Health Related Quality of Life and Influencing Factors among Welders

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Abstract

Background: Occupational exposure to welding fumes is a serious occupational health problem all over the world. Welders are exposed to many occupational hazards; these hazards might cause some occupational diseases. The aim of the study was to assess the health related quality of life (HRQL) of electric welders in Shanghai China and explore influencing factors to HRQL of welders.

Methods: 301 male welders (without pneumoconiosis) and 305 non-dust male workers in Shanghai were enrolled in this study. Short Form-36 (SF-36) health survey questionnaires were applied in this cross-sectional study. Socio-demographic, working and health factors were also collected. Multiple stepwise regress analysis was used to identify significant factors related to the eight dimension scores.

Results: Six dimensions including role-physical (RP), bodily pain (BP), general health (GH), validity (VT), social function (SF), and mental health (MH) were significantly worse in welders compared to non-dust workers. Multiple stepwise regress analysis results show that native place, monthly income, quantity of children, drinking, sleep time, welding type, use of personal protective equipment (PPE), great events in life, and some symptoms including dizziness, discomfort of cervical vertebra, low back pain, cough and insomnia may be influencing factors for HRQL of welders. Among these factors, only sleep time and the use of PPE were salutary.

Conclusions: Some dimensions of HRQL of these welders have been affected. Enterprises which employ welders should take measures to protect the health of these people and improve their HRQL.

Introduction

Welding is a very important process used for joining metals. With the quick development of science and industry, welding is used in more production fields, and the quantity of welders is increasing. Occupational exposure to welding fumes is a serious occupational health problem all over the world [1]. Welders are exposed to many occupational hazards such as dust, heavy metals, fluoride, ozone, nitrogen oxides, carbon monoxide, and noise, ultraviolet rays during welding. These hazards might cause some occupational diseases such as pneumoconiosis, poisoning, electric ophthalmialm, hearing impairment, and so on. Welding fumes are a complex mixture of different metals. Most welding fumes contain a small percentage of manganese [2]. There are many studies concerning about the potential neurological effects associated with exposure to manganese in welding fumes [3–8], and some studies explored the association between parkinsonism and exposure to welding fume [9,10]. However, welders’ quality of life has not gotten enough attention, and there are very little literatures about this.

Health related quality of life (HRQL) is an individual’s satisfaction or happiness with dimensions of life insofar as affected by “health”. HRQL has been introduced to assess people’s health status. To date, a number of questionnaires have been developed to evaluate HRQL, and the 36-item Short Form Health Survey (SF-36) is the most common one [11], SF-36 has been applied to many areas and studies, especially in surveys on HRQL of many patients suffering from different diseases. A study which used SF-36 showed that the quality of life of coal dust worker was significantly lower than ordinary people [12]. Another study which used Chinese World Health Organization Quality of Life-brief version (WHOQOL-BREF) questionnaire also showed low quality of life for coal dust workers without pneumoconiosis in mainland China [13]. A cross-sectional study of UK assessed HRQL of professional divers who had worked as a welder (PDW, n = 153), professional welders who had not dived (NDW, n = 108), and offshore oil field workers who had neither dived nor welded (NDNW, n = 252) with Short Form 12 questionnaire (SF12), and the result showed that health-related quality of life, either physical or mental, did not differ between groups [14]. However, as far as we know, no specific study assessing HRQL of welders with SF-
## Table 1. General information of welder group and control group.

