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Original Research Article

Assessment of work-related health hazards, personal hygiene and utilization of personal protective equipment's among stone quarry workers: a cross sectional study in Central India

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ABSTRACT

Background: It is estimated that exposures in the workplace account for around one in ten cases respiratory morbidities in adulthood. Being a respiratory ailment, this group of disorders impairs the pulmonary functions. The objective of the study was to assess the work-related health hazards, personal hygiene and utilization of personal protective equipments among stone quarry workers in Wardha district in Maharashtra.
Methods: This cross sectional study was conducted among 348 subjects working in the stone quarries situated in Yelakeli, Deoli, Paloti, Pulgaon, Borgaon, Nachangaon in Wardha district in Maharashtra.
Results: 114 (32.75%) of the people reportedly had respiratory problems, body ache was reported by 154 (44.2%), eye problem was reported by 66 (18.9%), fever was told by 13 people (3.7%), other problems (like hearing related, skin, GIT etc) reported were 14 (4.02%). Chi-square test was found to be non-significant.
Conclusions: None of the workers had undergone pre-placement examination. Personal protective measures are rarely used by stone quarry workers.

Keywords: Stone quarry, Respiratory problems, Personal hygiene, Personal protective equipments

INTRODUCTION

Dust is present at all quarries; but the nature of the dust present differs in levels of risk. In general the highest risk is presented by dust containing high levels of respirable crystalline silica.[1] There are many hazards to which stone workers are exposed in the manufacturing process of stone, such as dust, noise and vibration. Opportunities of the workers to have lung diseases (such as silicosis and lung cancer) were much higher than that of ordinary people.[2] It is estimated that exposures in the workplace account for around one in ten cases of new or recurrent asthma in adulthood.[3] Being a respiratory ailment, this group of disorders impairs the pulmonary functions. However, this deterioration in the pulmonary function is noticed in the advanced stages of the disease when much of the lung tissue is damaged.[4] Therefore the present study was carried out with the objective to assess the work-related health hazards, personal hygiene and utilization of personal protective equipments among stone quarry workers in Wardha district in Maharashtra

METHODS

Study setting

This cross sectional study was carried out at in the selected stone quarries situated in Yelakeli, Deoli, Paloti, Pulgaon, Borgaon, Nachangaon in Wardha district.

Inclusion criteria

All the workers who were willing to participate in the study and stone quarry workers exposed to the dust for more than 1 year.

Exclusion criteria

Stone quarry workers exposed to the dust for less than 1 year and workers whose employment does not include exposure to dust.

Selection of study participants

All those workers who were exposed to dust for more than 1 year in the selected stone quarries situated in Yelakeli, Deoli, Paloti, Pulgaon, Borgaon, Nachangaon in Wardha district were randomly selected in the study. The study participants who willingly participated were chosen and interviewed until the required sample size of 348 was completed.

Duration of study: May 2012 to October 2014.

Study design: A community based cross-sectional study.

Samples size

Literature review indicated that respiratory morbidity amongst the quarry workers was found to be 32%.[5] Based on the above observation with an (alpha) α level of 0.05 and (beta) β of 0.05 (power = 95%). Sample size= z^2 x (p x q)/ l^2

p= prevalence,

q = 1- p, l = allowable error

p=0.32, q=0.68

Sample size = 334, where 348 subjects participated in the study and this formed the sample size.

Study tool

A pretested questionnaire was prepared comprising of; socio-demographic profile, use of personal protective equipments and personal hygiene, chief complaints, clinical history and physical examination.

Consent

After explaining the procedure in verbal and in written, the informed consent were obtained and data thus received were kept confidential.

Data collection

After building a rapport and ensuring confidentiality regarding the use of data for research purpose only a pretested questionnaire was used for collection of the data. The survey was done by a face to face interview; pulmonary function test of the workers were also carried out.

Ethical consideration

The necessary approval was obtained from the Institutional Ethics Committee, JNMC Sawangi, DMIMS (DU), Wardha.

Statistical methods

The data was entered in a computerized Excel (Microsoft Excel 2003) spreadsheet. Subsequently it was analyzed using SPSS (Statistical Package for Social Sciences) Version 16.0. Data were tabulated according to frequency distribution tables.

