

**FUTURE
OF
PREVENTING
SILICOSIS**

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FUTURE OF PREVENTING SILICOSIS

A study on silicosis prevention: progress made and future path

Prakash Tyagi

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FUTURE OF PREVENTING SILICOSIS

2014

GRAVIS

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FOREWORD

Silicosis is a significant health problem in the stone mines of Rajasthan. A common form of pneumoconiosis found in Rajasthan mines, silicosis has put lives of thousands of mineworkers on risk. Poor precautionary arrangements, lack of health checkups and delivery of health services and negligence of safety norms have worsened the complexity of situation leading to high prevalence of the disease. At an estimate, 2.5 million people work in mines in Rajasthan out of which some 300,000 work in stone mine sector and are prone to silicosis.

Since 1994, GRAVIS has been working actively in the area of lung health. Its interventions include providing curative and diagnostic services through a rural hospital, generating health awareness and advocating for occupational health safety.

Over the years GRAVIS has done extensive work on collecting data, surveying mining areas in the context of Silicosis and in the process several major study documents have been produced by us. At the same time the ground work on generating awareness on the disease and exploring prevention methods has continued. As a result of these efforts of GRAVIS, substantial progress on Silicosis prevention and control has been made. This study is an effort to understand the progress made and to look at future of Silicosis prevention in the Thar Desert.

I sincerely thank our team that participated in this research including Grace Remmington, Milla Tuominen, Jocelyn Boiteau, Vinod Kumar, Pragati Shukla, Priyanka Singh and Dhanna Ram. A special word of thanks goes to the mining communities, mine owners and health professionals who provided their valuable feedback.

I hope the study is useful, is read with interest and contributes to the future path of silicosis control and prevention in the Thar Desert and elsewhere.

Prakash Tyagi

Executive Director, GRAVIS



1. Background

MINING IN INDIA

Mining represents a major industry in India, and contributes an estimated 2.51% of Gross Domestic Product (GDP).¹ The mining industry in India covers mines for gold, mica, manganese, lead and zinc, iron ore, stone, and uranium.² India has recognized the dangerous health consequences that result from mining activities. In 1934, Rao, CK was the first to confirm cases of silicosis in India in the Kolar Gold Fields where 43.7% of workers had silicosis.² Silicosis is not only a problem in Indian mines, but also in factories such as slate pencil, ceramic, agate grinding, stone cutting, and quartz grinding industries.²

The Government of India has determined that the prevention of silicosis is a constitutional obligation of the government because silicosis is responsible for substantial morbidity and mortality of the country's people, and causes great economic loss to the nation and industry.² Therefore, the Article 246, Union list, Entry 55 of the Constitution of India states that the safety, welfare and health of persons employed in mines is concern of Central government and that of factories is the concern of State Government.² The Mines Act of 1952 and Factories Act of 1948 set rules and regulations for the mining and factory industries.² These laws were meant to protect mineworkers and make mine workers responsible for their safety. However, they are not adequately enforced, and most of the workers do not know that they exist.

A major challenge in India is the workers who are in the unorganized and self-employed sector. Official statistics on morbidity and mortality are not available to determine the extent of the problem of silicosis in India.² Therefore, the cases notified to enforcement agencies most likely only reflect a small portion of actual silicosis cases.

STONE MINING IN THE THAR

Sandstone from Jodhpur is famous worldwide, and is used for prominent buildings in India and abroad. Therefore, sandstone mining has been a major occupation in Rajasthan for over 500 years, second only to agriculture, which is the primary livelihood for people living in the Thar Desert.³ Typically small farmers, agricultural laborers and others related with agricultural activities will join regular sandstone quarry workers after the monsoon crop is harvested to earn their livelihood.³ During drought years, sandstone mining becomes the primary source of income for families.³

The Inter-Governmental Panel on Climate Change projects that the impact of climate change by the end of the 21st century will be greater on arid ecosystems than in semi-arid or sub-humid regions in India, as cited in Poonia et al, 2013.⁴ In Western Rajasthan, twelve arid districts represent 61% area of the Indian hot arid zone.⁴ Climate change projections indicate that temperatures in the Thar Desert will increase 2-5°C annually, with annual rainfall decreasing in a significant area.⁴ The changing climate and increasing drought conditions further contribute to issues with water security that negatively impact agricultural livelihoods. With more drought years, there is potential for more people living in the Thar Desert region to turn to mining to earn their livelihood.



A sand stone mine

Currently, thousands of mines employ a significant number of people, as the overall mining employment estimate exceeds 2 million people in Rajasthan.⁵ Working conditions and overall quality of life for these employees is poor. The sandstone quarries in the Jodhpur district often belong to the unorganized sector.³ As a result, mine owners do not implement rules or systems for mine safety, and workers are also not following safety rules.³ Mineworkers working in these unsafe conditions are underpaid and undernourished, and suffer from various health problems.⁵

SILICA DUST AND STONE MINING

Silica, chemically referred to as silicone dioxide, is the most abundant mineral worldwide.⁶ Occurring in crystalline and amorphous forms, quartz, tridymite, and cristobalite are the most common free crystalline forms of silica in labor workplaces.⁷ Quartz may occur naturally in rocks, for example in sandstone, which is 67% silica, and granite, which is 25-40% silica.⁷

Mineworkers of different categories, such as miner, driller, hammerer, digger, cutter, polisher, and grinder, are involved in many activities that lead to silica dust production, including grinding, stone crushing, and stone breaking.⁵ As a result, fine particles of silica are lifted into the air in the sandstone mining area, and are inhaled by the workers who are working without any protection.³

Silica dust that is not inhaled, settles onto the ground in the mining area. This poses a problem even for people and communities not directly involved in the mining areas because dust storms can transport a large amount of particulates, including silica dust, for long distances.⁸ Dust storms frequently occur in the desert, and appear to be occurring with greater frequency, which is expected to continue as a result of increasing land use and lower soil moisture due to climate change.⁸ In one mapping study of dust storm activity in arid zones of India, Middleton found that the greatest number of dust storms occur in the Thar desert, as cited in Goudie, 2014.⁸

When the contaminated dust storm material is inhaled over a continued period of time, non-occupational silicosis can develop, also known as desert lung syndrome.⁸ Evidence also suggests



Mine workers in a stone mine

that silicosis may be an important contributing factor to the higher prevalence of tuberculosis in deserts, including the Thar Desert.⁹ Further, reports indicate the incidence of silicosis in Himalayan children who were exposed to frequent dust storms.¹⁰

SILICOSIS

Occupational exposure to respirable crystalline silica occurs when rocks and stones containing free crystalline silica are broken down and form dust, and are inhaled by the worker. As discussed in the previous section, non-occupational exposure to respirable crystalline silica can occur when the free crystalline silica is carried and spread via dust storms. Silicosis is a dust-borne disease that causes irreversible scarring to the lung tissue.⁵

When the silica particles, less than 10 micron in size, enter the lungs, it causes an injury to the lung tissue, creating a wound. As this 'hit spot' heals, a node develops and leads to fibrosis at the later stages of silicosis.³ When this occurs, the affected person feels obstruction and restriction with breathing, and the vital capacity of lungs is considerably reduced, as cited in Yadav et al. 2011³. The most important factor in the development of silicosis is the cumulative dose of silica, which is the respirable dust concentration multiplied by crystalline silica content and exposure duration.^{6,11-14}

For affected mineworkers, they ultimately become unable to earn a livelihood during their illness, and become a socio-economic burden for their families and others.³ Although a lot is known about silicosis and the associated complications in the public health sector, many of the workers are unaware. For those workers who are aware of the dangers associated with unprotected stone mining, they still do not have the agency to leave the job because of poverty related issues.³

Silicosis clinically presents in three different forms: acute, accelerated and chronic. Acute form silicosis is caused by a significant exposure to silica dust, and presents itself within 2 years post the initial exposure.⁵ Silicoproteinosis, an acute silicosis, may occur, rarely, after someone is exposed to high concentrations of respirable crystalline silica for a few weeks to 5 years.¹⁵ Silicosis symptoms in the accelerated form appear after 2 to 10 years post initial exposure.⁵ These clinical features are similar to those of chronic silicosis, but progress at a faster rate.^{7,16}

Chronic silicosis is the most common form, and develops after 10 years or more of exposure to crystalline silica at low concentrations.^{6,17} Patients with silicosis may be asymptomatic, and discover the disease by chance after a radiological examination.¹⁵ Symptomatic patients may present with a cough, due to nerve irritation caused by silicotic nodules or associated Chronic Obstructive Pulmonary Disease (COPD). In the later stages of disease, particularly with advanced massive fibrosis, patients often experience shortness of breath. Patients with chronic silicosis may also present with associated conditions, such as tuberculosis and lung cancer.¹⁵

Chest radiography is the primary method used to diagnose silicosis, as it is widely available.¹⁵ In addition to viewing radiological features, diagnosis also considers the history of exposure to silica dust, occupational history, and exclusion of other competing diagnoses.¹⁵

SILICOSIS AND TUBERCULOSIS

Tuberculosis (TB) is an infectious bacterial disease caused by *Mycobacterium tuberculosis*. Unlike silicosis, TB can be completely treated with proper medication.⁵ The co-occurrence of silicosis and tuberculosis is known as silico-tuberculosis. Not only is the risk of tuberculosis positively associated with the severity of silicosis, but also exposure to silica increases tuberculosis risk even without silicosis.^{18,19} Panel 1 lists conditions, in addition to TB, that have been associated with crystalline silica exposure.

