A Study on Occupational Correlates For Workplace Wellbeing, Morbidities and Occupational Health and Safety Vulnerability Measures amongst Diamond Workers in Surat

Parita R Bhut[1], Deepak B Sharma[2]

[1]Senior Resident Doctor, Department of Community Medicine, SMIMER, Surat, India
[2]Director, Amrita Patel Centre for Public Health, Bhaikaka University, Anand.

Correspondence: Dr. Deepak B Sharma, Email: drdeepak1105@gmail.com

Abstract:

Introduction: Workers in diamond industry are exposed to various hazards. There are only few published scientific studies on workplace well-being, occupational health and safety measures in diamond workers. **Objectives:** To study occupational correlates for workplace wellbeing, morbidities and occupational health and safety vulnerability measures in diamond workers. **Methods:** The current study was a cross-sectional analytical study conducted on 350 diamond workers in four diamond industries located in Surat, Gujarat. Two stage convenient sampling was done with selection of industries in the first and selection of participants in the second. A questionnaire eliciting Socio demographic, Occupational and epidemiological variables was prepared along with workplace well-being questionnaire and Occupational Health and Safety (OHS) vulnerability measure. Proportions, Chi-square, Fishers exact test and ANOVA, Post Hoc tests were calculated for tests of significance. **Results:** Out of 350 workers, 260 experienced health issues. Pain in the wrists, elbows, and shoulders (Musculo skeletal disorders) was reported by 156 (44.5%). Significant difference was found between different styles of work amongst diamond workers and work satisfaction. The workers when asked about OHS (Occupational Health and safety) Vulnerability Measures, all the workers mentioned "Never" for Question 8WH (Workplace Hazards-WH) Experience being bullied or harassed at work. **Conclusions:** All the five types of workers have medium level of work satisfaction, but differences are evident by mean scores with Table work having highest score over other type of works. Those doing Taliya and Mathala work had more health issues than Table, Ghat, and Athphel workers.

Keywords: Diamond workers, Occupational health and safety measures, Workplace wellbeing

Introduction:

There are numerous processes involved in creating a shining diamond, and these processes require participation of many workers, known as "diamond cutters." It involves the following basic steps. Diamond rough is selected or sorted. 2.Marking the 'rough' for manufacturing. 3. 'Rough' crystal is cleaved and/or sawed. 4. Girdle bruiting 5. Facets polishing.[1] Newer and modern techniques have come up and there have been lot of advancement in this industry for different processes and procedures. Industries where there are human interface and the known five styles /type of jobs in diamond cutting workers were practiced were taken in this study. These types of works include 1. Talia tarasi – Polishing the Bottom 24 facets 2. Ghat tarasi – Cutting and Polishing (Bruiting) 3. Table – Polishing the topmost single facet 4. Athpel-Polishing the top 8 facets 5. Mathala – Polishing the top 24 facets [2,3,4] Dust, heat, poor

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lighting, inadequate hygiene, and other such issues are some hazards of many that diamond workers have to face.[3] The workers have to work in an atmosphere, which affects their mental, behavioural and physical health. Workplace satisfaction, safety, and health are the three pillars of workplace well-being.[5] The research was planned to study occupational correlates for workplace wellbeing, morbidities and occupational health and safety vulnerability measures in diamond workers.

Methods:

