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Original Research Article

Morbidity among mine workers: a cross sectional study in Chitradurga, Karnataka, India

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ABSTRACT

Background: Workers represent half the world's population and are the major contributors to economic and social development. Their health is determined not only by workplace hazards but also by social and individual actors and access to health services. Work-related morbidity and mortality result in suffering and hardship for worker as well as to his or her family. Thus occupational health of working people are crucial prerequisites for overall socioeconomic and sustainable development. The aims and objective were to assess the health status of the people working in mines and study their occupational hazards.
Methods: A cross sectional study was conducted in three actively working mines of Chitradurga city for a period of one year. Complete enumeration method was used to include 493 mine workers.
Results: Sesagoa mines were the biggest among the selected mines (69.5% workers). Majority belonged to the age group of 20-30 years with 37.5%, 69% workers were field workers. Around 76.3% workers were working since 1-5 years. 45.20% and 11% workers had undergone pre placement examination and periodic examination respectively. Personal Protective Equipments (P.P.E) were used by 90.50% workers. History of allergy was seen in 21.7% workers, while 11.2% workers reported history of vector borne diseases. Trouble smelling was found in 1.8% workers while 1.6% workers had trouble hearing.
Conclusions: Health education on pre placement, periodic examination and use of PPE was found to be less which on itself can be the reason for morbidities among the mine workers hence efforts must be made to improve their knowledge regarding these.

Keywords: Miner, Morbidities, Occupational hazards

INTRODUCTION

Every 15 seconds, a worker dies from a work-related accident or disease. Every 15 seconds, 153 workers have a work-related accident- ILO.[1] Workers represent half the world's population and are the major contributors to economic and social development.[2] About 45% of the world's population and 58% of the population over 10 years of age belong to the global workforce.[3]

There are 100 million occupational injuries causing 0.1 million deaths in the world according to WHO. It is also estimated that in India 17 million occupational non-fatal injuries (17% of the world) and 45,000 fatal injuries (45% of the total deaths due to occupational injuries in world) occur each year.[4]

Work-related morbidity and mortality not only results in suffering and hardship for the worker and his or her

family, but also it adds to the overall cost to society through lost productivity and increased use of medical and welfare services. The cost to society has been estimated at 2-14% of the gross national product in different studies in different countries.[5]

Lack of training of primary health care providers in occupational medicine has resulted in deficiency in estimating rates of occupational disease and deaths, because many of these diseases have multiple potential causes, including life-style factors, and the long latency period that is characteristic of many chronic diseases makes it difficult to establish whether the condition is work related.[6] Apart from this, there is the further factor of legal liability, which makes this area so difficult.[7]

India has rich mineral resources, contributing more than 1.5% of India's gross national product (GNP). A report by National Institute of Occupational Health[1999], records more than 3 million people working in various type of mines, ceramics, potteries, foundries, metal grinding, stone crushing, agate grinding, slate pencil industry etc.[8]

Mining is a multi-disciplinary industry, drawing on several professions and trades. Rising demands of minerals have resulted in booming mining activities.[9] The total workforce of the mining industry in India comprises more than one million workers.[8] In terms of man power involved and the capital amount invested in mining industry makes it to be in top five major industries in India.[10]

Traumatic injury remains a significant problem and ranges from the trivial to the fatal.[11, 12] Common causes of fatal injury include rock fall, fires, explosions, mobile equipment accidents, falls from height, entrapment and electrocution. Noise is almost ubiquitous in mining. It is generated by drilling, blasting, cutting, materials handling, ventilation, crushing, conveying and ore processing. Controlling noise has proven difficult in mining and noise-induced hearing loss remains common.[13, 14] Heat and humidity increase with depth, due principally to the geothermal gradient and auto-compression of the air column.[15]

The studies conducted on mining and its effects are very few in our country especially in Karnataka. This study was undertaken in Chitradurga district to know the health status of mine workers and to educate them about the health hazards associated with mining.

METHODS

Chitradurga city population is 1,39,914 and is geologically rich with various minerals such as iron ore, coal, manganese and carbide, the mining activity is being in the fore for many years. There are about 66 licensed mining sites out of which 26 were newly licensed.

This was a cross-sectional study conducted for a period of one year *involving* three licensed and active mines near Chitradurga, namely B.B.H (Bheemasamudra), SESAGOA (Bheemasamudra), John mines (D.Madikeripura), situated at about 10-15kms from Basaveshwara Medical College campus. These mines were included in the study after obtaining permission from concerned authorities. There are approximately 600 persons working in the above mentioned mines and workers above the age 18 years with minimum of 1 year working in the mines were included. A total of 493 mine workers who were available at the time of examination were included in the study using complete enumeration method. Mine workers who did not give consent and remained absent even after two visits were excluded.