RESULTS

Table 1 shows workers less than 20 years old, where male were 6.8% and female 1.1%. In 21 to 30 years age group 27.29% were male and 6.8% females. Those in the age group 31 to 40 years old, male were 29.02% and female were 4.3%. 12.9% males and 2.5% were females in the age group of 41 to 50 years. In age group 51 to 60, 6.6% were males and 0.8% females. In more than 61year old age group, male were 1.1% and female 0.2%. Maximum population in the quarry belonged to Hindu (60.54%) by religion followed by Buddhist (29.88%) and Muslims (0.57%).

Table 2 reveals that 4.88% males and 0.00% females completed college studies. 16.66% male and 1.14% female were educated up to high school. 48.85% males and 8.04% females had been Middle school educated. 5.1% male and 0.57% female were primary school educated. Total male and female literate population was 75.57% and 9.77% respectively. Total illiterate male and female population was 8.3% and 6.32% respectively. 85.34% of the stone quarry workers were literate and 14.65% were illiterate.

According to the modified B.G. Prasad Scale, none of the workers belonged to Class I. In Class II, 0.57% were males and none females. In class III, 78.73% were males and 13.50% females. In Class IV, 4.02% were males and 2.58% were females. In Class V, 0.57% workers were male and none females. Most of the participants (92.23%) belonged to Class III socioeconomic status.

Workers who were working since 1 to 5 years were 29.59% males and 6.03% females. 25.86% were males and 3.44% were females in the age group of 6 to 10 years. Those in the age group of 11 to 15 years were 13.21% males and 3.44% females. 15.22% males were working for more than 15 years and females for the same duration were 3.16%.

Table 3 shows that stone cutting was done by 44.54% male and 9.19% female participants. Stone extraction was done by 47.98% males and 10.08% female workers. Drilling was done by 9.4% male and 0.28% female workers. Participants working on the crusher machine were 11.49% male and 1.43% females.

Table 1: Distribution of the study population according to age and religion.

Variables	Workers in quarry		Total (n=348) N (%)
	Male (n=292) N (%)	Female (n=56) N (%)	
Age (years)			
<20	24 (6.80)	4 (1.10)	28 (8.04)
21 to 30	95 (27.29)	24 (6.80)	119 (34.19)
31 to 40	101 (29.02)	15 (4.30)	116 (33.33)
41 to 50	45 (12.90)	9 (2.50)	54 (15.51)
51 to 60	23 (6.60)	3 (0.80)	26 (7.40)
>61	4 (1.10)	1 (0.20)	5 (1.40)
Religion			
Hindu	186 (53.44)	25 (7.10)	211 (60.54)
Buddhist	104 (29.88)	31 (8.90)	135 (38.79)
Muslim	2 (0.57)	0 (0.00)	2 (0.57)

Table 2: Distribution according to education, socio-economic status and duration of work in the study population.

Variables	Quarry workers		Total (n=348) N (%)
	Male (n=292) N (%)	Female (n=56) N (%)	
Education			
College	17 (4.88)	0 (0.00)	17 (4.88)
High School	58 (16.66)	4 (1.14)	62 (17.81)
Middle School	170 (48.85)	28 (8.04)	198 (56.89)
Primary School	18 (5.1)	2 (0.57)	20 (5.74)
Total Illiterate	29 (8.3)	22 (6.32)	51 (14.65)
Socio-economic status (Modified BG Prasad scale)			
Class I	0 (0.00)	0 (0.00)	0 (0.00)
Class II	2 (0.57)	0 (0.00)	2 (0.57)
Class III	274 (78.73)	47 (13.50)	321 (92.23)
Class IV	14 (4.02)	9 (2.58)	23 (6.6)
Class V	2 (0.57)	0 (0.00)	2 (0.57)
Duration of work (years)			
1 to 5	103 (29.59)	21 (6.03)	124 (35.63)
6 to 10	90 (25.86)	12 (3.44)	102 (29.31)
11 to 15	46 (13.21)	12 (3.44)	58 (16.66)
>15	53 (15.22)	11 (3.16)	64 (18.39)

Availability of dettol in the quarry was responded by 18.54% participants. 70 (20%) participants responded cotton gauze was present. 22.7% workers said medicines were also present at the work site. Total 76.72% workers said no information about presence of first aid kit were available in their respective quarries.

