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Occupational injuries and safety measures adopted by welding workers: a cross sectional study in South India

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ABSTRACT

Background

Welders have been identified as a high risk group according to ranking of occupations based on cost related injuries. Employment of safety measures and practices among welders are potential ways of preventing occupational injuries. Adherence to these precautions is nearly universal in the developed world but there is scarcity of information about the situation in developing world including India.

Objectives **1) To estimate the prevalence of occupational injuries among welding workers in Udupi district; 2) To assess the perception towards occupational hazards and the safety measures adopted by the welders**

Material and Methods **A cross- sectional study was conducted among 160 non- industrial welding workers in Udupi district. A pre-structured interviewer-administered questionnaire was used.**

Results **The prevalence of occupational injuries was found to be 80%. Only 24.4% of the welders had undergone professional training. Though 95% of them were aware of the importance of personal protective equipments (PPE), only 37.5% of them were regularly using PPE. Majority (75%) of them reported that welding profession was dangerous. Around 79% of the workers reported carelessness being the major cause of injury during work. Working hours of less than 8 hours in a day, reading of safety manual and maintenance of equipments were significantly positively associated with occupational injuries among welding workers.**

Conclusion **Occupational injuries during welding are preventable. The level of experience, training and attitude while working can reduce the injuries to large extent.**

Keywords: *Occupational injuries; welding workers; personal protective equipment*

BACKGROUND

Welders are one of the important occupational groups, especially in developing countries owing to rapid urbanization and industrialization[7].The workers get exposed to a range of risks during the welding process. The World Health Organization (WHO), states that there are about 250 million cases of work related injuries per year worldwide. One of the occupations that contribute to these work related injuries is non-industrial welding in context to developing countries[1]. Welding workers in the non-industrial sector are primarily involved in the automobile or real-estate sectors. Welders involved in the former sector usually undertake work concerned with welding of mufflers or repairs of automobiles following automobile accidents or crashes[8]. This frequently involves lying underneath the vehicle for carrying out welding or repair. The welding process involves cutting and joining of metal parts using flame, electric arc or other heat

sources. Welders usually get injured by flying sparks and particles of hot metal, ultraviolet radiation, and metal fumes[9].

According to the International Labor Organization (ILO), welders are a potential group often suffering bodily injuries. Welders have been identified as a high risk group according to ranking of occupations based on cost related injuries[3]. Traumatic eye injury is one of the most significant occupational health and safety concern for the welding workers. Injuries mostly occur during a normal operation of welding machine and not as a consequence of any mechanical failure. The mechanism of particulates, hot substances, and solid objects is primarily propelled or airborne. The ultraviolet and infrared radiations of electric arc welding can cause excruciating burns or even serious eye injuries. A recent study regarding occupation related eye injuries reported that workers who were untrained or partially trained exposed to welding had a fourfold greater risk of an eye injury as compared to a trained worker. Formal training for welders varies; some just receive the basic training in a vocational-technical school, while others it comes with experience in the field. Because of this inconsistency in training, knowledge of occupational hazards also varies greatly among the welding workers. As a result, workers who produce good welds aren't necessarily safe welders[4].

Occupational hazards contribute to 2.3% of disability-adjusted life year (DALY) lost among middle-income countries. Employment of safety measures and practices among welders are potential ways of preventing or reducing the levels of health hazards associated with the occupation. While adherence to these precautions is nearly universal in the developed world, there is scarcity of information about the situation in developing world including India. A study in costal south India reported low awareness of occupational hazards and utilization of safety measures among welders. With this background this study was undertaken to find out the prevalence of occupational injuries among the welders; their perception of hazards and the safety measures adopted by them.

MATERIALS AND METHODS

Study design and population

The study was carried out among welders working in garages and workshops, in Udupi District, Karnataka, India. The study design was restricted to welding workers working in garages or workshops, excluding their apprentice. Udupi taluk was randomly selected out of the three taluks in Udupi District by lottery method. The list of all garages and workshops was obtained from the association for welding workers. The welding workers were randomly chosen from the list of all the garages and workshops. The study was descriptive and cross-sectional in design. A sample size of 160 was obtained based on the following assumptions; 95% confidence interval, prevalence of 0.85 from previous research and seven percent margin of error. Ethical Approval for the study was obtained from institutional ethics committee, Kasturba medical college, Manipal University, India.

Instrument description and data collection

A pre-structured interviewer-administered questionnaire was used. The sub-sections included questions regarding the working conditions, history of injury while at work, perception about hazards and safety measures adopted by the welders. Injury was defined as injury caused during work that required treatment from physician; self and topical application of ointments or taking self medication for the injuries. Major injury was defined as having taken leave due to injury for more than two days with or without hospitalization and disability. Minor injury was defined as having taken leave due to injury for two or less than two days with or without external medication or consultation by a physician.

