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Original Article

Descriptive Epidemiology of Occupational Injuries among urban construction workers - an observation from Eastern India

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ABSTRACT

Introduction: Bhubaneswar, Odisha, is seeing a boom in construction activities, with workers from remote areas coming for work. Poverty, illiteracy, coupled with employment and regular payments make them oblivious to unsafe working conditions. Long hours of heavy work in bad postures affect their musculoskeletal system leading to work-related musculoskeletal injuries. This study aimed to understand the epidemiology of the above injuries among the construction workers in Bhubaneswar

Methods: It was a work-site-based multistage cross-sectional study, where the sites engaging >=15 workers were selected randomly. A total of 520 workers (consented, >=21 years of age, and in this profession for at least 3 years) were recruited randomly. Data was collected by interviewing the study participants with the help of a pre-tested questionnaire focusing on sociodemographic profiles and relevant epidemiological variables related to occupational injury of urban construction workers. Data entry and analysis were done using SPSS version 20.

Results: Over 95% of the participants were heavy workers, 23.1% were laborers, 28.1% had < 10 years of experience, and 72.3% were satisfied with their job. A little more than 19% had work-related injuries in the last 3 months. Age, gender, alcohol abuse, better education, lesser work experience, skilled work and job dissatisfaction were found to be statistically significant when associated with the workplace injuries. Multivariate analysis revealed only age and lesser duration of working experience in the construction industry were associated with an increase in occupational injuries.

Conclusion: This study found that younger age, less work experience, male gender, use of alcohol, nature of work and lack of job satisfaction, and a few other factors were associated with work-related injuries. Often their occupational health and injuries get overlooked. Employers should be primarily responsible for their health, safety, and well-being.

Keywords: Construction Workers, Musculoskeletal Injuries, Occupational Accidents, Occupational Injuries, Work-related Injuries.

Introduction

Occupational healthcare delivery services are grossly neglected in many Asian countries including India.[1,2] The workforce and their occupational well-being are mostly under the ministry of labor, mines and industries, whereas healthcare is mostly under the ministry of health. India is one of the fastest growing economies in the world with about 500 million workforces and more than 90% of them are in informal economy sectors with almost no occupational health care delivery services for them.[1,2] It may be noted that the construction industry is one of the largest industries, ranking second only, next to agriculture. Being a labour-intensive sector, construction provides with opportunities for investment and employment (direct and indirect) to a sizeable chunk of the population, thereby being a vital part the economic activity, growth and development of our country.[1,2] Despite the contribution of construction industry and its workers towards the growth and development of our economy, health and safety of the workers remain overlooked, and the accurate statistics of occupational accidents and injuries are not even available.[2] Unfortunately, most construction workers belong to informal economy sectors, who are highly exploited socially, economically and medically, contrary to facilities of workers of formal economy sectors. Bhubaneswar, capital of Odisha, a state on the eastern coast of India, upon being listed as one of the cities under National Smart City Mission projects by the Government of India[3] has seen a boom in the development and construction activities in the city.

Workers from remote areas flock to the cities for work. Poverty and lack of education, coupled with regular employment and assured payments make the workers oblivious to unsafe working conditions. Long hours of laborious heavy work in bad postures over a prolonged period affects the musculoskeletal system of the workers. The afflictions are both short-term (in case of any injury) and long term (due to ergonomic reasons).[2] A systematic review revealed that work-related musculoskeletal disorders (WRMSD) and injuries were high in construction workers ranging from 25% of the studied population to as high as 96% of the studied population.[4] Occupational injuries often lead to musculoskeletal disorders (MSD), which in turn, diminish productivity, cause absence from work, impose costs on the public health system. Construction workers happen to be a class of people suffering from MSD often.[5] Musculoskeletal impairment was found to be a cause for frequent sickness absenteeism from work, in a study by Taimela et al.[6] Since limited data is available on WRMSD in construction workers in India, particularly in the eastern part of India, hence, this study was conducted to understand the epidemiology of work-related injuries among the construction workers in Bhubaneswar city, eastern India.

Methods

It was a construction site-based multistage cross-sectional study. North Zone of Bhubaneswar in Odisha was chosen; plots (standalone houses) that had active construction work going on, engaging a minimum of 15 workers were the chosen construction sites for this study. Construction workers (both males and females) who were of 21 and above years of age, with a minimum of 3 years of work experience in the construction industry and who gave consent to the study were included. The workers who were not physically involved in active construction activity, seriously ill workers, pregnant/lactating women and those who did not understand the local language were excluded.

