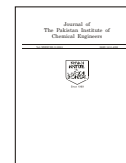




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Safety Measures in Welding and Spray Painting in Pakistan: A Systematic Review

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Abstract

Use of Personnel Protective Equipment (PPE) is an integral segment in occupational safety program in order to improve injury and loss prevention; however, in developing nations the occupational safety is often undermined. Across the under developed countries, employees in informal sector are executing their duty in the absence of adequate safety setup. We conducted a systematic literature review of studies on use and impact of protection equipment in informal sector focusing on welding and spray painting in Pakistan. Google Scholar, directory of open access journal and Pub Med were searched for studies pertaining to use of occupational PPE in welding and spray painting in Pakistan. Search resulted in fifty six (56) studies. The initial, abstract and full text review finally yielded seven (7) studies for this review. Overall state of use of PPE was found very disappointing. No Policy exists and poor field implementation was reported. Eye shields and gloves were among the highest available used PPEs. There was no use of respirators in welding and spray painting areas. This is the first-ever review on the state of occupational safety in informal welding and spray painting sectors in Pakistan. Detailed studies in informal sector are required to depict the safety practices.

Keywords: Worker Health, PPE, Accident, Injury, Training, Occupational Safety

1. Introduction:

With the advancement of entrepreneurship and commercial activities, more and more small business are setting place in the informal sector. Especially the welding and spray painting are part of many commercial, manufacturing and construction-related activities [1]. It is believed that approximately 1 million people around the globe are engaged in welding and spray painting jobs and there will be around 26 % increase in demand in 2020 [2].

Occupational workers in these areas are prone to many injuries and risk while at work, especially in the absence of proper occupational health and safety (OHS) setups [3]. The Occupational ill health and injury caused by welding and spray painting included but not limited to asthma [4], respiratory tract problems [5, 6], bronchitis [7] metal fumes toxicity [8] and eye injuries [9]. The occupational risks include explosion, fire, burns etc. Eye injuries account 25 percent for welding claims [10].

To mitigate the hazardous effects of welding and

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paint fumes, the best approach is to manage the threat by applying the hierarchy of controls i.e. elimination, substitution, administrative controls, engineering, and environmental controls and by the use of PPE [11]. Elimination or substitution of threat and application of engineering and environmental controls is an advisable and viable approach, however, due to limited resources and costly technology, it is not always possible in countries like Pakistan to substitute and switch over to safer technology. Companies require the services of a qualified safety specialist to ascertain which course of action is most suitable in any given situation [12]. Viable options available in under developed countries are administrative controls and the use of PPE. Administrative controls comprise issuances of standard procedures and protocols, rotations of employees and awareness programs. PPEs are considered an essential necessity in order to mitigate the effects of any accident and saving the life and health of workers from toxic effects of welding and painting fumes. The selection of appropriate level of PPE depends upon the toxic gas level at site [13].

Previous studies revealed a state of poor knowledge about health hazards associated with welding and spray painting fumes [10]. Moreover, there are also evidences that despite awareness of the health hazards, there is reluctance in use of PPE among occupational workers [14]. The injuries and risks caused by welding and paintings hazards are 100 % preventable if proper PPE is donned [12]. The main components of PPE for welding and spray painting tasks are helmet, eye shield, respirator, gloves, and safety boots [15-19]. The helmet fitted with eye shield is used extensively for protection of eyes. To protect the hands from conventional injury and shock gloves are used. To get protection from fumes of welding and spray painting, use of respiratory protection is inevitable [20-22].

With the advancement in technology, there is a continuous up gradation in the field of PPE both in terms of design and material in welding and spray

technology. Most studies were conducted in developed countries, whereas limited research has been conducted in under developed countries. Welders and spray painters in Pakistan have mere arrangements of safety protection at work. The working conditions are poor and occupational workers health surveillance system is weak [23]. The aim of this study was to ascertain the use of safety measures in welders and spray painters in Pakistan.

2.0 Method:

2.1 Study Design:

A systematic literature review (SLR) was done using PRISMA guidelines.