Data analysis

The data was analyzed using SPSS version 15. Quantitative variables were summarized using mean and standard deviation. Categorical variables were tabulated using frequencies and percentages. Logistic regression analysis was done to find out the factors associated with occupational injuries among welders.

RESULTS

Socio Demographic and Occupational Characteristics

Table 1 depicts the variables for socio-demographic and occupational characteristics. A total of 160 participants (welding workers) were included in the study. The results of 160 respondents are presented under various domains as frequency and

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percentage of the total 160 study participants, all the 160 participants were males. The mean age of the participants was 32.37 years (SD 10.62). The maximum age being 62 and the minimum age 18. Of the total 160 participants, 68.17% were urban residents and 31.83% of the participants were from rural. Majority of the participants worked for 8-12 hours in a day.

Table 1 Socio-demographic characteristics

Variables	Characteristics	Frequency (Percentage)
Age (years)	Less Than 25	40 (25)
	More Than 25	120 (75)
Education status	Primary	48 (30)
	Secondary	79 (49.4)
	PUC	29 (18.1)
	Graduate	4 (2.5)
Experience in welding field (years)	Less than 1	14 (8.8)
	1-10	59 (36.9)
	11-20	53 (33.1)
	21-30	28 (17.5)
	More than 30	6 (3.8)
Working hours/ day	Less than 8	1 (0.6)
	8-12 hours	157 (98.1)
	More than 12 hours	2 (1.2)

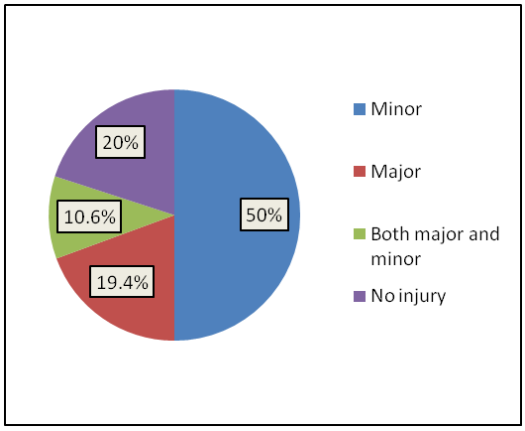
Prevalence of Injury

The prevalence of occupational injury was found to be 80%. The respondents also reported the number of times they were injured and the complications faced by them, represented in **Table 2**. The occupational injury was classified as major injury and minor injury as explained in the operational definitions. Majority of them reported minor injury and a low percentage of the participants reported no injury.

Table 2 Distribution of welding workers according to Occupational injuries

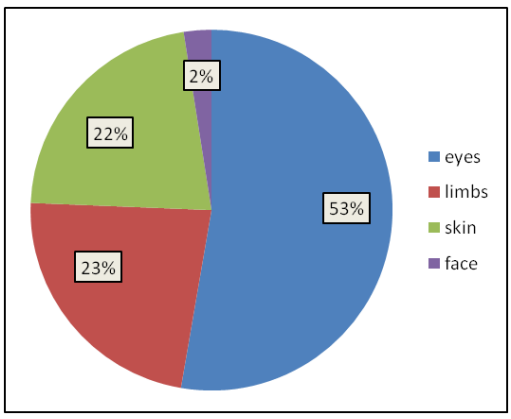
Variables	Characteristics	Frequency (Percentage) (N=160)
Any kind of occupational Injury	Yes	128 (80)
Number of times injured	Less than 5	94 (58.8)
	More than 5	28 (17.5)
Complications due to injury (N=158)	Disability	6 (3.8)
	Surgery	49 (31.0)

Graph 1 shows the type of injuries experienced by the workers. Majority of the respondents reported eyes being the major body part involved in the injury followed by skin, limbs and face.



Graph 1 Distribution of welding workers based on the type of injury

Graph 2 shows the frequencies and percentages of the body parts involved.



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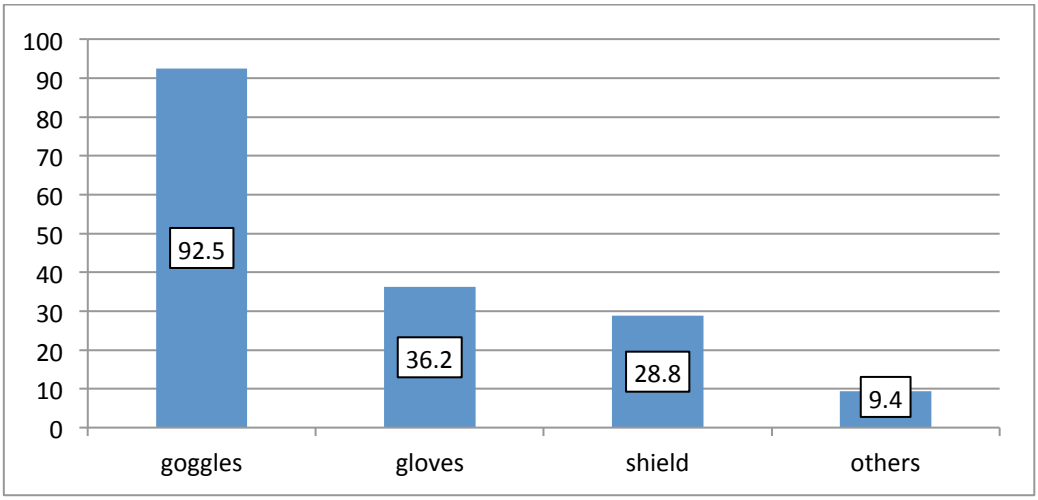
Graph 2 Distribution of welding workers according to body parts involved during the injury

