

Relationship between Individual Characteristics and Hearing Complaints in Home Industry Workers

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ABSTRACT

Introduction: Home metal industry is an informal industry activity engaged in the manufacture of metal. The process of metal-making creates noise that causes hearing loss complaints in workers. The purpose of this study was to analyze the relationship between workers' individual characteristics and hearing complaints in metal-making home industry workers in Ngingas North Village, Sidoarjo Regency. **Methods:** This research used an analytic observational method with a cross-sectional design. The population was 28 workers, and the research samples were 23 workers in the metal cutting and welding areas, determined using a purposive sampling technique referring to the inclusion criteria. The independent variables used in this study were individual characteristics including age, years of work, and the utilization of ear protection. The dependent variable in this study was hearing complaint and the data analysis used contingency coefficient C method. **Results:** Most workers were aged 26-45 years at 65.2%, had years of service >15 years at 43.5%, did not use ear protection at 69.6%, and complained of hearing loss at 65.2%. The results of the contingency coefficient C test analysis obtained a p-value <0.05 between individual characteristics and hearing complaints. **Conclusion:** There was a relationship between individual characteristics including age, years of service, and use of ear protection and hearing complaints.

Keywords: ear protection, age, hearing complaints, years of work

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INTRODUCTION

Home industry for metal making in Ngingas North Village, Sidoarjo Regency is one of the home industries in Sidoarjo Regency that produces metal manufacture. This home industry has been established since 1990 with the number of employees increasing every year. At present the number of employees who work in the metal-making home industry is approximately 45 people. Along with the development of the metal-making business era, several other home industries engaged in the same field are also developing. An easy metal processing process that already uses adequate equipment can make it easier for workers. This kind of home industry in a day manages to produce 500-1,000 sales to several regular customers. At the

beginning of the new year season, this home industry always gets orders for more than 2,000 metals from customers outside Java. The workplace in this home industry does not have a partition or barrier, so workers in the production section for metal cutting and welding carry out activities in one room. The work environment in this home industry has a noise impact on workers when all machines are operating. Thus, further research is needed to see the health impact on workers.

Health is a condition in which a person is able to work and has good physical, mental, social, and spiritual conditions without any defects from any disease, and is able to carry out activities properly (World Health Organization, 2019). Health is a factor that affects productivity for workers. Workers as actors in human resources need to pay attention to their health (Prayogi *et al.*, 2020). Workers must meet health requirements, and this is necessary to allow workers to work productively (Litchfield *et al.*, 2016). If these requirements are not met, there

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will be health problems for workers that affect the level of company productivity (Suhartono, 2015; Litchfield *et al.*, 2016; Musdalifah, 2017). If health conditions are not considered, it can increase the potential for hazards in the work environment.

Potential hazards exposed to the workers in the work environment can cause health and safety problems for workers, including potential physical hazards, one of which is exposure to noise (Ihsan and Siti Salami, 2015). Noise exposure in the industrial environments is known to be a very big problem because there are more than 600 million people in the world exposed to noise in the work environment (Sumardiyono *et al.*, 2019). Noise is defined as all unwanted sounds that originate from the production process tools and or work tools which can cause hearing loss at a certain level of exposure. A workplace that has a source of noise hazards is a workplace that has continuous, intermittent, impulsive, and repetitive sources of noise (Ministry of Manpower, 2018).

Noise can pose a hazard to workers' health because it is influenced by the length of time a person is exposed to noise. A person will not experience health problems from noise if the noise level does not exceed the threshold value. According to the Regulation of the Minister of Manpower year (2018) No. 5 concerning the Work Environment, the threshold value is a standard of hazard factors in the workplace as a time-weighted average intensity level that can be accepted by the workers in the workplace without causing illnesses or health problems, during their daily work time not exceeding 40 hours a week or 8 hours a day. The noise threshold value according to the regulation is 85 dB. If the noise level is exposed to workers during a long period of time, it can cause hearing loss (Lie *et al.*, 2016).