Sample size was estimated to be 260 using a formula of $n = (Z)^2p\ (1-p)/\varepsilon^2$; where n= required sample size, p=estimated prevalence, ε = desired precision. An empirical study design of 2 was considered to adjust for the possibility of variance inflation due to higher inter-cluster (construction sites) and lower intra-cluster variation. Thus total sample size came to 260 x 2= 520.

Using the random method, the North Zone (comprising 21 wards) out of the three zones of Bhubaneswar was chosen in stage I. Five out of the twenty-one wards were chosen randomly for this study, in stage II. In stage III of the sampling, 10 random construction sites were chosen from each ward. In stage IV, construction site managers were

explained the project and its purpose and their permission was taken. The list of workers at the site was obtained and people meeting the inclusion and exclusion criteria were listed. By simple random technique, 10-11 workers were selected from each site and the process continued till 104 were selected from each ward. After that, another selected ward was visited and stage IV activity was repeated.

Data was entered in an MS Excel sheet. Frequency distribution, and univariate and multivariate analysis using SPSS Version 20 were done in this study. Ethical Clearance was obtained from the Research Committee and the Institutional Ethics Committee at Kalinga Institute of Medical Sciences, Bhubaneswar before the commencement of the study. For the purpose of this study, the workers were classified as heavy and moderate on the type of work and the hours they worked daily. Workers who were into masonry, rod-binding, centering, plumbing, marble work, carpentry and the manual labourers, who worked >=8 hours daily were classified as heavy workers. Painters, welders and electricians who were found to work 6 hours or less a day, were classified as moderate workers. Injuries that occurred at the workplace while performing assigned tasks have been defined as work-related injuries. Job satisfaction has been defined as the workers being content with their jobs and having no complaints despite the low income or hazardous surroundings - it was a subjective question that had 2 parts; first they were asked if they were satisfied with their job, and then they were asked why did they feel so. For this study, use of alcohol has been explained as use of alcohol at least once a week. Body Mass Index (BMI) is an easy, quick and inexpensive way of assessing one's nutritional status. BMI score of less than 18.5 is considered to be underweight. Personal Protective Equipment (PPE) are needed to be worn by workers to shield them from certain harsh elements and thereby prevent accidents at their workplace; these include rubber gloves, goggles, ear plugs, helmets, etc. All the workers who had some form of training (from some older family member or as an apprentice to an older colleague) and needed some sort of special skills to do their work have been categorised under skilled workers while workers who have never had such training were grouped under unskilled workers.

Results

A total of 520 workers fulfilling the study criteria were subjected for this study. The following table-1 shows the distribution of various demographic variables related to the study subjects. More than half of the studied workers were less than 40 years of age and more than two/thirds were males (73.8%), 73.5% were literates, 64.2% were Hindus, nearly 75% earned less than Rs.2252/- per capita per month, 64.6% were married and more than 70% lived in joint families (Table 1).

Table 1: Socio-demographic profile of the study participants (N=520)

Variable	N=520	Percentage (%)
Age Group (in years)		
21 - 29	168	32.3
30 - 39	102	19.6
40 - 49	92	17.7
50 - 59	114	21.9
60 - 69	44	8.5
Gender		
Female	136	26.2
Male	384	73.8
Education		
Illiterate	138	26.5
Primary School (Up to class 5)	160	30.8
Upper Primary (Class 6 & 7)	108	20.8
High School (Class 8 - Class 10)	106	20.4
Higher Secondary (Class 11& 12)	8	1.5

Religion		
Hindu	334	64.2
Muslim	180	34.6
Christian	6	1.2
Economic status (per capita per month – Rs.)*		
≥ 7770 Upper	10	1.9
3808 - 7769 Upper-middle	52	10.0
2253 - 3807 Middle	70	13.5
1166 - 2252 Lower-middle	288	55.4
<1166 Lower	100	19.2
Marital status		
Married	336	64.6
Unmarried	104	20.0
Divorced/ Widowed	80	15.4
Type of family		
Joint	384	73.8
Nuclear	104	20.0
Single Person	32	6.2

*using B.G. Prasad Scale[7]

Most of the workers (95%) were heavy workers in the studied sample. Over two-fifths were found to be unskilled workers who dabbled in cement work and worked as manual laborers. Nearly half of the workers were in the industry for less than 20 years (Table 2). Nearly one-fifth (19.2%) of the workers reported occupation-related injuries in the past 3 months. Over 70% were satisfied with their jobs - low wage, lack of job security, hard physical labour and not being able to see the family for long stretches of time were mainly cited as reasons for lack of job satisfaction.