2.2 Search Strategy:

Studies were searched through Google Scholar, DOAJ and Pub Med using specific words. Following specific words were used: 'PPE', 'protection Equipment', 'eye shield', 'face mask', 'respirator', 'gloves', 'welding', 'Spray Painting', 'Fumes fever', 'Pakistan', 'Punjab', 'Sindh', 'Balochistan' and 'Khyber Pakhtunkhwa'. The studies were included till 2019 with a limit of 10 results per page. First five pages for each key word were reviewed. After initial scrutinizing, the authors conducted review of title and abstracts for final selection of studies for comprehensive review.

2.3 Selection of Studies:

Occupational surveys, Exploratory and descriptive studies conducted in any city of Pakistan and published in English language were incorporated in review. The review emphasised on the use of protective equipment in welding & sprays painting industry. Therefore only those studies are included in which PPE was discussed. Conference papers were excluded.

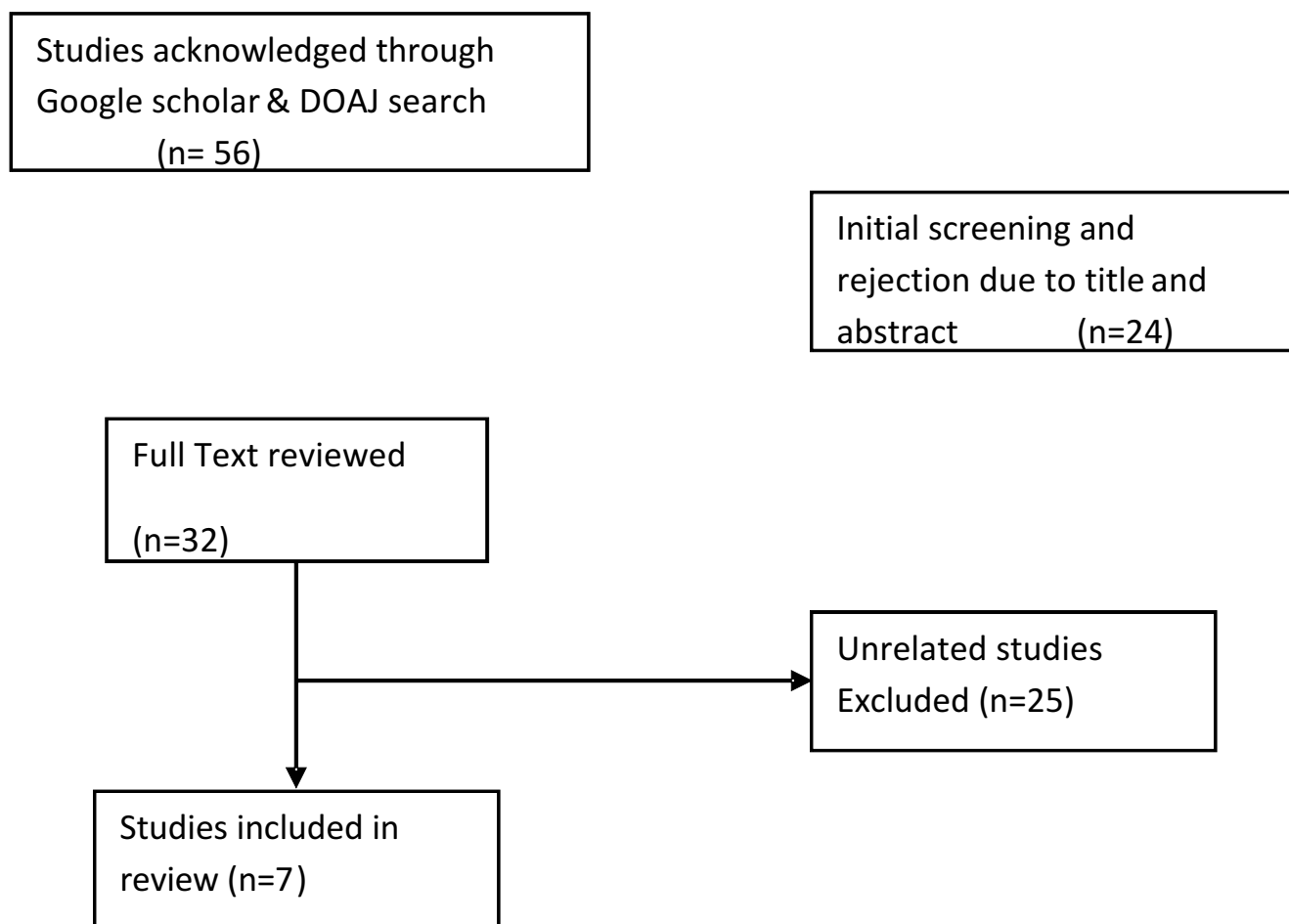


Figure 1: Flow chart of literature survey

3.0 Results:

3.1 Types of studies:

After through scrutinizing and abstract review, a total thirty two (32) studies were selected for full study review out of fifty six (56) studies. Full study review yielded seven (7) relevant studies which are included in this study and displayed in Table No 1. We reported safety issues in occupational welding / spray painting studies conducted in informal sector

of Pakistan. Total seven studies discussed the use of PPE in welding & spray painting and effects on human health. Three of them discussed welding in shops and manufacturing areas [2, 24, 25], while one study discussed the effects on lungs [26]. Three studies discussed the health effects of spray painting on painters and machinists in the absence of PPE [27-29].

Table 1: Selection of health & safety studies conducted in welding & sprays painting in Pakistan

| Author/study year | Study design | Participants | Area Focused | Main Findings |
|-------------------|---------------------------------------|---|--|--|
| [2]☐ | cross-sectional-descriptive☐ | 70 welders☐ | Eye, Burns and injury☐ | Poor awareness and education in welding profession¶ Lack of standardized eye-shielding¶ Poor Health and injury support☐ |
| [29]☐ | Cross-sectional-study☐ | 20 mechanics, 20 painters-¶ 20 control-☐ | Blood-samples☐ | Painters are more prone to Benzene exposure¶ Poor ventilation system, poor PPE and hygiene state and uncontrolled use of chemicals☐ |
| [27]☐ | Survey and Experimental Study☐ | 29 Painters¶ 25 Mechanists¶ 20 Control☐ | Hematologic al evidence to exposure to chemicals☐ | Awareness about use of PPE is to be enhanced☐ |
