



Counseling and application of personal protective equipment to reduce work accidents in welding workshops

Penyuluhan dan penerapan penggunaan alat pelindung diri untuk penurunan kecelakaan kerja pada bengkel las

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ABSTRACT

Dinoyo Welding Workshop is one of the welding workshops located in Dinoyo, Lowokwaru, Malang City. The workshop is quite small with an owner and 3 employees. Even so, this workshop does have a lot of customers. Understanding and awareness of Occupational Safety and Health (OHS), especially in the use of Personal Protective Equipment (PPE) here was heavily ignored, causing the frequent occurrence of work accidents. The purpose of this activity was to reduce the occurrence of accidents and occupational diseases when doing work and to instill the understanding of workers regarding the importance of OHS aspects, especially the use of PPE. The method used was the Participatory Rural Appraisal (PRA) method by conducting OHS counseling and training as well as training on the use of PPE in the welding workshop. This activity caused work accidents to decrease significantly with an average decrease rate of 69.44%. The occurrence of work accidents met the highest decrease in work accidents caused by fire on the skin which became 0 events, which means accidents did not happen anymore because of fire, as well as accidents that occurred in the eye due to metal splash and fire sparks. The next highest decreases are the occurrence of hot welding fires, breathing problems due to welding fumes, scratches, and red eyes.

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1. INTRODUCTION

Despite today's modern era, it is possible that there are still many companies or SMEs that still ignoring Occupational Safety and Health (OHS). This causes a lot of work accidents or occupational diseases when someone is doing their job. OHS is something that must be considered both in manufacturing and services.

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To be accordance with the increasingly rapid development in most industries, the application of high technology, the use of increasingly complex and complex materials and equipment is inevitable, thus requiring skilled workers. (Agustin & Sunaryo, 2021). In a situation where workers do not have sufficient skills or lack of expertise or are less skilled, would likely trigger work accidents or occupational diseases to occur. In some cases, work accidents are generally caused by improper use of tools, inappropriate use of PPE and other errors (Mualim, 2021). OHS is something that must be considered, especially in manufacturing and services. Workers in the formal sector or the informal sector have the right to OHS, as well as for welding workers (Nikmah, 2021). Work in the informal sector plays an important role in people's lives (Rafi'ah & Maliga, 2021). The more advanced the tools, the more complex it is in relation to use, maintenance, and work risks (Hakim & Haryana, 2021). Errors in operating equipment, and the lack of equipment such as PPE and insufficient workforce competence can trigger work accidents (Heryadi et al., 2021).

This case is happened in the Dinoyo welding workshop which is one of the welding workshops located in Dinoyo, Lowokwaru, Malang City. This workshop is a relatively small welding workshop with an owner and 4 employees, but does have quite a lot of customers. The workshop location is located in a small alley with limited work space and small room size. Work tools placement are also still scattered without proper arrangement. Welding workshops is one of the informal sectors that has relatively high dangers and risks (Afdahluka et al., 2020). Lack of awareness and knowledge of the importance of OSH between workshop workers can lead to work accidents (Saptadi et al., 2020). Meanwhile, in this workshop, workers also do not use Personal Protective Equipment (PPE) when doing work. The use of PPE here is ignored, considering that it should not ignore matters related to OHS. The level of employee awareness of OHS is still low, as is the case in several workplaces including workshops (Joniarta et al., 2020). In a study that analyzed the relationship between organizational aspects, worker psychology, and the situation on behavior in using PPE, the results showed that PPE motivation and training had a relationship with compliance in using PPE. (Brito, 2015).

In an effort to reduce the number of work accidents, it is necessary to seek an activity that can be a solution. Research in a workshop that aims to reduce work accidents is recommended to provide counseling about the importance of using personal protective equipment for iron welding workers to reduce the number of accidents due to unsafe work (Dalimunthe & Mithami, 2018).

Based on data obtained from the owner of this Dinoyo welding workshop, the number of work accidents is still quite high. The following is work accident data from various types of events at the Dinoyo Welding Workshop.

