



## ANALYSIS OF MUSCULOSKELETAL DISORDERS COMPLAINTS OF ASSEMBLY AND DECORATION AREA WORKERS AT PT. X

Alhabsy Chusumadinata <sup>1</sup>, Yustinus Denny Ardyanto Wahyudiono <sup>2</sup>, Shinta Arta Mulia <sup>3</sup>,  
Bagus Wicaksono <sup>4</sup>

<sup>1,2,3</sup> Department of Public Health Sciences, Faculty of Public Health,

Universitas Airlangga, Jl. Dr. Ir. H. Soekarno, Mulyorejo, Kec. Mulyorejo, 60115 Surabaya, Indonesia

Email: <sup>1</sup> [alhabsy.chusumadinata-2020@fkm.unair.ac.id](mailto:alhabsy.chusumadinata-2020@fkm.unair.ac.id)

<sup>4</sup> PT. Albea Rigid Packaing Surabaya,

Jl. Rungkut Industri IV No.23, Rungkut Tengah, Kec. Gn. Anyar, 60293, Surabaya, Jawa Timur, Indonesia

### Abstract

One of the tasks of humans in the industrial world is moving and transporting materials at great risk of triggering Musculoskeletal Disorders (MSDs). One production area with the potential for occupational disease hazards is the Assembly and Decoration area, which is a place for mixing colors. This area has a fairly high potential for occupational diseases in the form of MSDs because everyday workers always use manual product handling or what is known as lifting for 8 hours, hence workers often experience complaints of MSDs on the back, waist, shoulders, and arms. This research is a descriptive quantitative research type with analytical observational methods. This research is cross-sectional. The population in this study was 30 workers in the assembly and decoration area of PT. X. Measurement of MSDs among workers in the Assembly and Decoration areas using the Nordic Body Map (NBM) questionnaire and the RULA method. The results of measurements using the Nordic Body Map (NBM) questionnaire show that workers in the Assembly and Decoration sections have the potential to experience MSDs problems. Apart from that, based on the results of RULA measurements on Assembly and Decoration workers, a total score of 5 was obtained. so it can be concluded that this work is in the medium category and action is needed soon.

**Keywords:** Humans, MSDS, NBM, RULA

### Introduction

The rapid infrastructure development that has been implemented by the government is currently bringing about the development of global industrialization (Oesman and Wisnubroto, 2019). The development of industrialization is closely related to the use of technology to meet all current human needs (Mawardani et al 2022). The application of technology has been widely used in various sectors, including the industrial sector. One of the industries that utilize the latest and modern technology in every production process is advanced industry and Micro, Small, and Medium Enterprises (MSMEs) (Sutajaya, 2016). However, the use of technology can cause problems between machines/work equipment and the workers themselves (Ginanjari et al 2018).

Humans as the main source of labor are often used to carry out manual production processes. One of the tasks of humans in the industrial world is moving and transporting materials at great risk of triggering Musculoskeletal Disorders (MSDs) (Abdillahtulkhaer et al 2022). This is caused by humans doing this work repeatedly with heavy tasks and the wrong body position. MSDs disorders that appear affect several parts of the body such as joints, muscles and other body parts that connect to each other (Sedarmayanti, 2017). Therefore, the risk factors that cause MSDs problems are quite high in workers,

namely work activities and the work environment itself (Luh et al 2019).

According to data from the World Health Organization (WHO), musculoskeletal complaints are the second highest cause of disability globally, especially in the area of lower back pain. Musculoskeletal disorders also occur in developed countries, one of which is Germany. Where musculoskeletal disorders cause 20% of workers to lose work time and 50% of workers are forced to retire early. Meanwhile, in England, 43.4% of workers' morbidity is caused by musculoskeletal causes (Aminuddin, 2018). Musculoskeletal disorders occur in several areas such as the back (45%), hands (22%), and arms (13%). In addition, the United States records 6 million cases of musculoskeletal disease per year or an average of 300-400 cases per 100,000 workers, and makes musculoskeletal disease a significant cause of work accidents and occupational diseases in the world with a total of 155 cases per 100,000 workers (Ramdan 2012).

In Malaysia itself, based on data from the Social Security Organization (SOCSO), musculoskeletal cases increased sharply from 2005 to 2014 with an increase of 675 cases (Luan, et al 2018). Apart from that, in Indonesia, based on the results of basic health research, the percentage of musculoskeletal sufferers alone reached 11.9% of cases with 24.7% of sufferers showing signs (Health Research and Development Agency, 2013). In Indonesia itself, most of the symptoms that arise due to musculoskeletal disorders do not receive special attention, because most workers think that this is normal, but what needs to be underlined is that work fatigue is the beginning of the emergence of occupational diseases due to work that is carried out manually and repeatedly in a long time (Aziz et al 2018).