Content validity was conducted before data collection of the questionnaires, the title and the objectives of the study by the panel of experts including researchers, health professionals. They evaluated relevance, clarity and completeness of each item as well as the suitability of the tool for measuring the study objectives. According to the feedback obtained, the questionnaires were modified. Final modification was made after the pilot study.

Pilot study

Pilot study was conducted among 50 mine workers of B.B.H mines before starting data collection, to identify problems in the research design, test the applicability and validity of the study, evaluate the appropriateness of the questions, test the clarity of the wording, and to clarify areas of ambiguity and suitability of the questionnaire. The results were reviewed and some modifications were taken in consideration.

The proforma included the socio-demographic characteristics, details of their occupation, present health complaints, existing morbidity if any, sleeping, dietary and other habits among the participants; anthropometry measurements and general physical examination. They were also educated about the importance of using PPD's and the various health hazards associated with mining.

The data thus collected was entered in excel and analysed using SPSS version 20. Descriptive statistics and inferential statistics were used to analyse the data. The association between various factors were examined using the Chi-square test and P value <0.05 was considered as statistically significant.

RESULTS

Of the 493 study population, 313 (63.5%) workers were working in Sesagoa mines which is the biggest among the selected mines. BBH mines accounted for 110 (22.3%) workers and least was in John mines with 70 (14.2%) workers. The study population is constituted by the field workers who were 340 (69%) followed by people who

were working in the transport i.e., 92 (18.7%) and with office work being done by 61 (12.4%).

In the present study, 185 (37.5%) of the respondents were in the age group of 20-30 years, followed by 139 (28.2%) in the age group of 31-40 years and only 45 (11%) and 4 (0.8%) in the age group of 51-60 and <20 years respectively. About 430 (87.2%) study participants were married, 273(62.4%) belonged to nuclear type of family and 451 (91.5%) were Hindus. Majority of the respondents were educated up to High school 182 (37%), followed by 105 (21.3%) workers up to primary high school and 91 (18.5%) were either graduates or Post graduates. Only 38 (7.7%) were illiterates. Most of the respondents 197 (40%) were from class IV and only 19(3.9%) belonged to class V socio economic status. 451(91.5%) workers were from nearby localities while remaining 8.5% of the workers were staying away from their families (Table 1).

Table 1: Socio-demographic characteristics of study participants.

Socio demographic characteristic		Frequency	Percentage
Age (years)	<20	4	0.8
	20-30	185	37.5
	31-40	139	28.2
	41-50	111	22.5
	51-60	54	11
Marital status	Un married	56	11.4
	Married	430	87.2
	Widowed	4	0.8
	Divorced	3	0.6
Type of family	Nuclear family	273	62.4
	Joint family	163	26.0
	3 Generation family	57	11.6
Religion	Hindu	451	91.5
	Muslim	34	6.9
	Others	8	1.6
Education	Illiterate	38	7.7
	Primary school	105	21.3
	High school	182	37.0
	P.U.C	29	5.9
	Diploma	48	9.7
	Graduate / Post graduate	91	18.5
Socio-economic status	Class I	52	10.5
	Class II	55	11.2
	Class III	170	34.5
	Class IV	197	40.0
	Class V	19	3.9
Locality	Local	451	91.5
	Non local	42	8.5

Among the working population, 376 (76.3%) of the workers had being working in the mines since 1-5 years. 95 (19.3%) of workers were working since 6-10 years and only 16 (3.2%) and 6 (1.2%) of workers were working since 11-15 years 16-20 years respectively. Drug abuse was seen among the workers and alcohol consumption 204(41.40%) was most common among them. The pattern of tobacco usage showed that 172 (34.90%) of workers were chewing tobacco while smoking was seen among 168 (34.10%) of workers. Only 223 (45.20%) and 50 (11%) of workers had under gone pre placement examination and Periodic examination respectively. Among the workers who were using personal protective equipments (PPE), 62.9% were using it regularly and the rest 30.5% were using irregularly. Vaccination status of the workers showed that 51 (10.3%) of the workers were vaccinated for T.T alone and 3 (0.6%) of the workers for both T.T and Hepatitis B (Table 2).

The general physical examination of the workers revealed that, 15 (3%) of workers had discoloration of skin, 8 (1.6%) were pale, and 6(1.2%) had both pallor and icterus. Obesity of different degree was seen in 190

(32.1%) and 47 (9.5%) were malnourished. Prevalence of hypertension based on diastolic blood pressure (DBP) readings was 157 (31.8%) of workers were having high normal blood pressure, mild hypertension was found in 23 (4.7%) and 36 (7.3%) of workers were moderately hypertensive. 33 (6.7%) were diabetic (Table 3).

Table 2: Characteristics of workers working in mines.