Table 2: Frequency distribution of study participants according to their work environment details (N=520)

Variable	N=520	Percentage (%)
Work Type		
Heavy	496	95.4
Moderate	24	4.6
Nature of Work		
Masonry	54	10.4
Rod - Binding	50	9.6
Centering	44	8.5
Plumbing	50	9.6
Marble work	36	6.9
Carpenter	48	9.2
Cement work	94	18.1
Labourer	120	23.1
Welding	04	0.8
Painting	10	1.9
Electrical	10	1.9
Work years		
< 10 years	146	28.1
10 - 19 years	110	21.2
20 - 29 years	120	23.1
30 - 39 years	86	16.5
40 - 49 years	58	11.1

Work related injury in last 3 months		
Yes	100	19.2
No	420	80.8
Job Satisfaction		
Yes	188	72.3
No	72	27.7

Factors including age less than 40 years, male gender, use of alcohol, better education, skilled nature of work, lesser duration of work experience and lack of job satisfaction were found statistically significant (using the Chi-Square test) when the issue of work-related injury in the last 3 months was raised (Table 3). BMI, use of PPE, marital status, economic status, religion, presence of family and type of work were found to be not statistically significant (Chi-square test) with respect to workplace-related injuries in the last 3 months.

Table 3: Frequency and Significance of Factors contributing to Occupational Injuries

Variable	Grouping of Variable (Number)	Subjects with injury in the last 3 months (Out of 100)	Subjects with no injury in the last 3 months (Out of 420)	Odds ratio (95% CI of odds ratio)	p-value
Age	≤ 40 years (280)	78 (27.9%)	202 (72.1%)	**3.8 (2.3-6.3)**	0.00001*
	>40 years (240)	22 (9.2%)	218 (77.8%)		
Gender	Males (384)	90 (23.4%)	294 (76.6%)	**3.9 (1.9-7.7)**	0.000043*
	Females (136)	10 (7.4%)	126 (92.6%)		
B.M. I	< 18.5 (154)	36 (23.4%)	118 (76.6%)	1.4 (0.9-2.3)	0.12
	≥ 18.5 (366)	64 (17.5%)	302 (82.5%)		
Use of PPE	Used (114)	28 (24.6%)	86 (75.4%)	1.5 (0.9-2.5)	0.1
	Never (406)	72 (17.7%)	334 (82.3%)		
Current use of alcohol	Used (342)	76 (22.2%)	266 (77.8%)	**1.8 (1.1-3.0)**	0.016*
	Never (178)	24 (13.5%)	154 (86.5%)		
Currently Married	Yes (336)	60 (17.9%)	276 (82.1%)	0.8 (0.5-1.2)	0.28
	No (184)	40 (21.7%)	144 (78.3%)		
Family Present	Yes (488)	99 (20.3%)	389 (79.7%)	7.9 (1.1-58.5)	0.1
	No (32)	1 (3.1%)	31 (96.9%)		
Education	Upto class 5 (298)	38 (12.8%)	260 (87.2%)	**0.4 (0.2-0.6)**	.000014
	> class 5 (222)	62 (27.9%)	160 (72.1%)		
Economic status	Higher (62)	8 (12.9%)	54 (87.1%)	0.6 (0.3-1.3)	0.178
	Lower (458)	92 (20.1%)	366 (79.9%)		
Religion	Hindu (334)	72 (21.6%)	262 (78.4%)	1.55 (0.96-2.5)	0.7
	Non-Hindu (186)	28 (15.1%)	158 (84.9%)		
Work Type	Heavy (496)	96 (19.4%)	400 (80.6%)	1.2 (0.4-3.6)	0.744
	Moderate (24)	4 (16.7%)	20 (83.3%)		
Nature of Work	Unskilled (214)	30 (14%)	184 (86%)	**0.6 (0.3-0.9)**	0.012*
	Skilled (306)	70 (22.9%)	236 (77.1%)		
Duration of Work (Years)	<20 (256)	68 (26.6%)	188 (73.4%)	**2.6 (1.7-4.2)**	0.000029*
	>=20 (264)	32 (12.1%)	232 (87.9%)		
Job Satisfaction	Yes (376)	54 (14.4%)	322 (85.6%)	**0.4 (0.2-0.6)**	0.00001*
	No (144)	46 (31.9%)	98 (68.1%)		

* Statistically significant as per Chi-square test

A total of 520 workers were interviewed, out of which 280 were less than or equal to 40 years of age while 240 were over 40 years of age (Figure 1). The number of injured workers is taken into account; a person having more than one type or one episode of injury in the last 3 months is considered as one person reporting to having a work-related injury. It was found that 19.2% of the total workers had injuries while 27.9% of the less than up to 40 years age group had injuries and 9.2% of the above 40 years had injuries.

