To Assess the Physical Morbidity Profile among the Welders

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Authors’ contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Introduction: The welding profession poses many health hazards that the welders are exposed to everyday during working time. This leads to a large number of health consequences and diseases. Worldwide 10 million employees are exposed to iron fumes. Most are exposed by inhaling welding fumes that have iron as their main component. Exposure to iron fumes in steel mills and iron/steel foundries is also significant.

Background: For welders it is most important to take safety measures during working time. Welders are exposed to various types of hazardous substances that can affect their health. Worldwide welder’s morbidity is in a large number of welders affected. We conducted a study to find the physical morbidity pattern of welders in the Wardha region.

Objective- To assess the physical morbidity profile among the welders, and associate the physical morbidity profile with selected demographical variables in Wardha, India.

Methods: A purposive sample was conducted among 100 welders to identify the physical morbidity among welders. Welding workshop in separated space outside and inside the city of Wardha, one way ANOVA and t-test used to estimate the degree of association between the physical morbidity profile and the selected demographic variables.

Results: All welders were having some type of physical morbidity. The most frequent issues with the welding workers are injury to the eyes and skin. Age of welding worker, educational
qualification, experience of welding work, hours worked per day are in association with the physical morbidity among welders.

**Conclusion:** In this study, the physical morbidity pattern of welders is identified. 87% welders were identified with mild physical morbidity and 13% of welders with moderate physical morbidity. Need some training program for welders to do right and safety welding and certificated course for welders.

**Keywords:** Diseases; hazards; identity; physical morbidity; welders.

1. **INTRODUCTION**

Occupation is the main source of income in any family to lead their life or meet the family's needs. Many industries are providing occupation to several peoples and also there are many diseases, which can affect the worker during the processing of the product [1].

The welders are exposed to certain welding smoke such as chromium, nickel, arsenic, asbestos, manganese, silica beryllium, cadmium, nitrogen oxides, phosgene, fluorine compounds, carbon monoxide, cobalt, copper, lead, selenium, and zinc, which can become highly toxic. It can lead to a greater risk of health impairment of the welders which mainly causes short term effect like metal fever, irritation to the eyes, nose, chest, and respiratory tract and pneumonitis, and also long-term effect shows that welders at increased risk of lung cancer [2].

Welding, if the appropriate precautions are not taken, can be dangerous and unsafe. However, the use of advanced equipment and adequate safety significantly decreases the risk of welding-related injury and death.

Welders wear personal protection equipment in the form of thick leather gloves and long-sleeve protective jackets to avoid exposure to excessive heat and flames in order to prevent injury.

The size of the particles in question appears to affect the toxicity of the fumes, with greater danger being posed by smaller particles. This is because of the capacity of tiny particles to cross the blood-brain barrier. Fumes and gases such as carbon dioxide, ozone, and heavy metal fumes can be toxic to welders without sufficient ventilation and preparation.

Worldwide 10 million employees are exposed to iron fumes. Most are exposed by inhaling welding fumes that have iron as their main component. Exposure to iron fumes in steel mills and iron/steel foundries is also significant. Epidemiological studies have indicated high lung cancer risk among steel welders, stainless steel welders, and metal welders [3].

The use of compressed gasses and flames in many welding processes presents a risk of explosion and burning. Some common measures include reducing the amount of oxygen in the air and holding fuel substances away from the workplace.

2. **BACKGROUND**

In developing countries, the number of injuries and diseases at work is rising. More than 120 million occupational accidents and more than 200,000 deaths are estimated to occur annually in these countries. An estimated 42 million workplace injuries were registered, with more than 54,000 deaths annually [4].

Welding is one of the professions in developing countries which contributes towards labour accidents and diseases. The cycle continues to be the most common method for joining metals today and forms part of the process of metal making. The process of metal making includes the production of metallic structures by cutting, bending and joining. With the other methods, the polishing, decoration or colouring of the metal components goes along. Acute and chronic health risks can arise from welding hazards such as the luminous and blinding arc light, the harmful components of the welding gases, the sharp metal edges as well as the hot and falling molten metal particles, fast-moving equipment, noise and vibration [5].