Noise-induced hearing loss which also known as Noise-Induced Hearing Loss (NIHL) is a hearing loss caused by long noise exposure in the work environment for about 10 years in both ears with a level of 85 dB for more than 8 hours a day (Putri, Halim and Nasution, 2021). There are several risk factors known to influence noise-induced hearing loss. These factors include age, gender, years of service, noise level, frequency, length of exposure per day and type of noise (Wardani *et al.*, 2020; Putri, Halim and Nasution, 2021). Based on these conditions, the researchers wanted to see if there was a relationship between individual characteristics (age, years of service, use of ear protection) and hearing complaints in metal-making home industry

workers in Ngingas North Village, Sidoarjo Regency.

It is important to conduct research related to the impact of noise on hearing loss because hearing is the main medium used for communication other than using the eyes and mouth. If the ear receives exposure to noise in the long term, the likelihood to experience hearing loss is faster. Thus, it is important to conduct research on how to prevent hearing loss before it occurs (Alnuman and Ghnimat, 2019). Thus, this study aims to determine the relationship between individual characteristics and hearing complaints in home industry workers (a case study of metal making in Ngingas Utara village, Sidoarjo district).

METHODS

This research was analytical observational research because it was carried out by observing the research subject without giving intervention to the subject and by explaining a hypothesis that determines the relationship between the variables used, namely independent and dependent variables. The research design used was cross sectional because the research was conducted at the same time. This study used direct observation methods, namely the measurements of noise, interviews and questionnaires.

The population in this study were workers in the metal-making home industry in North Ngingas Village, Sidoarjo Regency. The population had inclusion criteria including having a minimum of 5 years of service, serving as permanent workers, and working in metal production (cutting and welding). The samples used in this study were production workers (cutting and welding) in the metal-making home industry, Ngingas North Village, Sidoarjo Regency who had met the inclusion criteria. The sample size was taken by purposive sampling that met the inclusion criteria as many as 23 workers, obtained from a total population of 28 workers. Data collection was carried out in February – March 2020.

The independent variables in this study included individual characteristics (age, years of service, use of ear protection). The dependent variable in this study was complaints of hearing loss, with hearing complaints and no hearing complaints. The data on hearing complaints and no hearing complaints were obtained from the results of the questionnaires and included problems such as ringing in the ears when not working, having difficulty communicating,

experiencing decreased hearing, having difficulty hearing the other person, and feeling disturbed when working in noisy places. Data were collected through the measurements of a sound level meter at a point near the noise source to get the results of the noise level in the work area and questionnaires to find out the individual characteristics and the presence or absence of hearing complaints of workers in the work area. Also, validity and reliability tests were conducted before the distribution of the questionnaires.

Noise measurements were conducted using a sound level meter referring to the Regulation of Ministry of Manpower of Republic of Indonesia Number 5/2018. The measurement of each point

Table 1. Age, Years of Service, and Use of Ear Protective Equipment Distribution of Metal-Making Home Industry Workers in Ngingas North Village, Sidoarjo Regency in 2020

Variable	Category	N	%
Age	12-15 years old	2	8.7
	26-45 years old	15	65.2
	>45 years old	6	26.1
Years of service	5-10 years	7	30.4
	11-15 years old	6	26.1
	>15 years old	10	43.5
Use of Ear Protection	Using Ear Protection	7	30.4
	Not Using Ear Protection	16	69.6

was carried out for 25 minutes with recording every 15 seconds, so that 100 recordings were obtained. Measurements were made on the same day.

The statistical test used the contingency coefficient C test to analyze the relationship between individual characteristics (years of service, age, and the use of ear protection) and hearing complaints. The contingency coefficient C test was used because the nominal data scale was included in the statistical test requirements. The research has received the ethical feasibility test from the Ethics Committee of Universitas Airlangga, Faculty of Dental Medicine

Table 2. Results of the Hearing Complaints of Metal-Making Home Industry Workers in Ngingas North Village, Sidoarjo Regency in 2020

Hearing Loss Complaints	N	%
Complaints	15	65.2
No complaints	8	34.8
Total	23	100.0

Table 3. Results of Noise Level Measurements in Metal-Making Home Industry Workers in Ngingas North Village, Sidoarjo Regency in 2020

Source Point	Noise Level (dB)
Welding area	81.8
Cutting area	90.9

Table 4. The Analysis Results of the Relationship between Individual Characteristics and Hearing Complaints in Metal-Making Home Industry Workers, Ngingas North Village, Sidoarjo Regency in 2020