Table 4 shows that 32.75% people reportedly had respiratory problems, body ache was 44.2%, eye problem 18.9%, fever 3.7% and other problems (like hearing related, skin, GIT etc.,) 4.02%.

Table 5 shows 89.94% of the stone quarry workers used to bath daily, 10.0% of the participants were found ignorant for maintenance of hygiene and neither bathed daily nor cut their nails regularly. None of the workers had undergone any kind of pre placement examination. 92.81% of the workers were satisfied with their work at the stone quarries. Large numbers of participants 80.45% were not using any personal protective measures. Only 19.5% of the stone quarry workers were using personal protective instruments.

Table 3: Distribution of study population according to type of quarry work, availability of first aid (multiple responses).

Variable	Quarry workers		Total N (%)
	Male (n=292)	Female (n=56)	
	N (%)	N (%)	
Type of quarry work (multiple response)			
Cutting	155 (44.54)	32 (9.19)	187 (53.73)
Extraction	167(47.98)	35 (10.08)	202 (58.04)
Drilling	33 (9.4)	1 (0.28)	34 (9.77)
Crusher machine	40(11.49)	5 (1.43)	45 (12.93)
Availability of first aid (multiple response)			
Dettol	68 (19.54)	0 (0.00)	68 (18.54)
Cotton Gauze	70 (20.11)	0 (0.00)	70 (20.00)
Medicines	76 (21.83)	3 (0.86)	79 (22.70)
None	215(61.78)	53 (15.22)	268 (77.01)

Table 4: Relation of morbidity profile and duration of work (multiple responses).

Duration of work (years)	Health problems					
	Respiratory morbidity (%)	Body ache (%)	Eye problem (%)	Fever (%)	Other (%)	None (%)
<5	39 (11.20)	49 (14.00)	21 (6.00)	4 (1.10)	5 (1.40)	54 (15)
5 to 10	30 (8.60)	41 (11.70)	25 (7.10)	7 (2.00)	5 (1.40)	49 (14)
11 to 15	22 (6.30)	29 (8.30)	13 (3.70)	1 (0.20)	3 (0.80)	34 (9.70)
>15	23 (6.60)	35 (10)	7 (2)	1 (0.20)	1 (0.20)	14 (4.00)
Total	114 (32.75)	154 (44.20)	66 (18.90)	13 (3.70)	14 (4.02)	151 (43.4)

Table 5: Distribution of study population according to the personal hygiene and protective measures.

Questions	No of workers (n=348)
	N (%)
Baths daily or not?	
Yes	313 (89.94)
No	35 (10.05)
Cuts nail regularly or not?	
Yes	313 (89.94)
No	35 (10.05)
Wash hands with soap and water daily?	
Yes	313 (89.94)
No	35 (10.05)
Number of workers who undergone pre-placement examination?	
No	348 (100)
Yes	0 (0.00)
Job satisfaction?	
Yes	323(92.810)
No	25 (7.10)
Use of personal protective measures?	
Yes	68 (19.50)
No	280(80.45%)

Table 6: Various factors associated with morbidity in quarry workers.

Variables	Any morbidity (n=197)	No morbidity (n=151)	Chi-square test
	N (%)	N (%)	
Duration of work (years)			
<5	70 (20.11)	54 (15.51)	$\chi2$=1.44 df = 3 p=1.000 NS
6 to 10	54 (15.51)	48 (13.79)	
11 to 15	34 (9.77)	24 (6.80)	
>16	39 (11.20)	25 (7.10)	
Education			
College	11 (3.10	6 (1.70)	$\chi2$= 4.804 df= 4 p>0.308 NS
High school	40 (11.40)	22 (6.30)	
Middle school	105 (30.10)	93 (26.72)	
Primary school	14 (4.02)	6 (1.70)	
Illiterate	27 (7.70)	24 (6.80)	

Table 6 shows those who worked for less than 5 years reported morbidities 20.11%, followed by 15.51%, 11.2% and 9.77% by those who worked 6 to 10 years, more than 16 years and 11 to 15 years respectively. Middle school educated workers reported 30.1% morbidity followed by

high school 11.4%, illiterate 7.7%, primary school educated 4.02% and college educated 3.1%.

