

RAPID UPPER LIMB ASSESSMENT: BASIS FOR INTERVENTION OF FACTORY WORKERS IN A GARMENT COMPANY

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ABSTRACT

This study investigated the work related musculoskeletal disorder caused by working improperly and awkward postures at the sewing section of XYZ International Incorporation. Ocular observation and interviews with the worker, as well as ergonomic intervention were conducted as an initial input for the study. Results show that worker's duration of stay and factors that the respondents experienced has no significant relationship with the risk exposure on the task they are executing. However, the comfort of the workers has a significant relationship with the productivity of meeting their quota. Moreover, the survey results show that neck to shoulder is mostly affecting the upper body region of the workers that hinders their productivity of meeting the desired quota. In conclusion, the results of the study proved that the risk of having musculoskeletal disorders cannot be eliminated in every worker in the sewing area of the company. Therefore, using multidisciplinary intervention to address the problems is necessary to reduce the problem.

Keywords: Rapid Upper Limb Assessment, Intervention

INTRODUCTION

Rapid Upper Limb Assessment (RULA) was developed to evaluate the exposure of individual workers to ergonomic risk factors associated with upper extremity. The RULA ergonomic assessment tool considers biomechanical and postural load requirements of job tasks/demands on the neck, trunk and upper extremities (Middlesworth, 2012). According to Middlesworth (2012), RULA is a single page worksheet that is used to evaluate required body posture, force and repetition. The results will be evaluated in order to know the level of pain the workers experience. The primary goal of RULA is to know if there is a need to change the movement of the worker. Such study was conducted in the Philippines by Domingo, et al (2015) due to the nature of this industry the workers are constantly exposed to dangerous environments and are at high risks for musculoskeletal disorders (MSDs). RULA is also the tool that they used to evaluate the workers condition.

The goal of RULA is to help evaluate worker's suffering from upper limb disorder. In the Philippines, very few local studies have been conducted in the light of occupational and environmental monitoring of companies (Dayani, 2012). In the garments company, workers suffer from upper limb disorder due to the nature of their work. Many repetitive movements are made due to the nature of their work.

This study serves as basis for conducting an intervention to lessen the WMSD's or prevent it. Hence, this study aims to know the level of pain to related upper limb disorder using rapid upper limb assessment (RULA).

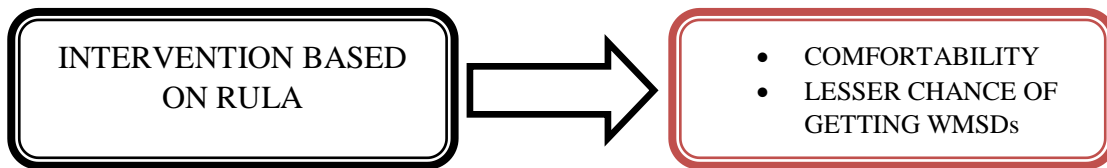


Figure 1.1 Conceptual Framework

RULA (rapid upper limb assessment) was used for evaluating upper limb disorder to know the current working situation of the workers. Based on the result of RULA, the researcher designed an intervention that corresponds to the results of RULA and verified questionnaire. By implementing the intervention, the workers will be comfortable and will lessen the occurrence of work related musculoskeletal disorder.

The study aims to lessen the discomfort level of the workers that may result for unproductive work. Therefore, it is important to have an assessment to the workers to know the level of pain they are experiencing.



Figure 1.2 Operational Framework

The study aimed to determine the type of intervention which is effective for the workers' condition. The independent variable is RULA which will be used to determine the worker's condition. On the other hand, the dependent variable would be worker's comfort. Comfort is the state where in the workers can work without hindrances. The intervening variable is intervention which will help the workers work comfortable.

The problem of this study was the level of comfort the workers that hindered their work. Moreover, it will answer the following sub-problems:

1. What is the profile of the respondents in terms of;

Duration of stay in the company, age, gender, comfort in neck, shoulder, upper back, upper arm, lower back, forearm and wrist?

