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Worker Safety Risks Related to Welding Operations for The Manufacturing Industry

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Abstract: The safety of workers is a very important aspect to prevent accidents. In the manufacturing industry this problem arises due to employee safety risk factors. The purpose of this study was to identify aspects of worker safety risks associated with welding operations in the manufacturing industry in Batu Pahat, Johor. Identify aspects of safety risks in terms of hazards (hazards), unsafe practices, precautions and the relationship between aspects of safety risks related to workers related to welding operations carried out in the manufacturing industry. This study is quantitative in nature using survey method. Respondents consisting of 75 people selected in this study are from welding workers in five manufacturing industries in Batu Pahat, Johor. The results of the study will be analyzed using Statistical Package for Social Science version 21.0 and the data are analyzed using inferential analysis method (Pearson-r) to find the value of Pearson correlation. Based on the analysis, the Pearson correlation value shows that the relationship between aspects of employee safety risk to hazard (hazard) is 0.820, the relationship between aspects of employee safety risk to unsafe practices is 0.528 and the relationship between aspects of employee safety risk to precautions is 0.383. Overall, based on the findings of the study analyzed, it can be concluded that the employee safety risks associated with welding operations in the manufacturing industry are at the highest level. The results of the study found that employees are aware of employee safety risks and the rules that have been set.

Keywords: Safety Risk, Hazard, Unsafe Practices, Precaution

1. Introduction

Malaysia is a country that is moving towards progress in the manufacturing sector. Industrialization in the sustainable manufacturing sector is able to improve the country's economy for the better on the world stage. The need for skilled manpower and an understanding of safety in the welding industry in particular is a necessary criterion in order to drive a productive country (Ismail, 2018). In addition, safety is also closely related to the way the workforce performs work, proper equipment cares as well

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as a clean and safe environment covers the scope of good work in the welding industry. Making the workplace safe, healthy and free of accidents and diseases is very important. It contributes to the improvement of the level of the work environment which is an important component to the quality of life of employees and organizational productivity (Ismail, 2018). Therefore, good personal safety care in the welding industry can guarantee less accidents with more danger.

The safety aspect in the manufacturing sector in the welding industry is the main thing that is emphasized to achieve a developed country. According to (Selamat, 2018), the level of awareness on occupational safety and health issues is still at a minimal level in Malaysia. The minimum level is the level that is less encouraging in a group of study samples studied. Moreover, safety means where a situation is avoided or protected from danger, disaster, or disruption that could lead to an accident (Sadon, 2018). Furthermore, safety is also an important factor in a work process that involves the use of human resources. Injuries, loss of life and property damage can occur if safety aspects are neglected (Mustaffa et al., 2018). In conclusion, security is the key to the success of a company which can help increase productivity if security is practiced properly.The manufacturing sector in Malaysia, especially the welding sector is a branch of the economy where the safety aspect needs to be given special attention. Safety not only saves lives from danger, but also the safety of equipment and machines used also plays an important role in protecting workers from injury while doing welding work (Halim & Ahmad, 2019). Accidents involving the use of equipment will occur if not taken care of and maintained properly from time to time (Ismail, 2018). Among the causes that caused the accident was negligence by the management and also the failure of the equipment used. This default attitude can lead to accidents (Halim & Ahmad, 2019). Therefore, each management organization must keep track of the schedule of inspections of equipment used by their employees and systematically recorded so that the equipment used is safe to use.

The welding sector is also not immune to the occurrence of accidents where the existing risks may occur and will cause accidents. Risk refers to a combination of the factors "the likelihood of a hazard occurring within a specified period or under specified circumstances" with the factor of "severity i.e. injury or adverse effect on human safety, property, environment or a combination of any of the this is what was caused by the incident." (University of Malaya occupational safety and health manual, 2017). In this regard, good risk management should be planned by management and applied by every employee in an organization in reducing accidents. Therefore, every individual should practice a culture of safety to the best of their ability.Safe work activities can save themselves while carrying out welding activities. Rules are the main thing that needs to be ingrained in the welder when he is at work. This is because, the rules are a guide for welders not to make mistakes where mistakes can invite accidents. Following the rules while working can prevent accidents. The welder should apply this in every welding work done. Rules developed by the management and take into account the safety measures highlighted by the authorities of the Department of Occupational Safety and Health (DOSH). In addition, the use of Personal Protective Equipment (PPE) is highly demanded when performing welding activities. This can prevent self -injury from arc sparks, Ultra Violet (UV) radiation, scroll fragments while grinding work pieces that can lead to accidents. The welding equipment used must also always be in a safe condition.