		Frequency	Percentage
Duration of work (years)	1-5	376	76.3
	6-10	95	19.3
	11-15	16	3.2
	16-20	6	1.2
Drug abuse	Tobacco chewing	172	34.9
	Smoking	168	34.1
	Alcohol consumption	204	41.4
Preplacement examination	Yes	223	45.20
	No	270	54.80
Periodic examination	Yes	50	10.14
	No	443	89.86
Frequency of using personal protective devices	Do not use	47	9.5
	Use -Irregularly	136	27.6
	Use- Regularly	310	62.9
Vaccination status	T.T	51	10.30
	T.T and Hepatitis B	3	0.60
	NIL	439	89.20

Table 3: General physical examination of mine workers.

	Characteristic	Frequency	Percentage
General physical examination	Nil	464	94.1
	Pallor/Icterus	6	1.2
	Pallor	8	1.6
	Skin discoloration	15	3.0
Body mass index	Under weight	47	9.5
	Normal	288	58.4
	Pre-obese	131	26.6
	Obese class I	26	5.3
	Obese class II	1	.2
Grading of hypertension	Normal	277	56.2
	High normal	157	31.8
	Mild hypertension	23	4.7
	Moderate hypertension	36	7.3
Diabetes	No	460	93.3
	Yes	33	6.7

Of 493, 107 (21.7%) gave a history of allergy and 55 (11.2%) history of vector borne diseases such as malaria, dengue etc. History of injuries during their working time was reported by 42 (8.5%) but was not notified based on the nature of the injury. Trouble smelling was seen in 9(1.8%) and trouble hearing was seen in 8 (1.6%) of the workers. HAVS features was seen in 24(4.9%) workers. Ocular morbidity was seen among the mine workers of which 112 (22.72%) had refractive errors, 61 (12.37%) were suffering from conjunctivitis, 24 (4.87%) had pterygium and cataract was found in 14 (2.84%) of the workers (Table 4).

When comparing history of allergy, history of vector born disease, trouble smelling and trouble hearing with different job description, there was no significant association found (p value >0.05). History of injury was found to be associated with duration of work for >10years in mines and was statistically significant (p value- 0.0402) (Table 5 and 6).

Table 4: Health hazards in mine workers.

	Frequency	Percentage
H/O allergy	107	21.7
H/O vector born disease	55	11.2
H/O injury	42	8.5
Trouble smelling	9	1.8
Trouble hearing	8	1.60
Hand Arm Vibration Syndrome	24	4.9
Ocular morbidity		
Refractive errors	112	22.72
Conjuctivitis	61	12.37
Pterygium	24	4.87
Cataract	14	2.84

Table 5: Comparison of health hazards and job description in mine workers.

	Office work	Field work	Transport	p value
H/O allergy	138 (27.9%)	107 (21.8)	88 (17.4%)	0.305
H/O vector born disease	7 (11.5%)	36 (10.6%)	12 (13%)	0.799
Trouble smelling	1 (1.7%)	8 (2.35%)	0	0.325
Trouble hearing	2 (3.3%)	5 (1.5%)	1 (1%)	0.532

Table 6: Comparison of health hazards and duration of work in mines.

	Duration of work		
	<10 years	**>10 years**	**p value**
H/O allergy	104 (22.08%)	3 (13.63%)	0.499
H/O vector born disease	53 (11.25%)	2 (9.09%)	0.905
Trouble smelling	8 (1.27%)	1 (4.54%)	0.899
Trouble hearing	6 (1.27%)	2 (9.09%)	0.0568
H/O hand arm vibration syndrome	23 (4.88%)	1 (4.54%)	0.706
H/O injury	37(7.86%)	5 (22.73%)	**0.0402**

DISCUSSION

Workers represent half the world's population and are the major contributors to economic and social development. Occupational factors make an important contribution to the global burden of disease. Their health is determined not only by workplace hazards but also by social and individual actors and access to health services.

Among the study population, 76.3% of the workers had being working in the mines for the duration between 1 – 5 years and 40% were working since 15 – 30 years. This finding was not in corroboration with the studies conducted by Giri et al and Biswas et al which showed 38.75% of workers were working since >20 years and 24.25% of workers working since 10 – 15 years respectively.[16,17] Vinod et al Duration of work for the subjects was 38% were working since more than 10 years, 33.78% were working since 5-10 years and 22.82% were working for less than 5 years.[18] In the study conducted by Athavale et al 25% of workers worked for <10 years, 33.93% worked for 11 – 20 years and 41.07% worked for > 20 years.[19]

The general physical examination of the workers revealed that, 3% showed discoloration of skin, 1.6% were pale, and 1.2% had both pallor and icterus. These findings are lower comparative to other studies. The prevalence of anemia among workers was found to be 18.2% and 7.4% had skin discoloration in the study conducted by Giri et al.[16] While study conducted by Ahmad revealed that, 1.5% of the mine workers had skin discoloration.[20] In the study conducted by Biswas et al occupational dermatitis was seen in 27% of workers while discoloration of skin was seen in 13% of workers.[17]

Based on the complaints given by the workers, the history of allergy was seen in 21.7% of the workers. This finding is higher when compared to study by Giri et al which showed that 12% workers had allergy to dust.[16]

Hearing problems were seen in 1.6% of the workers in the present study. This finding is very low when compared to studies done by Giri et al which showed Deafness/ear problems were present in 23% of workers.[16] In the study from Goa, 38.16% of workers had various grades of hearing impairment.[21] The lower occurrence of trouble hearing in the present study can be attributed to better use of personal protective devices by the mine workers.

