

## Research Article

# Socio-economic and health status of sandstone miners: a case study of Sorya village, Karauli, Rajasthan

Absar Ahmad\*

Doctoral Student, International Institute for Population Sciences, Mumbai, Maharashtra, India

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**\*Correspondence:**

Mr. Absar Ahmad,

E-mail: r.absar.ahmad@gmail.com

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### ABSTRACT

**Background:** This study is carried out with aims to assess socio-economic and health status of the miners in Sorya Village of Karauli district of Rajasthan, India. Mining has always been among the most hazardous of occupations and rapidly increasing demand for metal and minerals to meet the demand for growing infrastructure has greatly increased the importance of mining. The quarrying and crushing are carried out in many parts of India and majority of stone mines are unorganized.

**Methods:** A cross sectional study was conducted among 126 miners in Sorya village, Karauli during 20 to 30 May 2014.

**Results:** Average ages of miner were 41 and average household sizes of the miners were six. Around 80 % miners addicted to substance abuse and spend average Rs. 17 daily. Average monthly incomes of them were Rs. 3200 and 39 % has miners are in debt of more than 1 lakh. One of the reasons of debt was father died in debt and carried forward to the children. Seventy-seven percent of miners belong to lower caste and rest of them belongs to other backward class. Average BMI of miners was 19.7 kg/m<sup>2</sup> and 38% miner were malnourished (BMI <18.5 kg/m<sup>2</sup>). Health problem reported by most of them were TB, silicosis, chest pain, back pain, Cough and Musculoskeletal disorder. Some of miners reported about low vision and hearing loss too.

**Conclusion:** From the study, it can be concluded that one reason for miner's indebtedness is father carry forward. Sandstone mining leads to Silicosis, TB and body pain and musculoskeletal disorder. Large sample size studies will give a clearer picture that will helpful in policy implication for more than 2.5 million miners in Rajasthan, India.

**Keywords:** Karauli, Sandstone Mine, Silicosis, TB

### INTRODUCTION

Sandstone is one of the most common types of sedimentary rock and is found in sedimentary basins throughout the world<sup>1</sup> and India have an aerial extent of about 1.79 million sq. km.<sup>2</sup> The sandstone is composed of mineral, rock, and organic materials with varying percentage. Mineral part in sandstone is usually quartz. The quartz content of these sands can be - up to 90% or more. It is a chemical compound consisting of one part silicon and two parts oxygen called silicon dioxide

(SiO<sub>2</sub>). It is the most abundant mineral found in Earth's surface with varying colors of white, gray, purple, yellow, brown, black, pink, green and red.<sup>1</sup>

Rapidly increasing demand for metal and minerals to meet the demand for growing infrastructure has greatly increased the importance of mining. Sandstone is one of those material used in roofing, flooring, paving, paneling, beams, pillars, arches, doors and window sills, wall facing, fence posts, milestones, etc. It is especially useful for exterior cladding in sea shore buildings due to acid &

thermal resistant properties. As such the effect of saline winds is negligible on sandstone. It is also suitable for use in chemical industries as flooring, wall fixing & lining due to its acid and alkali resistant properties. It is also suitable for carving and making windows and jallis. The sandstone is being quarried and used from centuries and a number of historical buildings and monuments such as Buddhist Stupas of Sarnath, Red Fort, Sansad Bhawan, Rashtrapati Bhawan, and National Museum, Delhi; Chhitar Palace, Jodhpur, etc. are made of sandstone.<sup>3</sup> Rajasthan is producing about 90% of sandstone<sup>4</sup> and because of its regular bedding, uniform grain size, suitable nature and durability, has been used extensively not only in Rajasthan but also in Northern India and even exported to Canada, Japan, and Middle East countries.<sup>3</sup> Karauli is one of the district in Rajasthan where vast deposits of sandstone that contain 96% of SiO<sub>2</sub>.<sup>3</sup> Sandstone mining in Rajasthan is small-scale mining that includes enterprises or individuals that employ workers for mining,<sup>5</sup> and workers work with hand tools.<sup>6</sup>

Mining has always been among the most hazardous of occupations.<sup>7</sup> The Second National Commission on Labour highlighted that the working conditions in mines was dangerous and full of hazards. Workers are exposed to serious health risks that affect their longevity. The most serious health risks are silicosis, pneumoconiosis and tuberculosis that miners get affected because of lack of onsite and offsite care of protection.<sup>8</sup> Stone quarrying and crushing operations give rise to large amount of fine dust containing free silica in the range of 20-70%<sup>9</sup> Inhaling finely divided crystalline silica dust can lead to silicosis, bronchitis, or cancer, as the dust becomes

lodged in the lungs and continuously irritates them, reducing lung capacities.<sup>10,11</sup>