| [28]☐ | Experimental Study☐ | 20 Painters-¶ 20 Mechanists¶ 20 Control sample☐ | Evaluate the blood-naphthalene levels (NAPH)¶ evaluate blood-naphthalene☐ | Poor work place Hygiene and long exposure are major factor of exposure.¶ Smoking and non adherence to PPE are major personal factors.☐ |
| [26]☐ | Matched case-control cross-sectional☐ | 50 non-smoker welders☐ | Lungs, Respiratory area☐ | Welders showed a positive indication of lungs disease in the absence of PPE☐ |
| [24]☐ | Cross-Sectional-Survey☐ | 208 welders☐ | ☐ | Lack of awareness and relevant education☐ |
| [25]☐ | Cross-Sectional-Descriptive☐ | 36 welders☐ | Eye injuries, Burns☐ | Poor education & awareness¶ No use of protective equipment¶ They rate the occupation hazardous / nonhazardous based on their experience☐ |

3.2 Safety Culture, Awareness and Education:

There is a dire deficiency of safety culture in welding and spray painting areas in Pakistan. Workers were executing their jobs without formal training and education, they were unaware of the majority of hazards associated with welding & spray painting [2, 25]. There were no safety policies and operating instructions for occupational workers in those areas. Workers were getting training through observation and experiences without any written instructions and formal training [2, 25]. There were no statistical data available about the exact number of welders and spray painters working in the country; in addition no independent legislation was formulated for occupational workers working in informal sector in Pakistan [2]. The absence of statistical data regarding occupational welders and spray painters in informal sector was considered a major constraint to devise an effective OHS policy [2, 25].

3.3 Availability and USE of PPE:

Studies showed that workers were not issued proper PPE to prevent the occupational injury [25], moreover, in certain cases the PPE provided to workers were not standardized and appropriate for injury prevention [2]. The relation of health injury with the absence of PPE is supported by researchers, one study in this regard pointed towards the positive result of lungs disease in the absence of PPE [26]. Researchers also pointed out the tendency of workers for not using the PPE, besides they were provided with adequate PPE [28]. One study explained that workers were considering injuries as part of job and they were not using PPEs [2]. The significance of availability and use of PPE for injury and ill health prevention is also discussed among researchers [27]. Gloves were reported on the top of list in available PPEs, where as eye shields and respirators were reported on 2nd and 3rd place [2].

