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ORIGINAL ARTICLE

Occupational Injuries and Associated Risk Factors Among Construction Workers: A Cross-Sectional in Rural Areas of Eastern India

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Keywords

Construction Workers,

Injury,

Personal Protective Measures,

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ABSTRACT

Background: Due to the nature of their work, construction workers are always at high risk of sustaining physical injuries. This study assessed the prevalence, types of workplace injuries, and associated factors among construction workers in Bhubaneswar, Odisha, India.

Methods: The study was conducted in the Outpatient Department (OPD) at a Rural Health Training Centre (RHTC) linked to a medical college in Bhubaneswar, Odisha, India, from October 2021 to March 2022. A total of 260 workers aged 18 and older selected by systematic random sampling from various construction sites related to RHTC were interviewed. Trained field staff, guided by one of the investigators, gathered data using a questionnaire.

Results: Most participants (49.62%) were between 19 and 28 years of age, predominantly male (85%), and studied up to primary level of education (48.5%). The prevalence of injuries was 50.77 %, and the most prevalent injuries include sprains and cuts/lacerations (24.24%). Falling objects at construction sites were the most common cause of injury (40.91%). Plumbers (odds ratio of 11.11, 95% CI: 1.27-96.87) and rod binders (odds ratio of 2.67, 95% CI: 1.08-6.59) faced greater odds of sustaining injuries, while the duration of work significantly influenced the likelihood of workplace injuries.

Conclusion: Construction workers at the study place had a relatively high prevalence of external injuries. The present burden of injuries in the locality must be lessened by effective implementation of health and safety management, training construction workers, and ensuring access to appropriate personal protective equipment.

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INTRODUCTION

Work is a fundamental requirement for everyone. Both structured and informal sectors offer livelihoods to many individuals. Agricultural labourers, construction workers, contract workers, and home-based workers primarily belong to the informal sector. As the second-largest industry, construction employs a large

number of individuals, particularly among marginalized and impoverished communities in India.[1] This industry accounts for about 7% of the country's gross domestic product (the second largest contributor).[2] Oxford Economics' 2020 report positioned the Indian construction industry as the ninth-largest market worldwide.[2] The estimated Labour force in India is 317 million (75% of the global workforce), with 8.5% in the organized sector and a larger proportion (91.5%) in the unorganized sector, with approximately half of them working in the construction industry.[3,4] Recently, the construction industry has emerged as the principal industry owing to the rise in industrialization and ongoing developments.[3] This industry encompasses various specialized trades such as builders, manual Labour, masonry, welders, electricians, bricklayers, carpenters, armature fixing workers, plumbers and internal finish workers.[5]

Due to the nature of work, construction workers are at high risk of sustaining injuries and different ailments like silicosis, pneumoconiosis, chronic obstructive pulmonary diseases and lung cancer, ischemic heart disease, acid peptic disease, skin and eye infections and many cancers in different parts of the body. They may also be exposed to unguarded machinery, struck by heavy construction equipment, electrocutions, and prone to accidental injuries while moving to different floor levels for shifting cement, bricks and sand, leading to disabilities and death.[2,6]

In India, around 335,000 people die each year due to occupational injuries, with 30-40% of these occurring in the construction sector.[7,8] Since passing the 'Regulation of Employment and Conditions of Service Act' in 1996 and the "Central Rules" in 1998, construction safety has become subject to legal enforcement.[9] In India, workers in many construction sites are typically unorganized and frequently unaware of relevant legislation, rendering them ineligible for free or subsidized care. Moreover, their low education level, ignorance about the different preventive and safety measures, migration from remote villages, and limited language skills hinder their understanding of the safety precautions and ability to articulate their concerns.[4]

In light of the above context, this study aimed to examine the prevalence and types of workplace injuries among construction workers visiting the OPD at RHTC of a medical college in Bhubaneswar, Odisha. The study also evaluated the factors associated with these injuries.