| General information          | Welder group | Control group | Statistics | p    |
|------------------------------|--------------|---------------|------------|------|
|                              | n | %  | n | %  |          |      |
| **Age**                      |   |    |   |    |          |      |
| < 30                         | 130 | 43.2 | 116 | 38.0 | Z = −1.724 | 0.085 |
| 30–45                        | 141 | 46.8 | 144 | 47.2 |          |      |
| ≥45                         | 30  | 10.0 | 45  | 14.8 |          |      |
| **Native place**             |   |    |   |    |          |      |
| local                       | 78  | 25.9 | 110 | 36.1 | $X^2 = 7.296$ | 0.007 |
| nonlocal                    | 223 | 74.1 | 195 | 63.9 |          |      |
| **Education**                |   |    |   |    |          |      |
| Primary school              | 14  | 4.6 | 6 | 2.0 | Z = −8.516 | <0.01 |
| secondary school            | 214 | 71.1 | 120 | 39.3 |          |      |
| high school                 | 73  | 24.3 | 179 | 58.7 |          |      |
| **Monthly income**          |   |    |   |    |          |      |
| 1000–                       | 41  | 13.7 | 45  | 14.8 | Z = −2.888 | 0.004 |
| 2000–                       | 135 | 45.0 | 172 | 56.4 |          |      |
| 3000–                       | 67  | 22.3 | 54  | 17.7 |          |      |
| 4000–                       | 57  | 19.0 | 34  | 11.2 |          |      |
| **Marital status**          |   |    |   |    |          |      |
| Single                      | 63  | 21.0 | 86  | 28.2 | $X^2 = 7.434$ | 0.059 |
| Married                     | 228 | 76.0 | 216 | 70.8 |          |      |
| Divorced and others         | 9   | 3.0 | 3 | 1.0 |          |      |
| **Quantity of children**     |   |    |   |    |          |      |
| 0                           | 84  | 27.9 | 119 | 39.0 | Z = −3.629 | <0.01 |
| 1                           | 158 | 52.5 | 153 | 50.2 |          |      |
| 2                           | 48  | 16.0 | 30  | 9.8 |          |      |
| ≥3                          | 11  | 3.7 | 3 | 1.0 |          |      |
| **Smoking**                 |   |    |   |    |          |      |
| No                          | 188 | 62.5 | 206 | 67.5 | $X^2 = 1.721$ | 0.190 |
| Yes                         | 113 | 37.5 | 99  | 32.5 |          |      |
| **Drinking**                |   |    |   |    |          |      |
| No                          | 222 | 73.8 | 210 | 68.8 | $X^2 = 1.778$ | 0.182 |
| Yes                         | 79  | 26.2 | 95  | 31.2 |          |      |
| **Sleep time per night**    |   |    |   |    |          |      |
| < 7 h                       | 69  | 22.9 | 80  | 26.2 | Z = −0.869 | 0.385 |
| 7–9 h                       | 220 | 73.1 | 213 | 69.8 |          |      |
| ≥9 h                        | 12  | 4.0 | 12 | 3.9 |          |      |
| **Exercise frequency per week** |   |    |   |    |          |      |
| 0                           | 143 | 47.5 | 102 | 33.4 | Z = −3.424 | 0.001 |
| 1–2                         | 134 | 44.5 | 170 | 55.7 |          |      |
| ≥3                          | 24  | 8.0 | 33 | 10.8 |          |      |
Table 2. Comparison of physical symptoms between the two groups.

| Physical symptoms          | Welder group | Control group | Statistics | P   |
|----------------------------|--------------|---------------|------------|-----|
|                            | n            | %             | n          | %   |     |
| Cough                      |              |               |            |     |     |
| No                         | 142          | 47.2          | 180        | 59.0|     |
| Occasionally               | 138          | 45.8          | 116        | 38.0|     |
| Often                      | 21           | 7.0           | 9          | 3.0 |     |
| Z                          | = 2.3177     | Z             | = 3.177    |     | 0.001|
| Headache                   |              |               |            |     |     |
| No                         | 185          | 61.5          | 207        | 67.9|     |
| Occasionally               | 103          | 34.2          | 89         | 29.2|     |
| Often                      | 13           | 4.3           | 9          | 2.9 |     |
| Z                          | = 1.698      | Z             | = 1.698    |     | 0.089|
| Dizziness                  |              |               |            |     |     |
| No                         | 175          | 58.1          | 213        | 69.8|     |
| Occasionally               | 111          | 36.9          | 84         | 27.5|     |
| Often                      | 15           | 5.0           | 8          | 2.7 |     |
| Z                          | = 0.072      | Z             | = 0.072    |     | 0.002|
| Somnia                     |              |               |            |     |     |
| No                         | 172          | 57.1          | 191        | 62.6|     |
| Occasionally               | 112          | 37.2          | 104        | 34.1|     |
| Often                      | 15           | 5.0           | 8          | 2.7 |     |
| Z                          | = 1.532      | Z             | = 1.532    |     | 0.126|
| Low back pain              |              |               |            |     |     |
| No                         | 111          | 36.9          | 161        | 52.8|     |
| Occasionally               | 133          | 44.2          | 115        | 37.7|     |
| Often                      | 57           | 18.9          | 29         | 9.5 |     |
| Z                          | = 4.385      | Z             | = 4.385    |     | <0.01|
| Discomfort of cervical vertebra |        |               |            |     |     |
| No                         | 150          | 49.8          | 160        | 52.5|     |
| Occasionally               | 118          | 39.2          | 120        | 39.3|     |
| Often                      | 33           | 11.0          | 25         | 8.2 |     |