The current study was a cross-sectional analytical study done in four diamond-cutting and polishing industries located in Surat, Gujarat during May 2021-November 2022. The study population comprised of Diamond workers from selected industries who fulfilled inclusion criteria. Sample size n was calculated by = [DEFF*Np (1-p)]/ [(d2/Z21-á/2*(N-1) +p*(1-p)][6] where p- 72% in this study is taken as the prevalence of musculoskeletal disorders [7]. Confidence limits as % of 100 (absolute +/- %) (d)=5% and N- Population size= 100000, DEFF- Design effect 8X8 1, Z21-á/2= 1.96. The calculated sample size was 310 and 31 for non-responses. So, final sample size came as 341 which was rounded to 350. The sampling was basically done in 2 steps and in both it was convenient sampling as getting the responses was a big challenge. Studying occupational correlates in industry is a challenge owing to permission to conduct the study, as several industry owners declined to participate. A list of fourteen industries was prepared where more than 500 workers were employed and were within the reach of the authors by area. Four of the fourteen diamond industries approached agreed to participate in the study. In the second stage, total of 350 participants for the data collection were selected from the four identified industries where the owner granted permission for the study. 150 study participants (diamond workers) form 1st Industry, 90 from 2nd Industry, 80 from 3rd Industry and 30 from 4th Industry.

Inclusion criteria: Workers who were working in the diamond industry for more than 1 year. The workers who were present during the date and time of interview were interviewed.

Exclusion criteria: Workers who were working in diamond industry, but not directly working with diamonds like clerks, accountants, gatekeepers

Ethical Clearance: The study has been cleared by IEC of the institute with reference number IEC/BU/129 Faculty/17/145/2021 dated 31/05/2021

Questionnaires

A questionnaire eliciting Socio demographic, Occupational and epidemiological variables was prepared. For workplace wellbeing, the work place well-being questionnaire by Gordon Parker, Black Dog institute [8] was used. For workplace health and safety, the Occupational Health and Safety (OHS) vulnerability measure of the Institute for Work & Health (IWH)[9] was used. Both these questionnaires are available in public domain. The translated Gujarati questionnaire was read out to the respondents and responses were noted. Hazard risk matrix was prepared by asking the diamond workers. This includes likelihood of occurrence of an event and its severity. The multiplication of both gives the risk level of the event.

Workplace wellbeing was measured in four different constructs, 1. Work satisfaction 2. Organizational respect for the employee 3. Employer care 4. Intrusion of work into private life

Total there were 31 questions and each question was measured on a scale of Not at all as 0 to Extremely as 4.

Work satisfaction categories based on scoring were Low = 0-11; Medium = 12-30; High = 31-40. Include questions no -1,2,3,6,10,12,19,23.

Organisational respect for the employee categories based on scoring were Low =0-7; medium 8-21; High = 22-28. Include question no-4,7,9,11,17,20,24,31.

Employer care categories based on scoring were Low 0-7; medium 8-21; High 22-28. Include question no-8,13,16,21,25,28,29.

Intrusion of work into private life categories based on scoring were Low = 0-5; medium 6-17; High= 18-26. Include question no -5,14,15,18,22,26,27,30. Question 26 is reverse scored.

OHS (Occupational Health and safety) Vulnerability Measure questionnaire

The tool assesses OHS vulnerability in four parts: There is no scoring.

1: Workplace hazards (WH) (9 questions). The 8 options are from Never to Everyday with one as Don't know/Not Applicable.

   For other 3 constructs, the 5 options are from Strongly agree to Strongly disagree and one option as Don't know/Not Applicable.

2: Workplace policies and procedures (WPP) (7 questions).

3: Occupational health and safety awareness (OHSA) (6 questions)

4: Participation in occupational health and safety (POHS) (5 questions)

Results:

A total of 350 participants took part in the study. The distribution of workers among the various work types in the diamond cutting industry is shown in Table 1. A total of 350 participants took part in the study, of which 44 (12.57%) were working with the Ghat type, 107 (30.57%) with the Taliya, 69 (19.71%) with the Table work type, 46 (13.14%) with the Athphel type, and 84 (24%) with the Mathala work type. 106 (30.28%) workers were in the age category 40-45, 90 (25.71%) were in 30-35 years, 69 (19.71) were in 35-40 years. 300 (85%) workers chewed tobacco, and 72 (20.6%) used to smoke cigarettes.