MATERIAL AND METHODS

This cross-sectional study was conducted at the OPD of the RHTC (Rural Health Training Centre) within the Community Medicine Department of a medical college and tertiary care facility in Bhubaneswar, from October 2021 to March 2022. The centre serves numerous nearby rural villages, offering general OPD services and specialist care. The study participants comprised workers from various construction sites close to the centre. Construction workers of any gender aged 19 and older who were willing to participate were eligible. Pregnant women and individuals unable to communicate were excluded from the

study. Informed consent was obtained from all study participants before the study. The study conformed to the provisions of the Declaration of Helsinki, and ethical approval was obtained from the institution before the study (DRM/IMS.SH/SOA/28026).

Table 1: Socio-demographic profile of construction workers (N=260)

Characteristics	Number of participants (n)	Percentage (%)
Gender		
Male	221	85
Female	39	15
Age group		
19-28	129	49.62
29-38	99	39.08
39-48	25	09.61
49-58	07	2.69
Marital status		
Married	194	74.62
Unmarried	66	25.38
Religion		
Hindu	237	91.15
Muslim	23	8.85
Socio-economic status		
Lower	93	35.8
lower-Middle	164	63
Middle	03	1.2
Education		
Illiterate	61	23.46
Primary	126	48.46
Secondary	65	25
Higher-Secondary	08	3.08
Type of family		
Nuclear	154	59.23
Joint	106	40.77
Nature of work		
Masonry	43	16.54
Rod bending	38	14.62
Centering	69	26.54
Plumbing	09	3.46
Painting	05	1.92
Electrical	04	1.54
Miscellaneous (welding, mixing, carrying)	92	35.38
Addiction history		
No addiction history	98	37.69
Addiction to tobacco	78	30.0
Addiction to both tobacco and alcohol	84	32.3

The sample size was determined to be 240 based on a workplace injury prevalence of 28.6% among construction workers, an allowable error of 20%, and a confidence interval of 95%.[10] To account for a non-response rate of 10%, data collection included 260 individuals. At the time of data collection, the study area had 7 construction sites tied up with RHTC. A separate registry (around 750 construction workers from 7 sites) consisting of the names and contact

numbers of construction workers was kept at RHTC for their regular check-ups. Systematic random sampling was employed in this study to ensure that the sample was evenly distributed across the entire population. The sampling interval was determined to be 3 by dividing the total registered construction workers (750) by the sample size (260). A random number between 1 and 10 was generated using a random number generator, which came as 2 as the starting point for the systematic sampling. Hence, the first participant was 2nd construction worker in the register, and every 3rd worker was selected thereafter (i.e., 5th, 8th, 11th, and so on) until the desired sample size of 260 was reached. About 10 or more workers were contacted daily to visit our OPD for regular health check-ups under their supervisor's guidance. After their health checkup and consent, information was collected through a semi-structured questionnaire by our field staff, trained by one of the investigators who prepared and validated the questionnaire. The questionnaire was tested and validated by doing a pilot study in a village other than the study area, and necessary changes were made. The data was collected until the desired sample size was met within our study period. The questionnaire contains questions relating to socio-demographic profile, present health status, past health events, and previous treatment history. The individual's socio-economic status was calculated using the Modified B.G. Prasad scale for the year 2021.[11.] Questions were asked in the local language, though prepared in English. Each interview lasted for approximately 20 to 25 minutes. Relevant treatment and primary aids were provided to the participants for any diagnosed deformity or disease.

Table 2: Association between injury and socio-demographic characteristics of participants (n=260)

Sociodemographic characteristics	Total	Injured no. (%)	Not injured no. (%)	Crude Odd's ratio	p-value
Gender					
Male	221	109(49.3)	112(50.7)	1.89 (0.91 - 3.93)	0.08*
Female	39	23(58.9)	16(41.1)	1.00	
Age group					
19-28	129	62(48.1)	67(51.9)	1.49(0.32-6.91)	
29-38	99	50(50.5)	49(49.5)	1.36(.29-6.40)	0.26
39-48	25	16(64)	09(36)	0.889(0.16-4.85)	
> 48	07	04(57.1)	03(42.9)	1.00	
Education					
Illiterate	61	35(57.4)	26(42.6)	1.00	
Primary	126	68(53.9)	58(46.1)	0.87 (0.47-1.61)	0.25
Secondary	65	26(40)	39(60)	0.49 (0.24-1.00)	
Higher Secondary	08	3(37.5)	5(62.5)	0.45 (0.09-2.03)	

* Statistically significant

The data were analysed using SPSS (version 25.0) software after entering into Microsoft Excel. Categorical data were presented in percentages. The Chi-square test and simple logistic regression test were applied for the associated factors. A p-value of less than 0.05 was taken as statistically significant.