One production area with the potential for occupational disease hazards is the assembly and decoration area 1, which is a place for mixing colors. This area has a quite high potential for occupational diseases in the form of MSDs because everyday workers always use manual product handling or what is known as lifting and lifting. This is done by workers in assembly and decoration section 1 for 8 hours per day. So workers often experience complaints of Musculoskeletal Disorders (MSDs) in the back, waist, shoulders, and arms (Ariska, 2018). The Assembly and Decoration area is part of the production area which has the function of printing labels on packaging using automatic printing machines. Apart from that, this work area also has the function of providing brand stamps on packaging using a roll hot stamping machine and an up-down hot stamping machine. Workers in the Assembly and Decoration Area work for 8 hours and in monotonous conditions. So that's why researchers are interested in analyzing complaints of musculoskeletal disorders among workers in the Assembly and Decoration areas.

## **Research Methods**

This research is a descriptive quantitative research type with analytical observational methods. This research is cross sectional. The population in this study were 30 workers who worked in the assembly and decoration area of PT. X. Data collection techniques were carried out by interviews and distributing questionnaires directly in the form of Google forms to respondents containing MSDs complaints. The questionnaire used in data collection was the Nordic Body Map (NBM) Questionnaire. The NBM questionnaire is one of the measurement instruments used to determine complaints of musculoskeletal disorders (MSDs) in workers (Madani and Pratiwi, 2021).

Apart from that, MSDs measurements were also carried out using the RULA method to determine the ergonomics of the worker's upper limbs. Data collection activities at PT Data analysis was carried out using Microsoft Excel.

## Results

### Results of Musculoskeletal Disorders (MSDs) Measurement Using the Nordic Body Map (NBM) Method

The Nordic Body Map (NBM) is the questionnaire most often used to determine discomfort or pain in workers' bodies (Santosa, 2018). In this questionnaire, workers can fill in the condition of the complaint they are experiencing by indicating whether or not there is a disturbance in the body area. With the NBM questionnaire, identification can be carried out to find out more details about the parts of the worker's body that experience problems or pain while working. This is because every question item in it has been standardized and has been arranged neatly and systematically (Dewi, 2020).

The Nordic Body Map (NBM) is used to assess body parts including muscles that experience complaints ranging from Very Painless, Not Painful, Painful, and Very Painful. The results of the NBM questionnaire are used to estimate the type and level of complaints, fatigue, and pain in the muscles during work. Even though this questionnaire is subjective, it is standardized and valid for use. Where later respondents were asked to provide a checklist (v) on the conditions they felt while working based on a Likert scale according to complaints in certain body parts (Madani and Pratiwi, 2021).

Musculoskeletal Disorders (MSDs) measurements using the Nordic Body Map (NBM) method were carried out using the NBM questionnaire for workers in the Assembly and Decoration sections. The following are the results of measurements using the NBM questionnaire to 30 workers in the Assembly and Decoration (AD) section. The following are the results of the data analysis that was carried out on 30 workers in the Assembly and Decoration section.

### Individual Characteristics

The following are individual characteristics measuring Musculoskeletal Disorders (MSDs) for 30 PT Assembly and Decoration workers. X uses Google Forms.

**Table 1. Individual Characteristics**

Variable	N	%
<b>Gender</b>		
Male	3	10
Female	27	90
<b>Age</b>		
15-24 years old	5	16,7
25-34 years old	12	40
35-44 years old	4	13,3
>44 years old	9	30
<b>Length of working</b>		
8 hours	20	66,7
12 hours	10	33
<b>Body mass index (BMI)</b>		
<18,5 Kg/m <sup>2</sup>	1	3,3
18,5-24,9 Kg/m <sup>2</sup>	22	73,3
25-29,9 Kg/m <sup>2</sup>	6	20
>30 Kg/m <sup>2</sup>	1	3,3

Based on the results of questionnaire data collection from 30 respondents in the Assembly and Decoration (AD) section, it is known that 3 respondents (10%) were male, and the remaining 27 respondents (90%) were female. Thus, it can be concluded that the majority of workers in the Assembly and Decoration 1 (AD1) section are women.

