**Sociodemographic Profile of Workers in the Mining Industry of Jodhpur District in Rajasthan, India**

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**Abstract**

**Introduction:** Mining industry has grown sharply to satisfy demands of metal and minerals for rising infrastructure. Mining is hazardous, although it is among major occupations in India involving huge work force. This study was conducted to assess sociodemographic profile of sandstone mine workers in Jodhpur and to identify their major social issues. **Material and Methods:** A cross-sectional study was conducted among mine workers of Jodhpur, Rajasthan. Data on socioeconomic status, and occupation of each family member were collected. Data were analyzed using Statistical Package for the Social Sciences (SPSS) software program, version 23.0. A value of \( P < 0.05 \) was considered as statistically significant. **Results:** A total of 1604 workers were enrolled in study. More than three fourth (78.7\%) of them were male. Their age ranged between 14 and 82 years with a mean age of 37.62 ± 12.30 years. Mean age of female workers was significantly higher than males. Average years of working for males were significantly higher than females. Majority were illiterate, proportion being higher in females. Approximately 13\% mine workers married before legal age. Approximately 2.68\% children under 14 years of age were involved in income generation activity. **Conclusion:** More than three fourth of workers were male. Mean age of female workers was significantly higher than males. Illiteracy, child marriage, and child labor were present among mine workers. **Strengths and Limitations:** Robust dataset, complete enumeration, large sample size.

**Keywords:** Females, health status disparities, mining, occupational health, silicosis

**INTRODUCTION**

Importance of mining has increased precipitously to provide for the demand of metal and minerals for the emerging infrastructure.\(^1\) Although mining is a dangerous occupation, it is among one of the major occupations in India involving huge work force which is going to grow in near future.\(^2\) Approximately 90\% sandstone in India is acquired from the land of the state of Rajasthan. There are approximately 30,000 mines in Rajasthan, in which more than 2.5 million people are employed. Miners are involved in various activities in mines that expose them to high levels of silica dust for prolonged periods of time.\(^1\)

Although there are studies carried out on mine workers in Jodhpur, they focused on disease aspects.\(^3\) It has been proved that mine workers, especially males, are usually exposed to silica since childhood, and die due to silicosis at quite early age.\(^4\)

This study was carried out with the aim to assess the sociodemographic profile of sandstone mine workers in Jodhpur and to identify their social issues.

**MATERIAL AND METHODS**

Descriptive cross-sectional study was conducted (April 2018 to March 2019) in Jodhpur district of Rajasthan. Study was carried out in the residential area of mine workers. Mine owners of all selected mines were contacted, explained about study and rapport was established. All the mine workers who were present during survey were included and

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informed consent taken. Semi-structured questionnaire was used which collected data on selected sociodemographic variables (age/gender/education status/marital status/age at marriage/occupation, etc.) of workers and his family members. Study was approved by Institutes Ethical Committee of All India Institute of Medical Sciences (AIIMS), Jodhpur. Data were analyzed using Statistical Package for the Social Sciences (SPSS) software program, version 23.0, appropriate tables and graphs were prepared, and inferences were drawn using Chi-square and t test. A value of $P < 0.05$ was considered statistically significant.

**RESULTS**

A total of 1604 mine workers were enrolled in study [Table 1]. More than three fourth 1263 (78.7%) of them were male. Age of mine workers was normally distributed [Supplementary Figure 1]. Mean age of female workers was significantly higher than mean age of male workers. Widowhood was significantly higher among female workers, whereas proportion of unmarried was significantly higher among males. In the study population 212 (13.22%) mine workers got married below the legal age of marriage (21 for male and 18 for female). Child marriage was significantly higher among females (85, 24.92%) compared to males (127, 10.05%). More than half of the mine workers were illiterate 856 (53.4%); illiteracy was significantly higher among females (294, 86.2%) compared to males (562, 44.5%).

It is evident from Table 2 that approximately two third 1003 (62.6%) of the workers were working for >10 years in mines. Average years of working for males were significantly higher than females. Mean age of entry into mines for male workers (20.33 ± 6.69) was significantly lower than female workers (24.59 ± 8.52). Workers started working in mines from 9 years of age to 62 years of age.