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36 has been done. In this study, we aim at assessing HRQL of welders in Shanghai, China with SF-36, and evaluating influencing factors to welders’ HRQL.

**Methods**

**Study population**

This cross-sectional study included 301 male welders from 7 factories as welder group, and 305 male general employees from 8 factories as control group in Baoshan district of Shanghai city. Eligibility criteria of welder group included the following: (1) at least one year’s welding experience; (2) clinically proven absence of pneumoconiosis (diagnostic criteria of pneumoconiosis was GBZ70-2002 [15]); (3) aged 20 to 55 years old, and without any chronic diseases such as hypertension, diabetes etc. Eligibility criteria of control group were: (1) aged 20 to 55 years old, without chronic diseases such as hypertension, diabetes etc. (2) without any chronic diseases such as hypertension, diabetes etc. (3) aged 20 to 55 years old, and without any chronic diseases such as hypertension, diabetes etc.

**Instruments**

The instruments applied in this study consisted of two parts: general information and Mandarin version of SF-36. General information was collected on age, height, weight, native place, educational level, personal monthly income, marital status, information about working years, welding type, local ventilation in workplace, and use of personal protective equipment for welder workplace, and use of personal protective equipment for welder group was also collected.

The Mandarin version of SF-36 was selected for use in this study because it is one of the most commonly used forms internationally, and it has been tested and proved having good reliability and validity in two surveys of Shanghai [11,16]. It has 36 items of 8 dimensions of health: physical functioning (PF), role-physical (RP), bodily pain (BP), general health (GH), vitality (VT), social function (SF), role-emotional (RE), mental health (MH), and one single item dimension on health transition.

**Data collection and statistical analysis**

The study was conducted from January 2011 to November 2012, and used a self-finished interview method. Interviewers were trained by experts from the project group. Workers filled in the questionnaires by themselves and submit to interviewers who examined questionnaires for any errors and ensured the quality of the survey. In SF-36 questionnaire, item scores ranged from 1 to 2, 3, 5 or 6 and were recorded so that all items scored in the same direction, with higher values indicating fewer limitation or better health states [17]. The raw score of each of the eight dimensions was derived by summing the item scores, and transformed to a value for the dimension from 0 (worst possible health state measured by the questionnaire) to 100 (best possible health state) by a formula [11]. 301 from 320 welders and 305 from 320 welders from 7 factories as welder group, and 305 male general employees from 8 factories as control group in Baoshan district of Shanghai city.