SILICOSIS OCCURRENCE

Panel 1: Conditions that have been associated with silica exposure⁸	
Silicosis	
	• Chronic silicosis
	• Accelerated silicosis
	• Silicoproteinosis
Infections	
	• Tuberculosis (pulmonary and extrapulmonary)
	• Other mycobacterial, fungal and bacterial lung infections (usually with silicosis)
Airway disease	
	• Chronic obstructive pulmonary disease
Malignant disease	
	• Lung cancer
	• Gastric, oesophageal, and several others (possible association)
Autoimmune diseases	
	• Scleroderma
	• Rheumatoid arthritis
Renal diseases	
	• Chronic renal disease

While silicosis occurs worldwide, it is largely prevalent in low- and middle-income countries, where poor surveillance exists and cases are under-reported.¹⁵

Still, silicosis remains an occupational health concern in high-income countries. Countries that have taken protective measures, such as dust control and respirators, have realized a steady decline in death rates due to silicosis in the past few decades.^{17,20} In 1990-93, an estimated 600,000 workers in the UK, and more than 3 million workers in Europe were exposed to crystalline silica.²¹ Between 1996 and 2009, less than 100 cases were reported annually, and deaths due to silicosis declined from 28 in 1993 to 10 in 2008.²² Similar improvements to occupational silica exposure occurred in the USA, where more than 121,00 workers were exposed to elevated concentrations of respirable crystalline silica in 1993.²³, which fell to 3600-7300 annual silicosis cases from 1987-1996.²⁴ Further, the overall age-adjusted mortality rates in the USA declined from 8.9 million in 1968, to 0.7 in 2004.^{17,24}

Mineworkers in the Thar Desert of Western Rajasthan experience poor living and working conditions. Not only are the mineshafts crowded and poorly ventilated, but also the hostels where over twelve men may share a small room. These substandard conditions promote high infection rates of recurrent tuberculosis.⁵ Further, many miners are migrant workers who have been forced to search for work outside of their local communities due to drought, as discussed previously.

About half of the mineworkers in the Thar Desert region have developed lung diseases from the dust of the mines.

Silicosis is a non-curable disease that leads to premature death, about 10-15 years premature. Further, in 1996 it was found that 50% of sandstone quarry workers suffering from silicosis also suffered with tuberculosis, as cited in Yadav et al. 2011.³ In Rajasthan, the prevalence of silico-tuberculosis is high in the stone mines. Over the years, silico-tuberculosis has greatly affected mining communities and resulted in significant social and economic losses.⁵

SILICOSIS PREVENTION

To date, there is no proven curative treatment for silicosis.¹⁵ Research in some countries has shown improvements in pulmonary function and suspended disease progression with the administration of tetrandrine, which is a plant-derived alkaloid that contains antioxidant, antifibrogenic, anti-inflammatory, and immunomodulatory properties. Corticosteroids and therapeutic bronchoalveolar lavage (BAL) have been tested as well. However, both have produced unpromising results.⁵

The most appropriate approach to date is the elimination of the crystalline silica exposure source.⁵ Patients diagnosed with silicosis should be removed from further exposure. As mentioned before, issues of poverty may prevent or delay an affected worker from leaving the job.

Since there is no curative treatment, preventative measures are all the more important. Workplace accommodations and personal protective measures are necessary for individuals who remain working in high-risk environments, even though these measures cannot completely protect workers who already have the disease from further damage.¹⁵

Further, health care workers who are involved in the treatment of patients with silicosis should attempt to prevent and detect associated complications, as previously listed in Panel 2, early.⁵ Smoking cessation, and influenza and pneumococcal vaccines are also useful to reduce complications associated with silicosis.¹⁵

Panel 2: Suggested preventative measures	
Suggested measures	
Primary prevention	
Silica exposure	Substitution of materials; modification of processes and equipment; wet methods; silica warning sign; work practices
Control silica dust emission or transmission	Isolation of the source or worker; enclosed processes; air curtain; water spray; local exhaust ventilation' general ventilation system; enclosed cabs; air supply system
Control silica dust emission or transmission	Training and education about work practices; personal protection; personal hygiene; personal protective equipment; health promotion
Secondary prevention	
Surveillance of working environment	Establish concentration of silica dust; assess health risk for workers exposed for silica dust
Surveillance of worker health	Periodic health examination, such as chest radiography; early detection of the disease; research into biomarkers for early stages of silicosis
Tertiary prevention	
Removal from environment; prevention of complications; modification of work processes; rehabilitation	
Source: National Institute of Occupational Safety and Health (126) as cited in Leung et al. 201215	

GRAVIS' WORK ON SILICOSIS

GRAVIS has been working for 20 years with the mining communities in the Jodhpur and Nagaur districts, promoting and advocating for the basic human rights of mineworkers and their families. In addition to educating mineworkers on their rights, health and safety, we also focus on alternative livelihoods to mining for women and children. GRAVIS works with partner organizations to achieve successes in this development area.

Given the violations of basic human rights in the mining industry, GRAVIS has helped mine workers to get together and understand their health conditions and threats better. In 4 districts of Western Rajasthan, GRAVIS has intensively worked on raising awareness among mineworkers on their health issues.

In addition, GRAVIS also organizes training workshops to teach mineworkers basics in first aid, and to educate them on existing laws that protect mineworkers. During awareness camps, workers learn about the risks of working in the mines. Also, GRAVIS hosts street plays with messages further explaining the health risks of their profession.

GRAVIS has worked with mineworkers in Jodhpur to establish cooperative shops in the mining area. Owned and operated by the mineworkers, the shops allow mineworkers the opportunity to buy and sell goods between each other rather than buying goods from shops owned by mine owners. This activity helps mineworkers conserve the little money that they earn.

Men are not the only people who work in the mines. Women and children mineworkers represent a particularly challenging population, as they work under the same hazardous conditions as men, facing the same frequent psychological and physical abuse. GRAVIS works with communities to bring access to education to children who are working in the mines as a pathway out of the mines. To date, GRAVIS has created ten primary schools in mining communities with a total of over 500 children enrolled. Child mineworkers are legally forbidden. GRAVIS works with mining communities to identify when children are working in the mines, and to take appropriate action to help the children out of the mines.



A medical camp for mineworkers

In order to help people who have already contracted silicosis, we hold medical camps that provide free testing and treatment, and we help workers to obtain legal compensation for their losses. Awareness camps and health camps are help in mining communities to increase the access to knowledge and health care for these vulnerable communities.

GRAVIS routinely works with mineworkers to secure workers' compensation for patients who have acquired disabilities from working in the mines. As a result of GRAVIS' work, with partner organizations, medical boards in Jodhpur have been formed to advise and oversee medical departments to screen laborers for silicosis and provide appropriate documentation for positive diagnoses in order for affected laborers to apply for and receive compensation from the government silicosis board.

GRAVIS continues to advocate for mineworkers' rights and engages in discussions with government officials, journalists and other influential member of society. GRAVIS submits legal cases and petitions for the enforcement of existing national and state legislation protecting mineworkers, and closely documents the health and general status of the mining communities in Rajasthan. GRAVIS also conduct research on the causes and impacts of various lung conditions. GRAVIS seeks to spread knowledge and awareness about the issues of mineworkers' rights, poor health, and risk of silicosis, and makes publications available to the public.

2. The premise and design of study

GRAVIS has been working for the causes of mineworkers and their occupational health issues over the last 20 years. Effort have been made to get in-depth understanding of Silicosis and other health issues of mineworkers, and to find way forward to protect mine worker from the life threatening consequences of Silicosis .