RESULTS

The study included 260 participants. The largest group was aged 19-28 (49.62%), while 38.08% fell into the 29-38 age category. Most respondents identified as Hindu (91.15%). Approximately 85% of the participants were male, with nearly half (48.5%) having completed only primary education.

Masonry accounted for 16.54% of all types of work, while Rod bending, Centering, Plumbing, Painting, and Electrical comprised 14.62%, 26.54%, 3.46%, 0.77%, and 1.54%, respectively. Apart from these mainstream job descriptions in construction, 35.38% of workers were engaged in miscellaneous jobs like welding, mixing, carrying, etc. While 37.69 % of participants had a negative history of addiction to tobacco or alcohol, about one-third, i.e., 30% of the total, were addicted to tobacco, and around 32.3% were addicted to both tobacco and alcohol. **(Table 1)**

Table 3: Association between injury and nature of work among study subjects (n=260)

Nature of work	Total (n)	Injured (no. %)	Not injured (no. %)	Crude odds ratio (95% CI)	P value
Masonry/bricklaying	43	19(44.2)	24(55.8)	1.00	
Rod- binding	38	25(65.8)	13(34.2)	2.67 (1.08-6.59)	0.03*
Centering	69	32(46.4)	37(53.6)	1.20 (0.56-2.59)	0.64
Plumbing	09	8(88.9)	1(11.1)	11.11 (1.27-96.87)	0.03*
welder	04	03(75)	1(25)	4.16 (0.40 to 43.38)	0.23
Others	97	45(46.4)	52(53.6)	1.22 (0.58-2.53)	0.59
Total	260	132(50.7)	128 (49.2)	-	-

* Statistically significant

The prevalence of workplace injuries among study participants was 50.77 % (132 participants). The most prevalent injuries the construction workers sustained were Sprains and Cuts/Lacerations, comprising 24.24 % each, while the next most common sustained injury was Abrasions (18.18%). **(Figure 1)**

Objects falling at the construction site were found to be the most common cause of injury among the construction workers (40.91%), followed by accidental stepping or striking of the on-site objects and artifacts (38.64%). **(Figure 2)**

Table 4: Association between Injury and duration of work as construction worker (n=260)

Duration of work	Total no.(n)	Injured (n, %)	Not injured (n, %)	Crude odds ratio (95% CI)	*p*-value
1-5 years	140	62 (44.3)	78 (55.7)	0.37 (0.17 – 0.79)	0.009*
6-10 years	82	44 (53.7)	38 (46.3)	0.53 (0.23 – 1.20)	0.13
> 10 years	38	26 (68.4)	12 (31.6)	1.00	
Total	260	132 (50.7)	128 (49.2)	-	-

* Statistically significant

In the present study, males had higher odds (1.89) of getting injured than females, while workers between the ages of 19 and 28 years had higher odds (1.49) of injury than workers of other age groups. It was found that an increase in levels of education was protective against injury propensity. However, none of these associations between socio-demographic parameters and

injury was significant. **(Table 2)**

On determining the association between the nature of work and the construction site injury, it was found that Plumbers (odds ratio as 11.11 (1.27-96.87)) and rod binders (odds ratio as 2.67 (1.08-6.59)) had significantly higher odds of sustaining an injury than others. **(Table 3)** Similarly, it was found that the duration of work in construction played a significant role in sustaining a workplace injury, as evident from table 4. **(Table 4)**