Based on the results of questionnaire data collection from 30 respondents in the Assembly and Decoration (AD) section, it is known that as many as 5 respondents were aged 15-24 years (16.7%), 12 respondents were aged 25-34 years (40%), 4 respondents were aged 35 -44 years (13.3%), and the remaining 9 respondents were >44 years old (30%). Thus, it can be concluded that the majority of workers in the Assembly and Decoration (AD) section are 25-34 years old.

Based on the results of questionnaire data collection from 30 respondents in the Assembly and Decoration (AD) section, it is known that 20 respondents worked 8 hours per day, and the remaining 10 respondents worked 12 hours per day. Thus, it can be concluded that the majority of workers in the Assembly and Decoration (AD) section work 8 hours a day with a break of 1 hour.

Based on the results of questionnaire data collection from 30 respondents in the Assembly and Decoration (AD) section, it is known that 1 respondent had a BMI <18.5 Kg/m<sup>2</sup> (3.3%), 22 respondents had a BMI of 18.5-24.9 Kg /m<sup>2</sup> (73.3%), 6 respondents had a BMI of 25-29.9 Kg/m<sup>2</sup> (20%), and the remaining 1 respondent had a BMI >30 Kg/m<sup>2</sup> (3.3%). Thus, it can be concluded that the majority of the BMI of workers in the Assembly and Decoration (AD) section is in the range of 18.5-24.9 Kg/m<sup>2</sup> or the normal category.

### Nordic Body Map (NBM) Questionnaire Calculation Results

**Table 2. Nordic Body Map (NBM) Measurement Results**

<b>Parts of</b>	<b>Score</b>	<b>Information</b>
Neck	3	Sick
Shoulder	3	Sick
Upper arm	3	Sick
Back	3	Sick
Waist	3	Sick
Hips	3	Sick
Butt	2	A bit sick
Elbow	2	A bit sick
Forearm	1	Painless
Wrist	1	Painless
Thigh	2	A bit sick
Knee	3	Sick
Calf	2	A bit sick
Ankle	2	A bit sick
Foot	2	A bit sick
<b>Total Score</b>	<b>35</b>	<b>Medium (There</b>

Based on the table above, it can be concluded that workers in the Assembly and Decoration (AD) section have the potential to experience Musculoskeletal Disorders (MSDs) based on the results of measurements using the Nordic Body Map (NBM) questionnaire. However, this cannot be proven validly considering that the Nordic Body Map (NBM) questionnaire is a subjective questionnaire based on the experiences felt by workers during work (Dewi, 2020). In addition, relatively long working hours ranging from 8 hours to 12 hours in a monotonous position trigger the risk of experiencing Musculoskeletal Disorders (MSDs) (Suma'mur, 2009). Therefore, there is a need for further measurements using the RULA measurement method to assess the condition of workers' Musculoskeletal Disorders (MSDs) while working in the Assembly and Decoration (AD) section.

### MSDs Measurement Using the RULA Method

RULA is a measurement method for analyzing ergonomics in the posture of upper workers (Tarwaka, 2014). RULA analysis is carried out if there are complaints from workers due to unergonomic body posture. The target itself is workers who work in the Assembly and Decoration area for stamping and printing. The following is a measurement of RULA for stamping workers in Assembly

and Decoration (AD) while sitting while working. So, from the dominant working position carried out sitting, the RULA method is considered suitable for use in assessing workers in the stamping section in Assembly and Decoration (AD). This is because the RULA method only assesses the condition of the worker's upper body and requires workers to stay in one particular place/work station, just like workers in the Assembly and Decoration (AD) stamping section (Dzikrillah and Yuliani, 2015). Meanwhile, the REBA method is not suitable for assessing the working position of workers in the stamping Assembly and Decoration (AD) section, because the REBA method is used to measure all parts of the worker's body and requires movement when working, not just sitting/static.

### **Worker's Upper Arm Position**



**Figure 1. Angular position of the upper arm**

Based on the results of angle meter measurements on workers in the Assembly and Decoration (AD) section, it is known that the movement of the worker's upper arm when working is at an angle of  $71^{\circ}$  so the resulting RULA score is 3.

### **Worker's Forearm Position**



**Figure 2. The Angular position of the forearm**

Based on the results of angle meter measurements on workers in the Assembly and Decoration (AD) section, it is known that the movement of the worker's forearm when working is at an angle of  $58^{\circ}$  so the resulting RULA score is 2.

### Wrist Position



**Figure 3. The angular position of the wrist**

Based on the results of angle meter measurements on workers in the Assembly and Decoration (AD) section, it is known that the movement of the worker's wrist when working is at an angle of 26° so the resulting RULA score is 3.