Over the years GRAVIS has done extensive work on collecting data, surveying mining areas in the context of Silicosis and in the process several major study documents have been produced by us. At the same time the ground work on generating awareness on the disease and exploring prevention methods has continued. As a result of these efforts of GRAVIS, substantial progress on Silicosis prevention and control has been made. This study is an effort to understand the progress made and to look at future of Silicosis prevention in the Thar Desert.

As a progressive and incurable disease, GRAVIS now wishes to look at methods of prevention of silicosis as a movement towards elimination. In order to understand the factors affecting silicosis rates, it is important to analyse the social, economic and policy-related decisions between all stakeholders of silicosis control in Rajasthan.

The study aims to achieve a greater understanding of these factors in order to take measures to control silicosis in the Thar Desert. Areas of study are on the current effectiveness and potential effectiveness of: policy, exposure reduction technology, awareness, education, unionization and healthcare.

PARTICIPANTS

The study has looked at the opinions/views of the following:

Mine owners

To understand mine owners opinions on health threats, safety arrangements made and what should be future priorities. A questionnaire took the views of 100 mine workers.

Mine workers

The most important participants in the study were mineworkers. Their views on existing issues regarding silicosis, changes made in recent years and what should be the focus of prevention in future were recorded. A total of 198 mineworkers were served through a questionnaire.

Physicians and health workers

To get the medical perspectives, 4 physicians from the local areas interviewed. In addition, 12 health workers were talked to through two focus group discussions (FGDs).

STUDY PHASES

The study was organized through following phases:

- Conceptualization and developing a framework
- Literature review
- Data collection – survey, interviews and FGDs
- Data entry and analysis
- Syntheses of findings
- Writing of the report

3. The findings

Questionnaires recorded the views of mineworkers and mine owners. The questionnaires were developed in consultation with GRAVIS field team and with important inputs from the mining communities. A wide range of aspects were included in the questionnaires including casts, socio-economic status, health issues, knowledge of silicosis, available services and insights on future of silicosis prevention.

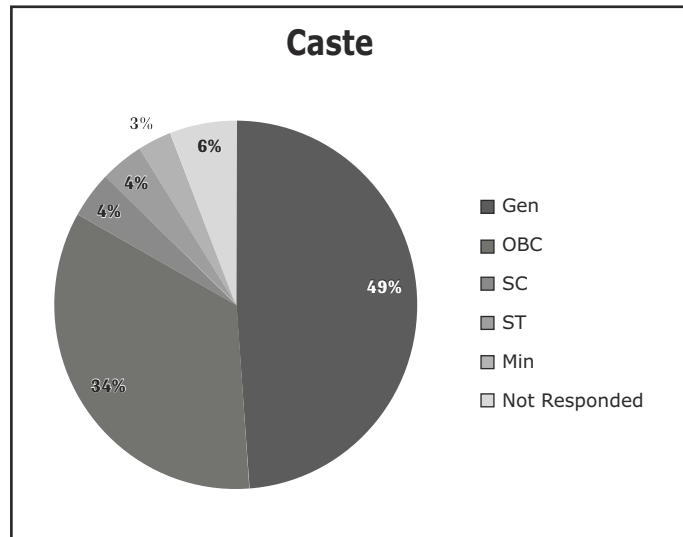


Figure 1

A total of 198 mineworkers and 100 mine owners were surveyed. Major findings of these surveys are presented in this chapter.

According to the survey (Figure 1), 49% of the mine workers come from General Caste's category. 34% comes from Other Backward Castes (OBC). Smaller percentage comes from Scheduled Castes (SC) i.e. 4%, and 3% from Scheduled Tribes (ST). Percentage of not responded is 6%.

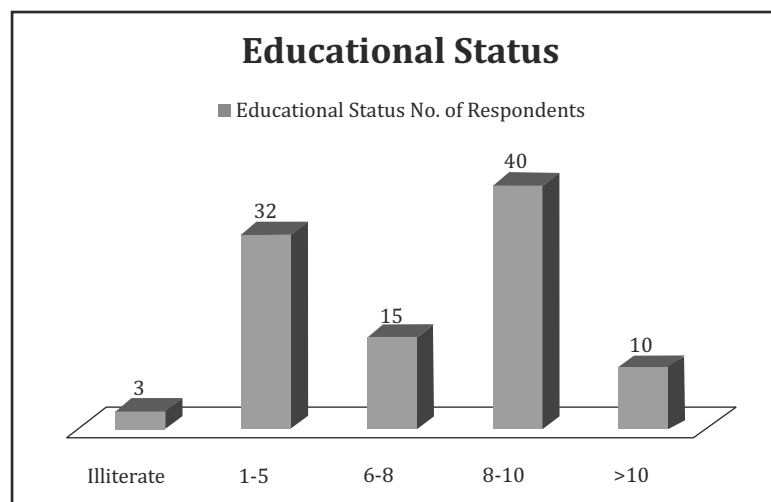


Figure 2

This figure (Figure 2) shows level of education in mineworkers. 3% of the mine workers are illiterate, 32% worker are educated up to grade 1- 5, 15% worker are educated up to grade 6-8, 40% worker are educated up to grade 8-10 and 10% worker are educated above grade 10th.

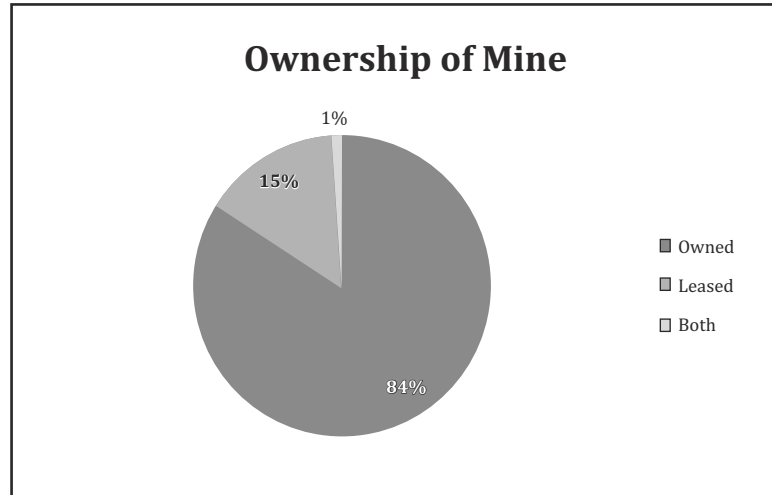


Figure 3

This diagram (Figure 3) shows the categories of mines ownership. 84% of respondents (mine owners) have own ownership. Leased percentage of mine is 15%. Only 1% has both categories.

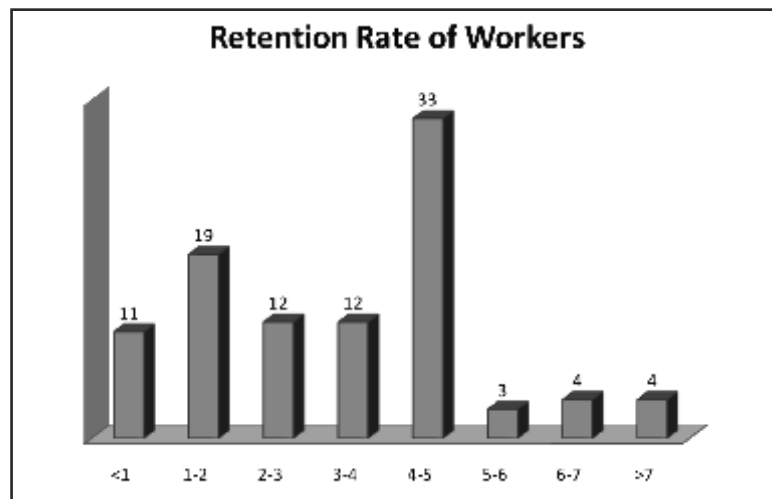


Figure 4

This graph (Figure 4) shows the retention rate of workers in years in a mine. 11% of the worker works below 1 year, 19% worker works between 1-2 years, 12% worker works 2-3 years, 12% worker work between 3-4 years, 33% worker work between 4-5 years, 3% worker works between 5-6 years, 4% worker works between 6-7 years and 4% worker work above 7 years.