Individual Characteristics	Hearing Loss Complaints				Total		P-Value
	Complaints		No Complaints		N	%	
	n	%	n	%			
Age							
12-25 years old	0	0.0	2	100.0	2	100.0	0.004
26-45 years old	9	60	6	40.0	15	100.0	
>45 years old	6	100.0	0	0.0	6	100.0	
Years of service							
5-10 years	3	42.9	4	57.1	7	100.0	0.008
11-15 years old	2	33.3	4	66.7	6	100.0	
>15 years old	10	100.0	0	0.0	10	100.0	
Use of Ear Protection							
Using Ear Protection	1	14.3	6	85.7	7	100.0	0.001
Not Using Ear Protection	14	87.5	2	12.5	16	100.0	

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RESULTS

The Individual Characteristics of the Workers Studied in this study Including Age, Years of Service, and Use of Ear Protective Equipment

Based on the results of the study in Table 1, it can be seen that the age group of workers was mostly 26-45 years old with a total of 65.2% respondents. The oldest workers were aged 53 years old and the youngest workers were aged 25 years old.

The results of the study in Table 1 show that the majority of workers had a working period of >15 years with a percentage of about 43.5%. The longest working period for metal-making home industry workers was 27 years. Based on the results of the study in Table 1, it can be seen that the level of the use of ear protection among workers was still low with a percentage of 69.6% of workers not using ear Protection.

The results of this study in Table 2 show that as many as 65.5% workers in the metal-making home industry, Ngingas North Village, Sidoarjo Regency had complaints of hearing loss. Meanwhile, the number of workers who did not have hearing complaints was around 34.8%.

According to Table 3, it is known that there were two areas which were measured to identify the noise level, the welding area and the cutting area. The cutting area had 90.9 dB noise level which exceeded the threshold limit based on the Regulation of the Minister of Environment Number 48/1996, which regulates about the Noise Level and Standard. In addition, the total area of work was only around 450 m².

Analysis of the Relationship of Individual Characteristics with Hearing Complaints

The analysis of the relationship of individual characteristics of workers including age, years of service and use of ear protection with hearing complaints was conducted using a cross tabulation table with the contingency coefficient C test as shown in Table 3. Based on the results of the study, it is shown that at the age of more than 45 years old, all of the workers had hearing complaints of about 100%. Meanwhile, at the young age of 12-25 years old, the workers did not have complaints of hearing loss.

The contingency coefficient C test result with a significance of 0.05 showed a p-value of 0.004. It can be concluded that there was a relationship between the workers' age and hearing complaints in metal-making home industry workers in Ngingas North Village, Sidoarjo Regency. Based on the age group of workers, it can be seen that during the working period of 5-10 years there were workers who experienced hearing loss complaints as many as 3 people with a percentage of 42.9%. In the working period of 11-15 years, there were 2 workers experiencing hearing loss complaints with a percentage of 33.3%. Meanwhile, in the work period > 15 years, there were hearing complaints in 10 workers with a percentage of 100%. The results of this study show that there was a relationship of years of service with hearing complaints among workers.

The results of the contingency coefficient C statistical test between the use of ear protection and hearing complaint variable showed that 1 person who used ear protection experienced hearing loss complaints with a percentage of 14.3%. Meanwhile, workers who did not use ear protection experienced hearing loss complaints as many as 14 people with a percentage of 87.5%. Table 5 above shows that the use of ear protection had a relationship with hearing complaints (p-value = 0.001). Based on the results of the analysis, it can be concluded that there was a relationship of age, years of service, use of ear protection with hearing complaint among workers.

DISCUSSION

Individual Characteristics of Metal-Making Home Industry Workers, Ngingas North Village, Sidoarjo Regency

This study had a total of 23 workers in the metal-making production sector and all workers were males. The home industry does not employ women because the physical workload to make metal is included in the heavy category. The age of workers in this study was in the category of adults and productive age for work. Along with increasing age a person will experience pathological changes in the body organs. The age group of 26-40 years old is one of the age groups that is more susceptible to organ dysfunction if someone works in a work environment with high noise levels (Amalia and Lanjahi, 2018).