Safety Measures Adopted

Only 24.4% of them had undergone professional training, most of the workers were not trained professionally. Only 15% of the work area had fire extinguishers. The PPE (Personal protective equipments) was regularly used by 37.5% of the workers. **Table 3** depicts the preventive measures adopted by welders and **Graph 3** represents the usage of protective gear by welders.

Table 3 Distribution of welding workers according to safety measures adopted

Variable	Characteristics	Frequency (%) (N=160)
Received training	Yes	39 (24.4)
Fire extinguisher in workplace	Yes	24 (15)
First aid kit in workplace	Yes	61(38.1)
Use PPE	Always	78 (48.7)
	Sometimes	67 (41.8)
	Never	15 (9.3)
Maintenance of equipment	Within every 6 months	98 (61.2)
	Within a year	20 (12.5)
Read safety manual	When needed	42 (26.2)
	Yes	31 (19.3)
	No	129(80.6)



Graph 3 Distribution of welding workers according to type of Protective Gear Used

Table 4 Factors associated with injuries

Variables	Frequency (%) N= 160	Adjusted OR (C.I)	p-value
Working hours (less than 8 hours/day)	1 (.6)	.019 (.001, 1.254)	.064
Gas welding	36 (22.5)	3.98 (.023, 7.00)	.600
Safety manual	31 (19.4)	1 (.001,10.00)	.16
Always use PPE	78 (48.7)	.120 (.002, 4.3)	.61
Use shield	46 (28.8)	.019 (.01,1.25)	.064
First aid kit in workplace	61 (38.1)	.016 (.001,9.6)	.20
Regular maintenance of equipment	118 (73.7)	.195 (.041, .922)	.039

Perceptions of Occupational Hazards

Around 75% of them reported that welding profession was dangerous and 34.4% of them

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admitted that there was risk involved, around 79% reasoned carelessness being the major cause of injury. Majority of them reported that training and use of personal protective equipment was essential for preventing welding related injury. **Table 4** represents the perception of welding workers on the occupational hazards of welding.

Factors Associated With Occupational Injuries

Data was analyzed to see the associated factors with injuries. Though there were many factors associated with injuries as shown in **Table 5**, working hours for less than 8 hours in a day, reading of safety manual and regular maintenance of equipments were found to be significantly associated with injuries.

DISCUSSION

Prevalence of occupational injuries among welding workers is 80% and 33.4% of them reported complications.

Study shows poor formal education amongst most of the welders, only 2.5% of them being graduates which is supported by many other studies showing 14.9% and 22.0% school dropouts amongst the welding workers.

The major body part at risk was eye which was reported by 53% of the welding workers, other studies show 75.7% and 73%[5] as the prevalence for eye injuries. Only 37.5% used PPE, out of which 95% used goggles, the reason for not using goggles as protective measure was the problem of visibility and discomfort. However, few other studies report the improvement made in the design of goggles to make it more comfortable for the welders to reduce the incidence of ocular injuries[3,6].

A majority of the welders (74.4%) were aware that welding profession was hazardous, 95% of welding workers reported that PPE is important, however utilization rate was only 37.5%, there was also evidence reporting the usage of PPE only by one-third of the participants (6). The monetary hurdle of the workers plays a major role for the decreased utilization of PPE.

Increase in the awareness and education for the welders on the usage of PPE is very important, support and care for their safety should be a responsibility taken up by the private and government sectors. Majority (95%) of the welders recommend for the strong legislation on the protection. The study suggests the need for the strong welder's union take up initiatives to approach the government for their safety benefits.

Only 24.4% of the welders have undergone professional training, but 93% of welders feel training is important. Professional training of the welders might decrease the injuries and add safety for the welding workers. Around 73% of the welding workers maintain their equipments regularly which was a protective factor that should be mandated at work places of welding workers.

LIMITATIONS

Only the welding workers, working at garages or workshop were included in the study. Industrial welders were not included in the study due to permission issues. We have not addressed any confounding factors in particular in the study.

CONCLUSION

The prevalence of occupational injury was high among welders and the proportion of welders using protective measures was low. The level of experience, training and attitude while working can reduce the injuries dramatically. The study recommends regular training, awareness and safety intervention programs to be advocated to minimize occupational injury among welding workers.

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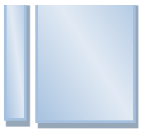

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