The frequency distribution of the nature of injuries (age-wise distribution of injuries in the past 3 months) is shown below (Figure 2). All 134 episodes of injuries, experienced by 100 workers are taken into account. Here it is seen that the major share of injuries falls under the musculoskeletal system (fractures, sprain/strain, dislocation and ligament tears), which has the potential to affect their ability to work and earn a livelihood. Also, it was the younger people who reported experiencing work-related injuries 104 cases out of 134 (77.6%) while their older counterparts reported to the rest 30 (22.4%) cases of injuries.

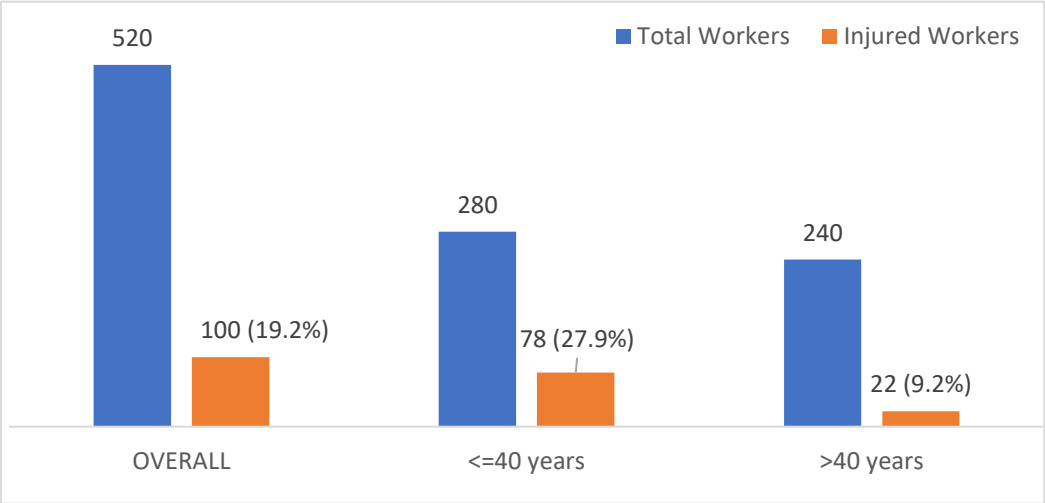

Figure 1: Distribution of study subjects with various age groups along with the prevalence of injuries

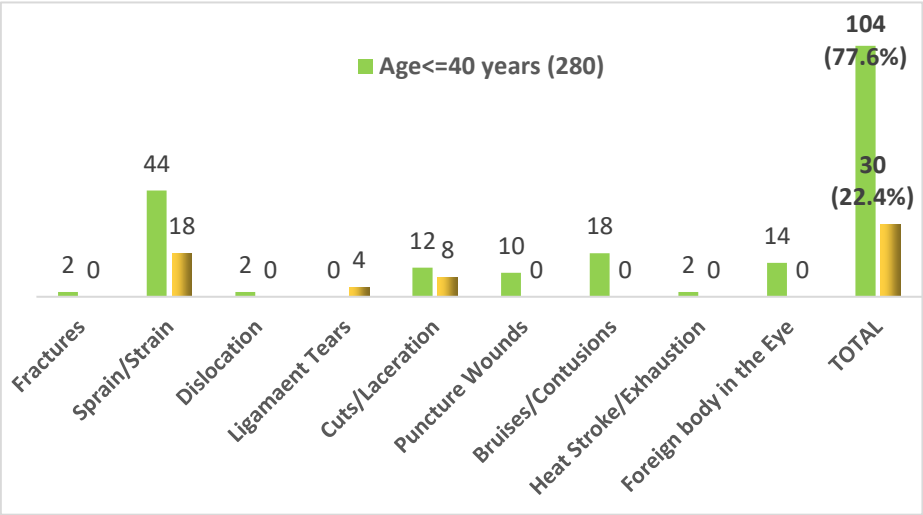

Figure 2: Association between nature of injury with age (multiple answers)

Discussion:

This study comprises 520 construction workers working at various construction sites in Bhubaneswar city, eastern India. It revealed that the overall prevalence of occupational injuries was 19.2% in the past 3 months. Breaking them into below 40 years and above 40 years age groups, revealed that the younger age group (<40 years) had a higher prevalence of occupational injuries compared to the workers above 40 years of age. This difference was statistically significant. This could be due to the fact of better adjusting healthy balance by the older workers while working, which helped them better avoid work-related injuries. Sex-wise, females had fewer injuries compared to their male counterparts (7.4% vs. 23.4%), which is statistically significant (table 3). This could be because females are usually associated with relatively milder work, whereas males are often associated with moderate to heavy work. These findings were supported by a Mangalore-based study, published in 2020.[8] The study reported that the prevalence of occupational injuries among their study participants was 36.28%. Lower age (<30 years) was one of the important causes and statistically significant factors associated with work-related injuries among construction workers. A Delhi-based study found that in 2017, only 37 females out of 44978 (0.82%) reported having construction site injuries as compared to 1043 out of 711,960 males (0.15%).[9] A Bangladesh-based study found that 57% of its study participants had occupational injuries in the past 12 months.[10] The same study too reported that lower age (<30 years) was associated with injury at the workplace. An Egyptian study among construction workers supported these findings.[11] The study found the overall prevalence of occupational injuries to be 46.2% and younger age was associated with more injuries. Hard physical labor with a high risk of occupational injuries is usually done by men according to ILO and WHO. As per ILO, the age of 46 years and above are considered to be old age since working on construction site require a lot of energy.[12] A study in Ethiopia found that being male elevated the odds of occupational injuries among construction workers.[13]

Better education and skilled work (table 3) were seen to be significantly associated with more reporting of workplace injuries in this study. This can be explained by the fact that better-educated ones were more aware and could report/recall their injuries better. Perception of these workers was more. On the other hand, the unskilled workers perhaps, were better adjusted to healthy ergonomic balance during their work - their muscle activities were possibly more coordinated as compared to that of the skilled workers. A Belgian study on farmers and a Korean study on construction workers too reported that better education led to a better perception of symptoms and resulted in more self-reporting.[14,15] But the Bangladesh-based study found that less education and lack of training increased the chances of injuries among the construction workers.[10]

Over half (65.8%) of the studied workers in this study, had reported consuming alcohol on the weekly basis. Also use of alcohol is statistically significant when associated with work-related injuries (table 3). Upon interviewing the study subjects further, it was learned that workers with self-reported injuries often consumed alcohol to subdue the physical pain. Rajeshkannan et al[16] found that 55.7% of the participants consumed alcohol, and a significant proportion of the study participants were users of multiple substances. It also reported that among the major industries, the highest rates of heavy alcohol use were found among construction workers. The Mangalore-based study too found that alcohol consumption was associated with more occupational injuries among construction workers. [8]

Even though 72.3% of the participants had reported being satisfied with their jobs in this study yet lack of job satisfaction is seen to be significantly associated (table 3) with injuries at the workplace. Other studies too have found that job dissatisfaction contributed to an increase in work-related injuries.[8,11,13] Less work experience in the construction industry also increased the instances of workplace injuries, this study found (table 3). Similar findings were reported by other studies.[8,11] This can be explained by the fact that a

lesser duration of employment is associated with less experience and a lack of awareness regarding workplace safety habits and hazards which results in increased chances of risk-taking behavior.[17,18] Younger workers did not usually comply with safe work procedures as per an Egypt-based report.[19] Nearly 75% of the study subjects earned less than Rs.2252/- per capita per month and thus had to be categorized under lower-middle and lower classes in the economic scales as per the B. G. Prasad Scale.[7] Bhubaneswar is classified under Area B and the skilled workers were to be paid Rs.389/- while the unskilled workers were to be paid Rs. 324/- as their daily minimum wage during the study period.[20] But our study found that they were getting paid way less than their right.

Following the above, multivariate analysis showed that only two factors - age less than equal to 40 years and lesser work experience (lesser duration of work) were statistically significant [2.9 (1.7 - 4.1) and 2.2 (1.5 - 3.9) respectively]. On the other hand, factors such as BMI, use of PPE, marital status, presence of family, socioeconomic status, religion, and work type were found to be not statistically significant in this study. With time, the women's workforce in the construction industry is on the rise.[21] These women need to be catered to not only for their occupational health but also obstetric care during their ante-natal and post-natal periods.

Limitations

Usual limitations associated with a cross-sectional study, self-reported behavior of the study subjects, non-availability of adequate representative female workers for the interview, interviewing participants in workplaces where privacy and suitable spaces were not available, apprehension of revealing unwanted information of the owner, loss of business hours and recall bias in some cases are some of the important limitations of this study.

Conclusion

This study looked into the issues of work-related injuries among the urban construction workers of Bhubaneswar, eastern India. This study revealed that young age (less than 40 years) and lesser work experience along with a few other factors are associated with higher occupational injuries. The study also observed that the health and safety issues of these underprivileged workers are often ignored. These need to be addressed by the local authority. A suitable intervention program targeting this group, need to be initiated based on their felt needs.

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