Table 3 depicts that 110 (6.9%) mine workers were living alone. As much as 124 (7.7%) workers were having only one family member in their house. It is evident from Supplementary Figures 2 and 3 that the other family member for majority (82.1%) of male workers was their wife followed by parents (8.4%), brother (4.2%), son/grandson (3.1%), and daughter (2.1%), whereas for most of the female workers (45%) the other family member was son/grandson followed by husband (38%), daughter (14%) and mother-in-law (3%). This average family size was significantly large for male workers (4.87 ± 1.93) as compared to female workers (4.23 ± 1.98). Approximately 40% of the mine workers were having at least one more family member as mine worker. Among family members of female mine workers 205 (68.10%) families had at least one member working as a mine worker which is significantly higher compared to family members of male mine workers 384 (32.20%) [Table 3].

Table 4 shows the age and sex distribution of family members of mine workers.

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**Table 1: Sociodemographic attributes of mine workers ($n=1604$)**

|                  | Male ($n=1263$) | Female ($n=341$) | Total | $P$       |
|------------------|-----------------|------------------|-------|----------|
| **Age (years)**  |                 |                  |       |          |
| <20              | 34              | 5                | 39    | 2.40     |
| 20-29            | 331             | 78               | 409   | 25.50    |
| 30-39            | 367             | 105              | 472   | 29.40    |
| 40-49            | 295             | 74               | 369   | 23.00    |
| 50-59            | 145             | 56               | 201   | 12.50    |
| ≥60              | 91              | 23               | 114   | 7.10     |
| **Mean age**     | 37.62±12.30     | 39.16±12.56      | 37.95±12.37 | 0.041 |
| **Age range**    | 68 (14-82)      | 57 (18-75)       | 68 (14-82) |          |
| **Marital status** |                |                  |       |          |
| Unmarried        | 66              | 3                | 69    | 4.30     |
| Married          | 1186            | 317              | 1503  | 93.70    |
| Widow            | 11              | 21               | 32    | 2.0      |
| **Married before legal age** |        |                  |       |          |
| Yes              | 127             | 85               | 212   | 13.22    |
| No               | 1136            | 256              | 1392  | 86.78    |
| **Educational status** |        |                  |       |          |
| Illiterate       | 562             | 294              | 856   | 53.40    |
| Pre-primary      | 161             | 15               | 176   | 11.00    |
| Primary          | 220             | 22               | 242   | 15.10    |
| Middle           | 200             | 8                | 208   | 13.00    |
| Secondary        | 75              | 1                | 76    | 4.70     |
| Higher secondary | 35              | 0                | 35    | 2.20     |
| Graduate and above | 10             | 1                | 11    | 0.70     |

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Table 2: Work-related attributes of mine workers (n=1604)

|                      | Male (n=1263) | Female (n=341) | Total | P     |
|----------------------|--------------|---------------|-------|-------|
|                      | n            | Percentage    | n     | Percentage |
| Years of working     |              |               |       |         |
| ≤5                   | 153          | 12.10         | 56    | 16.40   | 209 | 13.00% |
| 6-10                 | 279          | 22.10         | 113   | 33.10   | 392 | 24.40% |
| 11-15                | 234          | 18.50         | 37    | 16.70   | 291 | 18.10% |
| 16-20                | 249          | 19.70         | 56    | 16.40   | 305 | 19.00% |
| 21-25                | 130          | 10.30         | 16    | 4.70    | 146 | 9.10%  |
| 26-30                | 107          | 8.50          | 27    | 7.90    | 134 | 8.40%  |
| >30                  | 111          | 8.80          | 16    | 4.70    | 127 | 7.90%  |
| Mean years of working| 17.29±9.81   | 14.57±9.09    | 16.71±9.72 | <0.05 |
| Range of working years| 59 (1-60)   | 49 (1-50)    | 59 (1-60) | <0.05 |
| Age of entrant (years) |            |               |       |         |
| ≤10                  | 27           | 2.10          | 5     | 1.50    | 32  | 2.00%  |
| 11-15                | 276          | 21.90         | 43    | 12.60   | 319 | 19.90% |
| 16-20                | 511          | 40.50         | 81    | 23.80   | 592 | 36.90% |
| 21-25                | 246          | 19.50         | 89    | 26.10   | 335 | 20.90% |
| 26-30                | 112          | 8.90          | 54    | 15.80   | 166 | 10.30% |
| >30                  | 91           | 7.20          | 69    | 20.20   | 160 | 10.00% |
| Mean age of entrant  | 20.33±6.69   | 24.59±8.52    | 21.24±7.32 | <0.05 |
| Range of age of entrant | 46 (9-55) | 53 (9-62) | 53 (9-62) | <0.05 |

