

# Analysis of Determinants of Musculoskeletal Disorders and Life Quality of Informal Workers

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**Abstract**—Musculoskeletal disorders are a pain in muscles, tendons, and nerves. Building workers and workers with heavy physical workloads and static muscles so that the muscles experience pressure and cause muscle and bone pain. This affects the life quality of informal workers. The aim of the study was to analyze factors that influence musculoskeletal disorders and to identify the quality of life of informal workers. This is quantitative research using a cross-sectional design. Meanwhile, the population of study was 123 informal workers and technique used was accidental sampling technique. Then, the research found that noise intensity of 86 - 90 dB related to musculoskeletal. The Musculoskeletal complaints included back pain (34.9%), low back pain (66.6%) and right arm pain (25%). The life quality of the majority was low for 116 people (94%). The identification of exposure that affected musculoskeletal complaints was a noise factor value of p-value 0.017. It significantly caused musculoskeletal complaints. The Exp (B) value of 2.919 showed that the effect of workers exposed to noise at 2.9-fold. It caused a risk of experiencing musculoskeletal complaints compared to workers who were not exposed to the noise. The noise interfered the cardiovascular system, increased blood pressure and released catecholamines in the blood resulting a fatigue of central nervous system (CNS). The inadequate central nervous system activated a motor nerve which resulted weakness, pain and decreased working ability. The workers were recommended to use earplug as personal protective equipment while working.

**Keywords:** *noise, musculoskeletal disorders, life quality, informal workers, low back pain, central fatigue*

## I. INTRODUCTION

Informal work is one of the alternative choices for living without certain requirements such as education and expertise. This is a phenomenon that is related to employment which is very rapidly developing in Indonesia. Informal sector workers are a labor force which is very dominant. Based on Statistics Central Data (2017), the number of workers in the informal sector is 53.6%. [1]. Workers who work both in formal and informal sectors will be at risk of experiencing occupational diseases. It depends

on the type of work carried out. The exposure will be different whether mild or severe. Therefore, it is important to apply occupational health and safety in workplaces [2].

A noise can occur everywhere. In a working environment, a noise will affect someone's work power and is a dangerous stressor condition for workers [3]. Noise can significantly reduce the auditory system for informal workers. Hearing is an important component to communicate well. If the hearing system is physiologically normal, hearing can function properly. On the contrary, if the physiological hearing is impaired, the ability to hear will be disrupted and will have an impact on the interference of communicating and relating to other people.

Workers interact with their working environment. In physical work, environmental factors includes conditions of vibration, temperature, and exposure to ergonomics. Exposure to ergonomics can be in the form of position during work, repetitive movements, working equipment found to be associated with MSDs [4]. Musculoskeletal disorders can occur in all types of work. Workers in the informal sector are at risk of having an impact on work-related diseases or musculoskeletal disorders. Musculoskeletal disorders are caused by biomechanics which cause damage to bones, muscles, tendons nerves and blood circulation. Generally, it occurs due to incorrect posture which causes repetitive pressure and functional disturbances due to work [5]. MSDS is a disorder that is often felt by workers. Complaints in the form of pain in the musculoskeletal sections which are spine, joints or parts of the nerve muscles are caused by the type of work carried out every day. Muscle conditions that experience disruption affect the disruption of daily activities because muscle strength is very important to be able to carry out activities to the fullest.

Although it is evident that few workers in the informal sector have contributed to overcome the difficulties in providing employment and reducing labor unemployment. This is also clear that the health for informal workers are

still very alarming and need more attention from the organizers. Some work accident cases have resulted in deaths in Indonesia within a week. Formal and informal sector workers indicate that government' surveillance and attention to employers are still very low [6]. Promotive and preventive efforts are needed so that such cases can be prevented.

Occupational health promotion in order to improve work methods and posture and to reduce workload can reduce MSDS problems. The decline can be done in various ways, like improving work. Previous research has shown that musculoskeletal disorders significantly decrease by 23.98% and reduced fatigue after improvement in assembling game webs [7]. Then, MSDS health problems can affect work ability [8] and work productivity gradually decreases. Life quality is a subjective perception that is felt by individuals towards physical, psychological, social, and environmental conditions in their daily lives. Meanwhile, environmental aspects are aspects that greatly affect the condition of one's life quality. Life quality is also a technology related to health conditions.

Health conditions are one aspect of improving quality of life, this study is important to analyze the extent of the life quality informal workers with various subjective complaints. Therefore, it is important to apply occupational health and safety to informal workers so that increased work productivity can be achieved. The aim of this study itself was to identify musculoskeletal complaints of informal worker and to analyze factors that influence musculoskeletal disorders. The hypothesis of the study was that there was an influence of noise intensity on musculoskeletal disorders.

**II. METHOD**

This research was a quantitative research using a cross-sectional design. The study populations were informal workers who worked physically, had heavy workloads and did the work manually. Gutter diggers and construction workers on Perjuangan street and Pancing street, in Medan. The samples were 123 people and an accidental sampling technique was used. The data analysis was carried out by univariate, bivariate and multivariate analysis. The multivariate analysis was conducted using multiple logistic regression.