Table 1. Types and Frequency of Work Accidents at Dinoyo Welding Workshop March – August 2021

Type of work accident	March	April	May	June	July	August	Total	Average
Red-eyed followed by tears	8	9	6	4	4	6	37	6.2
Heat shocks	9	8	5	4	4	5	35	5.8
Welding sparks on skin	3	2	2	1	1	2	11	1.8
Breathing problems due to smoke	3	2	2	1	1	2	11	1.8
Scratches	2	2	1	0	1	2	8	1.3
Metal splash	1	1	0	0	0	1	3	0.5
Welding sparks on eyes	1	1	0	0	1	0	3	0.5
Total	27	25	16	10	12	18	108	18

Source: Dinoyo Welding Workshop

The purpose of this activity is to reduce the occurrence of accidents and occupational diseases when doing work and to grow workers' understanding regarding the importance of OHS aspects as well as the use of PPE. This activity was carried out with counseling related to OHS and training on the use of PPE in welding workshop.

Welding workshop is one of the business units that has high risk of accidents, because welding work uses work tools that have a high level of danger and an environment that is not suitable for the health of its workers. Various types of work accidents can occur in the workplace in the workshop such as heat shock, welding sparks, scratches, and so on.

The types of hazards based on the group are divided into 2 (Mulya, 2018) namely: (1) Safety Hazards. This type of hazard is oriented to the safety of individual humans related to operations, equipment used and technology. The types are: (a) Mechanical Hazard, which is the danger contained in an object or a process that moves and can result in being stabbed, pinched, cut, scratched, and so on; (b) Electrical Hazard, which is the danger associated with electric current; (c) Chemical Hazard, which is a hazard originating from various chemicals, both gaseous, liquid and solid and has flammable, corrosive and explosive properties. (2) Health Hazard. This hazard focuses on human health whose impact is chronic, continuous and has a high probability of occurrence. The types are: (a) Physical Hazard, which is a hazard in the form of energy such as noise, radiation, lighting, vibration, and so on; (b) Chemical Hazard, which is a hazard originating from chemicals in the form of gas, liquid and solid as well as being toxic, pathological and irritant; (c) Biological Hazard, which is a hazard originating from microorganisms, especially pathogens and can cause health problems; (d) Ergonomics, which are hazards that can cause health problems as a result of incompatibility of work designs with workers.

PPE in the work environment is a complete set of equipment worn by workers in protecting the body in whole or in part from possible occurrences of potential hazards/work accidents (Jayati et al., 2021). The use of Personal Protective Equipment (PPE) is very important and is used as a defense tool to protect the user from negligence or unexpected conditions. This PPE does not perfectly protect the wearer's body, but if used properly and regularly, PPE can reduce the severity of an accident. According to Permenakertrans No. 8/MEN/VII/2010, there are various types of PPE related to work in welding workshops, namely (Peraturan Menteri Tenaga Kerja Dan Transmigrasi Republik Indonesia Nomor Per.08/Men/VII/2010 Tentang Alat Pelindung Diri, 2010): (1) Eye and Face Protective Equipment. This tool has a function in preventing the eyes and face both from chemicals, splashes of hot objects and hot steam, emission of light and electromagnetic wave radiation. Such as, safety glasses (spectacles), goggles, full face masks, and others. (2) Respiratory Protection Equipment and its accessories. This tool serves to filter the air so that it is clean and does not enter directly into the breath. This tool can filter from dust, fog, smoke, steam, gas and others. Examples of these tools are Air hose masks, respirators, masks, and so on. (3) Hand Protective Equipment. This hand protection device is intended to protect hands from direct exposure to fire, chemicals, etc. Gloves can be made of leather, rubber, canvas, and so on. (4) Foot Protective Equipment. This tool is intended to protect the feet from either hot or cold liquids, or hot steam, extreme temperatures and so on. This includes protection from being punctured by sharp objects, falling by heavy objects, and slipping. (5) Protective Clothing. This clothing is intended to protect against exposure to fire, hot objects, hot temperatures, both air, liquid and metal as well as hot steam. Protective clothing also protects against chemical splashes. Examples: jackets, aprons, vests, and protective clothing that covers the body completely or partially. (6) Ear Protective Equipment. This tool is intended for protects the ear from pressure and noise. Examples: ear muffs, ear plugs.