**Table 3. Comparison of SF-36 dimension scores between the two groups.**

| Dimension | Control group (n = 305) | Welder group (n = 301) | t  | P   |
|-----------|-------------------------|------------------------|----|-----|
| PF        | 90.2 ± 14.0             | 89.6 ± 13.2            |    | 0.568 | 0.570 |
| RP        | 87.3 ± 28.2             | 77.2 ± 35.6            |    | 3.884 | <0.01 |
| BP        | 88.4 ± 15.7             | 81.3 ± 19.2            |    | -4.977 | <0.01 |
| GH        | 59.9 ± 8.1              | 58.1 ± 9.1             |    | -2.557 | 0.011 |
| VT        | 68.3 ± 16.4             | 61.0 ± 19.3            |    | -5.003 | <0.01 |
| SF        | 84.7 ± 16.4             | 79.9 ± 18.3            |    | -3.442 | 0.001 |
| RE        | 85.6 ± 30.5             | 81.9 ± 33.4            |    | -1.395 | 0.164 |
| MH        | 69.4 ± 16.4             | 64.8 ± 17.9            |    | -3.292 | 0.001 |

**Table 4. Comparison of SF-36 dimension scores among the three groups.**

| Dimension | Control (n = 305) | Non- CO2 arc welder group (n = 204 | CO2 arc welder group (n = 97) | F  | P   |
|-----------|------------------|------------------------------------|-------------------------------|----|-----|
| PF        | 90.2 ± 14.0      | 90.2 ± 13.2                        | 89.3 ± 13.3                   |    | 0.318 | 0.727 |
| RP        | 87.3 ± 28.2      | 83.0 ± 31.0                        | 74.4 ± 37.3**                | 9.992 | <0.01 |
| BP        | 88.4 ± 15.7      | 83.9 ± 16.7*                       | 80.1 ± 20.2**                 |    | 13.952 | <0.01 |
| GH        | 59.9 ± 8.1       | 59.8 ± 9.8                         | 57.3 ± 8.8**                 |    | 6.104 | 0.002 |
| VT        | 68.3 ± 16.4      | 63.5 ± 19.3*                       | 59.8 ± 19.3**                 |    | 13.943 | <0.01 |
| SF        | 84.7 ± 16.4      | 79.8 ± 19.2*                       | 79.9 ± 17.9**                 |    | 5.934 | 0.003 |
| RE        | 85.6 ± 30.5      | 89.0 ± 27.1                        | 78.6 ± 35.6**                 |    | 4.503 | 0.011 |
| MH        | 69.4 ± 16.4      | 67.1 ± 18.4                        | 63.7 ± 17.6**                 |    | 6.760 | 0.001 |

*: Compared with Control, P < 0.05; **: Compared with Control, P < 0.01;
*: CO2 arc welder group Compared with non- CO2 arc welder group, P < 0.05; **: CO2 arc welder group Compared with Non- CO2 arc welder group, P < 0.01.

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### Results

To explore the influencing factors for HRQoL of welders, multivariate stepwise regression was applied using eight SF-36 dimensions as the dependent variables, and the risk factors in Table 5 as independent variables. The statistical inclusion level of the independent variables was set at 0.10 in the stepwise process. In the Table 6, multivariate stepwise regression results show that native place, monthly income, and mental health (MH) were significant \( P<0.05 \). Among the 301 welders, 204 \( (67.8\%) \) were carbon dioxide (CO\(_2\)) shielded arc welders, 41 \( (13.6\%) \) were manual arc welders, and the rest 56 welders worked at submerged arc welding, argon arc welding or other types of welding. In Baoshan district, there are many metal processing factories, where carbon dioxide shielded arc welding is the most common welding type. Meanwhile, carbon dioxide shielded arc welding processes usually produce much welding fume. Considering these reasons, we divided welder group into CO\(_2\) arc welder group and non-CO\(_2\) arc welder group. The SF-36 scores of the two welder groups were compared with control group in Table 4. One-Way ANOVA results show that the differences of 7 dimensions scores except PF among the three groups were significant \( P<0.05 \). Multiple comparisons results show that the means of BP, VT and SF of non-CO\(_2\) arc welder group were significantly lower than that of control group \( P<0.05 \). Compared with control group, the means of 7 dimensions except PF of CO\(_2\) arc welder group were significantly lower \( P<0.05 \). At the same time, the scores of RP, GH and RE of CO\(_2\) arc welder group were significantly lower than non-CO\(_2\) arc welder group \( P<0.05 \).