**III. RESULTS**

The results of the study, such as the characteristics of respondents age, working period, and musculoskeletal pain complaints, were analyzed univariately. They were done by using frequency distribution and displayed with frequency and percentage. The results of the analysis can be seen in the following figure:

*A. 3.1 Characteristics of research respondents.*

The research respondents had a working time between 10 and more than 20 years. Table 1 below is the characteristics of respondents based on the age and years of service.

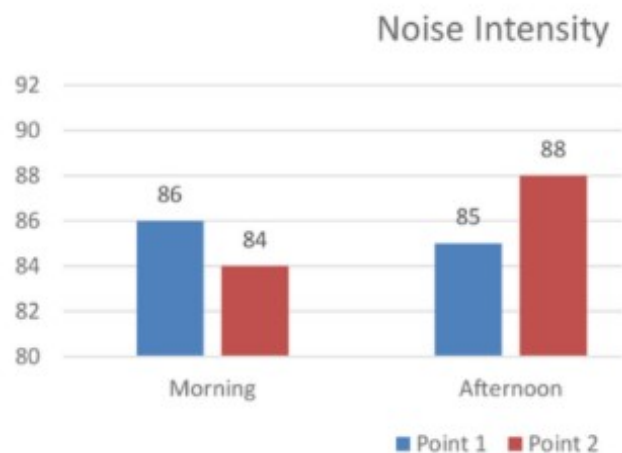
TABLE I. CHARACTERISTIC OF RESPONDENTS BASED ON AGES AND PERIOD OF SERVICE

Ages (year)	Frequency	Percent (%)
20 – 30	45	37
31 – 40	36	29
41 – 50	15	12
51 – 60	12	10
> 60	15	12
<b>Total</b>	<b>123</b>	<b>100</b>
Period of Service (year)	Frequency	Percent (%)
1	21	17.1
1–10	66	53.7
11 – 20	21	17.1
> 20	15	12.2
<b>Total</b>	<b>123</b>	<b>100</b>

The results of the study of the respondents' age varied. They were the age of 20 years to more than 60 years. The table above shows that 45 respondents (37%) are 20-30 years of age. Then, there are 12 respondents (10%) that are between 51-60 years of age. Workers have different tenure characteristics. Based on the working period, 66 respondents (53.7%) have a tenure of 1 - 10 years. At last, 15 respondents (12.2%) have more than 20 years working period.

*B. 3.2 Measurement of noise intensity*

The following diagram is the data of the noise intensity at the research location. Measurements were conducted three times that are morning, afternoon and evening.



**Figure 1.** Noise intensity measured at the research site.

*C. 3.3 Complaints about Musculoskeletal disorders*

Musculoskeletal complaints occur in certain areas. Table 2 below shows complaints of pain felt in 3 areas which are back, waist and right arm.

TABLE II. TYPES OF COMPLAINTS ON MSDS

Pain complaints	Yes	Percentage (%)	No	Percentage (%)	Amount	Percentage (%)
Back	43	34.9	80	65.1	123	100
Waist	82	66.6	41	33.4	123	100
Right arm	31	25	92	75	123	100

Based on the table, the complaints involving back pain is (34.9%), low back pain is (66.6%) and right arm pain is (25%). The majority of workers experiences low back pain (66.6%).

TABLE III. LIFE QUALITY CONDITIONS FOR INFORMAL

Quality of Life	Frequency (f)	Percentage (%)
Low	116	94
Medium	5	4
High	2	2
Amount	123	100

There are 116 people (94%) workers that have low life quality and two people (2%) have high life quality.

3.5 Logistic regression analysis

Analysis of logistic regression is used to determine the assumed factors affecting MSDS complaints. The analysis was carried out simultaneously after all four variables met the requirements to enter the logistical analysis. The results of the analysis of all variables which are cramping, drinking water, smoking, and noise are shown in table 3 below.

TABLE III. RESULTS OF PHASE 1 LOGISTIC REGRESSION ANALYSIS

Variable	B	Sig.	Exp (B)	95% C.I for Exp (B)	
				Lower	Upper
Cramps	.488	.243	.614	.270	1.393
Drink	.452	.282	.636	.279	1.449
Smoke	.374	.419	.688	.278	1.703
Noisy	.914	.062	2.495	.955	6.517

The stage 1 logistic of regression analysis found that the four variables which are cramping, drinking, smoking and noise had the greatest significant value. They were excluded from the analysis. Then, the following analysis is carried out in step 2.

TABLE V. RESULTS OF PHASE 2 LOGISTIC REGRESSION ANALYSIS

Variable	B	Sig.	Exp (B)	95% C.I for Exp (B)	
				Lower	Upper
Cramps	.468	.262	.627	.277	1.418
Drink	.545	.177	.580	.263	1.279
Noisy	.914	.017	2.919	1.210	7.044

3.4 Life Quality

The following are the results of informal workers life quality measurement. The noise factor value of p-value 0.017 significantly affects musculoskeletal complaints. Exp (B) value of 2.919 means the effect of noise exposure on workers, that workers exposed to noise are 2.9 times more likely to experience musculoskeletal complaints than workers who are not exposed to noise.