The National Institute of Miner's Health conducted a study of silicosis among stone workers from Karauli district in 2011. The study reported evidence of silicosis in 73 of 93 workers who were examined and had a history of working in mines.<sup>12</sup> In the second round of study among 298 miners 149 had evidence of silicosis.<sup>13</sup> Apart from Silicosis, accidents in Mines are too rampant and due to this loss of limbs occurring when workers operate without safety. In India, about 20 percent of the deaths had been caused by falling objects on the site.<sup>14</sup>

The Rajasthan Environment and Health Administration Board in its 6th meeting held on 30.05.2013 under the chairmanship of Principal Secretary (Finance), has decided exgratia payment of Rs. 1.00 lakh for silicosis affected person and Rs. 3.00 lakhs for family of the person died of silicosis to be paid from Rajasthan Environment and Health Administrative Board (REHAB) that collects a mining cess.<sup>13</sup>

Table 1 represents the official figure of employment and mining leases. Nevertheless, People in Karauli district about 15 to 20% dependent on stone mining for their livelihood. There is a general lack of education and awareness about occupational diseases among workers, employers and even local medical practitioners. It is not uncommon that most cases of silicosis are treated with anti-tubercular drugs without many responses as pulmonary tuberculosis is rampant in the area.<sup>13</sup>

**Table 1: Number of leases, area, production, sale value, revenue and employment of Sandstone, Rajasthan.**

	Leases	Area	Production	Sale Value	Revenue	Employment
<b>Rajasthan</b>						
Years	(No.)	(in Hectors)	( Lac'Tons)	(Crore 'Rs.)	(Lac 'Rs.)	(Nos.)
	1280	12408.42	163.81	738.75	13524.69	76573
2012-13	1276	12210.680	325.13	1799.33	13709.55	70742
2013-14	Leases	Area	Production	Sale Value	Revenue	Employment
<b>Karauli</b>						
	Leases	Area	Production	Sale Value	Revenue	Employment
	(No.)	(in Hectors)	(Tons)	(')	(')	(Nos.)
2012-13	146	6441.81	845158	321160040	120354000	15400
2013-14	140	6176.0588	1074203	537101500	125934000	20000
Source: <a href="http://www.dmg-raj.org/sandstone.html">http://www.dmg-raj.org/sandstone.html</a>						

## METHODS

### Profile of study area

Sorya village located in Karauli Tehsil of Karauli district, Rajasthan located at a distance of 160 km from pink city Jaipur. Maximum temperature reaches 47°C in summers

and minimum 4°C in winters. Literacy rate of village was 60.68% compared to 66.11% of Rajasthan. Male literacy stands at 78.09% while female literacy was 40.50%. Most of the villagers are from Schedule Caste (SC) constitutes 62.88% while Schedule Tribe (ST) were 5.17%.<sup>15</sup> Main occupations of the villagers are mining and mines are located 1 km from the village (Table 2). There are one

primary school and one Anganwadi center (AWC) placed in the village. Source of water is government pipeline that store in the tank. Karauli town is about 8 km from the village and frequent Auto/Jeep services are available.

**Table 2: Village profile (Composed from villagers).**

Village profile (Composed from villagers)	
Total Households	200
Primary school	0
Middle school	1
High School	0
Private school	0
Main occupation <sup>#</sup>	Mining
Major Caste <sup>##</sup>	Jattaw (SC), Gurjar (OBC)
Anganwadi	1
Sub Center	No
Primary health center	No
Mining available near village	Yes
Distance from town	8 km
Water facility <sup>@</sup>	Government tap
Sanitation	No
Bus stand	No
Bear shop	Yes
Post office	0

#### Data and methodology

The present cross-sectional and descriptive study was carried out in Sorya village, Karauli during 20 to 30<sup>th</sup> May of 2014. It is one of sampled village of author Ph.D. Socio-economic and health status related information was collected from 126 mine workers. For measuring weight and height, weighing machine and measuring tape were used. During whole survey time author stayed in the same village. Data was analysed using IBM SPSS21, and data entry were done using EPI info 7.0.

#### RESULTS

The study comprised of 126 miners taken from the village (Table 3).

Sixty-six percent of them aged between 31 to 60 years and the mean age of miners were 4. Out of 126 miners, 77% belong to SC/ST category. Seventy percent reported monthly income less than Rs.3000. Twenty percent were income between Rs.3000-5000 and 9% were more than Rs. 5000. Ninety-nine percent said they were in debt. Thirty-nine percent were debt of more than 1 lakh. Twenty-three percent were reported less than Rs. 50000 and 36 percent were between 50000 - 1 lakh. Thirty-eight percent said they were debts carry forwarded by their father after the death. Forty-two percent miners were spending less than Rs. 10, 31% Rs. 11-50 and six percent more than Rs. 50 per day on substance uses.