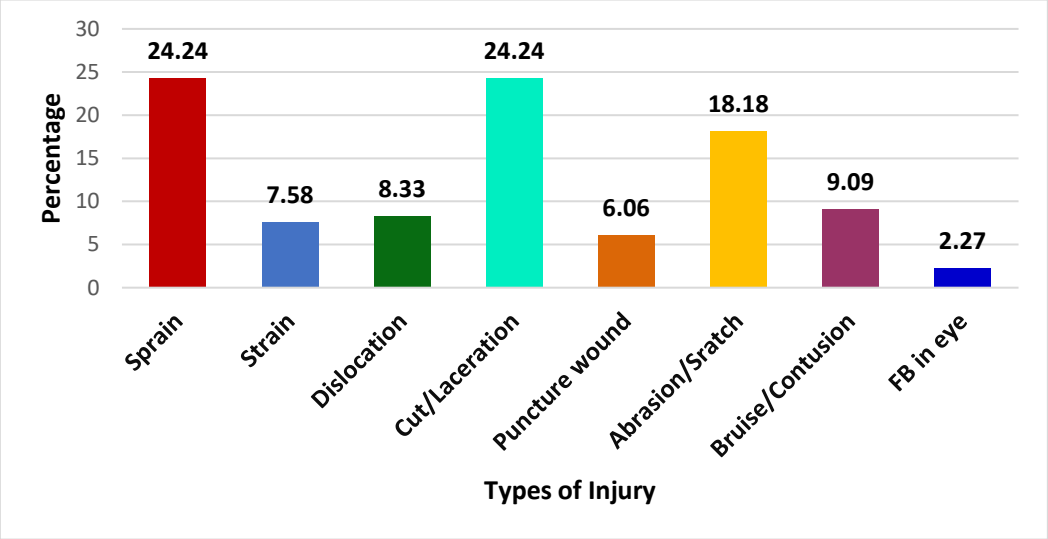

Fig 1: Bar diagram depicting the distribution of types of Injuries sustained among the construction workers (In percentage). *FB: Foreign body

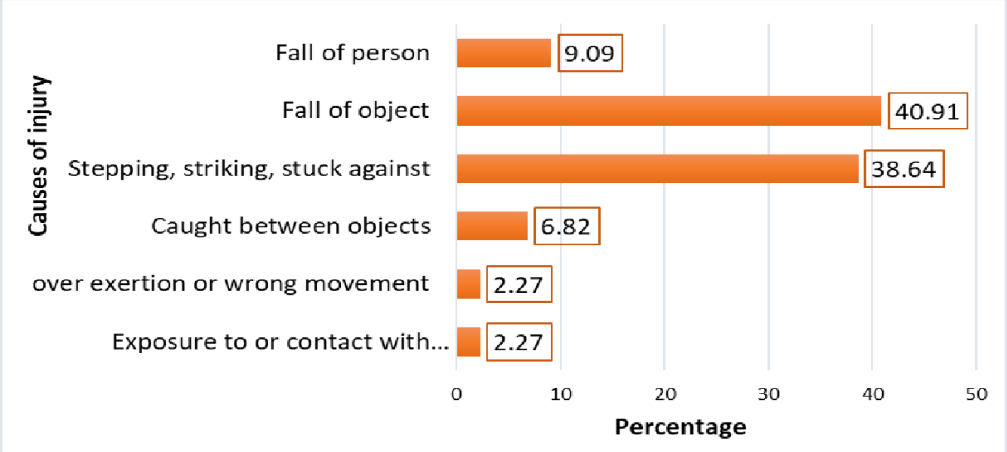

Fig 2: Bar diagram depicting the distribution of construction workers according to cause of injury (In percentages)

DISCUSSION

Construction workers face many morbidities; one important morbidity among them is injury at the construction site during working hours. A review paper on musculoskeletal disorders among construction workers in India done by Jaiswal et al. revealed that musculoskeletal disorders due to physical injuries are the most common physical ailments among these workers.[12] The present cross-sectional study sheds light on the prevalence of external injuries and their associated factors in construction workers in the study area.