The longest working period was > 15 years with a total of 10 employees (43.5%). Some of the

workers in the metal-making home industry were old workers who had worked for more than 15 years. It is known that a long working period will have an impact on the health of workers (Heidari *et al.*, 2019; Saputro, Mulyono, and Puspikawati 2019; Wong, Chan, and Ngan, 2019). A person's working period will affect the risk of hearing complaints. The longer a person works in a place with high noise intensity, the higher the risk to his health (Jayanti *et al.*, 2016). The working period can also have a relationship to the occurrence of hearing loss complaints because exposure to noise causes the ears to feel disturbed (Le *et al.*, 2017; Lie *et al.*, 2016). Over time, the ear will no longer feel the noise because the hearing threshold value increases (Rahayu and Patangan, 2016; Bell and Jędrzejczak, 2021).

Based on the measurements of the use of ear protection equipment in this study, it was found that 16 people (69.6%) did not wear ear protection that had been provided by the workplace in the form of earplugs. Workers sometimes felt there was no need to use ear protection because it was uncomfortable and easy to lose. One of the impacts for workers if they do not use ear protection is the occurrence of work stress that causes discomfort during work. Workers who do not wear ear protection equipment have a 4,411 times greater chance of potentially experiencing work stress (Amir, Wahyuni, and Ekawati, 2019). Study of As'ad (2019) stated that workers are not comfortable using ear protection because they cannot do the installation properly, so the noise can still be heard.

The effectiveness of the use of ear protective can be done with the selection of appropriate materials (Retnaningsih, 2016). The use of ear protection such as earplugs made of silicone is more comfortable to use because it can be adjusted to the shape of the worker's ears (Syah and Soedjajadi, 2017). Ear protection devices made of silicone are known to be ineffective in their function of reducing noise because silicone earplugs can only absorb 8-10 dB of noise. Ear protection material made of foam, on the other hand, can reduce noise by 31 dB - 44 dB, making it more effective in preventing noise from workers, by also providing modifications to the strap so that it is not easily lost (Kvaloy, Berg, and Henriksen, 2016).

In accordance with the Ministry of Manpower Regulation year 2018 No. 5, noise which is allowed to be exposed to workers with 8 hours of work per day is 85 dB. Ear protection for workers that is effectively comfortable to use is made of silicone,

for workers in the home industry work environment on metal cutting parts with noise intensity of 90.9 dB, exceeding the noise level threshold. Using silicone-based ear protectors can reduce noise in the ear up to 81.8 dB and the intensity is allowed to be exposed by workers. This result is in line with research conducted by Kozłowski and Mlynski (2019) stating that silicone ear protection devices are more effective at reducing noise exposure to the ears.

Hearing Complaints of Metal-Making Home Industry Workers

The results of the questionnaire related to hearing complaints found that 65.2% of workers had hearing complaints due to exposure to noise in the work environment, so it was found that the majority of workers had complaints of hearing loss. Hearing complaints are a collection of symptoms of hearing problems without a medical examination (Waskito, 2008; Taber, Leyva and Persoskie, 2015). In research related to hearing complaint in drivers who worked at high noise intensity it was found that the drivers had complaints such as not being able to hear the conductor speaking, and the interference of sound from the engine to the driver's activities (Raya, Asnifatimah, and Ginanjar, 2019).

Hearing loss will appear suddenly or slowly over months to years. Sometimes this is not realized by the sufferer, so that when the patient begins to experience complaints of being unable to hear it usually has already reached an irreversible stage (Korver *et al.*, 2017). The main risk that is likely to cause hearing loss in workers exposed to noise is very high noise levels (Dewanty and Sudarmaji, 2016). Research related to hearing complaints experienced by workers at PT. Pertamina shows that one of the symptoms felt by some respondents are ringing in the ears (Azzahri and Ikhwan, 2019).

Analysis of the Relationship between Individual Characteristics (age, years of service, use of Ear Protection) and Hearing Complaints

Analysis of the Relationship between Age and Hearing Complaints

The results of this study indicate that there was a relationship between age and hearing complaints. Workers who often experienced hearing loss complaints was those in the age group of 26-45 years old and more than 45 years old. This research is in

line with research conducted by Azzahri and Indriani (2019) which showed that there was a relationship between age and hearing complaints at PT. Hervenia Kampar Lestari. Several other studies also stated that there was a relationship between age and hearing complaints (Raya, Asnifatimah, and Ginanjar, 2019; Tuwongkesong, Akili, and Kalesaran, 2019).