**Table 3: Profile of mine workers, Sorya village, Karauli (N=126).**

Variables	N (%)
<b>Age</b>	
0-30	36 (28.6)
31-60	83 (65.9)
60+	7 (5.6)
<b>Mean ± SD</b>	40.98 ± 12.98
<b>Caste</b>	
SC/ST	97 (77.0)
OBC/General	29 (23.0)
<b>Income (monthly)</b>	
Less than 3000	88 (69.8)
3000-5000	27 (21.4)
5000+	11 (8.7)
<b>Loan</b>	
No loan	2 (1.6)
Less than 50000	29 (23.0)
50000-1 lakh	46 (36.5)
1 lakh+	49 (38.9)
<b>Father carry forward loan</b>	
No	88 (69.8)
Yes	38 (30.2)
<b>Expenditure on substance use/day</b>	
No	26 (20.6)
Less than 10	53 (42.1)
Nov-50	39 (31.0)
50+	8 (6.3)
<b>Average household size</b>	5.6

**Table 4: Association of BMI with miner's age.**

BMI/Age group	30 and less	31-60	60+	N
Severe malnutrition (<15.9 kg/m <sup>2</sup> )	2 (25.0)	4 (50%)	2 (25%)	8
Moderate malnutrition (16.0-16.9 kg/m <sup>2</sup> )	2 (14.3%)	11 (78.6%)	1 (7.1%)	14
Mild Malnutrition (17.0-18.4 kg/m <sup>2</sup> )	3 (11.1%)	22 (81.5%)	2 (7.4%)	27
Normal (18.5-24.9 kg/m <sup>2</sup> )	26 (38.8%)	39 (58.2%)	2 (3.0%)	67
Over weight (25+ kg/m <sup>2</sup> )	3 (30%)	7 (70%)	0	10
'P' value, $\chi^2$ , df	0.047, 15.67, 8			

Table 4 represents the association of Body Mass Index (BMI) with miners age group. Mean BMI were 19.7 kg/m<sup>2</sup>. Thirty-eight percent miners were malnourished. Among them, 6%, 11%, and 21% respectively had severe, moderate and mild malnutrition. Four severely malnourished miner, 11 moderate and 22 mild malnourished belong to 31-60 age groups. This finding was found to be statistically significant at 5% level of significance. Risk factor of silicosis/TB among miner were significantly higher for malnourished with Hazard

ratio 5.61 (95% CI 1.87, 16.78) (Table 6). Hazard ratio for not substance use is lower, but it's not shows significant.

Table 5 represents the health status of the mine worker. Out of 126 miners, 23 had reported disease of TB or silicosis. Among them, twelve reported of TB and 11 silicosis. Chest pain and cough were the most common health problem.

Musculoskeletal disorders were reported among mine workers due to manual work and wrong posture of work. Back pains were reported by one-fourth of the mine worker, and twelve miners reported joint pain. Due to dusty workplace respiratory symptom is common.

Fifty-five were regular cough; 60 were reported of chest pain and 22 were severe shortness of breath. These are symptoms of TB and silicosis. Eight miners reported about low vision, and six of them reported hearing loss.

**Table 5: Health problem reported by miners in Sorya village, Karauli.**

N=126	
<b>Disease</b>	
TB	12
Silicosis	11
<b>Musculoskeletal disorder</b>	
Joint Pain	12
Back pain	31
<b>Respiratory problem</b>	
Cough	55
Chest pain	60
Shortness of breadth	22
<b>Low vision</b>	8
<b>Hearing loss</b>	6
<b>Accident at work place</b>	17
<b>Blood in stool</b>	1
<b>Skin infection</b>	2

Accident at workplace is also prevalent at the mining area. Thirteen percent reported they were had accident at the workplace. Only two reported of skin infection, and one was reported for blood in the stool. Seventeen miners of this village have diagnosed for silicosis by NIMH and seven of them received one lakh as ex gratia from government.<sup>10,11</sup>

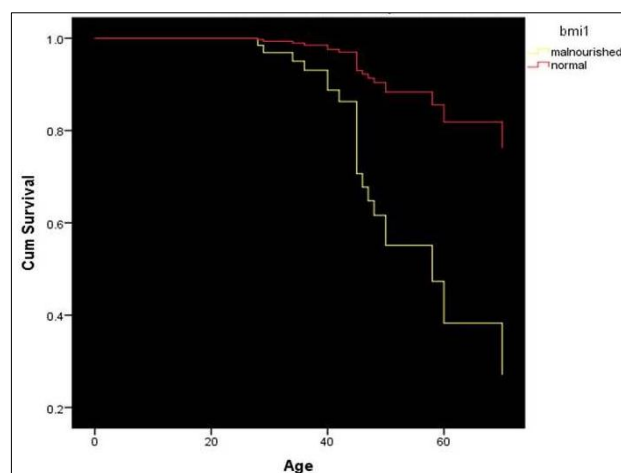
**Table 6: Cox proportional hazard model of risk factor for silicosis/TB among mine workers in Sorya village.**