Table 7 shows that those workers who were working for less than 5 years had respiratory problem 11.2%, and those working since 6 to 10 years had respiratory problems 8.62%. Those working since 11 to 15 years reported respiratory issues were 6.32% and those working for more than 15 years were 6.6%. Total workers who had respiratory problems were 114 (32.75%). Chi square test was found to be non-significant.

Table 7: Relation of respiratory disease and duration of work.

Duration of work (years)	Respiratory morbidities		Chi-square test
	Yes (%)	No (%)	
<5 (n=124)	39 (11.20)	85 (24.40)	$\chi2$=0.69, df=3, p>0.05 NS
6 to 10 (n=102)	30 (8.62)	72 (20.68)	
11 to 15 (n=58)	22 (6.32)	36 (10.34)	
>15 (n=64)	23 (6.60)	41 (11.78)	
Total (n=348)	114 (32.75)	234 (67.20)	

Table 8: Relation between the workplace accidents and injuries and duration of work (years).

Length of exposure at work (years)	Work place accidents/injuries in last 1 year		Chi square test
	Yes (%)	No (%)	
<5 (n=124)	110 (31.6)	14 (4)	$\chi2$= 15.969, df = 6, p<0.05
5 to 10, (n=102)	91 (26.14)	11 (3.1)	
10 to 15, (n=58)	44 (12.6%)	14 (4)	
>16, (n=64)	42 (12)	22 (6.3)	

Table 8 shows that the workers who were working less than 5 years reported history of accident in last one year were 110 (31.6%), those working since 5 to 10 years were 91 (26.14%), followed by those working since 10 to 15 years i.e. 44 (12.6%) reported history of accidents or injuries and 42 (12%) reported history of accidents or injuries at the working site who worked for more than 16 years.

DISCUSSION

It was observed that most of the workers were in the age group between 21 to 30 years i.e., 34.19%, followed by 33.33% in the age group 31 to 40 and 15.51% in the age group 41 to 50 years. Similar observations were seen in the following studies Sharma et al in 2011 studied in Shakarpura in Gujarat and found that maximum workers were from the age groups 30-50 in both males and females.[6,7] Tiwari et al study in 2004 observed majority of the subjects were in the age group <35 years (59.6%). The mean age for male was found to be 33.18±10.39 years while that for female was 30.10±9.3 years and for the whole group was 31.77±9.99 years.

It was observed that most of the workers in the quarry, 83.90% were males and 16.09% were females.[6] Sharma et al in 2011 studied in Shakarpura in Gujarat and found that 66.3% agate workers were males and 33.7% were females.

85.34% of the workers were literate and were middle school educated i.e., 56.89% followed by 17.81% high school educated. Total male and female literate population was 75.57% and 9.77% respectively. 14.65% of the workers were illiterate. Total illiterate males and females were 8.3% and 6.32% respectively.[6] Sharma et al in 2011 studied in Shakarpura in Gujarat and found similar observations that maximum number of workers 61.2% completed primary education; out of 98 agate workers 21.4% were illiterate.

More than ¾th workers belonged to socio economic status class III i.e., 78.73% males and 47 (13.50%) females according to BG Prasad`s classification.[8] Ugbogu et al in the year 2009 in Nigeria observed similar findings as most of the workers belonged to lower class.

Most of the workers in the stone quarries were working since 1 to 5 years i.e., 124 (35.63%) followed by 102 (29.31%) since 6 to 10 years and 58 (16.66%) since 11 to 15 year while those working since more than 15 years duration were 64 (18.39%).[6] Sharma et al in 2011 studied in Shakarpura in Gujarat and found that out of 98 workers, 37 (37.8%) has worked for 5-10 years followed by 26 (26.5%) workers who has worked for 2-5 years. 15 (15.3%) workers has worked for 10-15 years and 10 (10.2%) workers has worked for >20 years.