IV. DISCUSSION

Based on research findings, informal workers generally experienced impaired low back pain, back pain, and right arm. This finding was different from previous studies. MSDS complaints due to high workloads and heavy working conditions in oil company workers in China showed that the area MSDS was felt by workers in the waist 83.74%, neck and shoulders (78.01%). Meanwhile waist, neck, and shoulders reached (75.78%) It indicated that MSDS was a serious problem [8].

The age of the study respondents was found to be 50 years and above. It is the age that is not productive to work, especially informal workers who use physical activity at work. Previous research on blacksmith workers in Bantaran Subdistrict, 41 years old were the average workers and the level of risk found 60% of workers that experienced MSDS complaints. At that age, workers have experienced a physical decline so that bone elasticity decreases and causes fatigue [9]. The average working period of respondents is more than 10 years. It is assumed that the longer a person works on a job, the more expert and experienced in the same field. The population of workers who have a service life is more than 13 years (75%). They mobilize high energy while working and it is a risk factor for MSDS [9].

Complaints of low back pain were found in respondents due to the bent work position. A research was conducted in a group of dental practice specialists. They were at risk of experiencing ergonomic hazards due to long-standing work positions and bending, noise originating from suction machines, and repetitive work. 54-93% of dentists feel complaints of pain in the waist, shoulders, and hands [10]. The condition of informal workers who experience MSDS complaints will result in the loss of working hours of 8,784,000 workdays. The loss is due to MSDS conditions experienced by workers or 34% of workdays lost due to MSDs [11]. Working environment conditions greatly affect the quality of life of a person. Therefore, informal workers generally have a poor life quality. The findings of previous studies explain that there is a very strong relationship

between physical working environment and psycho-social factors on MSDS risk [4].

The finding of noise factors has a very significant value affecting musculoskeletal complaints about informal workers. Exposure to noise levels received by workers increases the risk of musculoskeletal disorders [12]. Noise causes fatigue in the nervous system so that muscles weaken and it decreases the ability to work. Woodcutting workers in the forest carrying heavy equipment (wood cutting tools) exposed to noise increase the risk of musculoskeletal disorders. The tool produces vibrations and noise [12]. Tolerable noise of 85 dB workers can be exposed to 8 hours per day. Noise not only causes hearing loss and decreases the quality of work but also results in work stress and cardiovascular system disorders, blood pressure and the catecholamine hormone [13]. Previous research on the inadequacy of the work environment and musculoskeletal complaints found a relationship between physical work environment and MSDS complaints. The results of the study found that work environments such as lighting and noise contribute 2.22 times the risk of workers experiencing MSDS (4).

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Musculoskeletal disorders causes fatigue. It is characterized by muscle activity that cannot be carried out anymore, weakness in the muscles or muscles cannot respond to stimuli received [14]. Fatigue will occur earlier in occupations with high physical activity. Musculoskeletal disorders are also influenced by work design. Professional workers such as computers operators, industrial workers, therapists, and drivers also experience repeated MSDS complaints [15]. Pain disappears when the activity is stopped, but pain can persistently occur. Preventive measurement need to be disseminated to workers to avoid persistent pain. According to Macphail (2018), health education, physiotherapy, exercises that are adapted to muscle abilities are interventions which can be given to patients who experience chronic low back pain, before the patient's condition gets worse [16].

If workers experience MSD complaints and are not immediately treated and cured, the health of workers can be more severe due to repeated musculoskeletal complaints. Work will decline and workers become unproductive. Velayudhan's research (2017) describes that the life quality of workers such as developing, enhancing and utilizing human resources productively provides maximum results [17]. Thus, complaints of the musculoskeletal disorder can affect the life quality of workers. Unhealthy conditions of workers will certainly disrupt their work. On the other hand, another threat is the risk of having a work accident. The same opinion is explained by Pratiwi (2014) that the life quality is high if workers get satisfaction with personal needs, organizational needs and the need for security [18].

## V. CONCLUSION

Noise interferes the cardiovascular system, increases blood pressure and releases catecholamines in the blood which causes central nervous system (CNS) fatigue. The inadequate central nervous system activates the motor nerve which results in weakness, pain and decreased work ability. Low work ability shows a low quality of life because it is unproductive and inefficient in doing work.

It is recommended for workers to use personal protective equipment such as earplugs during work, to reduce noise exposure. Drinking enough water at least 2.5 liters prevents dehydration which can lead to muscle cramps and decrease the ability of muscles to work.

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This research is for the sake of scientific development, competitive culture enhancement and application in research so that its existence can be recognized at the world level.

**Conflicts of Interest:** There is no conflict of interest between authors. The authors agree on the results of the research published. This research is solely to build academic culture and develop public health science, especially occupations.

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