### Wrist Turn

Based on Figure 3, it is known that the wrist rotation of workers in the Assembly and Decoration (AD) section when working is in the middle position of the rotation with a RULA value of 1.

**Table A RULA**

Table A		Scores							
		Wrist Score							
Upper Arm	Lower Arm	1		2		3		4	
		Wrist Twist	Wrist Twist	Wrist Twist	Wrist Twist	Wrist Twist	Wrist Twist	Wrist Twist	Wrist Twist
1	1	1	2	2	2	3	3	3	3
	2	2	2	2	2	3	3	3	3
	3	2	3	3	3	3	4	4	4
2	1	2	3	3	3	4	4	4	4
	2	3	3	3	3	4	4	4	4
	3	3	4	4	4	4	5	5	5
3	1	3	3	4	4	4	4	5	5
	2	3	3	4	4	4	4	5	5
	3	4	4	4	4	4	5	5	5
4	1	4	4	4	4	4	5	5	5
	2	4	4	4	4	4	5	5	5
	3	4	4	4	5	5	5	6	6
5	1	5	5	5	5	5	6	6	7
	2	5	6	6	6	6	7	7	7
	3	6	6	6	7	7	7	7	8
6	1	7	7	7	7	7	8	8	9
	2	8	8	8	8	8	9	9	9
	3	9	9	9	9	9	9	9	9

**Figure 4. Table A RULA**

### Muscle Use Score

For workers in the Assembly and Decoration (AD) section, the muscle use score given is 0 because the worker's body posture is dynamic when working.

### Force Load Score

For workers in the Assembly and Decoration (AD) section, the given is 0 because the work load carried out is less than 2 kg.

### Skor Total Grup A RULA

$$\begin{aligned} & \text{Score A} + \text{muscle use score} + \text{force score} \\ & = 4 + 0 + 0 \\ & = 4 \end{aligned}$$

### Neck Position



Figure 5. Neck Angle Position

Based on the results of angle meter measurements on workers in the Assembly and Decoration (AD) section, it is known that the worker's neck when working is at an angle of  $25^{\circ}$  so the resulting RULA score is 4.

### Back Position



Figure 6. Position of the back angle

Based on the results of angle meter measurements on workers in the Assembly and Decoration (AD) section, it is known that the worker's back when working is at an angle of  $0^{\circ}$  so the resulting RULA score is 1.

### Foot Position

Based on the work in the Assembly and Decoration (AD) section above, it is known that the foot position during work is included in the normal/balanced category so the resulting RULA score is 1.

**Table B RULA**

Neck Posture Score	Table B: Trunk Posture Score											
	1	2		3		4		5		6		
	Legs	Legs	Legs	Legs	Legs	Legs	Legs	Legs	Legs	Legs	Legs	
	1	2	1	2	1	2	1	2	1	2	1	2
1	3	2	3	3	4	5	5	6	6	7	7	7
2	3	2	3	4	5	5	5	6	7	7	7	7
3	3	3	4	4	5	5	6	6	7	7	7	7
4	5	5	6	6	7	7	7	7	7	8	8	8
5	7	7	7	7	8	8	8	8	8	8	8	8
6	8	8	8	8	8	8	8	9	9	9	9	9

**Figure 7. Table B RULA**

**Table C RULA**

Table C		Neck, Trunk, Leg Score						
		1	2	3	4	5	6	7+
Wrist / Arm Score	1	1	2	3	3	4	5	5
	2	2	2	3	4	4	5	5
	3	3	3	3	4	4	5	6
	4	3	3	3	4	5	6	6
	5	4	4	4	5	6	7	7
	6	4	4	5	6	6	7	7
	7	5	5	6	6	7	7	7
	8+	5	5	6	7	7	7	7

**Figure 8. Table C RULA**

Based on the results of Rula's measurements on Assembly and Decoration (AD) workers, a total score of 5 was obtained. So it can be concluded that this work is in the medium category and action is needed in the near future.

**Discussion**

Based on the results of data collection, it is known that the majority of PT Assembly and Decoration workers. X is a male worker. This is because work activities carried out in the manufacturing industry require a lot of muscle strength and energy due to work being carried out repeatedly in unergonomic body positions during the production process (Tjahayuningtyas, 2019). This is reinforced by research conducted by (Azwar, 2020) where men tend to experience more MSDs problems compared to women, because men have the highest workload, mental demand and frustration levels. Meanwhile, the majority of workers who work in the Assembly and Decoration area are 25-34 years old. This is because the productive age of the workforce is around 25-34 years. This age is believed to be the ideal age for producing maximum work productivity (Juswadi & Sumarna, 2023).