Out of 350 workers, 260 experienced health issues. Fatigue was reported by 180 (51.4%) followed by pain in the wrists, elbows, and shoulders (MSDs) 156 (44.5%) and minor injuries to any body part 141 (40%). 135 (38.5%) of workers reported visual issues, 120 (34.2%) workers mentioned perceived stress, 114 (32.5%) reported headache and 77 (22%) complained of backache. 41 (11.7%) reported bodily pain. Hypertension was reported by 28 (8%) of workers and 29 (8.3%) had diabetes. The difference was significant for Fatigue. Perceived stress, bodily pain, giddiness and diabetes by type of work. (Table 2)

Significant difference was found between different types of work in diamond industry and all the constructs of workplace wellbeing. (Table 3) In Work satisfaction, Employer care and Intrusion of work into private life average scores fall in the medium category of satisfaction in all. In Organizational respect for the employee, average scores fall in the low category for Athpel type of work whereas it is in medium category of satisfaction for all other 4 types of work (These categories are mentioned in the Materials and Methods). The mean scores were highest for Work satisfaction in Table type of work. By post Hoc test (Tukey HSD), a significant difference was found between Taliya & Ghat, Table, Mathala for Work satisfaction. The mean scores were highest for Organizational respect for the employee

Table 1: Distribution of Diamond Workers According to their Type of Work with Age and Addiction (N=350)

Variables	Type of work					Total, n (%)
	Athpel	Ghat	Table	Mathala	Taliya	
Age Groups (Years)						
25-30	7	2	5	11	13	38 (10.85)
30-35	8	22	19	18	23	90 (25.71)
35-40	7	4	20	16	22	69 (19.71)
40-45	14	13	16	31	32	106 (30.28)
45-50	5	3	8	3	9	28 (8.0)
50-55	5	0	1	5	8	19 (5.42)
Addictions						
Tobacco chewing	41	40	59	69	91	300 (85)
Smoking (Cigarrete)	11	17	11	16	17	72 (20.6)
Total	46 (13.14)	44 (12.57)	69 (19.71)	84 (24.0)	107 (30.57)	350 (100.0)

Table 2: Distribution of Workers According to Different Morbidities and Type of work (n=350)

Particulars	Type of work					n (%)	x^2, p value
	Athpel	Ghat	Table	Mathala	Taliya		
Reported Health Problems	30	39	42	63	86	260 (74.28)	15.32, .004
Specific Morbidities[#]							
Small injuries over any body part	13	22	27	30	49	141 (40)	6.609, .158
Fatigue	20	15	36	36	73	180 (51.4)	21.02,<.001
Pain over wrist, elbows, and shoulder (MSD)	19	24	31	32	50	156 (44.5)	3.60, .46
Difficulty in hearing	1	1	2	1	9	14 (4)	6.28, .139*
Difficulty in vision	13	19	27	26	50	135 (38.5)	7.53, .110
Backache	7	11	14	20	25	77 (22)	1.85, .76
Stress (Perceived)	15	22	11	28	44	120 (34.2)	17.43, .002
Headache	17	17	21	22	37	114 (32.5)	3.03, .552
Breathlessness	4	4	2	0	9	19 (5.4)	11.38,.013*
Bodily pain	2	4	7	6	22	41 (11.7)	11.24, .021*
Giddiness	2	2	13	1	1	19 (5.4)	23.99, .001*
Anxiety	1	6	2	5	4	18 (5)	6.72, .123
Hypertension	4	2	5	5	11	28 (8.0)	2.47, .64
Diabetes	2	8	9	7	3	29 (8.3)	12.46, 01

Note. [#]Multiple responses, MSD-Musculoskeletal disorders, *Fisher, Exact, Test

Table 3: Workplace well-being and the type of work (N=350)