	B	SE	Sig.	H.R.	95.0% CI	
					Lower	Upper
Malnourished	1.725	0.559	0.002	5.614	1.878	16.785
No substance use	-0.54	0.519	0.298	0.583	0.211	1.612

## DISCUSSION

Present study finding suggested that most of miner were SC/ST. This finding confirmed by Yadav<sup>16</sup> and MLPC<sup>17</sup> too. Seventy percent of miner monthly incomes were less than Rs. 3000. Yadav<sup>16</sup> too proved 89% sandstone mine workers in Jodhpur get less than Rs. 3000. Substance use or personal habits were very common in mine workers. Present study finding suggested that 80% were addicted to it. Yadav<sup>16</sup> and Ahmad<sup>18</sup> found substance use were common among Jodhpur sandstone miners. Thirty-eight percent miners reported they had debts that carry forwarded by their father. This finding justified by Gunasekran<sup>19</sup> that floating and seasonal nature of the job among miner doesn't give sustained income or social security to them. Moreover, the wage was calculated on piece rate basis. Thus, those who were physically strong, particularly the workers in their teens and youth, could produce more pieces and thus earn the minimum wage or more. Finally, stone quarrying involves physically taxing and hazardous work, which soon starts affecting the health of a worker. Between the ages of 35 and 40, symptoms of tuberculosis and Silicosis started.<sup>12,13</sup> Medical expenses on these diseases took them into indebtedness.<sup>20</sup>

Present study finds the association between TB/Silicosis and Malnutrition. Association between TB and malnutrition is well recognised; TB can lead to malnutrition and malnutrition may predispose to TB.<sup>21</sup> Figure 1 shows survival curve of mine workers for onset of TB/Silicosis by BMI. It clearly shows that onset of TB or Silicosis among malnourished mine workers started just after age 20. TB is also associated with various socioeconomic factors and often occurs in populations suffering from poverty, poor housing, and economic deprivation and these are also major factors predisposing to poor nutritional status and impaired immune function.<sup>22</sup>



**Figure 1: Shows survival curve of mine workers for onset of TB/Silicosis by BMI.**

Musculoskeletal disorders were reported in this study. Low Back Pain (LBP) is ranked first as a cause of disability and inability to work and is expected to affect up to 90% of the world's population at some point in their lives.<sup>23</sup> Awkward postures, repetitive work or handling heavy loads are amongst the risk factors that may damage the bones, joints, muscles, tendons, ligaments, nerves and blood vessels, leading to fatigue, pain and musculoskeletal disorders.<sup>24</sup> Egwuonwu et al.<sup>25</sup> has done a study on estimates the risk patterns and prevalence of work-related musculoskeletal disorders among quarry workers in southeastern Nigerian community. A total of 114 mine workers were interviewed, and found prevalence of musculoskeletal disorders was 83%. Low back discomfort was most prevalent with 80%. Repetitive movements and years of working were significantly associated with the occurrence of symptoms. Task repetition was found to be the major risk factor for low back pain.

Respiratory problem is one of the major health hazards reported by the workers. A study has done among 403 stone crushing workers aged 10-60 years in Nigeria. A result shows that 47.6% had chest pain, 41% had occasional cough, 6.5% had occasional shortness of breath, and 5% had wheezing problem.<sup>26</sup> In Present study, 12 miners reported TB and 11 of them Silicosis too. The workers in mines, construction work, stone-crushing and other similar occupations are exposed to silica dust and are vulnerable to TB and Silicosis.<sup>27</sup> Present study finds eight miners reported about low vision and six of them reported hearing loss. Low vision might be because of dust<sup>28</sup> or sunlight<sup>29</sup> because miners were exposed to dust and sunlight during work. Worldwide, 16% of the disabling hearing loss in adults is attributed to occupational noise.<sup>30</sup> Noise level of the drill machine used in mining is more than 90 dBA of permissible limit. Worker working without any protective equipment could lead to temporary or permanent hearing loss. Therefore the workers either should be provided with ear plug or ear muff before going to the field or minimize the exposure time to the field.<sup>31</sup>

## CONCLUSION

From the study, it can be concluded that one of the reasons for miner's indebtedness is father carried forward to their son. Sandstone mining leads to Silicosis, TB, and musculoskeletal disorder. Large sample size studies will give a clearer picture that will helpful in policy implication for more than 2.5 million miners in Rajasthan, India.

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