2. What are the factors that affect worker's comfort?
3. Is there a significant relationship in the worker's duration of stay in the company and occurrence of work related musculoskeletal disorder?
4. Is there a significant relationship in the occurrence of work related musculoskeletal disorder and their comfort?

By assessing the worker's working condition using RULA (Rapid Upper Limb Disorder), the researcher designed an intervention based on the findings. The goal was to help the workers to work comfortable without experiencing upper limb disorder.

The researcher focused on the workers working in the sewing production of the XYZ International Inc. located at Golden Mile, Carmona, Cavite. The researcher chose sewing area because most of the manual work was being performed there. The scope of the study was up to the design of the intervention only. The intervention was based on the results of the verified survey questionnaires and was counter checked by Rapid Upper Limb Assessment.

Ergonomics is the scientific approach concerned with the relationship of human being and workplace environment (Human Factors, WMSD's, design of the system) that will help humans to work comfortably (McCauley-Bush, 2012). Ergonomics is broad that it can be used or implemented in other fields. Ergonomics is not limited in the factories or offices but also in other fields (Hospital, Services and Schools). Ergonomics'

goal is to fit the human to a certain job. Ergonomics considers all the factors that is related to the relationship of human and working environment.

Human factor or Ergonomics is defined as a scientific approach that will benefit the worker in the workplace. From Human Factors and Ergonomics Society (2011), Human Factors aims to know the things that affect human being in doing their specific job. By knowing the factors and resolving it, the overall productivity of a system/company will increase.

The focal point of Human Factors is on the relationship of workers from the job with respect to the principles of science and engineering (Marras, 2006). Human Factors contributes in designing worker's workplace and how task are assigned for workers (Salvendy, 2012). Relationship of humans and other essentials in the workplace focus on Human Factors. According to Lehto & Landry (2012), understanding human being and human capabilities will be a big help in designing and relating it to the workplace.

RULA or Rapid Upper Limb Disorder is an ergonomic tool use to evaluate upper extremity. RULA focuses on the neck, trunk and upper limbs (Gatchel, 2014). RULA is valid and follows certain principles about ergonomics. RULA is a quick assessment of the stress on a person's upper limb while performing a task. RULA is a quick evaluation tool that aims to assess the pain of the workers (Marras, 2006). RULA is a score sheet that categorized the risk the worker is experiencing that varies from no action needed to a complete change in the work process.

According to the Book Three, Title One of the Republic of Labor and Employment (DOLE), an employee's duration of work should not exceed eight (8) hours a day. The hours worked by an employee should include all the time during the employee

is on duty in the company or during the employee suffered or permitted to work. Work may exceed over eight (8) hours provided that the employee is paid overtime work that is equivalent to the regular rate plus twenty-five (25%).

Work related musculoskeletal disorder (WMSD) are gained when there are un-ergonomically design workplace, repetition of work, the load of work, the term of the worker in the company and the worker does not fit to the job. Occupational injuries are one of the major problems in the industry. Musculoskeletal disorder results to cost, injury, unproductively workers and accidents.

Ergonomics studies human beings and their interactions with the machines, procedures, information, materials and environment which uses work in everyday living (Khan, 2013). Anthropometry is a very basic core to determine the measurement of fitting people to machine (Gite, 2007). Szabova (2015) believed that anthropometry is a research area in ergonomics that deals with measurement of human body and dimensions. Anthropometric data can be used to specify the physical dimension of the workplace, equipment, and workstation.

According to (Ojolo, S.J, Olatunji, O.O, Orisaleye, J.I, 2016) the main objectives of this study is to increase the effectiveness and efficiency with which cashew nut cracking are carried out as follows: increase convenience of use of the worker, minimize errors, and maximize productivity, identifies the risk that results to the usage of the cracking machine, modify the use of the machine using postural analysis and aims to operate the cashew nut cracking machine that can be used by either left or right hands

Work-Related Musculoskeletal disorder (WMSD's) is the most common and costliest occupational health problems (Ojolo et al., 2016). Workers are exposed to health

issues. The prevalence of WMSD's are often connected with age and length of service and work-related musculoskeletal disorders are one of the main reason affecting dental practitioners (Khan et al., 2013). This study was conducted to minimize the prevalence of Work-related Musculoskeletal Disorder (WMSD) among dental students. The results of validated questionnaire show that neck and lower back are more prone areas to injury causing the risk of developing musculoskeletal disorders. Theory and practice of ergonomics should be implemented into the dental undergraduate curriculum to prevent the prevalence of musculoskeletal disorders to the dental students.