Welding hazards can lead to acute and chronic health effects, such as the bright and blinding light of the welding arc, the dangerous composition of the welding gases, the sharp metal edges, as well as the hot and falling molten metal particles, fast moving equipment, noise and vibration.

Therefore, this research aims to assess the physical morbidity profile among the welders at
selected Wardha city. This knowledge is crucial for identifying the nature of the issue and can be helpful in designing interventional approaches in this vital working group to promote and sustain good health and safe work practices.

3. METHODS

3.1 Study Setting and Design

We conducted a descriptive research study in the Wardha Districts of Maharashtra. We search for welders in a workshop located in Wardha city. Welding workshop in separated space outside the city and inside the city of Wardha city.

3.2 Sample Size and Sampling Technique

This research aims towards assessing the physical morbidity profile of welders in the city of Wardha. A total number of 100 welders were taken in this study. Age of welder, working experience, education qualification, Certified training in welding, Welding type, Hours Worked per day were asked. The study uses a convenient sampling technique. Welders those who are having already some type of symptoms of morbidity. Time given to welders for fill the checklist and collect after 30 min of time period.

3.3 Data Collection

Data was collected in selected area of Wardha city and data collected by the checklist prepared by expert consultation and literature review. In demographic data like age of welders, educational qualification welding experience, certified training in welding, welding type, metal type, hours worked per day. Reported symptoms are taken to study.

3.4 Statistical Analysis

The data was entered into the MS-Excel 2019 software and the Social Sciences Statistical Package (SPSS, version 17) was used for data analysis. The statistical tests used for the analysis of the result were Students unpaired t test, one-way ANOVA was used. Qualitative data of physical morbidity distribute in mild, moderate, sever, very sever.

4. RESULTS

A. Distribution of welders with regards to demographic variables

This study deals with the percentage-wise distribution of welders concerning their demographic characteristics. A Purposive sample of 100 subjects was drawn from the study population, who were from selected areas. The data obtained to describe the sample characteristics including the age of welder, educational qualification, welding experience, certified training in welding, welding type, metal type, hours worked per day.

The majority finding of physical morbidity in welders 38 (38%) were from the age group 34-41 years, 69 (69%) had secondary and higher secondary, 32 (32%) were from 11-15 years of welding experience, 51 (51%) had certified training in welding, 85 (85%) had been using metal arc welding, 80 (80%) had been using stainless steel metal, 93 (93%) had to work 7-8 hours per day Table 1 shows the socio-demographic characteristics of the welders.

B. Assessment of physical morbidity profile among welders

The assessment of physical morbidity profile ranges from 0-25. The finding of the study shows that mild level of physical morbidity profile had 87 (87%), moderate 13 (13%) level of physical morbidity profile, severe and very severe 0 (0%) level of physical morbidity profile and the maximum score was 08, the minimum score was 02, the mean score was 3.63 ± 1.002 with a mean percentage score of 22.68% as shown in Table 2.

C. Association of the physical morbidity profile with selected demographical variables

In multiple logistics regression age of welders, educational qualification, welding experience, hours worked per day were all associated with the morbidity problems of welders like burning, hyperpigmentation, metal fume fever, erythema, photophobia, vision loss, had conjunctivitis, hyper photosensitivity, hearing loss, myalgia, arthritis, bronchitis, pneumonia, asthma, migraine are associate with the related symptoms.

5. DISCUSSION

In this study, that involved (38%) welders in the category of 34-41 years of age group, the findings were similar to the findings of Sabitu et al, [6] where the majority(45.5%) fall in the same group, but varies from the analysis by Isah and Okojie8 in the same country where a higher percentage of welders(40.3%) fell in the category of 20-29 years. Although 69% of welders in the study had secondary and higher secondary education, only 51% of them had undergone
certified training in welding and knew about welding hazards and proper use of personal protective types of equipment. Such results are identical to Singh's study [7].