Safe means nothing can cause an accident to happen. This is to ensure that the power generated from the welding machine does not exceed the standards that have been organized by the manufacturer. In addition, the welding result can also be improved because the stable current control facilitates the welding work. Cable inspections should also be done to prevent current from flowing out. This is also important because welders who are doing welding work in wet conditions due to sweating can be subjected to electric shock. This can result in serious injury to the welder if no early action is taken by checking the equipment used is in good condition. In addition, a good workplace environment can control the safety risks of the welder. A good workplace environment means that the place to perform welding work is clean and orderly. Making the workplace safe, accident and disease free is important as it contributes to increasing the level of quality work environment while increasing organizational productivity. This is very important because healthy employees are a valuable asset in an organization.

1.1 Research Objectives

In addition to avoiding welder safety risks, the productivity of an organization increases. The safety risk of the welder can be reduced by having safer equipment to use on the welder. Therefore, this study was conducted to see the level of safety risk aspects of welders related to operations based on welding safety factors for the manufacturing industry in Batu Pahat. Research objectives for this study is to: -

i. Identify aspects of safety risks in terms of safety hazards associated with welding operations in the manufacturing industry.
ii. Identify aspects of safety risks in terms of unsafe practices related to welding operations in the manufacturing industry.
iii. Identify aspects of safety risks in terms of precautions that can be practiced by workers related to welding operations in the manufacturing industry.
iv. Study the relationship between aspects of employee -related safety risks related to welding operations carried out in the manufacturing industry.

2. Methodology

The purpose of the study design is to get answers to the research questions. The results of a study are based on the methodology and design of the study. Descriptive quantitative and inferential analysis (*pearson-r*) methods were chosen by the researchers to be used in this study. A total of 76 random sample workers from welding workers in the manufacturing industry were selected. This is based on the Krejcie and Morgan samples size table which sets the number of samples required for a study to be conducted based on the population. The population for this study to be conducted involves workers in five manufacturing industries in Batu Pahat, Johor.

3. Results and Discussion

The results of the data collected from the instrument of the questionnaire have found that it is a normal distribution based on the analysis report from the software SPSS version 21.0.

Table 1: Safety Risk Analysis in Terms of Safety Hazards Associated with Welding Operation in the Manufacturing Industry

Item	Mean (M)	Standard deviation (SD)
My job is vulnerable to ...		
1. Explosion	4.93	0.25
2. Electric shock	4.82	0.39
3. Extreme heat	4.78	0.42
4. Radiation that can cause eye related diseases (arc radiation)	4.97	0.16
5. Eye infections (iron dust)	4.72	0.45
6. Lung infection	4.92	0.27
7. Chronic respiratory problems	4.72	0.45
8. Toxic gases and fumes	4.96	0.20
9. Hard to breath	4.79	0.41
10. Hearing problems caused by noise and vibration	4.80	0.40
11. Musculoskeletal disorders	4.95	0.23
12. Bleeding of the gastrointestinal tract	4.41	0.50
13. Inflammation of the skin caused by radiation and extreme heat	4.96	0.20
14. Injuries and personal accidents such as wounds	4.82	0.39
Overall average	4.83	0.34

Based on the findings of the analysis of Part C (refer to Table 1) shows that the safety risk aspects in terms of safety hazards associated with welding operations in the manufacturing industry at a high level (M = 4.83; SP = 0.34). Specifically, item 4 (radiation that can cause eye -related diseases (arc radiation)) has shown the highest mean value and standard deviation of (M = 4.97; SP = 0.16). In item 12 (gastrointestinal bleeding) got the lowest mean value in the questionnaire Part C that is (M = 4.41; SP = 0.50).

Table 2: Analysis of Safety Risk Levels in Terms of Unsafe Practices Related to Welding Operations in the Manufacturing Industry.