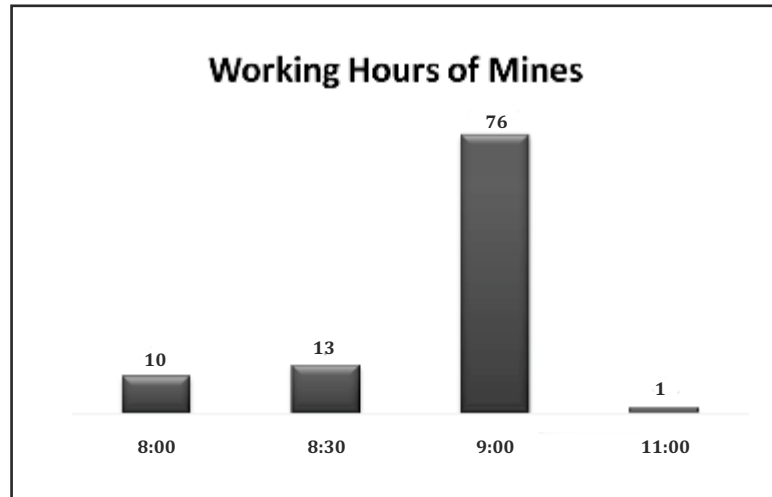


Figure 5

This graph (Figure 5) shows the working hour of mine workers. The range reported in from 8 hours to 11 hours in a day with most miners working 9 hours in a day.

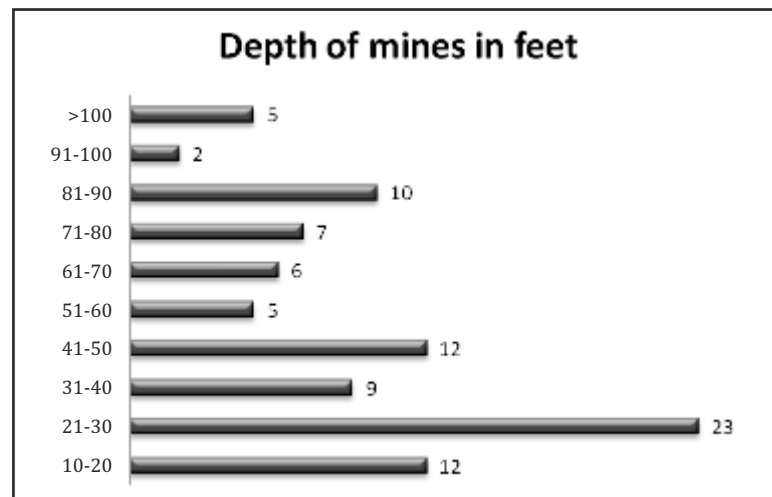


Figure 6

The graph (Figure 6) shows the depth of mines where mineworkers work. The range reported in 10 to 100 feet. 44% work at a depth level of 21 to 50 feet.

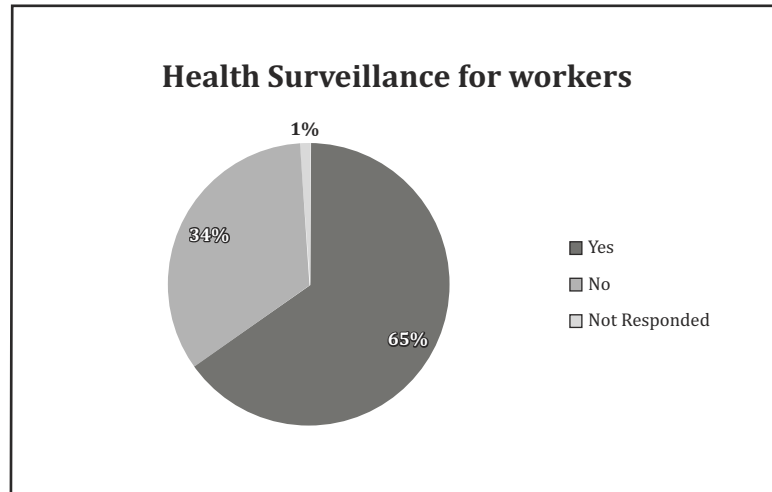


Figure 7

About 65% (Figure 7) of mine worker go for a health check up, which is quite positive. 34% of workers do not go for a checkup.

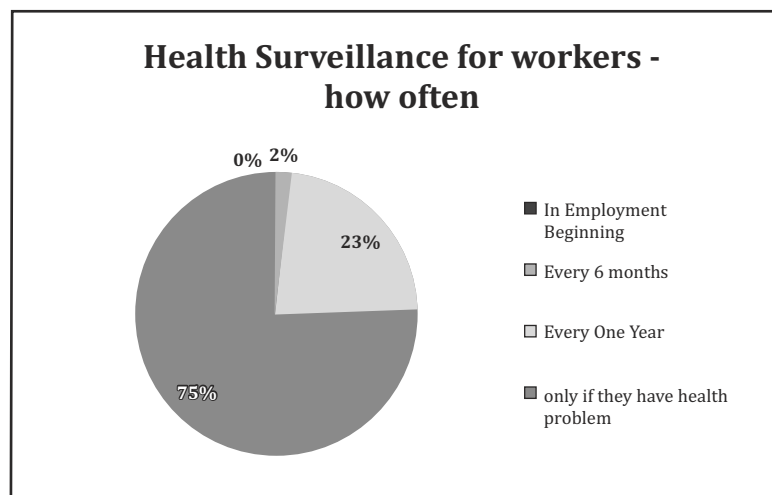


Figure 8

This figure (Figure 8) shows how often mine workers go for a health check up. 75% of worker report of going for health checks only if they have a health problem. 23% of workers go for their checkup every year.

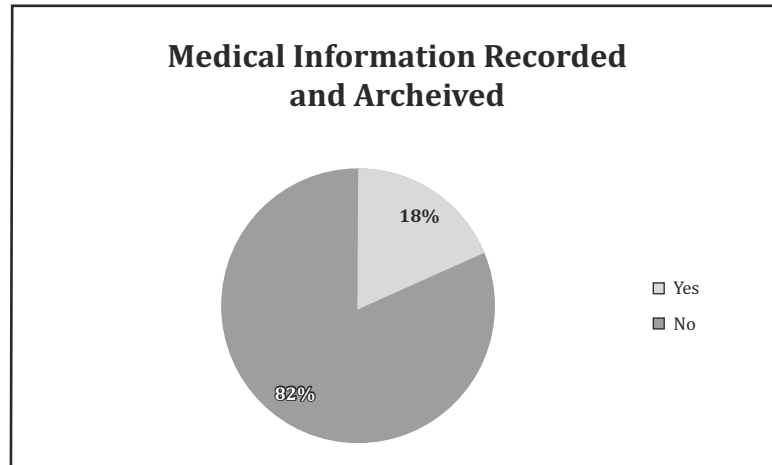


Figure 9

Only 18% (Figure 9) mine workers reported that they save their medical records and health check information/results.

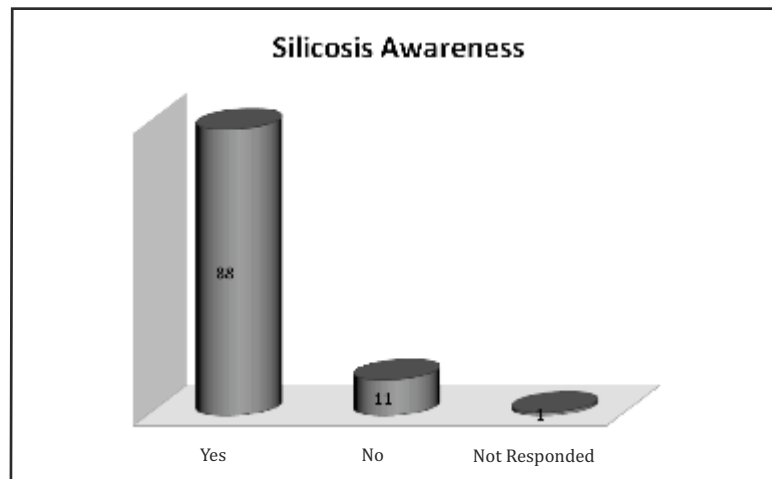


Figure 10

88% mine workers (Figure 10) report that they are aware of silicosis. This is a significant progress due to ongoing educational efforts.