Workplace Wellbeing Particulars	Type of work					F Test, p value
	Athpel	Ghat	Table	Mathala	Taliya	
	Mean (SD)					
Work satisfaction	27.02 (2.54)	27.39 (1. 57)	27.77 (2.15)	27.61 (1.57)	26.07 (3.31)	6.97, <.001
Organizational respect for the employee	21.98 (1.14)	22.95 (.42)	22.46 (.96)	22.15 (.66)	21.54 (1.48)	16.21, <.001
Employer care	23.46 (.72)	23.48 (.54)	23.33 (.63)	23.55 (.68)	23.23 (.57)	3.42, .009
Intrusion of work into private life	13.93 (2.51)	12.45 (1.60)	13.59 (2.13)	15.46 (1.54)	13.12 (2.83)	17.97, <.001

in Ghat type of work. By post Hoc test, a significant difference was found between Ghat & Taliya, Athphel, & Mathala. Significant difference was also found between Taliya & Table, Mathala for Organizational respect for the employee. The mean scores were highest for Employer care and Intrusion of work into private life in Mathala type of work. By post Hoc test, a significant difference was found between Taliya & Mathala in Employer care. By post Hoc test, a significant difference was found between Ghat & Athphel, Mathala. Significant difference was also found between Mathala & Taliya, Table, Athphel for Intrusion of work into private life.

Noise, Headache, Difficulty in vision and hearing are very likely as identified by the workers and have moderate consequence. Injuries on hand and Fingers might be sliced were in likely chance of getting and severe consequence. (Figure 1)

For Occupational health and safety Vulnerability Measures in Part 1: Workplace Hazards (WH) Part 2: Workplace policies and procedures (WPP) Part 3:

Figure 1: Hazard Risk Matrix (5 x 5)[10] for Diamond workers

Likelihood of occurrence	Severity of consequences				
	Negligible (1)	Minor (2)	Moderate (3)	Significant (4)	Severe (5)
Very unlikely (1)	1	2	3	4	5
Unlikely (2)	2	4	6	8	10
Possible (3)	3	6	9 Acute respiratory infection	12	15
Likely (4)	4	8	12 Psychosocial effect	16	20 Injuries n Fingers might be sliced
Very Likely (5)	5	10	15 Noise Headache Difficulty in vision and hearing	20 Pain over wrist, shoulder Backache	20

Risk	Very Low	Low	Medium	High	Very High	Extreme

Occupational health and safety awareness (OHSA) Part 4: Participation in occupational health and safety (POHS), these are the findings.

All the workers mentioned "Every day" for Q 2 WH (Do repetitive movements with your hands or wrists (packing, sorting, assembling, cleaning, pulling, pushing, typing) for at least 3 hours during the day, Q 5 WH (Work in a bent, twisted or awkward work posture) & Q 7 WH (Work in noise levels that are so high that you have to raise your voice when talking to people less than 1 meter away.) All the workers mentioned "Never" for Q 8WH (Experience being bullied or harassed at work). Everyone strongly agreed for Q 10 WPP (Everyone receives the necessary workplace health and safety training when starting a job, changing jobs or using new techniques), Q 16 WPP (Communication about workplace health and safety procedures is done in a way that I can understand) and Q19 OHSA (I know how to perform my job in a safe manner). Collectively strongly agree and agree was seen as option opted for Q 17 OHSA (I am clear about my rights and responsibilities in relation to workplace health and safety), Q 20 OHSA (If I became aware of a health or safety hazard at my workplace, I know who (at my workplace) I would report it to) and Q25 POHS (I know that I can stop work if I think something is unsafe and management will not give me a hard time). The majority 94.9% of the workers disagreed with the Q 23 POHS (I feel free to voice concerns or make suggestions about workplace health and safety at my job). All the workers opted for "agreed" for Q 24 POHS (If I notice a workplace hazard, I would point it out to management.)