The main factor associated with upper limb disorder and neck musculoskeletal disorders are due to high frequency of movements, repetitiveness in the job done, awkward posture, excessive amount of force exerted and exposure to cold temperature (Mohammadi, 2012). Nordic standardize questionnaire and occupational repetitive action checklist method (OCRA) used to identify and describe the prevalence of upper limb and neck musculoskeletal disorders symptoms among the workers. The results suggest interventions for hands/wrist, elbow, shoulder and neck pain should be important and major priority for preventing the WMSD in the poultry slaughter workers.

RULA was developed to evaluate the exposure of individual workers to ergonomic risk factors associated with upper extremity MSD's. The RULA ergonomic assessment tool considers biomechanical and postural load requirements of job tasks/demands on the neck, trunk and upper extremities (Middlesworth, 2012).

There are such ways and ergonomic methods in assessing WMSDs which can be used in every different case that can improve the work condition of the worker. The study was made to create and design intervention using information to assess the level of

discomfort by the workers resulted by improper postures, repetitive movements and for improving the work and maximizing the productivity of the workers (Dayani, Forough et al, 2012). Different tasks were analysed by RULA (Rapid upper limb assessment) method and a set of worksheets were created out of them for assessment of the upper body work condition.

Honda design elements were extracted from the company's exoskeleton for lower body to generate a design for an upper body exoskeleton based on the same design. The research shows that HONDA Company's exoskeleton shows success in the upper body for improving work condition that minimizes the cause of WMSDs in the workers lead to greater productivity.

Hand operation combined with large force and awkward positioning can lead to upper limb disorder (Lowdnes, Heald et al, 2015.) Common lawn mowers that is available to the market often expose user to risk factors related to upper limb. Nontraditional lawn mowers decreased the exposure to upper limb disorder. This study compared different grips and evaluated possible position that will benefit the user, thus comfort ability will be the primary goal. The recommended angle for the lawn mower is 45 and 70 degrees plus the handle rotations is 48 and 78 degrees for ensuring the comfort and decreasing risk of upper limb disorder.

METHODOLOGY

The researcher used Descriptive and Correlation method. The researcher used the said methods above to know the working condition of the workers, area in the upper limb that is affected, factors that contribute to upper limb disorder and worker's comfort.

According to Shuttleworth (2008), Descriptive research is a scientific method that contains observing the behavior of the people that will be studied and will not alter the result. This aims to achieve the summary of the subject to be studied. Correlation is used to determine if there is a significant relationship between two variables.

The primary source of data was the Rapid Upper Limb Assessment, survey questionnaire, observation and interviews that was based on the answer of the sewing workers of a XYZ International Inc. that suffers from upper limb disorder. The secondary source of data was derived on published works/articles and recent literature that is related to the study. Literatures were about MSD's especially upper limb disorder.

The researcher conducted the study in XYZ International, Inc. located at B15 L11 Golden Mile Business Park, Carmona, Cavite, covered only the sewing area of the company where most workers labor manually. The researcher was interested in studying the workers that suffers from upper limb disorder.

The researcher chose to study the workers that suffers from upper limb disorder because to give a solution on how to make their work comfortable. By improving their working status, it will increase their comfort thus will lessen the occurrence of work related musculoskeletal disorder.

The researcher observed workers in the sewing area of the garments company that suffered from upper limb diseases/disorders. The respondents were given a survey questionnaire and assessed by Rapid Upper Limb Assessment (RULA). The researchers used purposive method of sampling and using Slovin's formula at 5% margin of error the sample computed is 134 respondents.