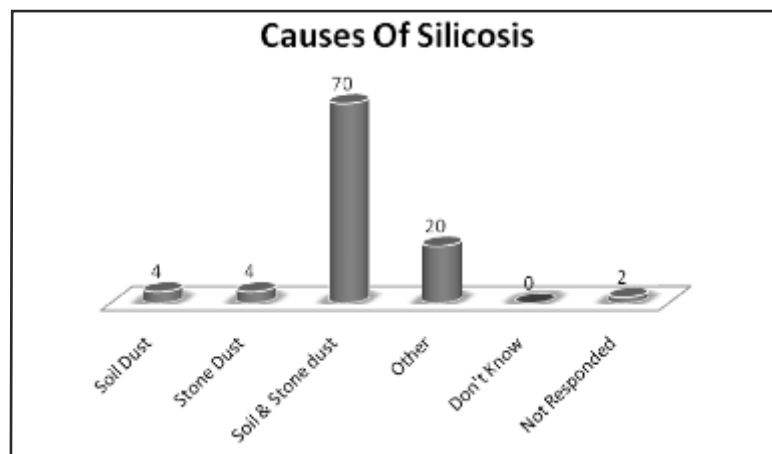


Figure 11

Majority of mineworkers understand the origin of silicosis well. About 78% (Figure 11) relate it to soil and stone dust. About 20% are not clear on how silicosis develops.

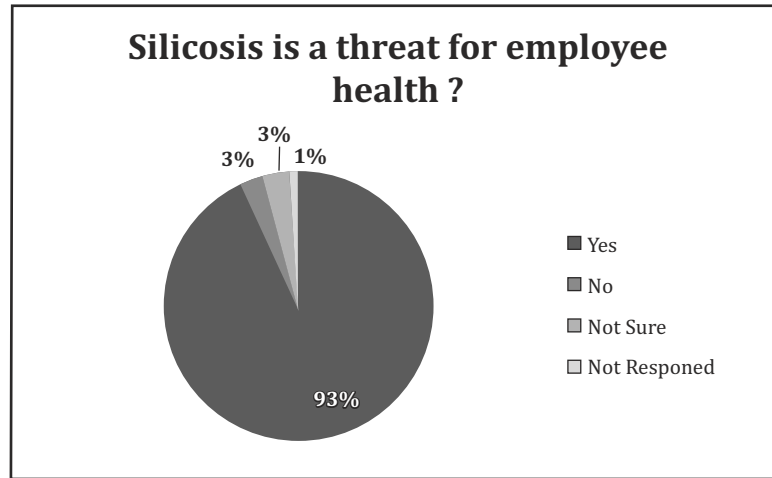


Figure 12

Mine owners realize silicosis as threat (Figure 12) for mineworkers' health. 93 % agreed.

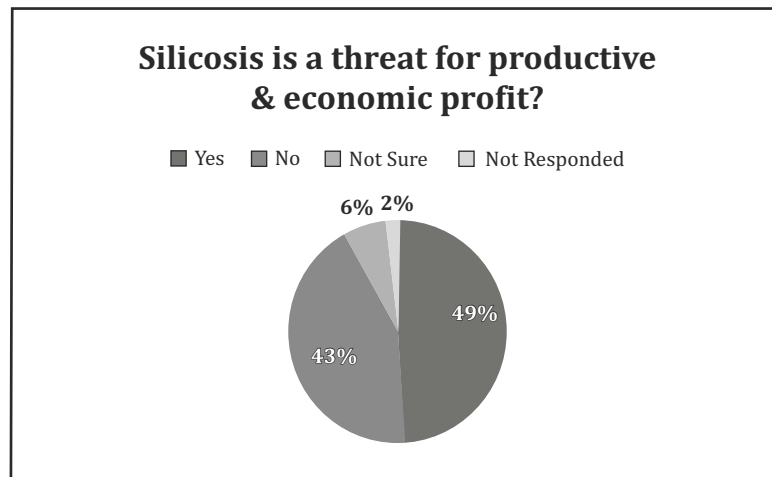


Figure 13

There is a different picture (Figure 13) on mine owners recognizing silicosis as a major productive and economic profit threat. 49 % agree and 43% think otherwise.

About 30% (Figure 14) mineworkers suffering with silicosis but still working have been provided with masks. Negligible percentages have been provided finance for medical support or medical support.

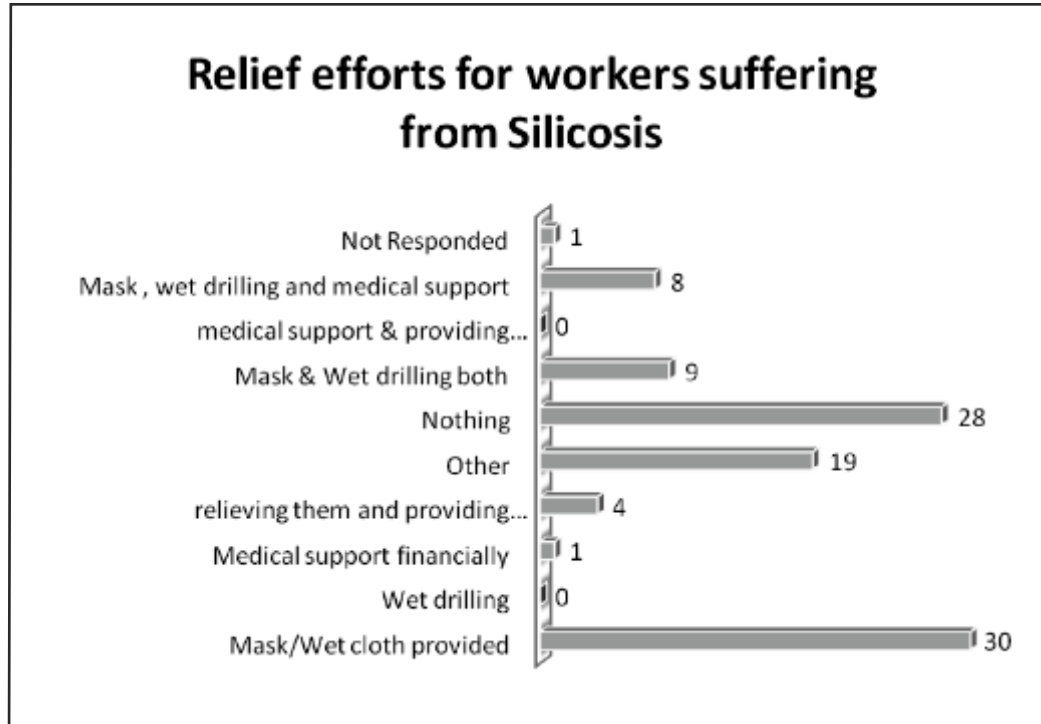


Figure 14

87% (Figure 15) mineworkers report that they have been paid no compensation by mine owners or the government after being impacted by silicosis.

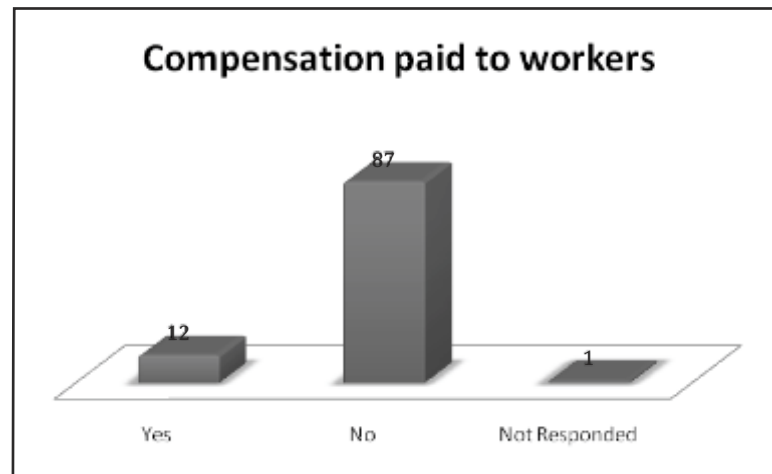


Figure 15

48% (Figure 16) reported of being aware of the national guidelines of silicosis elimination, which is a good number. 51% said no.