Table 5. Influencing factors and variable coding.

| Factors                    | variable coding                                                                 |
|----------------------------|---------------------------------------------------------------------------------|
| Age                        | Actual value                                                                    |
| Working years              | Actual value                                                                    |
| Education                  | Primary school = 1, secondary school = 2, high school = 3                       |
| Native place               | nonlocal = 1, local = 2                                                         |
| Personal monthly income    | ¥1000—¥2000 = 1, ¥2000—¥3000 = 2, ¥3000—¥4000 = 3, >¥4000 = 4                   |
| Quantity of children       | No child = 1, one child = 2, two children = 3, three children or more = 4       |
| smoking                    | No = 1, Yes = 2                                                                  |
| drinking                   | No = 1, Yes = 2                                                                  |
| Family great events        | No = 1, Yes = 2                                                                  |
| Exercise frequency per week| never = 1, once or twice per week = 2, three times or more per week = 3         |
| Sleep time per night       | 7h = 1, 7h—8h = 2, ≥9h = 3                                                      |
| Welding type               | Non CO\(_2\) shielded arc welding = 1, CO\(_2\) shielded arc welding = 2        |
| local ventilation in workplace| No = 1, Yes = 2                                                                 |
| Use of personal protective equipment(PPE) | No = 1, Gauze mask = 2, Dust mask = 3                                           |
| Cough                      | No = 1, Occasionally = 2, Often = 3                                             |
| Headache                   | No = 1, Occasionally = 2, Often = 3                                             |
| Dizziness                  | No = 1, Occasionally = 2, Often = 3                                             |
| Insomnia                   | No = 1, Occasionally = 2, Often = 3                                             |
| Discomfort of cervical vertebra | No = 1, Occasionally = 2, Often = 3                                           |
| Low back pain              | No = 1, Occasionally = 2, Often = 3                                             |

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members of control group completed the questionnaire. The total valid response rate was 94.69%. The 34 incomplete questionnaires with more than 50% of items missing were excluded. All valid questionnaires were doubly input into the database using software Epidata 3.0. Both manual checking and computer checking were conducted to find discrepancies. SPSS20.0 was used for analyzing the survey data. Student t test, One-Way ANOVA, nonparametric Wilcoxon test, and multivariate stepwise regression were applied to evaluate the influencing factors on quality of life.

### Results

The mean age of the welder group \( (n = 301) \) was 32.90±8.54, and the mean age of the control group \( (n = 305) \) was 34.27±10.03. Table 1 shows general information of the welder group and the control group. There were no significant differences on age, marital status, smoking, drinking, sleep time per night between the groups. However, significant differences were observed on native place, education, personal monthly income, quantity of children and exercise frequency per week between the two groups. The percentage of nonlocal in welder group was higher than that of control group \( P<0.05 \), and education level of welder group was lower than that of control group \( P<0.05 \). The exercise status of welder group was worse than that of control group \( P<0.05 \).

In the table 2, we can see almost all the physical symptoms incidental rate of welder group was higher than that of control group. However, nonparametric Wilcoxon test results showed that only in cough, dizziness and low back pain, the differences were significant \( P<0.05 \).

Table 3 showed that all the means of eight HRQoL dimensions of welder group were lower than that of control group, but the differences in six dimensions including role-physical (RP), bodily pain (BP), general health (GH), validity (VT), social function (SF), and mental health (MH) were significant \( P<0.05 \).
Welding years may affect PF and GH, and increasing welding years reduced quality of life in the two dimensions. Welding type may influence RP and RE dimension, CO2 shielded arc welding may reduce welders’ quality of life in the two dimensions. Some physical symptoms were evidently common risk factors reducing the scores of most of the dimensions, for example, low back pain decreased the dimensions scores in RP, BP, VT and SF; cough reduced the scores in BP, GH, SF and RE dimensions; insomnia affected the scores in dimensions of VT, SF, RE and MH. Among these factors, only the use of PPE, longer sleep time and more children were positive. Longer sleep time per night may increase scores in dimensions of VT and MH; using PPE properly may improve the quality of life in PF dimension; more children resulted in a higher scores in dimensions of RE. In this study, higher personal monthly income was negative in the dimensions of GH and MH. Among these factors, the influence of welding years and low back pain were relatively strong because their standardized regression coefficient were higher than other factors.