Observing the workplace and the workers especially the nature of their work that causes the prevalence of MSD's in their upper extremities can affect their health and safety. The researcher conducted an unstructured observation.

The researcher used standardized questionnaires specifically Dutch Musculoskeletal Questionnaire (DMQ) and Cornell Musculoskeletal Discomfort Questionnaire (CMDQ).

For verification purposes, the researcher used standardized questionnaires that were used previously in other studies. After evaluating the worker's working condition using Rapid Upper Limb Assessment, the next step was to use Cornell Musculoskeletal Disorder Questionnaire. The said questionnaire gave the researcher knowledge on what body parts and how often the prevalence of the upper limb disorder. After using Cornell Musculoskeletal Disorder Questionnaire, the DMQ or Dutch Musculoskeletal Questionnaire was used. The researchers excluded irrelevant questions and change some words that considered difficult to understand and turned it into much simpler terms.

The researcher used Cornell Musculoskeletal Disorder Questionnaire (CMDQ) which was a figure of a body (male, female) and learned which body part has the most discomfort, how often it occurred for the past week and how it interfered to their work.

The researcher used Dutch Musculoskeletal Questionnaire (DMQ) for further understanding what caused the discomfort they felt. These questionnaires were divided into parts; work and leisure time. The content of the questionnaire were some questions related to work. For example, the duration of stay, age, factors that contributes to MSD's and comfort.

Since the standard questionnaire CMDQ does not contain numerical equivalent, the research set values for Comfort and Interference as follows: Slightly – 1, Moderate – 2, Very – 3.

The researcher conducted interview for a few selected subjects that gave us in depth and real time answer. It was effective conducting an interview because it was face to face and subjects can clarify and ask questions they do not understand the question.

Rapid Upper Limb Assessment (RULA) was used to assess the selected individuals. This ergonomic assessment tool uses a systematic process to evaluate the MSD's in the upper body extremities. RULA was designed for easy use without the need for an advanced degree in ergonomics or expensive equipment. A single page worksheet used to evaluate the body posture, type of movement or action, repetition and coupling.

The following tables will be used to evaluate all the data gathered from the respondents and the results of the observations using Rapid Upper Limb Assessment (RULA) as ergonomic tool. Using the RULA Worksheet and a step-by-step guide provided by Ergonomics Plus, the researchers will be able to assign a score for each of the following body regions such as wrists, forearms, elbows, shoulders, neck, back, trunk, and legs.

Pearson r correlation was used to know if there is a relationship between Work Related Musculoskeletal Disorders (WMSD's) and worker's comfort.

RESULTS AND DISCUSSION

Profile of respondents in terms of duration of stay in the company

Table 4.1 Duration of stay in the company

Variables	Frequency	Percent	Rank
0-3 months	43	32.09	2
4-6 months	58	43.28	1
7-9 months	16	11.94	3
10months-1 year	9	6.72	4
More than 1 year	8	5.97	5
Total	134	100.00	

In table 4.1 shows that most of the respondent's duration of stay ranges from 4-6 months that was 58 out of 134 or 43.28% and the least is 8 out of 134 or 5.97% stayed from the company for more than 1 year.

Profile of respondents in terms of age

Table 4.2 Age of the respondents

Age	Frequency	Percentage	Rank
18-25 years old	14	10.45	4
26-33 years old	40	29.85	2
34-41 years old	53	39.55	1
42-49 years old	22	16.42	3
50 years old and above	5	3.73	5
Total	134	100.00	

Table 4.2 shows that most of the respondents have an age ranging from 34-41 years old with 53 out of 134 or 39.55% while the least ranges from 50 and above with 5 out of 134 or 3.73%.

Profile of respondents in terms of gender

Table 4.3 Gender of the respondents

Gender	Frequency	Percentage	Rank
Male	17	12.69	2
Female	117	87.31	1
Total	134	100.00	

Table 4.3 shows that most of the respondents comprises of female with 117 out of 134 or 87.31% while the male respondents comprise with 17 out of 134 or 12.69%.