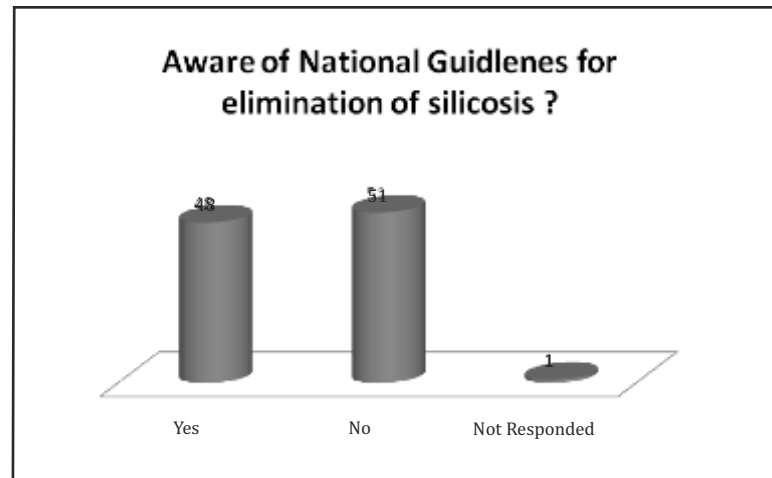


Figure 16

29% (Figure 17) owners report that they do provide masks to workers. 57% report that they do provide but mine workers do not use it.

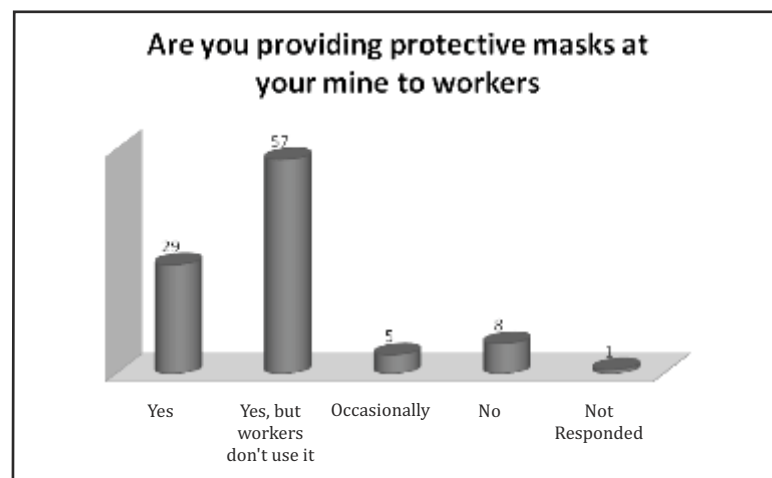


Figure 17

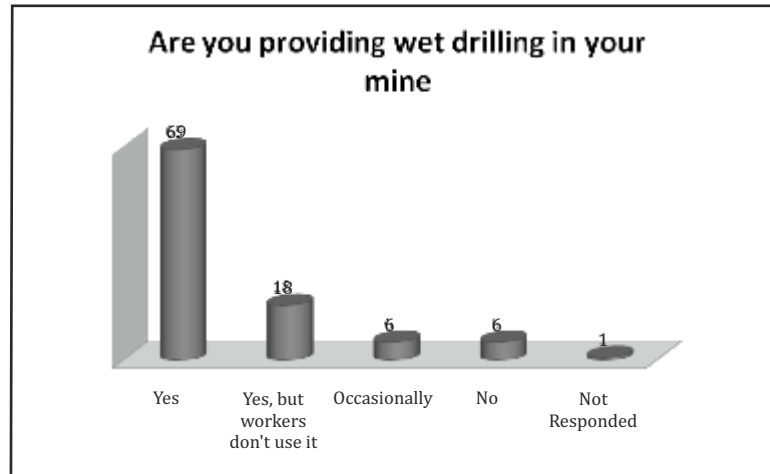


Figure 18

69% (Figure 18) mine owners reported that they are providing wet drilling in mines. This is a positive finding too, an important step towards preventing silicosis.

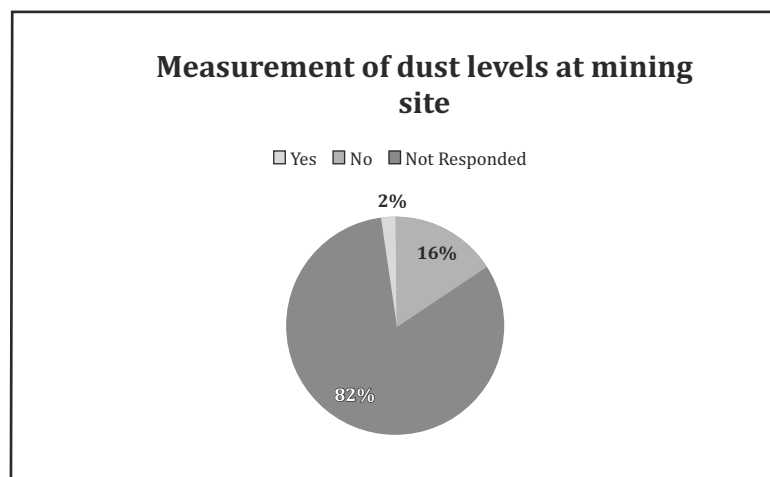


Figure 19

82% (Figure 19) mine owners reported that they have no arrangements for dust levels measurement in their mines. Most mines in that context are unsafe.

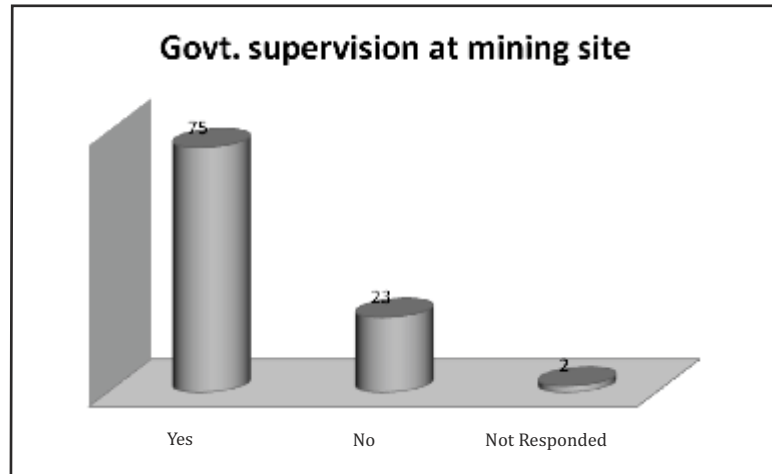


Figure 20

75% (Figure 20) owners report that they have some government supervision of their mines. This also is an increased and healthy percentage. The details of what kind of government supervision is given below in the next figure (Figure 21).

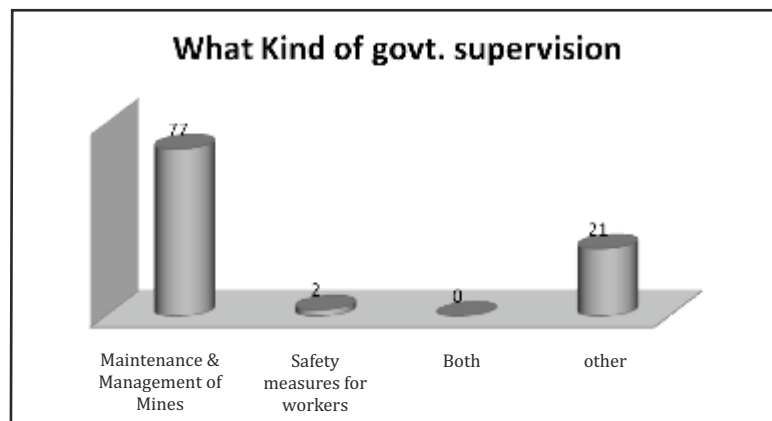


Figure 21

61% (Figure 22) owners have no insurances for their workers in the case of an accident. Only 36% have it.