Workers in the age group of 35 years and over and work in an area with high intensity noise can experience a natural decrease in hearing function, so it is often found that the older a person is, the lower his hearing function is (Jayakody *et al.*, 2018). This is because the hair cells in the ears at the age of 35 years old begin to die, causing the sound that is heard not to reach the inner ears (Ramadhani and Firdausiana, 2020).

However, the results shown in this study are not in line with the results of research conducted by Ramadhani and Firdausiana (2020) who said that hearing loss complaints did not have a significant relationship with a person's age. The same thing is also asserted in research by Abjasiqo, Winarko and Sari (2021) which shows that age had no relationship with hearing loss complaints.

Analysis of the Relationship between Work Period and Hearing Complaints

Based on the results of this research, it was found that there was a relationship between years of service and hearing complaints among workers. Workers who often experienced hearing complaints were those who had a working period of more than 15 years. A long working period affects the intensity of a person's exposure to noise, so it can have an impact on hearing conditions (Jayanti *et al.*, 2016; Raya, Asnifatimah, and Ginanjar, 2019).

The result of this research is in line with research conducted by Ibrahim, Basri and Hamzah (2016) showing that noise-induced hearing loss occurs over a long period of time from months to years. These changes are often unrealized by the sufferer, so that when the patient starts to feel the symptom of hearing loss, it has usually been in an irreversible stage. According to research by Maulina and Syafitri (2019), hearing loss is influenced by the working period or length of work of the workers at the workplace. Workers with long tenure have a higher risk of suffering from hearing loss complaints. This is because workers are exposed to noise sources for a long time (Azzahri and Indriani, 2019).

The relationship between years of service and the occurrence of hearing loss is that workers who

have worked for more than 10 years have a risk of hearing loss due to noise 3.656 times greater than workers with less than 10 years of service. Noise-induced hearing loss occurs gradually so that the worker is not aware of it. Noise with high intensity and a long work period of more than 10 years can cause a tear in the organ of Corti. This can lead to permanent hearing loss (Septiana and Widowati, 2017).

Analysis of the Relationship between the Use of Ear Protection and Hearing Complaints

According to the Regulation of Ministry of Manpower of Republic of Indonesia Number 5/2018, the noise level limit for workers who get the noise exposure throughout up to 8 hours per day is 85 dB. Based on the results of measurement, one work area had more than 85 dB of noise level that exceeded the threshold limit, which means that the workers should wear ear protection.

The results of this research indicate that there was a relationship between the use of ear protection and hearing complaints among workers. This is in line the research conducted by Ibrahim, Basri and Hamzah (2016) to workers in the production division of PT Japfa Comfeed Indonesia, Tbk. in Makassar. Workers who did not use ear protection had more hearing complaints, accounting for 20 people, than workers who used ear protection. The use of ear protection is one of the risk factors that causes hearing loss complaints. In accordance with this study, not all workers who work in noisy environments understand how to use ear protection because there are some workers who think that ear protection is not important because they are used to not using it while working (Ibrahim, Basri and Hamzah, 2016).

The metal manufacturing home industry in Ngingas Village has never provided education about the importance of wearing ear protection equipment in locations that have noise exposure more than 85 dB per day. Another thing to support workers to use ear protection while working is that the company can provide assistance related to education on the importance of using ear protection (Saliha *et al.*, 2019).

Research related to increasing awareness of the use of ear protection among blacksmith workers found that workers in practice using ear protection experienced an increase in attitude, knowledge and practice. This increased awareness occurs because of the assistance and education related to the use

of ear protection to maintain the safety and health of workers. This mentoring and education program is a collaboration between health workers and field officers and business owners in promoting and socializing the implementation of OHS to iron craftsmen (Wahyu *et al.*, 2019)

CONCLUSION

It can be concluded that the distribution of individual characteristics of metal-making home industry workers in North Ngingas Village, Sidoarjo Regency was dominated by workers aged 26-45 years, with a working period of >15 years. Moreover, regarding the use of ear protection equipment, some workers did not wear ear protection equipment. Based on the analysis test results using contingency coefficient C, it is shown that there was a relationship between age, years of service and the use of personal protective equipment with hearing complaints in metal-making home industry workers in Ngingas Utara Village, Sidoarjo Regency.

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