More than 70% mine workers use protective equipments like face masks while working in the mines, quarries, gangsaw, processing units
15. More than 90% workers have no idea about the government schemes meant for the sandstone mine and quarry workers.

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