Profile of Male respondents in terms of:

Table 4.4 Results of Cornell Musculoskeletal Disorder Questionnaire for male

Occurrence																					
Male																					
WORK RELATED MUSCULOSKELETAL DISORDER																					
Occurrence	Neck			Shoulder			Upper Back			Upper Arm			Lower Back			Forearm			Wrist		
	F	%	R	F	%	R	F	%	R	F	%	R	F	%	R	F	%	R	F	%	R
Never	0	0.00%		0	0.00%		0	0.00%		0	0.00%		0	0.00%		0	0.00%		0	0.00%	
1-2 times/week	9	52.94%	1	1	5.88%	3.5	2	11.76%	3.5	13	76.47%	1	1	5.88%	3.5	13	76.47%	1	1	5.88%	3.5
3-4 times/week	6	35.29%	2	9	52.94%	1	3	17.65%	2	2	11.76%	2	2	11.76%	2	2	11.76%	2	2	11.76%	2
once everyday	2	11.76%	3	1	5.88%	3.5	10	58.82%	1	1	5.88%	3.5	13	76.47%	1	1	5.88%	3.5	13	76.47%	1
several times a day	0	0.00%		6	35.29%	2	2	11.76%	3.5	1	5.88%	3.5	1	5.88%	3.5	1	5.88%	3.5	1	5.88%	3.5
Total	17			17			17			17			17			17			17		

Comfort																					
Male																					
WORK RELATED MUSCULOSKELETAL DISORDER																					
Level of Comfort	Neck			Shoulder			Upper Back			Upper Arm			Lower Back			Forearm			Wrist		
	F	WM	R	F	WM	R	F	WM	R	F	WM	R	F	WM	R	F	WM	R	F	WM	R
Slightly	5	0.29	3	7	0.41	2	2	0.12	3	11	0.65	1	2	0.12	3	10	0.59	2	2	0.12	3
Moderate	10	1.18	1	9	1.06	1	8	0.94	2	5	0.59	2	12	1.41	1	6	0.71	1	12	1.41	1
Very	2	0.35	2	1	0.18	3	7	1.24	1	1	0.18	3	3	0.53	2	1	0.18	3	3	0.53	2
Total	17			17			17			17			17			17			17		

Interfere																					
Male																					
WORK RELATED MUSCULOSKELETAL DISORDER																					
Interference	Neck			Shoulder			Upper Back			Upper Arm			Lower Back			Forearm			Wrist		
	F	WM	R	F	WM	R	F	WM	R	F	WM	R	F	WM	R	F	WM	R	F	WM	R
Not at all	6	0.35	2.5	7	0.41	2	2	0.12	3	5	0.29	2	3	0.18	2	5	0.29	2.5	2	0.12	3
Slightly	9	1.60	1	8	0.94	1	10	1.18	1	9	1.06	1	12	1.41	1	5	0.59	2.5	7	0.82	2
Substantially	2	0.35	2.5	2	0.35	3	5	0.88	2	3	0.53	3	2	0.35	3	7	1.24	1	8	FALSE	1
Total	17			17			17			17			17			17			17		

Table 4.4 shows the results from the Cornell Musculoskeletal Disorder Questionnaire. In terms of occurrence, 9 out of the 17 male respondents said the pain or discomfort occurred for 1-2 times per week. The occurrence which was 1-2 time per

week was moderate uncomfortable in terms of comfort (10 out of 17 or 58.82%). In terms of ability to interfere to work, the male respondents were slightly interfered by the pain or discomfort (9 out of 17 or 52.94%).

In terms of occurrence in the shoulder region, 9 out of the 17 male respondents said the pain or discomfort occurred for 3-4 times per week. The pain or discomfort which occurred 3-4 time per week was moderate uncomfortable in terms of comfort (9 out of 17 or 52.94%). In terms of ability to interfere to work, the male respondents were slightly interfered by the pain or discomfort (8 out of 17 or 47.06%).