Item	Mean (M)	Standard deviation (SD)
Unsafe practices at work are like ...		
1. Not practicing a proper maintenance culture	4.97	0.16
2. Failed to wear appropriate personal protective equipment	4.96	0.20
3. Consumption of alcohol and illicit drugs (drugs)	4.86	0.35
4. Non-compliance with safety rules and guidelines	4.87	0.34
5. Ineffective handling of weak welding equipment	4.80	0.40
6. Lack of awareness of health and safety hazards associated with the welding process	4.93	0.25
7. Use of faulty equipment and tools	4.97	0.16
8. Negligence during welding operations	4.78	0.42
9. Improper welding position puts pressure on the limbs	4.96	0.20
10. Doing welding work over a long period of time	4.97	0.16
11. Unchanged movement and repetitive welding work	4.96	0.20
12. Uncontrolled movement of equipment	4.82	0.40
13. Apply high welding force	4.93	0.25
Overall average	4.91	0.27

Based on the findings of the analysis in Part D (refer to Table 2) shows that the safety risk aspects in terms of unsafe practices related to welding operations in the manufacturing industry are at a high level (M = 4.91; SP = 0.27). The highest mean interpretation values in Part D were on items 1 (not practicing proper maintenance culture), 7 (use of faulty equipment and tools) and 10 (doing welding work over a long period of time) showing a mean interpretation figure of (M = 4.97; SP = 0.16). While the lowest mean interpretation in Part D is in item 8 (negligence during welding operations) which is at a mean of 4.78 and a standard deviation of 0.42. However, this item still shows that the interpretation score is at a high level.

Table 3: Analysis of Safety Risk Aspects in Terms of Precautions Practiced by Workers Related to Welding Operations in the Manufacturing Industry.

Item	Mean (M)	Standard deviation (SD)
Precautions to ensure safety while working are ...		
1. Enforcement of safety rules and guidelines	4.99	0.12
2. Use appropriate personal safety equipment	4.96	0.20
3. Use ultra violet anti -radiation eye protection	4.92	0.27
4. Keep a safe distance from welding fumes	4.99	0.12
5. Perform regular maintenance of welding equipment	4.99	0.12
6. Provides anti -glare face protection	4.93	0.25
7. Using a ventilation fan	4.99	0.12

8. Proper installation of welding equipment	4.96	0.20
9. Keep the work area clean and free of hazards	4.97	0.16
10. Handle the gas cylinder with care	4.99	0.12
11. Close the welding machine/equipment after use	4.97	0.16
12. Do not weld in a closed scope	4.76	0.43
Overall average	4.95	0.19

Based on the following Table 3, the findings of the analysis in Part E show that the average value of safety risks in terms of precautions practiced by workers related to welding operations in the manufacturing industry is at a high level (M = 4.95; SP = 0.19). Items 1 (enforcement of safety rules and guidelines), 4 (keeping a safe distance from welding fumes), 5 (performing regular maintenance of welding equipment), 7 (using a ventilation fan) and 10 (handling gas cylinders carefully -heart showed the highest mean interpretation compared to other items in Section E that is (M = 4.99; SP = 0.12). While for item 12 (not welding in a closed scope) recorded the lowest mean interpretation score in this section of analysis (M = 4.76; SP = 0.43) However, this item 12 still recorded a high interpretation score.

Table 4: Correlation Analysis

No	The relationship between aspects employee safety risks	Correlation Pearson	Significant	Relationship Level
1	Hazard	0.820**	0.000	High
2	Unsafe practices	0.528**	0.000	Moderate
3	Precautions	0.383**	0.001	Low

Table 4 shows the correlation between aspects of worker safety risks with welding operations in the manufacturing industry. From the correlation analysis table, the value of the correlation coefficient for the aspect of employee safety risk with hazard (hazard) is 0.820. it can be concluded that there is a high correlation. This relationship is positive and significant because the confidence level is 0.00 less than the set confidence level of 0.01. Next, the value of the correlation coefficient for the aspect of employee safety risk with unsafe practices is 0.528 indicates that there is a moderate relationship. This relationship is positive and significant because the confidence level is 0.00 less than the set confidence level of 0.01. Finally, the value of the correlation coefficient for the safety risk aspect of workers with precautions is 0.383. This relationship is positive and significant because the value of the confidence level is 0.001 less than the confidence level set of 0.01. Therefore, the hypothesis is accepted, this indicates that there is a relationship between aspects of worker safety risks with welding operations in the manufacturing industry.