This study showed the prevalence of hypertension based on systolic blood pressure (SBP) readings were found that mild hypertension was found in 17.4% of the workers, 3.4% were moderately hypertensive. Taking in to consideration diastolic blood pressure (DBP) mild hypertension was found in 4.7% of the workers, 7.3% were moderately hypertensive. The overall prevalence was found to be lower when compared to other studies conducted. In the study conducted by Giri et al[16] the prevalence was found to be 8.3% while in similar study conducted by Oliveira et al it was 11.8%.[16,21] In the study conducted by Biswas et al showed that 23% of the workers had hypertension.[17] The higher prevalence of hypertension in the present study can be attributed to the distribution of study population in age group beyond 40 years and the stress associated with the work.

In this study, 6.7% of workers had diabetes and were on treatment. These findings were slightly higher than study conducted in mine workers in Goa which showed Diabetes mellitus in 5.1% of workers.[21] Giri et al study revealed 15% of workers being diabetics.[16] This finding can be due the contributory factors including age, stress and dietary habits of the individuals.

In this study 9.5% workers were malnourished. These findings were contradictory to results found in other study conducted by Ahmad A[20] which showed 38% of miners were malnourished. Among them, 6%, 11%, and 21% respectively had severe, moderate and mild malnutrition. It indicates the better nutritional status of the workers in the present study.

In the study conducted 8.5% of workers reported minor injuries which weren't notified based on the nature of the injury. These observations were lower when compared to the studies conducted by Biswas et al in which 18.75% of workers had history of injuries.[17] Vinod et al found that 1.04% of workers had injuries while working.[18] This observation is down to the better work environment and ergonomic practices in place which reduce the chances of injuries at the work place.

About 4.9% of workers showed the features of Hand Arm Vibration Syndrome (HAVS) in this study. This finding was lower when compared to other studies conducted in other parts of India. In the study conducted by Mandal BB et al showed that, 8.6% of workers had features of HAVS.[22] The lower occurrence of HAVS in the present study can be attributed to the fact that majority of the mines were mechanized and the better enforcement of prohibitory laws which prevents the worker from hazardous situations.

In the study population, the majority 90.5% of workers were using the Personal Protective Equipments (P.P.E). Among the workers who were using PPE, majority 62.9% were using it regularly and the rest 30.5% were using irregularly. The commonly used PPE were boots, helmet, mask and goggles. Those who weren't using regularly cited inconvenience while working as the reason for not using. These findings were higher when compared to study conducted by Mehrparvar et al which showed that 77.8%, 26.3%, and 21% used gloves, respirators and hearing protection devices, respectively.[23] In the study conducted by Pandit et al 10%, 2%,16%,10% and 25% of workers used boots, helmets, gloves ,gloves and boots and eye shields respectively.[24]

In our study only 45.20% of workers had undergone pre placement examination and periodic examination was done only in 11% of the workers. This finding is lower when compared to study conducted by Giri et al in which 91% of the workers under gone periodic examination.[16] The fact that majority of workers were employed for less than 5 years in the present study can be the reason for lower periodic examination among workers.

CONCLUSION

Mining has the distinction of being the most dangerous profession in India. In the present study 493 mine workers from the three mines in Chitradurga were studied. Of these 37.5% of the respondents were in the age group of 20-30 years. About 76.3% of the workers had being working in the mines only since 1-5 years. Alcohol consumption was seen among 41.40%, 34.90% of workers were chewing tobacco while smoking was seen among 34.10% of workers. Only 45.20% of workers had under gone pre placement examination and 11% had undergone Periodic examination. 62.9% were using personal protective equipments (PPE) regularly. About 21.7% gave a history of allergy and 11.2% gave history of vector borne diseases. History of injuries during their working time was reported by 8.5%. Ocular morbidities included 22.72% refractive errors, 12.37% conjunctivitis, 4.87% pterygium and cataract was found in 2.84%. History of injury was found to be associated with duration of work for >10years in mines and was statistically significant (p value<0.05). It is clear that the pre placement examination and the periodic examination of most of the workers had not been done and also most of the workers did not use PPE regularly. Hence educating the people about these will help improve the health condition of the workers.

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