2. METHODS

This activity uses the Participatory Rural Appraisal (PRA) method, which is a method that involves the community in developing and analyzing their knowledge regarding their own lives and conditions for planning and action. (Noor Emiliyasi & Kosmajadi, 2020). This method has a purpose, i.e., the involvement of the target in realizing the planned program so that a reciprocal relationship arises between the servant and the target. The implementation of this activity is by conducting counseling and assistance on Occupational Health and Safety (OHS) as well as training on the use of Personal Protective Equipment (PPE) in welding workshops. The participants of this counseling and assistance are the owner of a welding workshop and 3 employees.

Method of Implementation

For the implementation of the activities carried out using five methods, namely:

Initial data collection of work accidents

Prior to the start of the explanation of the extension material, data was collected regarding the incidence of work accidents that occurred during the last 6 months. This data collection is intended to determine the level of success from before and after the counseling and assistance activities for the application of OHS and PPE in this welding workshop.

OHS Counseling

In this outreach activity, material on OHS was given, namely related to the OHS concept, hazards in welding workshops and their types and prevention, as well as various Personal Protective Equipment (PPE) that should be used in welding workshops along with an explanation of each.

Demonstration and practice of using PPE

Training on the use of Personal Protective Equipment (PPE) in welding workshops is carried out after the counseling materials are completed and the PPE provided by the service team is handed over to the welding workshop partners. The demonstration of the use of PPE was carried out by Mr. Sugiono as the owner of the welding workshop, assisted by community service team.

Assistance

After being given an explanation of the counseling material and training on the use of PPE, the team then provided assistance in the practice of applying the use of PPE during daily work for 2 months. This assistance is intended so that the service team can ensure that workshop workers understand and get used to always using PPE at work, as well as observing the impact of workshop activities using PPE at work, especially related to work accidents.

Module giving

The modules given to the participants were distributed during the counseling. The module contains material on OHS, the purpose of OHS, an overview of OHS in the workplace such as workshops, understanding of hazards and their types, the impact of hazards in particular on health, prevention of hazards, explanations of PPE and various types of PPE especially in welding workshops and also training on the use of Personal Protective Equipment (PPE).

Evaluation Planning

The evaluation criteria used in the implementation of the service program in the form of this assistance include: (1) the implementation of counseling which is attended by all employees and also

welding workshop owners properly. (2) The consistent application of the use of PPE in daily work activities during the assistance period by the community service team. (3) The results of the measurement of the occurrence of work accidents in the welding workshop which showed a decrease compared to before the counseling and application of the use of PPE by workers.

3. RESULTS AND DISCUSSION

Results

Counseling activities

In the Occupational Health and Safety (OHS) counseling activity, basic material on OHS was given. Counseling is given how to present material through laptop media and physically provide material modules to all participants. Sample material is given in the form of videos taken from various electronic social media sources. Extension activities are carried out as shown in Figure 1.



Figure 1. OHS Counseling

Demonstration activities and practice of using PPE

In demonstration activities and training on the use of PPE, the first handover of PPE was carried out to the owner of the Dinoyo welding workshop, Mr. Sugiono. The PPE handed over by the community service team includes: automatic welding helmet, automatic welding goggles, welding apron set, welding gloves, and safety shoes, as in Figures 2 and 3.



Figure 2. PPE equipment handover
Figure 3. PPE usage demonstration

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Figure 4. Training on the use of PPE

The training on the use of PPE that has been carried out was also demonstrated directly by the owner of the welding workshop, Mr. Sugiono, as shown in Figure 4. Complete sets of PPE were given to the Dinoyo Welding Workshop with the aim that workers use PPE in an orderly and orderly manner, and they also fully understand the dangers involved will happen to them if they do not use PPE when doing work.

Assistance activities

The results of the assistance activity as a continuation of the counseling activity, the community service team in the first and second weeks of the first month, was present at the workshop every morning since the workshop was opened at 8.00 WIB for 2 hours, and during the break for 2 hours. In the third and fourth weeks of the first month, the team's attendance at the workshop remained every day but the hours were reduced to 1 hour each, in the morning when it opened and after a break. Assistance in the first and second week of the second month, the assistance is carried out for 1 hour during working hours at random, and 1 hour after taking a break also randomly. Meanwhile, in the third and fourth weeks of the second month, the community service team made observations at random both in the morning and after 1 hour of rest. With random schedules and different frequencies, it will be possible to observe order and how consistently workers wear PPE at work without having to be supervised by the community service team all the time.