In the welding industry, the population in this area has a high income, and very few welders work in this field for a long time. However, surveys by Isah and Okojie [8] in Nigeria indicate that 74.8 % of welders have more than 10 hours of experience a day including 24.7 % of welders with more than 21 years of experience. Similarly, a Canadian analysis by El-Zein et al. [9] reveals that 81.8% of welders worked for 10 years and more and 22.8% of welders aged 30 years and over and worked in this field for 20.33 years. The studies by Isah and Okojie [8] and Sabitu et al. [6] in Nigeria show that there are welders even in the above 60 years category.

### Table 1. Distribution of welders with respect to demographic variables (n=100)

| Demographic variable                  | No. of welders | Percentage |
|---------------------------------------|----------------|------------|
| Age of welder                         |                |            |
| 18-25                                 | 13             | 13         |
| 26-33                                 | 21             | 21         |
| 34-41                                 | 38             | 38         |
| 42 above                              | 28             | 28         |
| Educational qualification             |                |            |
| Primary education                     | 20             | 20         |
| Secondary and higher education        | 69             | 69         |
| Graduate                              | 11             | 11         |
| Postgraduate and above                | 0              | 0          |
| Welding experience                    |                |            |
| 1-5 Year                              | 16             | 16         |
| 6-10 Year                             | 29             | 29         |
| 11-15 Year                            | 32             | 32         |
| > 15 Year                             | 23             | 23         |
| Certified training in welding         |                |            |
| Yes                                   | 51             | 51         |
| No                                    | 49             | 49         |
| Welding type                          |                |            |
| Metal arc welding                     | 85             | 85         |
| Gas metal arc welding                 | 15             | 15         |
| Metal type                            |                |            |
| Stainless steel                       | 80             | 80         |
| Aluminium/ Brass                      | 20             | 20         |
| Hours Worked per day                  |                |            |
| 1-2 hours                             | 02             | 02         |
| 3-4 hours                             | 0              | 0          |
| 5-6 hours                             | 05             | 05         |
| 7-8 hours                             | 93             | 93         |

### Table 2. Assessment of physical morbidity profile among welders (n=100)

| Level of Physical Morbidity | Score Range | Level of Morbidity Score |
|----------------------------|-------------|--------------------------|
|                            | Frequency   | Percentage               |
| Mild                       | 87          | 87                       |
| Moderate                   | 13          | 13                       |
| Severe                     | 0           | 0                        |
| Very Severe                | 0           | 0                        |
| Minimum score              | 02          |                          |
| Maximum score              | 08          |                          |
| Mean physical morbidity score | 3.63 ± 1.002 |                  |
| Mean % physical morbidity Score | 22.68      |                  |
Table 3. Association of the physical morbidity profile with selected demographical variables (n=100)

| Age (yrs) | No. of welders | Mean score | F-value | p-value |
|-----------|----------------|------------|---------|---------|
| 18-25 yrs | 13             | 2.85±0.37  |         |         |
| 26-33 yrs | 21             | 3.14±0.91  |         |         |
| 34-41 yrs | 38             | 3.79±1.16  | 8.738   | 0.00    |
| 42 yrs above | 28    | 4.14±0.59  |         | S, p<0.05|

| Education | No. of welders | Mean score | F-value | p-value |
|-----------|----------------|------------|---------|---------|
| Primary   | 20             | 3.85±0.67  | 8.738   | 0.00    |
| Secondary | 69             | 3.71±1.07  |         |         |
| Graduate  | 11             | 2.37±0.46  | 5.65    | 0.05    |
| Postgrad. | 0              | 0 ±0       |         |         |

| Welding experience | No. of welders | Mean score | F-value | p-value |
|--------------------|----------------|------------|---------|---------|
| 1-5 year           | 16             | 2.88±0.34  |         |         |
| 6-10 year          | 29             | 3.38±0.86  | 7.674   | 0.00    |
| 11-15 year         | 32             | 3.84±1.24  |         | S, p<0.05|
| >15 year           | 23             | 4.17±0.65  |         |         |