3.1 Discussion

The discussion of the findings of this study answers the question of this first research question. According to Wardhani and Simanjuntak (2017) not practicing proper work measures as well as violating the rules can result in welders being exposed to the risk of accidents. At-risk welders are exposed to hazards while performing welding work. Safety aspects need to be updated from time to time to prevent accidents from happening. The act of joking while doing welding work is a violation of safety rules where this can cause an accident. Based on the mean value in item 8 shows the respondents are exposed to toxic gases and smoke. Good ventilation can reduce the welder's exposure to toxic gases from the welding process (Rahul et al., 2020). Adequate auxiliary devices such as portable industrial fans, portable fume extractors and even permanent fume extractors can be used to get rid of toxic gases effectively. Doing work in poor ventilation can cause welders to experience disturbances in the respiratory system (Pega et. al., 2020). This makes the welder uncomfortable doing the welding work and can interfere with the welding result. According to the study of Dahar and Ismail (2010) workers who perform the welding process are generally at high risk of disorders of the musculoskeletal system

because workers in the field of welding often perform various inappropriate body movements. The mean findings in item 11 of this study are in line with the findings of researchers where welding workers are aware that they often perform body posture movements repeatedly while doing work is a risk of danger (hazard). This is because, if the worker is still performing movements that are not ergonomic it will have a bad effect either on the body, bleeding in the digestive tract or the results of the work done.

A discussion of the findings of this study answers this second research question. The mean findings of the study on item 1 (not practicing proper maintenance culture) were the highest scores in this study question. Accidents involving equipment often occur if not practiced (Ismail, 2018). This is especially bad because welders are prone to accidents that can result in injury. Maintenance should be performed periodically whereby equipment should be inspected, recorded, stored and segregated if in a damaged condition and is likely to cause injury when in use. Next, the findings from the mean score of the item 7 study (use of faulty equipment and tools) can invite to accidents. Damage to welding equipment can cause the welder to be injured or permanently deformed. Welders should also check the safety of welding tools before performing welding work (Albert et al., 2020). Therefore, workers need to be sensitive to the equipment used to prevent accidents from happening. In addition, the results of the study mean score of items 10 (doing welding work in a long period) is also at a high level. This is because, respondents often do work for a long period of time while putting pressure on the body. This indicates that welding field workers in the manufacturing industry often perform work with non -ergonomic work postures. According to Hamzah (2015) states that workers should carry out work with an ergonomic work pattern so that important parts of the body such as tendons, bones, nerves and other body organs do not occur injuries. This indicates that it is important for welding workers to be knowledgeable and always practice ergonomics while performing work.

A discussion of the findings of this study answers this third research question. Findings of the study mean score of items 1 (enforcement of rules and guidelines) at a high level. Not practicing proper work measures as well as breaking the rules can result in accidents (Wardhani & Simanjuntak, 2017). The joking attitude of welders while doing welding work can invite accidents (Aumpiem & Prateepasen, 2017). Temporary or permanent injury can occur if there are things that can cause injury to the clot. Welding table can cause injury to the welder if the joking activity is not curbed. Reminders such as warning letters should be issued from the administration to employees who break the rules while at work to prevent accidents from recurring. Furthermore, good facility management can ensure the safety of welders from being exposed to the risk of accidents (Ismail, 2018). The results of the study mean score of items 10 (handling gas cylinders carefully), providing special space for flammable materials can reduce the risk of fire and accidents. If flammable materials are exposed to welding operations, fire can occur. Therefore, good layout selection can prevent accidents from happening. In addition, the study findings mean score of items 4 (keeping a safe distance from welding fumes) was also at a high level. Large quantities of toxic in welding fumes contain cancer -causing agents such as cadmium, nickel, beryllium, chromium, and arsenic (Baloch et al., 2020). This is very dangerous and can affect the health of the welder. Welding workers have a high risk of getting lung cancer (MacLeod et al., 2017). Therefore, welders need to be vigilant and knowledgeable so as not to take lightly the welding fumes which can be fatal.

A discussion of the findings of this study answers this fourth research question. The results of the study show a positive value, where the relationship between these three factors is important for aspects of safety risks associated with workers with welding operations in the manufacturing industry. In the manufacturing sector, hazardous work is often done by workers from the welding field such as working in narrow, enclosed and poorly ventilated places. According to B. Singh and Singhal (2016) limited area causes workers to not be able to do work properly and can cause injuries to limbs such as back pain. The welder needs to adjust the welding position to get the perfect welding result. Therefore, welders should be smart in doing work such as making slings to support the limbs involved in performing the work while reducing the pressure on their limbs. Next, the researchers found that when the employees did not practice safe practices, they were vulnerable to injury. Welding equipment needs to be maintained to ensure safety. Unsafe practices stem from poorly maintained equipment (Ismail, 2018). Equipment identified as damaged should be isolated and reported to the head of the workshop. This can reduce the risk of accidents if employees are sensitive to their level of safety. Through the

results of the study as well, found that welding workers do not comply with the rules set. Adhering to proper work rules and measures can reduce risk to employees (Isa, 2020). My joking behavior while doing work is a violation of safety rules where this can cause an accident. Proper behavior and work measures need to be nurtured in employees so that awareness of safety risks can be practiced.