During this assistance, in addition to the community service team monitoring the use of PPE correctly and orderly, observations were also made on the occurrence of work accidents in the welding workshop every day. The following are the results of observations of work accidents at the Dinoyo Welding Workshop for 2 months after the counseling activity.

Table 2. Work accident data after assistance at Dinoyo Welding Workshop Malang

Type of work accident	October	November	Total	Average
Red-eyed followed by tears	4	3	7	3.5
Heat shocks	1	1	2	1
Welding sparks on skin	0	0	0	0
Breathing problems due to smoke	1	0	1	0.5
Scratches	1	0	1	0.5
Metal splash	1	0	1	0.5
Welding sparks on eyes	1	0	1	0.5
Total	9	4	13	6.5

From Table 2, it can be seen that the average occurrence of work accidents every month in October and November is 6.5 or rounded up to 7 accidents. Overall, the rate of work accidents has decreased. The types of work accidents that still occurred until the end of November were red eyes, and the heat of a welding fire. For the other 5 types of work accidents, they no longer occur.

Table 3. Comparative data on work accidents before and after counseling and assistance at Dinoyo Welding Workshop Malang

Type of work accident	Average Work Accident March-August 2021	Average Work Accident October-November 2021	Decrease in Work Accident Rate (%)
Red-eyed followed by tears	6.2	3.5	43.24
Heat shocks	5.8	1	82.86
Welding sparks on skin	1.8	0	100.00
Breathing problems due to smoke	1.8	0.5	72.73
Scratches	1.3	0.5	62.50
Metal splash	0.5	0	100.00
Welding sparks on eyes	0.5	0	100.00
Mean	18.0	5.5	69.44

Table 3 shows a significant decrease from before the existence of counseling and the application of the use of PPE, namely an average of 69.44%. The highest decrease was 100% in work accidents caused by sparks on the skin which resulted in 0 incidents or no more accidents due to these sparks, as well as accidents due to metal sparks and sparks in the eye. The next largest decrease in the incidence of accidents by 82.86% was the occurrence of hot flashes of welding, followed by a decrease of 72.73% in the incidence of respiratory disorders due to welding fumes, and 62.50% the incidence of scratches, and 43.24% watery red eyes.

Discussion

The process of activities went effective and efficient. This can be seen from the occurrence of an enthusiastic question and answer process from the participants, so that the interaction can provide a good picture of understanding the counseling material from the participants. All workers asked questions that showed workers were enthusiastic about the material and there was motivation to apply OHS well after understanding the material. Good questions asked in OHS in general, including in terms of hazards posed. Most of the questions related to the types of PPE and their use. Some of these questions were answered not only verbally, but also with videos of similar cases that occurred in workplaces such as welding workshops.

Based on the results of the demonstration on the use of PPE, all participants were pleased to try all the PPE provided. Especially workers in welding workshops who have tasks related to welding, cutting, and smoothing jobs who must wear PPE in the work process. The demonstration of the use of PPE is not only limited to how to wear the correct PPE, but also how to practice it when working in welding, cutting, and smoothing processes. At first, workers find it rather odd wearing PPE, because the condition of wearing PPE would be different from when working without wearing PPE. Workers need adjustments and building habits to wear PPE when working. Each worker has different adaptability, so they need direction and guidance at the beginning of the use of PPE when working. This is what is done during the assistance period.

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Table 4. Schedule and results of assistance activities

First month, week 1 and 2	
Activities	<ul style="list-style-type: none">- Workers wear PPE fully assisted by the community service team- Workers operate tools using PPE assisted by the community service team and assisted by other workers- The community service team accompanies for 2 hours at the beginning of working hours and 2 hours after break hours
Results	<ul style="list-style-type: none">- Workers can wear PPE with the help of the community service team- Workers can operate tools while wearing PPE with the help of the community service team and assisted by other workers

First month, week 3 and 4	
Activities	<ul style="list-style-type: none">- Workers wear PPE with a little help from the community service team- Workers operate tools using PPE assisted by the community service team and assisted by other workers- The community service team accompanies for 1 hour at the beginning of working hours and 1 hour after break hours
Results	<ul style="list-style-type: none">- Workers can wear PPE with the help of other workers- Workers can operate tools while wearing PPE but it is not very adept overall and still needs a little help from the community service team and assisted by other workers.