Discussion:

It remains a challenge to obtain jobs in highly urbanized and industrialized cities like Surat, the people can easily get employment in these diamond industries. To start working in the diamond industry, the workers felt that they don't require any resource as such. Due to this, the workers were moderately satisfied with the current work based on their education. Global recession in diamond industry has impact on diamond workers as well.[11] Bhardava[12] found that 71.2 % workers had history of tobacco use, among them 68.1 % were active in consuming tobacco. Smoking form of tobacco was actively used by 11.4 %. Out of 350 workers, 260 (74.28%) experienced health issues. Those doing Taliya

and Mathala work had more health issues than Table, Ghat, and Athphel workers. This association was found to be significant. Taliya (68%) and Table (52.2%) workers had experienced more fatigue than Ghat ,Mathala and Athpel.. Yadav et al [3] in their study found mild level of stress among the diamond workers manifesting in form of headaches, diarrhoea, constipation, nausea, aches, and many more symptoms. Mehta and Ribadiya [13] reported that more than 35% had refractive problems and 6.58 % of workers had hypertension. Bhalala B et al[14] found that overall, 47% were suffering from work related musculoskeletal disorders. These authors identified the work-related musculoskeletal disorders for separate works and have found that in Polishing (bottom) 41% had elbow pain, 24% had low back pain. In polishing (top) unit, they found 46% had low back pain, 22% had cervical spine pain. In bruiting work unit, 67% had thumb and fingers pain, 33% had low back pain. The working requires a variety of physical activities which includes continuous, repetitive motions, uncomfortable postures for extended periods of time, and exposure to vibrations. Mechanical stressors affect neck, back, shoulder, elbow, wrist, hand and fingers.[14] Nahar S mentioned musculoskeletal discomfort in the low back, followed by the neck and fingers as the most common. In diamond assorters, it was in the elbow, then the neck. The posture adopted by diamond workers while at work induces muscle exhaustion and muscle imbalance, resulting in protective muscle contraction and muscle spasm.[15] Polishing work requires high level of concentration and focus. It is also physically exhausting because it requires long sitting durations which causes strain in different body parts.[4] In this study, it was found that light was adequate to do the work. In a study done by Agarwal and Patel[4], they found that the workers perceived light, noise, temperature and humidity as comfortable. The fine work which requires proper lighting, that involves constantly checking the diamond facet through an eye piece can cause a lot of eye strain. They mentioned that the polishing unit owners must provide adequate lighting facilities in their units.[4] Agarwal and Patel also found the sound levels within the range of the permissible standards.[4] Every day, these workers are exposed to dangerous particles like carbon dust. These workers were also exposed to injuries in eyes by flying chips or injuries from sharp tools.[16] Every day, workers adopted a bent, awkward work posture. As the result, some workers reported chronic back aches and generalized body pain. Noise levels are so loud that workers must raise their voices when speaking to persons who are less than one meter away. All the workers mentioned "Yes" for this. As a result, workers have complained about hearing problems. Occupational Safety and Health Administration (OSHA) sets limits on noise exposure in the workplace. These limits are based on a worker's time weighted average over an 8 hours day. OSHA'S permissible exposure limit (PEL) is 90 dBA for all workers for an 8 hour per day.[17] Information regarding workplace health and safety procedures is communicated in a way that is easy for workers to understand and everyone agreed to it. The findings from Bhopal gas tragedy has mentioned that the instruction manuals were in English, which the workers were not able to understand.[18] Hazard risk matrix helps in identification of hazards at workplace, likelihood of being affected and the impact. This is a way to ensure safety and mitigation of suffering. Workplace health promotion increases employee's capacity, workplace productivity, and employee and employer relationship. In order for employees to feel comfortable and motivated, a company must be concerned about their safety and health. [4]

Limitations:

Causal association of morbidities can't be proved as this study was a cross-sectional study. These were associated problems with the work. Age related outcomes and the duration of service/employment which is added in years is contributing to more exposure over time so to prove the causal association longitudinal studies are warranted. The current associations are static associations based on cross sectional study.

Conclusion:

All the five types of workers have medium level of work satisfaction, but differences are evident by mean scores with Table work having highest score over other type of works. Those doing Taliya and Mathala work had

more health issues than Table, Ghat, and Athphel workers. Periodical medical examination is important to address the health problems in the workers in diamond industry.

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Conflict of Interest: Nil

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