4. Conclusion

This research has examined the level of worker safety risk for welding workers in the manufacturing industry. The results of the study show that workers in the field of welding should be given exposure to aspects of safety risks where this can increase the level of awareness of safety risks of workers. The contribution of the results of the study on the safety risks of welding workers is the result of the reference of previous scientific materials. Implications for the Industries under the Manufacturing Sector related to aspects of worker safety risks can be used as much as possible to help increase the level of worker safety risks associated with welding operations. Therefore, the role of employers in relation to aspects of employee safety risks is considered important and needs to be taken seriously in order to produce work that is free from employee safety risks. Therefore, the industry, especially the field of welding, needs to play an important role in implementing the aspects of worker safety risks associated with welding operations.

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References

Ahmad, M. A., Hashim, S. A., & Chulan, M. R. (2015). Study on the Joining Strength of Spot Welding using POMISPOT Device. *NTC 2015: Nuclear Technical Convention 2015*.

Aumpiem, A., & Prateepasen, A. (2017). *FMEA for Risk Assessment in Discoloration Pipe Welding*.

Halim, S. K., & Ahmad, R. (2019). *School of Law, College of Law, Government and International Studies, Universiti Utara Malaysia*. *10*(July), 45–77.

Hamzah, A. (2015). Perkaitan tubuh badan dan kesihatan. *Ergonomik*. http://www.ukm.my/rosh/wp-content/uploads/2015/11/Slot-6-Ergonomik-Di-Tempat-Kerja.pdf

Heinrich 1886-1962, H. W. (Herbert W. (1931). *Industrial accident prevention; a scientific approach*. First edition. New York ; London : McGraw-Hill book company, inc., 1931. https://search.library.wisc.edu/catalog/999854352802121

Ismail. (2018a). Amalan keselamatan pelajar dalam bengkel katering. *Online Journal for TVET Practitioners, 3(1).*

Ismail, M. S. (2018). (2018b). *Pembinaan dan validasi Instrumen Perkembangan Sosioemosi Kanak-Kanak Prasekolah menggunakan model pengukuran Rasch*. *2*(1), 1–13.

Pega, F., Chartres, N., Guha, N., Modenese, A., Morgan, R. L., Martínez-Silveira, M. S., & Loomis, D. (2020). The effect of occupational exposure to welding fumes on trachea, bronchus and lung cancer: A protocol for a systematic review and meta-analysis from the WHO/ILO Joint Estimates of the Work-related Burden of Disease and Injury. *Environment International*, *145*(April), 106089.

Sari, D. L., & Isharyanto. (2017). Analisis Faktor Yang Berhubungan Dengan Perilaku Penerapan Keselamatan Pasien Pada Perawat Di Ruang Rawat Inap Rsud Kabupaten Sukoharjo. *Prosiding Seminar Nasional Hasil-Hasil Penelitian Dan Pengabdian Bidang K3*, *36*, 250.

Sekarsari, D., pratiwi, A., & Farzan, A. (2017). Hubungan Lama Kerja, Gerakan Repetitif Dan Postur Janggal Pada Tangan Dengan Keluhan Carpal Tunnel Syndrome (Cts) Pada Pekerja Pemecah Batu Di Kecamatan Moramo Utara Kabupaten Konawe Selatan Tahun 2016. *Jurnal Ilmiah Mahasiswa Kesehatan Masyarakat Unsyiah*, *2*(6), 184961.

Selamat. (2018). Perceptions, Knowledge, and Attitudes of Students towards Safety Practice in Culinary Laboratories. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *24*(1), 23–31.

Wanjari, M. B., & Wankhede, P. (2020). Occupational hazards associated with welding work that influence health status of welders. *International Journal of Current Research and Review*, *12*(23), 51–55.

Wardhani, R. P., & Simanjuntak, R. D. (2017). Penerapan Welding Safety Procedure Untuk Mengatasi Hazard Risk Factors Pada Metode Pengelasan GTAW (*Gas Tungsten Arch Welding*). *Jurnal Penelitian TEKNIKA*, *17*(2).