Discussion

The SF-36 is one of the most widely used HRQL forms [18]. It has been referred to as a generic measure since it assesses health concepts that are pertinent to everyone’s functional status and well-being, and it can be used in diseased groups as well as general population [19]. Previous studies showed that the SF-36 has a good reliability and validity, which is available for the evaluation of quality of life among Shanghai population [11,16]. To our best knowledge, study on HRQL among welders is very limited. However, welders expose to multiple occupational hazards in workplaces, and their health status and quality of life are worthy of discussion.

Table 6. Multivariate stepwise regression results of welding group.

| Dimension | Factors | Regression coefficient | Standardized regression coefficient | t | P |
|-----------|---------|------------------------|-------------------------------------|---|---|
| PF        | Welding years | −0.545 | −0.322 | −5.812 | 0.000 |
|           | Drinking | −3.594 | −0.125 | −2.454 | 0.015 |
|           | PPE | 3.838 | 0.120 | 2.361 | 0.019 |
|           | Dizziness | −2.456 | −0.111 | −1.824 | 0.069 |
|           | Discomfort of cervical vertebra | −2.500 | −0.130 | −2.100 | 0.037 |
|           | RP | Welding type | −8.379 | −0.111 | −2.072 | 0.039 |
|           | Native place | −14.507 | −0.180 | −3.166 | 0.002 |
|           | Low back pain | −8.871 | −0.183 | −2.622 | 0.009 |
|           | Discomfort of cervical vertebra | −8.524 | −0.151 | −2.174 | 0.030 |
|           | BP | Low back pain | −11.290 | −0.428 | −6.864 | 0.000 |
|           | Cough | −4.216 | −0.136 | −2.544 | 0.011 |
|           | Discomfort of cervical vertebra | −4.363 | −0.154 | −2.562 | 0.011 |
|           | GH | Welding years | −0.155 | −0.130 | −2.211 | 0.028 |
|           | Monthly income | −2.245 | −0.233 | −4.162 | 0.000 |
|           | Drinking | −2.594 | −0.128 | −2.250 | 0.025 |
|           | Cough | −2.207 | −0.148 | −2.496 | 0.013 |
|           | VT | Sleep time | 7.078 | 0.174 | 3.380 | 0.001 |
|           | Low back pain | −7.054 | −0.264 | −4.429 | 0.000 |
|           | Insomnia | −4.474 | −0.140 | −2.325 | 0.021 |
|           | Dizziness | −6.138 | −0.188 | −3.060 | 0.002 |
|           | SF | Low back pain | −6.713 | −0.267 | −4.165 | 0.000 |
|           | Insomnia | −4.328 | −0.143 | −2.364 | 0.019 |
|           | Cough | −4.178 | −0.140 | −2.298 | 0.022 |
|           | RE | Welding type | −12.450 | −0.175 | −3.301 | 0.001 |
|           | Quantity of children | 5.424 | 0.134 | 2.544 | 0.011 |
|           | Native place | −11.967 | −0.157 | −2.859 | 0.005 |
|           | Insomnia | −10.302 | −0.186 | −3.226 | 0.001 |
|           | Cough | −10.476 | −0.194 | −3.350 | 0.001 |
|           | MH | Monthly income | −2.228 | −0.119 | −2.235 | 0.026 |
|           | Sleep time | 5.806 | 0.155 | 2.900 | 0.004 |
|           | Great events | −4.767 | −0.132 | −2.426 | 0.016 |
|           | Insomnia | −6.663 | −0.225 | −3.729 | 0.000 |
|           | Discomfort of cervical vertebra | −4.731 | −0.180 | −3.068 | 0.002 |