Table 3: Family attributes of mine workers according to gender distribution (n=1604)

|                      | Male (n=1263) | Female (n=341) | Total | P     |
|----------------------|--------------|---------------|-------|-------|
|                      | n            | Percentage    | n     | Percentage |
| Family size          |              |               |       |         |
| Single               | 70           | 5.50          | 40    | 11.70   | 110 | 6.90  |
| Two                  | 95           | 7.50          | 29    | 8.50    | 124 | 7.70  |
| Three                | 132          | 10.50         | 53    | 15.50   | 185 | 11.50 |
| Four                 | 210          | 16.60         | 63    | 18.50   | 273 | 17.00 |
| Five                 | 260          | 20.60         | 74    | 21.70   | 334 | 20.80 |
| More than five       | 496          | 39.30         | 82    | 24.00   | 578 | 36.00 |
| Mean family size     | 4.87±1.93    | 4.23±1.98     | 4.45±1.57 | <0.05 |
| Range of family size | 10 (1-11)    | 8 (1-9)       | 10 (1-11) | <0.05 |
| Number of mine workers among family members* | 809          | 67.80%        | 96    | 31.90%  | 905 | 60.60% |
| One                  | 293          | 24.60%        | 136   | 45.20%  | 429 | 28.70% |
| Two or more          | 91           | 7.60%         | 69    | 22.90%  | 160 | 10.70% |

*Proportion has been calculated out of those who were living with at least one family member

Table 4: Age and sex distribution of family members of mine workers

| No. of family members in different age groups | Male (n=1604) | Female (n=341) | Total | P     |
|---------------------------------------------|--------------|---------------|-------|-------|
|                                             | n            | Percentage    | n     | Percentage |
| Up to 5 years                               | 440          | 10.70         | 403   | 11.60   | 843 | 11.10 |
| Children 6-9 years                          | 418          | 10.20         | 375   | 10.80   | 793 | 10.40 |
| Adolescents (10-19 years)                   | 1076         | 26.20         | 913   | 26.20   | 1989| 26.20 |
| Adults (20-59 years)                        | 1974         | 48.10         | 1698  | 48.70   | 3672| 48.40 |
| Geriatric (≥60 years)                       | 199          | 4.80          | 98    | 2.80    | 297 | 3.90  |
| Total                                       | 4107         | 100.00        | 3487  | 100.00  | 7594| 100.00|

Table 5 depicts that 2.68% children under 14 year of age were involved in income generation activity. Child labor was significantly more prevalent among male children aged between 14 and 18 years. Among children of mine worker, significantly
lower proportion of girls (609, 37.80%) were enrolled in schools compared to boys (769, 41.54%) \( (P = 0.0248) \).

**DISCUSSION**

**Demographic and occupational profiling of mine workers**

In this study, majority of workers were males. Similar finding was reported by Shamim *et al.*\(^6\) in Rajasthan. Different gender distribution (55.1% males and 44.9% females) has been observed by Tiwari\(^6\) among quartz stone workers.

In this study, majority of workers were working in mines for more than 10 years. Nandi *et al.*\(^7\) have also reported similar level of work experience among mine workers. Contrary to this, Rajashekar *et al.*\(^8\) have reported that the majority of the mine workers in Karnataka had total work experience of 5 years. Mean years of working in this study was 16.71 ± 9.72 years which is lower than reported by Shamim *et al.*\(^9\) Mine workers were involved in various activities in mines from drilling, blasting, cutting of stones to carrying the stones, loading stones in vehicles, and cleaning of waste material.