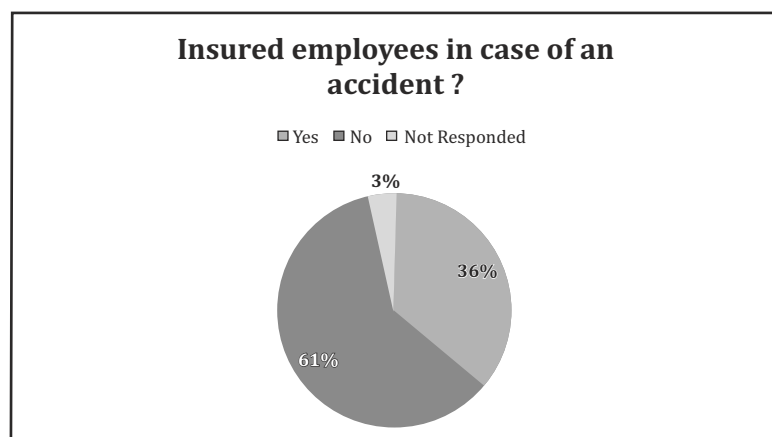


Figure 22

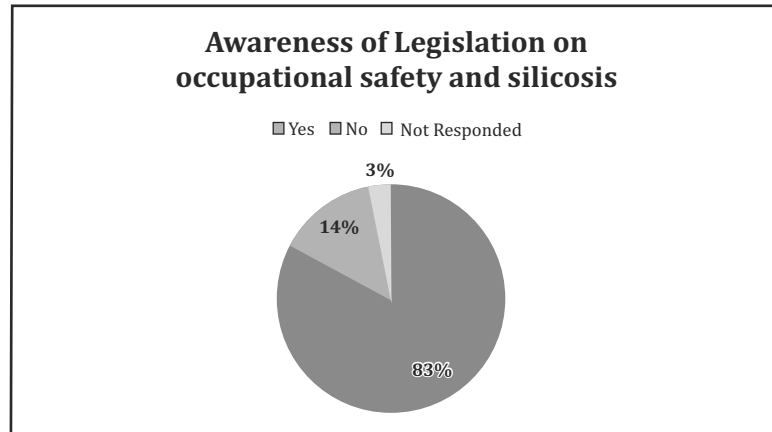


Figure 23

Here again (Figure 23), 83% mine workers say that they are aware of legislation on occupational safety and silicosis. This proves the positive value of educational work in mining areas over the years. The next figure (Figure 24) shows what laws mine workers are aware of.

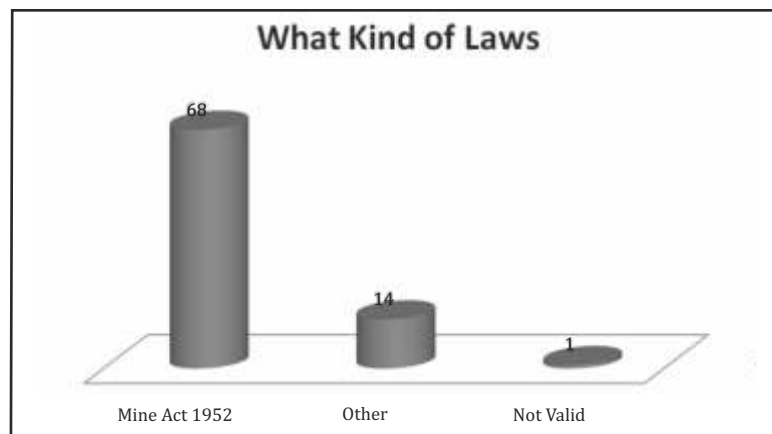


Figure 24

In the figure (Figure 25) below, mine owners views on what would they like to do for health safety in their mines are presented.

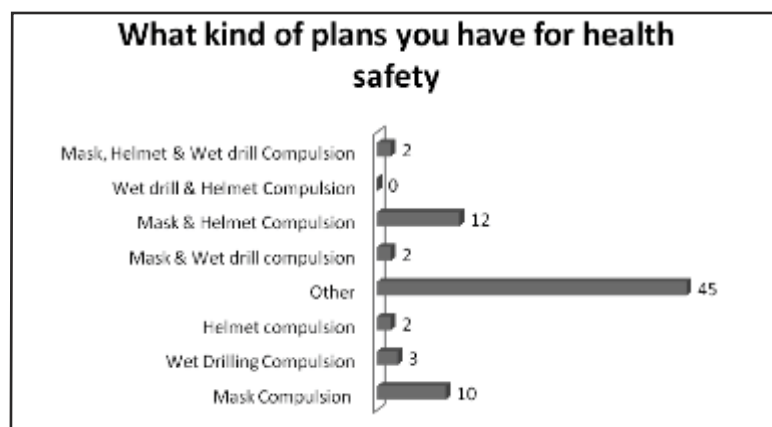


Figure 25

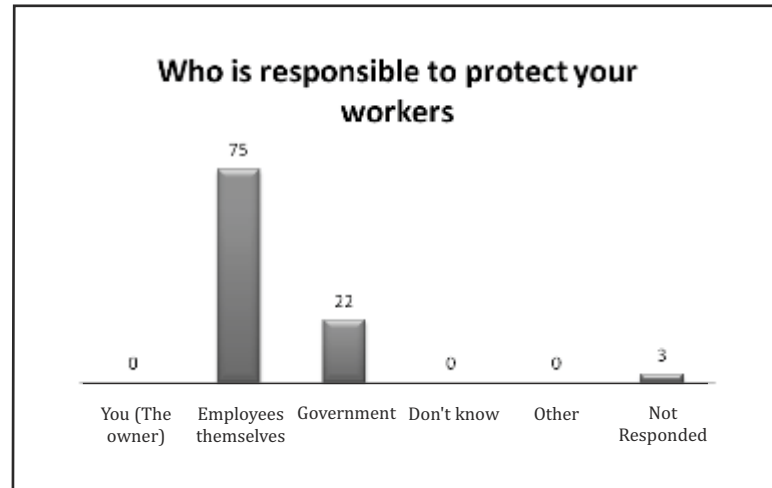


Figure 26

In a question related to who is responsible for workers health safety in the graph (Figure 26) above, 75% owners thought its mine workers' responsibility. 22% thought its government's job. None of the owners thought it's their responsibility.

SUMMARY OF DISCUSSIONS WITH PHYSICIANS AND HEALTH WORKERS

In order to understand the current status of Silicosis, interviews and discussions were organized with 4 physicians and 12 health workers from the Thar Desert region. Personal interviews and FGDs were organized for this purpose.

Following are the key observations of those discussions.

- Physicians agree that there was a lack of awareness on silicosis in health facilities in the past, which has improved gradually over the years through training and capacity building activities.
- It was suggested that more cases of both silicosis and tuberculosis are being reported in government clinics and hospitals in the last 3 to 4 years.
- Physicians feel that there is need of providing more training to them and their health staff to improve their skills on diagnosis and managing silicosis, as well as to enhance the understanding on silicosis elimination guidelines.
- According to Physicians the differential diagnosis between TB and silicosis, and treating patients with both TB and silicosis are very challenging.

- Diagnostic facilities to address silicosis are poor and outdated in many government health facilities.
- The health workers confirm that their knowledge on silicosis has increase significantly over the years because of trainings.
- Health workers feel that their work is very important to educate mineworkers on silicosis, and is well received.
- Health workers also realize a need of more training and capacity building in the forms of refresher programmes.
- Health workers are keen to work with government health staff and owners to act further on silicosis prevention and control.

4. Analysis of findings

Literature review, the feedbacks from the questionnaires responded to by mine workers and mine owners and discussions with health personnel including physicians and health workers provided a detailed picture of the current silicosis status in the Thar Desert. It is pleasing to note that on many aspects, substantial amount of success has been made. Here, the findings have been summarized as key learning.

OVERALL STATUS OF MINEWORKERS AND MINES

The study shows that over 50% of workers working in mines come from the lower economic sections of Indian society emphasizing the link between poverty and mining. While only 3% of mineworkers illiterate, about 32% are educated only up to grade 5. Only 10% of workers have completed high school, grade 10th. Poor literacy among workers has been another significant challenge in spreading health awareness.

The working conditions are still challenging in mines. More than 76% workers have to work for more than 9 hours in day. 44% workers going underground have to work in pits with a depth range of 21 to 50 feet. The retention rate of workers in a mine is usually good. About 44% workers stay in the same mine for 4 years or more.

In terms of ownership on mines, 84% mines belong to owners (i. e. – their own lands). About 15% are leased mines.

AWARENESS ON SILICOSIS

In 1994, when GRAVIS took up silicosis prevention and control as a campaign, the awareness levels on silicosis among mine workers and mine owners were very low. A large number of people always took silicosis as tuberculosis because of the similarity between the two diseases. In initial periods of awareness generation by GRAVIS, silicosis got the common nickname by communities – “the stone disease”.

The study suggests that 88% mineworkers surveyed understand what silicosis is about. Further, 78% workers have the understanding of silicosis' origin and relate it to dust from stones and/or soil. In the same vein, mine owners have also got better understanding of silicosis and its impact on their business. 93% mine owners agree that silicosis has serious health consequences on mine workers. On the question related to whether silicosis is a major threat to owners' productivity and profits, there is a lesser of an agreement. 49% think so. However, this too, is positive progress. This awareness generation on silicosis is crucial and must continue in order to prevent and control silicosis.

48% workers say that they are aware of the national guidelines on silicosis elimination. Further, 83% mine workers say that they are aware of legislation on occupational safety and silicosis. The awareness on government regulations on controlling silicosis among workers has certainly been raised to a significant extent.