In terms of occurrence in upper back region, 10 out of the 17 male respondents said the pain or discomfort occurred once every day. The pain or discomfort which occurred once every day was moderate uncomfortable in terms of comfort (8 out of 17 or 47.06%). In terms of ability to interfere to work, the male respondents were slightly interfered by the pain or discomfort (10 out of 17 or 58.82%).

In terms of occurrence in upper arm region, 13 out of the 17 male respondents said the pain or discomfort occurred 1-2 times for the past week. The pain or discomfort which occurred once every day was slightly uncomfortable in terms of comfort (11 out of 17 or 64.71%). In terms of ability to interfere to work, the male respondents were slightly interfered by the pain or discomfort (9 out of 17 or 52.94%).

In terms of occurrence in lower back region, 12 out of the 17 male respondents said the pain or discomfort occurred once every day. The pain or discomfort which occurred once every day was moderate uncomfortable in terms of comfort (12 out of 17 or 70.59%). In terms of ability to interfere to work, the male respondents were slightly interfered by the pain or discomfort (12 out of 17 or 70.59%).

In terms of occurrence in forearm region, 13 out of the 17 male respondents said the pain or discomfort occurred 1-2 times for the past week. The pain or discomfort which occurred once every day was uncomfortable in terms of comfort (10 out of 17 or 58.82%). In terms of ability to interfere to work, the male respondents were substantially interfered by the pain or discomfort (7 out of 17 or 41.18%).

In terms of occurrence in wrist region, 13 out of the 17 male respondents said the pain or discomfort occurred once every day. The pain or discomfort which occurred once every day was moderate uncomfortable in terms of comfort (12 out of 17 or 70.59%). In terms of ability to interfere to work, the male respondents were substantially interfered by the pain or discomfort (8 out of 17 or 47.06%).

Profile of Female respondents in terms of:

Table 4.5 Results of Cornell Musculoskeletal Disorder Questionnaire for female

Occurrence																					
Female																					
WORK RELATED MUSCULOSKELETAL DISORDER																					
Occurrence	Neck			Shoulder			Upper Back			Upper Arm			Lower Back			Forearm			Wrist		
	F	%	R	F	%	R	F	%	R	F	%	R	F	%	R	F	%	R	F	%	R
Never	0	0.00%		0	0.00%		0	0.00%		0	0.00%		0	0.00%		0	0.00%		0	0.00%	
1-2 times/week	9	7.69%	4	18	15.38%	4	11	9.57%	3	8	6.84%	4	4	3.42%	4	9	7.69%	4	14	11.97%	3.5
3-4 times/week	19	16.24%	3	25	21.37%	3	12	10.43%	4	17	14.53%	3	24	20.51%	3	26	22.22%	3	14	11.97%	3.5
once everyday	54	46.15%	1	36	30.77%	2	46	40.00%	1.5	48	41.03%	1	53	45.30%	1	46	39.32%	1	36	30.77%	2
several times a day	35	29.91%	2	38	32.48%	1	46	40.00%	1.5	44	37.61%	2	36	30.77%	2	36	30.77%	2	53	45.30%	1
Total	117			117			115			117			117			117			117		

Comfort																					
Female																					
WORK RELATED MUSCULOSKELETAL DISORDER																					
Level of Comfort	Neck			Shoulder			Upper Back			Upper Arm			Lower Back			Forearm			Wrist		
	F	WM	R	F	WM	R	F	WM	R	F	WM	R	F	WM	R	F	WM	R	F	WM	R
Slightly	27	0.23	3	14	0.12	3	14	0.12	3	24	0.21	3	16	0.14	3	37	0.32	3	23	0.20	3
Moderate	40	0.68	2	43	0.74	2	43	0.74	2	49	0.84	2	33	0.56	2	39	0.67	2	43	0.74	2
Very	50	1.28	1	60	1.54	1	60	1.54	1	44	1.13	1	68	1.74	1	41	1.05	1	51	1.31	1
Total	117			117			117			117			117			117			117		