Second month, week 1 and 2	
Activities	<ul style="list-style-type: none">- Workers wear PPE without being assisted by the community service team and with little assistance from other workers if needed- Workers operate tools using PPE assisted by other workers if needed- The community service team assists for 1 hour of initial work and 1 hour after break, each at a random time
Results	<ul style="list-style-type: none">- Workers now fairly adept at wearing PPE, only occasionally assisted by other workers- Workers wear PPE in an orderly manner when operating work- Workers can operate tools while wearing PPE but it is not very smooth overall and still needs a little help from the community service team and assisted by other workers.

Second month, week 3 and 4	
Activities	<ul style="list-style-type: none">- Workers wear PPE without being assisted by the community service team or by other workers if needed. Able to wearing their own PPE smoothly and well.- Workers operate tools while wearing PPE smoothly and without being assisted by other workers if needed- The community service team accompanies for 1 hour, from the initial working hours and after the break, at random times
Results	<ul style="list-style-type: none">- Workers wear their own PPE smoothly without being assisted by other workers- Workers are accustomed to wearing PPE in an orderly manner every time they do welding, cutting, and smoothing jobs- Workers can operate the tools using PPE smoothly as a whole without being assisted by the community service team and assisted by other workers

During the 2-month assistance period, the process of adjusting and getting used to using PPE at work was carried out. In the first and second weeks of the first month, the assistance process involved many community service teams to help from wearing PPE to doing work, including welding, cutting, and smoothing. At the beginning, workers were still not able to work smoothly using PPE. Occasionally retracts helmet/goggle for adjusting purposes. Likewise, when hands are wearing gloves, there are initial difficulties starting from turning on the switch to operating the tool. This happened several times in the first week and less in the second week. In the following week, he began to get used to operating tools using PPE. However, workers have not been too fluent in their work. In the third week, workers have started to wear PPE smoothly and work on operating the equipment by wearing PPE. The team visits on a shorter schedule, but workers are still enthusiastic about training themselves to do the job using PPE. In the third and fourth weeks of the first month, the team's attendance at the workshop remained every day but the hours were reduced to 1 hour each, in the morning when it opened and after a break. In the first and second week of the second month, this service team assistance is carried out for 1 hour during working hours at random, and 1 hour after taking a break also randomly. Meanwhile, in the third and fourth weeks of the second month, the community service team made observations at random both in the morning and after 1 hour of rest. With random schedules and different frequencies, it will be possible to observe order and how consistently workers wear PPE at work without having to be supervised too much by the community service team.

4. CONCLUSION AND RECOMMENDATIONS

The purpose of this activity is to reduce the occurrence of accidents and occupational diseases when doing work and to grow the understanding of workers regarding the importance of Occupational Safety and Health (OHS) aspects, especially the use of PPE. The results of this OHS material counseling can provide a good understanding of workers, thus creating motivation to apply OHS by using PPE properly when working, both in the welding, cutting, and smoothing processes. From the results of 2 months of assistance, it can be shown that the application of the use of PPE independently can be gradually improved both in the use of PPE and in operating equipment in the work process by wearing PPE. During the assistance period, the results of observations on the incidence of work accidents can decrease significantly from the previous 18 months of work accidents to 5.5 incidents of work accidents or an average decrease of 69.44%. The highest reduction in the incidence of work accidents is 100%, namely in work accidents caused by sparks on the skin which become 0 events or there are no more accidents due to these sparks, as well as accidents due to metal sparks and sparks in the eye. The next largest decrease in the incidence of accidents by 82.86% was the occurrence of hot flashes of welding, followed by a decrease of 72.73% in the incidence of respiratory disorders due to welding fumes, and 62.50% the incidence of scratches, and 43.24% watery red eyes.

This activity can be carried out continuously, both at the SME welding workshop Dinoyo, as well as other welding workshops in the vicinity or in other areas. It is also necessary to conduct a review or monitoring in the future, either periodically or incidentally to find out and maintain the commitment of this welding workshop to consistently apply OHS, especially this PPE for the safety and health of the workers. In addition, to identify problems that may develop or the need to share knowledge about existing problems related to OHS in the welding workshop work environment. Similar programs can be carried out not only in SMEs such as welding workshops, but also in other workshops that have the character of work that requires similar security in carrying out their work.