Our study revealed that the majority were male, belonged to the 19 to 28 age group, and had a primary level of education. Similar findings were also found in other studies.[4,13,14] In contrast to it, Thasmaiya et al. in Chennai reported that most construction workers belonged to the 25-year to 45-year age group and were illiterate, which was also found by other studies.[1,15-17] Construction work attracts more young males due to its physically demanding nature, irregular work hours, and not requiring advanced educational qualifications. In the present study, around 62.3% of participants had a history of addiction to alcohol or tobacco, or both. Mohankumar et al. in the Kancheepuram district also revealed that more than half of the participants had an addiction history.[17]

At the workplace, many study subjects were engaged in activities like carrying objects, mixing things, and welding. Other investigators also reported that most workers worked as helpers at construction sites. [4,14,15] In the present study, around half of the subjects (50.7%) had suffered from injuries at the construction sites. It showed that the prevalence of workplace injuries among these workers was relatively high in the locality compared to other studies' findings, which stated that injuries at construction sites were around 28% to 46%.[1,10,17,18] However, in findings reported by studies in southern Bangalore, the prevalence of injuries ranged from 8% to 12%. [13,16,19] Jasani et al. found a very low proportion of participants (2.56%) suffered from injuries at work, whereas Sandeep et al. reported only 3.72% of workers had injuries.[4,20] The variation in prevalence may be attributed to differences in safety regulations, enforcement, and workplace culture. In addition, better labour laws, stricter enforcement of safety standards, a strong union presence, and higher awareness of work rights may contribute to the low prevalence of workplace injuries in some places.[21]

In our study, the most prevalent types of injury were sprains and cuts/lacerations. This may be due to the nature of work and environmental conditions around the construction sites. Handling sharp or heavy or hazardous objects, heavy lifting, working at heights, uneven terrain on worksites, or sometimes even inadequate safety measures during working hours accounts for injuries at construction sites. The study by Jasani et al. also supports these findings as they also found that most injuries were abrasions followed by cuts among participants.[4] Sashidharan et al. found that of total external

injuries, 43% were abrasions or lacerations, followed by contusions (26%).[22] Sarkar et al. stated that in their study, most injuries were fractures, sprain/strain, and dislocation types, affecting their ability to work and earn.[14]

While assessing the cause of injury in our study, it was found that the falling of objects at the workplace was the commonest cause of injury, followed by accidental stepping or striking on-site objects and artifacts. This common occurrence can be attributed to poor securing of materials, equipment mishandling, lack of attention, cluttered environment, inadequate safety protocols and improper use of protective equipment. Edwards et al., in their study, found that the collapse of old buildings was the most common cause, followed by the collapse of under-construction buildings and electrical shock.[18]

In the present study, though males, participants in the age group 19 years to 28 years and illiterate ones had higher odds of having injuries at the workplace, these associations were not significant. Similar findings were obtained by Edwards et al.[18.] However, Sarkar et al. and Sashidharan et al. reported significantly higher odds of sustaining injuries for young workers and males than others.[14,22]

The people involved in rod binding and plumbers had significantly higher odds of injuries than other workers in the study area. Rod binding work involves manual precision, manipulation with sharp objects, awkward postures and repetitive motion, which may lead to many injuries among workers. Studies by others found that unskilled labourers had lower odds of having injuries than skilled labourers.[4,18] In contrast, Sashidharan et al. reported that unskilled labourers had significantly higher odds of having injuries than skilled labourers.22 Jayakrishnan et al. reported that civil workers had significantly lower odds of having injuries than building workers.[19] In our study, the workers who were new to this job and had less than 5 years had significantly lower odds of injuries. Sarkar et al. also revealed that work experience of less than 20 years was significantly associated with sustaining injuries.[14]

Limitation: In the present study, an assessment of safety measures, personal protective equipment, and knowledge about workplace ergonomics among construction workers could have been done to better understand the situation. However, the present study illuminated the risks and factors for the relatively high prevalence of injuries among construction workers. It served as a catalyst for further research into the conditions faced by construction workers in the region.

Construction workers in the study place faced a myriad of risks and hazards in the workplace, resulting in a relatively high prevalence of external injuries among them. This study revealed that accidental striking and falling of objects were the common causes of injuries, and workers involved in rod binding and plumbing work were more vulnerable to injuries than others. Intensive efforts should be made to decrease the high prevalence of injuries among

construction workers. Effective implementation of health and safety management, along with training construction workers about ergonomic principles, prevention of hazardous conditions, adaptation of safety performance, and ensuring access to appropriate personal protective equipment, can help control injuries. The present burden of injuries in the locality must be lessened to face the anticipated surge in construction activities in the upcoming decades.

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