| Certified training in welding | No. of welders | Mean score | t-value | p-value |
|--------------------------------|----------------|------------|---------|---------|
| Yes                            | 51             | 3.35±1.110 | 2.92    | 0.38    |
| No                             | 49             | 3.92±0.78  |         | NS, p>0.05|

| Welding type                | No. of welders | Mean score | t-value | p-value |
|-----------------------------|----------------|------------|---------|---------|
| Metal Arc welding           | 85             | 3.69±1.012 | 1.53    | 0.88    |
| Gas metal arc welding       | 15             | 3.27±0.88  |         | NS, p>0.05|

| Metal Type                  | No. of welders | Mean score | t-value | p-value |
|-----------------------------|----------------|------------|---------|---------|
| Stainless steel             | 80             | 3.71±3.71  | 1.66    | 0.66    |
| Aluminum or brass           | 20             | 3.30±3.30  |         | NS, p>0.05|

| Hours work per day          | No. of welders | Mean score | F-value | p-value |
|-----------------------------|----------------|------------|---------|---------|
| 1-2 hours                   | 02             | 8.0±0.00   | 31.35   | 0.00    |
| 3-4 hours                   | 0              | 0 ±0       |         | S, p<0.05|
| 5-6 hours                   | 05             | 3.60±0.80  |         |         |
| 7-8 hours                   | 93             | 3.63±1.00  |         |         |

It is the riskiest job and not every welding company is aware of all risks. [10] In this study, 51% of welders who had certified training in welding knew about the right use of PPE. There were contradictory findings as comparing with another research. The study conducted by Isah and Okojie in Benin, Nigeria, showed that 91.6% of welders were aware of one or more welding hazards, while another study conducted in Kaduna, Nigeria by Sabitu K et al. [6] revealed that 77.9% of welders were aware of one or more welding hazards.

We observed that welders who worked for longer periods of time were more conscious of the dangers of welding and reported becoming more aware of the longer length of operation. The reason behind that is the duration of working is giving the experience to welders about the hazard, fresher having more morbidity pattern and they have less knowledge about the hazards of welding and PPE.

Some welders are not trained properly or job oriented regarding occupational injury and use of PPE at work including first aids. This is the reason; they don't know about their profession's many hazards.

Welding is a risky occupation where workers reveal different kinds of occupational threats such as physical dangers on a regular basis, chemical hazards in the absence of PPE. Unknown exposure could lead to various disease among welders. The usage of endorse PPE at all working hours to minimise exposure to risks.

After investigating in this research, it was found physical morbidity profile among welders in Wardha city is a moderate condition, need to give health education to welders and health promotion camp to enhance worker condition and health promotion. In Wardha, the welder's association should decide on those who want to join welding work that workers have to undergo compulsory training certificated for all, want to make new policies for workers. That rule shall
improve the welder knowledge and skill with the protective measures.

6. CONCLUSION

Welders in Wardha units in Maharashtra are observed to have a high frequency of morbidity patterns like burning, musculoskeletal, eye, ear, respiratory problems in welders. In this study, age, education, welding experiences, hours work per day are significantly associated to physical morbidity profile among the welders. In Wardha most welders are not wearing PPE kit during working hours. Most welders are not having any professional training regarding welding these types of welders have more morbidity of welding. The unorganised welding fields should be imposed under the department of occupational safety, that can reduce the occupational untrained welders working in welder’s shops. Need some training program for welders to do right and safety welding and certificated course for welders. Criteria such as qualification and pre-placement medical check-up for welders are the significant challenges for developing country. At least a short-term program or course for welders to be trained for proper welding and trained in the use of PPE is essential. So, if they are well informed about need and importance of occupational hazards prevention, they communicate the knowledge with other welders to implement preventive measures Hence the investigator felt the need to conduct a study to assess the physical morbidity profile among the welders.

CONSENT

Before taking any type of history we took written consent from welders in their local language (Marathi).

ETHICAL APPROVAL

Ethics approval was obtained from IEC, DMIMS (DMIMS(DU)/IEC/Dec-2019/8658).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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