HEALTH SEEKING BEHAVIOURS IN MINEWORKERS

Low levels of awareness on health issues including silicosis and lack of health care facilities in mining settlements have been resulting into a poor health seeking behavior among mine workers in the Thar Desert. Our previous studies have clearly suggested that health seeking behaviors need to improve through a number of interventions. The current study notes a positive movement in health seeking behaviors aspect too, which is promising.

About 65% mine workers go for a health check up to the nearest health facilities. 75% report that they go to get health check up in case of a health problem, and 23% have started going for a routine check up once in a year without any health issues. These are significant numbers pointing at a health seeking behavior change due to years of health education and awareness generation among mine workers.

Only 18% mineworkers report that they save the records/findings of their health checkups. This is a crucial gap, often resulting into misdiagnosis, ineffective treatment and unnecessary expenditures on tests that have been done in the past.

WHAT IS BEING DONE TO PREVENT SILICOSIS AND TO SUPPORT WORKERS WITH SILICOSIS

Efforts on education, training and capacity building, as well as advocacy on mine workers health safety over the years have led to new beginnings in the context of preventing silicosis and providing aid/support to mineworkers suffering with this incurable disease. Both mine owners and government authorities have taken initiatives.

According to the study, 29% owners are providing respiratory masks to workers and they are using the masks. 57% say that they have been giving masks but the workers do not use them. 69% owners confirm that they are wetting the rocks before drilling to prevent dust being airborne in the mines. About 36% say that they have insurance in place for their workers in the cases of accidents and injuries.

According to owners, government officials are visiting mines more regularly and with interest. 75% confirm that there mines are being visited regularly. Over 70%, however, say that the visits are mainly focused on management of mines. Only 2 % say that the health safety measures are checked during these visits.

A vast majority of workers with silicosis have not been given any financial aid and are deprived of palliative medical care. 87% workers with silicosis have not been paid any compensation. 12% have been paid, which is small but is a positive beginning.

VIEWS OF HEALTH PERSONNEL

Discussions organized with physicians and health workers reveal that progress has been made on recognizing silicosis as a major health threat. Physicians agree that they and their health facilities are now more aware of silicosis. More workers with silicosis and TB are coming to government health

posts and hospitals for diagnosis management. There is also an opinion that trainings on health personnel's level on silicosis should continue and should include more technical knowledge and insights on national policies and programmes.

Health workers are keen to play their roles in silicosis prevention and control. Their knowledge and understanding on the disease have enhanced significantly and they wish to do more collaborative work with the government and with owners. There is a gross lack of equipment to address silicosis in many government health facilities in remote mining areas, which needs to be addressed.

VIEWS ON FUTURE

An important part of the study was to understand how different stakeholders view the future focus of silicosis prevention and control. This would then lay a foundation of developing a future plan to address a health issue which is far from being eliminated in the Thar Desert.

Somewhat discouraging was to know that one of owners surveyed felt that preventing silicosis is their direct responsibility. This remains to be a serious challenge. While some owners want to focus on masks and other protective equipment like helmets. Many are still quite unclear about their safety plans.

From a physicians and health workers' perspective, there is a strong need felt on more training, continuity of capacity building and updating equipment in remote health facilities. More collaboration between health workers and government and owners is also a strong view forward.

5. Future Path

Over the last 20 years, considerable amount of progress has been made on preventing and controlling silicosis in the Thar Desert. Those efforts have been led by GRASVIS and have been in the forms of education and awareness generation, training and capacity building and advocacy and research. We assume that progress has been made in other parts of the county too, where silicosis is prevalent. As a major public health threat globally, silicosis must be eliminated and focused efforts on its prevention must continue.

Based on the progress made in Thar and from stakeholders' feedbacks through this study, following should be considered the key areas of focus.

AWARENESS GENERATION

Excellent progress has been made on this in Thar. Silicosis is now a known fact. Mine workers, owners and health personnel have got deeper understanding of silicosis. The awareness generation interventions must continue in Thar to cover unreached mining areas and to address the needs of new mine workers joining mines. Similarly, the model of awareness generation must be replicated in other parts of the country where silicosis is a threat.

Village Health Workers have played a key role in this process of generating awareness. Their roles must continue with more training support to them. The contents/materials for awareness generation must be constantly upgraded to keep them fresh and interesting.

TRAINING AND CAPACITY BUILDING

Both at community level, and the level of healthcare providers, trainings on silicosis prevention must be given stronger focus. While at the community level these trainings could focus on general details of the disease, at the level of health providers the trainings need to have technical details including facts on the disease and available policies and programmes.

Especially for physicians, advanced training courses on diagnosing and managing silicosis must be designed and organized. Their medical knowledge on the disease is a critical part of the future of silicosis prevention. Training contents for health workers should also be regularly examined and revised according to the need.

BETTER SUPERVISION OF MINES

It has been observed that the supervision of mines by the government has become more regular. But the focus by and large has been on the management aspects. There is a need of checking safety arrangements in a more careful and organized way. Constant advocacy on this aspect is required.

WET DRILLING AND RESPIRATORY MASKS

Wet drilling and respiratory masks are two most important aspects of preventing silicosis in mines. Some progress on this has been made but there is still a long way to go. Regular supervisions and a weekly check list must be introduced to ensure wet drilling and use of masks on a regular basis. There are many mining areas where GRAVIS has not been able to reach, and hence they need to be covered too.

COORDINATION

More efforts need to be made to ensure more effective coordination at three levels. One – between mine owners, government authorities and NGOs to improve the efficiency of supervisions. Two – between health workers, government health personnel and NGOs to strengthen the awareness generation and training interventions. And three – between basic health services and tertiary level healthcare services to improve healthcare delivery to mineworkers.

RESEARCH AND DATA COLLECTION

GRAVIS has done extensive amount of research on silicosis – the trends, the etiology, the clinical issues and management. This previous research has helped us in understanding silicosis in a better way and has been behind the positive progress made so far. More research covering new geographic areas will be helpful to expand and replicate the campaign. Another critical issue will be to strengthen the research capabilities by generating facilities and training human resources. GRAVIS envisions to set up a unique Occupational Health Research Center at the community level in the Thar Desert.

ADVOCACY TO CONTINUE

Advocacy interventions including dialogues with workers and owners, workshops on gathering stakeholders' perspectives and disseminating research findings and public events like rallies and street plays must continue and must expand in new areas. Advocacy results so far have been fruitful and have brought silicosis in the forefront of public health discussions in Thar and should continue collectively with active participation from the government, NGOs, workers, owners and other stakeholders from academia and media.

6. Concluding remarks

In early 1990s, silicosis was an unheard word in Thar. It was a mysterious disease for workers and owners. The medical personnel also had difficulties in understanding the presence of the disease due to lack of a practical exposure to the disease. Continuous efforts of GRAVIS and other organizations have ensured that silicosis is now a well understood fact. This awareness has resulted into mine workers beginning to protect themselves from this fatal disease.

Silicosis prevention as a campaign must continue. The focus should be on strengthening the campaign in Thar where it was born and then replicating it in other parts of India and sharing the knowledge with other parts of the world where silicosis is a reality. Awareness generation, training and capacity building, better supervision of mines, wet drilling and respiratory mask, coordination, research and data collection and advocacy are seven critical components that would keep the campaign alive.

Silicosis is preventable and the miseries of workers living with it and dying due to it are avoidable. Collective efforts on silicosis prevention could bring relief to millions of mine workers around the world. As a global public health issue, silicosis needs to be given adequate priority and attention.

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8. Acronyms

GDP - Gross Domestic Product.

COPD - Chronic Obstructive Pulmonary Disease.

TB – Tuberculosis.

BAL - Broncho Alveolar Lavage.

FGD - Focus Group Discussions.

OBC - Other Backward Castes.

SC - Scheduled Castes

ST- Scheduled Tribes.

HSE - Health and Safety Executive.

Gramin Vikas Vigyan Samiti (GRAVIS) or Center of People's Science for Rural Development is a non-governmental, voluntary organization that takes a Gandhian approach to rural development by working with the poor of the Thar Desert to enable them to help themselves. Since its inception in 1983. GRAVIS has worked with over 55,000 desert families across over 1,200 villages in Rajasthan reaching a population of over 1 million, and has established over 2,500 Community Based Organizations (CBOs). Through its dedicated field work, as well as its research and publications, GRAVIS has come to occupy a leading position amongst the voluntary organizations in the region.



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