Most of the workers were engaged in the stone extraction 58.04%, stone cutting 53.73%, drilling of stones 21.55%, crusher machine 12.93%. Singh et al in the year 2007 in Jodhpur studied in stone quarries and found that most of them were engaged in extraction, cutting type of works.[9,10] Ghotkar et al in 1995 studied in Nagpur where they found the respirable dust concentration level at stone cutting loading and stone crushing was found to be 23.42ug/m^3, 20ug/m^3 and 15.38ug/m^3 respectively.

Presence of dettol in the first aid kit was told by 18.54%, gauze and cotton bandage presence was confirmed by 20% of the workers, 22% of the workers told that medicines were available at the working site, more than ¾th of the respondent said that none of the first aid kit was available at the stone quarries. First aid guidance cards should be available with first aid stores and kits in all the stone quarries. Should an injury occur it is

essential that first aid is readily available on site. Drinking water supply and disposable cups, soap and paper towels, a store room for first aid materials be readily available.[1]

Respiratory morbidity was reported by 32.75%, body ache by 44.20%, eye problem by 18.90%, fever by 3.70% and other problems 4.02% (e.g., ear problems, skin problem etc). No morbidity was reported by 43.39% of workers.[11] Aliyu et al in year 2006 studied in Nigeria and observed that most of the workers had injuries/cuts from stones 68.9%, respiratory symptoms, nasal discharge 52.3%, and occular irritations 14.9%.[8] Ugbogu et al in the year 2009 in Nigeria observed that a comparison of the occurrence of respiratory disease symptoms between manual quarry workers and a control population shows that there is a higher occurrence of respiratory diseases symptom among the quarry workers.[12] Aghilinejad et al in 2012 study shows out of 16 workers; 8 workers had irritating cough, 5 workers had cough and dyspnea and only 3 workers complained of exertional dyspnea.

89.94% of the workers used to bath daily. 89.94% used to cut their nails regularly. 89.94% used to wash their hands with soap water regularly. 100% of the workers did not undergo pre-placement examination. 92.81% of the workers were satisfied with their present job. 80.45% of them never used any personal protective instrument.[8]

Ugbogu et al in the year 2009 in Nigeria observed that about 87% of the responders acknowledged that their working environment could negatively impact on their health. About 83% of the respondents would prefer other jobs to quarrying, and only 6% covered their nostrils during work. The stone-quarry manual workers are exposed to dust from the rocks they crush, especially during sieving of the crushed rock materials, as they do not wear protective equipment.

General morbidity and comparison with education shows that morbidity increases as the education decreases as middle school (30.10%), primary school (4.02%) and illiterate (7.70%) population was found more prone to health problems than higher educated workers. Health illnesses found in workers who are working since less than 5 years was 20.11%, those working since 5 to 10 years were 16.66%, followed by, 10 to 15 years was 9.77% and those working since more than 16 years were 10%. This trend can be seen because the more the duration of work, more people opt out of stone crushing work, leading to more number of young individuals working in the stone quarries than the older ones.

As the duration of work increases lesser number can be found to have injuries, those working since less than 5 years duration had history of accidents 31.60%, those working since 5 to 10 years had accident history of 26.14%, those working since 10 to 15 years had accident history of 12.60%, those working more than 16 years had history of accidents of 12.00%. It can be interpreted that accidents are seen more in young untrained stone quarry workers. Adams et al in 2013 Tamil Nadu studied on the quarries protective eyewear and enhanced education reduced the incidence of eye injuries at three months by 16% (95% CI: 7-24%); and standard education by 13% (95% CI: 4-22%).[12]

CONCLUSION

So, it can be concluded that higher prevalence of respiratory morbidity among quarry workers. None of the workers had undergone pre-placement examination. There is a need to evaluate the health status of quarry workers at regular intervals to provide appropriate preventive measures. Personal protective measures are rarely used by stone quarry workers.

Recommendations

Information, Education and Communication (IEC) is required to create awareness among the quarry workers. Continuous use of personal protective measures during the working hours will improve the quality of life. Awareness should be created regarding causation, signs and symptoms, early diagnosis, treatment and if necessary advice about change of occupation.

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