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REFERENCES

- Agustin, C. R., & Sunaryo, M. (2021). Gambaran keluhan subjektif pekerja dan tingkat kebisingan di bengkel bubut CV. X Surabaya. *Jurnal Komunitas Kesehatan Masyarakat*, 3(1), 1–11. <https://doi.org/10.36090/jkkm.v3i1.1078>
- Brito, G. T. (2015). Analisis aspek pembentuk budaya K3 dengan kepatuhan penggunaan APD pada pekerja produksi resin di Sidoarjo. *The Indonesian Journal of Occupational Safety and Health*, 4(2), 134–143. <http://doi.org/10.20473/ijosh.v4i2.2015.134-143>
- Dalimunthe, K. T., & Mithami, D. B. (2018). Hubungan pengetahuan, sikap, dan tindakan terhadap pemakaian alat pelindung diri (APD) pada pekerjalas besi di Kecamatan Percut Sei Tuan Kabupaten Deli Serdang tahun 2018. *Jurnal STIKNA: Jurnal Sains, Teknologi, Farmasi Dan Kesehatan*, 2(2), 47–54.
- Emiliasari, R. N., & Kosmajadi, E. (2020). Pendampingan penerapan manajemen pemasaran produk home industri Desa Cikadu. *Jurnal PARAHITA ABDIMAS Jurnal Pengabdian Masyarakat*, 1(2), 106–115.
- Hakim, R., & Haryana, K. (2021). Penerapan keselamatan dan kesehatan kerja (K3) pada praktik kerja las siswa kelas X Program Keahlian Teknik Kendaraan Ringan SMK Tamansiswa Jatis Yogyakarta. *Jurnal Pendidikan Vokasi Otomotif*, 3(2), 9–17. <https://doi.org/10.21831/jpvo.v3i2.40436>
- Heryadi, J., Safarudin, & Franca, M. L. (2021). Evaluasi pelaksanaan kesehatan dan keselamatan kerja (K3) dan penggunaan alat pelindung diri pada karyawan PT. Semen Baturaja (Persero) Tbk. di Baturaja. *Jurnal Kotamo*, 1(21), 1–23.
- Jayati, T., Oryza, F., & Auloia, A. (2021). Faktor yang berhubungan dengan penggunaan alat pelindung diri (APD) pada pekerja bengkel motor di PT. Capella Honda. *Jurnal Kesehatan Lentera 'Aisyiyah*, 4(1), 375.
- Joniarta, W., Triadi, A. A. A., Mulyanto, A., Okariawan, I. D. K., & Setyawan, P. D. (2020). Revitalisasi penggunaan alat pelindung diri (APD) untuk menunjang keselamatan dan kesehatan kerja (K3) di UKM bengkel las pintu harmonika "Jaya Mandiri." *Prosiding PEPEADU Seminar Nasional Pengabdian Kepada Masyarakat Tahun*, 2, 16–23.
- Peraturan Menteri Tenaga Kerja dan Transmigrasi Republik Indonesia Nomor Per.08/Men/Vii/2010 tentang *Alat Pelindung Diri*, Pub. L. No. 8, Jakarta 1 (2010).
- Mualim. (2021). Pengetahuan dan sikap penggunaan alat pelindung diri (APD) pada pekerja las listrik. *Journal of Nursing and Public Health*, 9(1), 69–77. <https://doi.org/10.37676/jnph.v9i1.1443>
- Mulya, A. (2018). *Analisis dan pengendalian risiko keselamatan kerja dengan metode semi kuantitatif pada pekerja pengelasan di bengkel pabrik PT. ANTAM Tbk UBP Emas Pongkor Bogor tahun 2008*.

Nikmah, U. N. L. (2021). Hubungan antara pengetahuan dan praktik penggunaan alat pelindung diri dengan kejadian kecelakaan kerja pada pekerja Bengkel Las Sejahtera di Kabupaten Madiun. *Undergraduate Thesis*. Universitas Muhammadiyah Surakarta.

Rafi'ah, & Maliga, I. (2021). Upaya penerapan kesehatan dan keselamatan kerja (K3) pada sektor informal di Kabupaten Sumbawa. *Abdimas Singkerru*, 1(2), 141–147.