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Welders Quality of Life and Influencing Factors
Our results revealed that the welder group had lower scores of SF-36 than the control group in six dimensions except for PF and RE. Meanwhile, CO₂ arc welders’ average scores were significantly lower than that of control group in seven dimensions except for PR, and the scores of RP, GH and RE of CO₂ arc welder group were also significantly lower than non-CO₂ arc welder group. The results suggested that welders had worse HRQL, and CO₂ arc welders’ HRQL were affected more deeply. The occupational hazards in CO₂ arc welding are more serious than most of other type of welding. We had monitored welding fume and manganese and its inorganic compounds by personal sampling method, the results showed that the mean concentration of welding fume and manganese of CO₂ arc shielded welding was 5.22 mg/m³ and 0.221 mg/m³ respectively, which was 2.8 times and 2.7 times of non- CO₂ arc welding group [20]. The type of welding is important with regard to determining the fume composition and generation rate, which together with ventilation patterns will govern the exposure [6].

The HRQL may be influenced by multiple factors. To explore the factors, multivariate stepwise regression was used to identify significant factors related to the eight dimension scores. The results showed that some physical symptoms like discomfort of cervical vertebra, low back pain, cough, and insomnia affected almost all the dimensions of HRQL in welding group. During welding work, welders have to keep an unbalanced position like stoop and squat, and closely contact with welding fume, harmful gas and ultraviolet rays. These occupational hazards may cause impairment of respiratory system, nervous system and musculoskeletal system. All these impairments may cause physical discomforts and affect HRQL of welders.

In addition, welding years and the use of PPE are also influencing factors to HRQL of welders. Welders with longer welding years tend to have lower scores in PF and GH. The use of PPE was related to the dimension of PF, and using dust mask during work is helpful for protecting health and improving quality of life.

Among socio-demographic factors, native place, quantity of children, monthly income were associated with quality of life, especially in dimensions of RP, GH, RE and MH. Quality of life reflects gap between expectation and reality, and the bigger the gap, the worse the quality of life. The results showed that the Shanghai local welders had lower scores in RP and RE than the non-local welders, maybe because the Shanghai local welders have higher expectation, whereas the non-local welders usually come from rural areas of other provinces of China, unlike Shanghai local welders, they have lower expectation and easier to be satisfied. In this study, welders with higher monthly income tend to have lower dimension scores of GH and MH. It may be due to the fact that welders with higher monthly income usually undertake harder work or operate welding longer hours per day. The heavier labor intensity may lead to higher level of exposure to occupational hazards which do harm to their health and affect the HRQL of the welders. There are 19.7% of welders who have more than one child in their family. The results showed that more children in a family induced higher scores in dimension of RE because more children might arouse stronger sense of responsibility of a father.

In the welder group, drinking rate and smoking rate was 26.2% and 37.5% respectively. The multivariate stepwise regression results showed that drinking was a negative factor for the dimension of PF, but smoking was not a significant factors affecting HRQL. Welders should aloof from alcohol and avoid the synergistic effect induced by alcohol and some occupational hazards. As to the relation of smoking with HRQL of welders, a Greek study showed that in a random sample of 472 blue and white-collar heavy industry workers with 57% were current smokers, smoking was a significant hazard and a strong predictor of quality of life [21]. Because our survey sample size is small, and the smoking rate was lower than the abroad study, we temporarily can’t find the impact of smoking on the quality of life, so it’s not affirmed that smoking has no effect on quality of life of welders.

The results showed that longer sleep time per night may increase scores in dimensions of VT and MH, however, great events in life had negative correlation with the scores of MH dimension. To improve the HRQL, welders should develop a good daily routine and have a sufficient sleep after work. In addition, enterprises should pay attention to employees, and show solicitude for the workers who suffer from important events in life.

Studies on the quality of life of welders are very limited at present. Because the survey was only carried out in Baoshan district of Shanghai city, and the sample size is small, the representativeness may be insufficient. Welder’s health related quality of life and its influencing factors still await further research.

Author Contributions
Conceived and designed the experiments: JQ ZA. Performed the experiments: WL JZ WW JX. Analyzed the data: JQ ZA. Wrote the paper: JQ.

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