Based on the results of data collection, it is known that the majority of workers in the Assembly and Decoration (AD) section work 8 hours a day with a break of 1 hour. Workers who work 8 hours per day can be said to be productive workers. However, work carried out for 8 hours per day and repeatedly will indirectly cause work fatigue and trigger Musculoskeletal Disorders (MSDs) problems. This is because the higher the intensity of work, the lower the concentration in carrying out a work activity (Narpati et al, 2019). Meanwhile, the majority of BMI for workers in the Assembly and Decoration (AD) section is in the range of 18.5-24.9 Kg/m2 or in the normal category. This is because PT.X



implements a free lunch policy for workers every day in the form of rice, vegetables, side dishes, and fruit. Fulfilling workers' nutritional needs is adjusted to their daily calorie needs. Where the calorie content required by workers ranges from 1901-2200 kcal (Farhati & Wahyuningsih, 2021).

Based on the results of measuring MSDs using the Nordic Body Map (NBM) method, it is known that workers in the Assembly and Decoration sections have the potential to experience moderate-level MSDs disturbances. This is because many workers do work in awkward positions while working for more than 8 hours per day. This is in accordance with research conducted (Purba & Lestari, 2017) at one of the manufacturing companies, PT. Buyung Poetra. Where the MSDs disorders felt by workers vary greatly depending on the complaints they feel and when measured they show a moderate prevalence. Apart from that, MSDs conditions that fall into the medium to high category are usually caused by workers experiencing fatigue, workload, and work indicators which are interconnected with each other.

Based on the results of measurements using the RULA method, it is known that the work is in the medium category and requires action soon. This is because workers in the Assembly and Decoration area carry out work for 8 hours per day and do it repeatedly with freedom above 5kg. This is in accordance with research conducted by (Valentine & Wisudawati, 2020) at PT. WIKA. According to research conducted at PT. WIKA, work carried out using material handling in moving work can increase the risk of injury to workers. This is because abnormal body positions when working have the potential to cause muscle injuries or Musculoskeletal Disorders (MSDs).

### **Conclusions and Recommendations**

Based on the results of measuring MSDs complaints using the Nordic Body Map (NBM) questionnaire, it can be concluded that workers in the Assembly and Decoration (AD) section have the potential to experience Musculoskeletal Disorders (MSDs). In addition, relatively long working hours ranging from 8 hours to 12 hours in a monotonous position trigger the risk of experiencing Musculoskeletal Disorders (MSDs). Based on the results of RULA measurements on Assembly and Decoration (AD) workers, a total score of 5 was obtained. So it can be concluded that this work is in the medium category and action is needed soon. In this way, it is hoped that companies will be more aware of the conditions of their workers. Companies are expected to be able to implement good and correct work systems to maintain the health of their workers. Companies must always implement a hierarchy of control in preventing accidents and work-related illnesses, including Musculoskeletal Disorders (MSDs). Preventive measures that can be taken are to redesign workstations for workers in the Assembly and Decoration areas to make them more ergonomic. Apart from that, administrative efforts that can be made are by stretching the muscles after every work for at least 10 minutes. Apart from that, there is also a need for physical fitness exercises to be carried out every Friday to support workers' health before returning to their activities. The final control that can be carried out is to use Personal Protective Equipment (PPE) if the previous control cannot be carried out.

As a safety officer, our important role is needed, especially in preventing musculoskeletal disorders (MSDs). One important role that can be carried out is by carrying out preventive and promotive efforts in the work area. One effort that can be made is by providing education in the form of training, seminars, webinars, and several other programs to provide knowledge to workers about the dangers of Musculoskeletal Disorders (MSDs). Apart from that, every work area needs to be given a safety sign as a sign to identify potential dangers in the workplace, including ergonomic risks. If all preventive and promotive efforts have been carried out but there are still many ergonomic problems including Musculoskeletal Disorders (MSDs), then the Company must provide strict sanctions if there are violations such as Reprimanding, giving SP 1, and also expelling from the workplace if they are still found. workplace violations. The high number of Musculoskeletal Disorders (MSDs) problems in the

work area due to weak supervision from superiors to workers during work, causes other workers to ignore it because they feel that there are no sanctions when they violate K3 rules and signs in the area. Work. Thus, if all programs and sanctions are implemented, the Company will indirectly reduce the number of Musculoskeletal Disorders (MSDs) problems in its work areas, including the Assembly and Decoration areas.

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