3.4 Medical Support and Reporting Mechanism:

Studies revealed no proper medical support was available to occupational welders and spray painters in Pakistan. In addition, there was no first aid equipment available and there was no first aid training provided to those workers [2]. Poor industrial hygiene and extended working duration in contaminated environment were also considered as contributing factors in workers ill health [28]. Studies pointed out that there was no Reporting and Investigation mechanism of accidents in informal sector of Pakistan, which was a major impediment in executing the corrective actions [24].

4. Discussion:

We conducted review on physical protection measures and effects on workers health in case of non availability of these measures in welding and spray painting (informal sector) of Pakistan. There is deficiency of quality studies in these disciplines and advanced studies should be conducted to ascertain the impact of safety practices in welding and spray painting in Pakistan. The major issues observed were absence of safety culture at work place, unawareness and lack of education about hazards and their impacts, non availability of operating procedures, non availability of PPEs, sub standards PPEs and tendency to work without wearing proper PPEs. There is a need to nourish the safety culture at work stations and proper awareness and education about safe work practices be fostered among the workers. The awareness about hazards and cost of PPE are major factors while deciding about use of safety measures in Pakistan [2].

Risk assessment and awareness about hazards is the first step in order to motivate the workers to adopt any safety program and adopt safe measures. Workers should know the result of exposing themselves to these hazards. Studies showed that this most important step is entirely missing in Pakistan's informal sector. The awareness level was found very poor; no proper education was imparted to workers to operate safely [24]. The

occupational workers in these professions are normal workers with education less than high school and majority of them work on daily wages. There is no proper OHS training system for these workers. Workers should be trained to execute their assigned jobs in a safe manner [2, 24].

This study also highlights the non availability or availability of sub standard PPE at work stations in Pakistan. PPEs come as a last resort to prevent injury if other engineering and administrative measures fail. Studies revealed that in Pakistan other measures are also not in place as well. The most widely used PPEs are gloves and eye shield. The standardization of PPE is another challenging domain as workers were using normal eye shields instead of certified equipment[2]. The appropriate training should be provided to the workers to use PPE effectively [27]. The most alarming fact was that workers are using available protection measures for acute effects only e.g. protection from plasma, heat and physical effects only whereas chronic effects in terms of inhalation of contaminated air / welding fumes were not considered by workers in those areas [30].

Studies also showed the adverse effects of workers health in those areas mainly due to non availability of PPE or non adherence to standardized protection measures. Different studies showed the effect on workers health systems which include lungs, blood, eyes etc [26, 28]. In continuation to adverse effects, this study also highlights that there were no medical support available to workers. There was no concept of first aid at site, in addition, no annual or routine medical assessment support was available to the occupational workers in welding and spray painting of informal sector of Pakistan [2]. The study also showed that there was no mechanism of incident or accident reporting in welding and sprays painting of informal sector of Pakistan. Due to non reporting mechanism, there is no visibility at policy level about the real time problems and state of OHS at ground level. Moreover no corrective or preventive measures can be suggested by policy level to the occupational workers due to non reporting mechanism.

This study has only considers the Google scholar and DOAJ in search. Other data bases may yield more elaborated results.

5. Conclusion:

The state of OHS in welding and spray painting in informal sector of Pakistan depends upon many contributing factors. Mainly the unawareness and lack of education were major factors along with non availability of PPEs. Due to poor regulatory implementation of OHS laws, the overall state is very disappointing. Many injuries and health related issues were reported. Extensive training and proper education can enhance the safety state of occupational workers in these areas. Vocational training institutes can play significant role in promoting safe working culture. In addition, government should uplift the working conditions of informal sector in this regards. Studies involving many under developed countries are required to report the awareness level and use of safety measures by welders and spray painters in informal sector.

Disclosure statement:

No potential conflict of interest was reported by the authors.

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