**Social issues of mine workers**

**Illiteracy**

More than half of participants were illiterate in our study. Higher level of illiteracy among mine workers in North India has also been reported by other studies.\(^8\) Mine workers of Southern part of India had relatively better educational status.\(^9\) Proportion of illiteracy was significantly higher among female workers compared to male. Study also highlights that among family members of workers, more than half of the children between 14 and 18 year age group were dropped out from schools. This proportion of dropouts was significantly more for girls, which is opposite to the findings reported by the Government of India.\(^10\)

**Child marriage**

India has maintained laws against child marriage since 1929, but still child marriage is quite prevalent in certain areas of the country.\(^11\) It was observed that 13.22% mine workers got married below the legal age of marriage (21 for male and 18 for female) in our study, and this was significantly higher among female workers. This figure is quite lower than proportion reported by National Family Heath Survey 4\(^{th}\) round (NFHS IV) for both males and females for rural Rajasthan.\(^12\)

**Female mine workers**

Mean age of female workers was significantly higher than male workers. This could be due to late age of entry into mining work, as evident by significantly higher age of entrant in female workers as compared to the male workers. This may be due to the reason that females start working in mines to fulfil their financial needs only after marriage, when their husband got diseased or died due to silicosis, and they have several children to care for.\(^13\) This statement can be supported by fact that proportion of widowhood was significantly higher among female workers (6.4%), compared to male workers (0.2%), and mean years of working was significantly lower among female workers compared to male workers. Among two-member family of male workers, other member who was living with them was wife for majority (82.1%), whereas husbands as other family member were only among 38% of the female workers living in two-member family. This also supports the finding that wives join work after husband could no longer support them because of illness/death.

Recently significant strides have been taken by Government of Rajasthan in this direction by launching the Silicosis Policy on October 3, 2019. As per this policy, widow of a mine workers died due to silicosis will get all the social security benefits from state government including a monthly pension of up to Rs. 1500.\(^14\)

**Child labor**

Child labor is physically, mentally, socially, and morally dangerous and harmful to children, and also negatively relates to school attendance and learning.\(^15\) Although there is a provision of a free and compulsory education for children between 6 and 14 years of age, and prohibition of employment of children between 14 and 18 years of age in hazardous occupations in Constitution of India, child labor is quite prevalent in India.\(^16\) Children are forced into labor and sometimes in hazardous occupations due to poverty and to pay family debt.\(^17\) Child labor was also seen in the study area. This finding is well-supported by the prevalence of child labor reported in 2011 census survey of the country.\(^18\) A substantial contribution of child labor force among mine workers has also been highlighted by Murlidhar.\(^4\) The existence of child labor in mining industry is to supplement earning of parents.\(^18\)

### Table 5: Involvement of children of mine workers in income generating activities

| Income generating activities | Male |   | Female |   | Total |   | P   |
|-----------------------------|------|---|--------|---|-------|---|-----|
|                             | n    | % |        | n |       | % |     |
| <14 years                   |      |   |        |   |       |   |     |
| Yes                         | 41   | 3.12% | 26   | 2.19% | 67 | 2.68% | 0.1524 |
| No                          | 1273 | 96.88% | 1159 | 97.81% | 2432 | 97.32% |   |
| Total                       | 1314 | 100.00% | 1185 | 100.00% | 2499 | 100.00% |   |
| 14-18 years                 |      |   |        |   |       |   |     |
| Yes                         | 106  | 19.74% | 33   | 7.75% | 139 | 14.43% | 0.0077 |
| No                          | 431  | 80.26% | 393  | 92.25% | 824  | 85.57% |   |
| Total                       | 537  | 100.00% | 426  | 100.00% | 963  | 100.00% |   |
Elderly mine workers

Mining is hazardous occupation and not safe workplace for elderly. As much as 7.1% mine workers were elderly in this study. These findings are in accordance to the findings reported by other studies.[19]

Conclusion

More than three fourth of the mine workers were male. Approximately 7% of the mine workers were in elderly age group. Mean age of female workers was significantly higher than males. Illiteracy, child marriage, and child labor were present among mine workers. Also, among children of mine worker, significantly lower proportion of girls were enrolled in schools compared to boys.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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Supplementary Figure 1: Age distribution of mine workers

Supplementary Figure 2: Relation of other family member in two-member family of male mine workers

Supplementary Figure 3: Relation of other family member in two-member family of female mine workers