Interfere																					
Female																					
WORK RELATED MUSCULOSKELETAL DISORDER																					
Interference	Neck			Shoulder			Upper Back			Upper Arm			Lower Back			Forearm			Wrist		
	F	WM	R	F	WM	R	F	WM	R	F	WM	R	F	WM	R	F	WM	R	F	WM	R
Not at all	0	0.00		0	0.00		4	0.03	3	5	0.04	3	3	0.03	3	7	0.06	3	4	0.03	3
Slightly	94	1.61	1	27	0.46	2	81	1.38	1	31	0.53	2	49	0.84	2	22	0.38	2	26	0.44	2
Substantially	23	0.59	2	90	2.31	1	32	0.82	2	81	2.08	1	65	1.67	1	88	2.26	1	87	2.23	1
Total	117			117			117			117			117			117			117		

Table 4.5 for female shows how often discomfort occurs, level of comfort and ability to interfere to the work for female respondents in neck region. In terms of occurrence, 54 out of the 117 female respondents said the pain or discomfort occurred once every day (54 out of 117 or 46.15%). The discomfort which occurred once every day 1-2 time per week was very uncomfortable in terms of comfort (50 out of 117 or 42.74%). In terms of ability to interfere to work, the female respondents were slightly interfered by the pain or discomfort (94 out of 117 or 80.34%).

In terms of occurrence in shoulder region, 38 out of the 117 female respondents said the pain or discomfort occurred several times a day (38 out of 117 or 32.48%). The discomfort which occurred several times a day was very uncomfortable in terms of comfort (60 out of 117 or 51.28%). In terms of ability to interfere to work, the female respondents were substantially interfered by the pain or discomfort (90 out of 117 or 76.92%).

In terms of occurrence in upper back region, 46 out of the 117 female respondents said the pain or discomfort occurred once every day and several times a day (46 out of 117 or 39.32%). The discomfort which occurred once every day and several times a day was very uncomfortable in terms of comfort (60 out of 117 or 51.28%). In terms of ability to interfere to work, the female respondents were slightly interfered by the pain or discomfort (81 out of 117 or 69.23%).

In terms of occurrence in upper arm region, 48 out of the 117 female respondents said the pain or discomfort occurred once every day (48 out of 117 or 41.03%). The discomfort which occurred once every day was moderate uncomfortable in terms of comfort (49 out of 117 or 41.88%). In terms of ability to interfere to work, the female

respondents were substantially interfered by the pain or discomfort (81 out of 117 or 69.23%).

In terms of occurrence in lower back region, 53 out of the 117 female respondents said the pain or discomfort occurred once every day (53 out of 117 or 45.30%). The discomfort which occurred once every day was very uncomfortable in terms of comfort (68 out of 117 or 58.12%). In terms of ability to interfere to work, the female respondents were substantially interfered by the pain or discomfort (65 out of 117 or 55.56%).

In terms of occurrence in forearm region, 46 out of the 117 female respondents said the pain or discomfort occurred once every day (46 out of 117 or 39.32%). The discomfort which occurred once every day was very uncomfortable in terms of comfort (41 out of 117 or 35.04%). In terms of ability to interfere to work, the female respondents were substantially interfered by the pain or discomfort (88 out of 117 or 75.21%).

In terms of occurrence in wrist region, 53 out of the 117 female respondents said the pain or discomfort occurred several times a day (53 out of 117 or 45.30%). The discomfort which occurred once every day was moderate uncomfortable in terms of comfort (43 out of 117 or 36.75%). In terms of ability to interfere to work, the female respondents were substantially interfered by the pain or discomfort (87 out of 117 or 74.36%).

Factors that hindered worker's comfort

Table 4.6 Factors that hindered worker's comfort for male and female

Male	Factors that hindered worker's comfort															
	Noise			Lack of Fresh Air			Dry Air			Temperature			Bad Smell			
	F	%	R	F	%	R	F	%	R	F	%	R	F	%	R	
Yes	5	29.41%	2	3	17.65%	2	7	41.18%	2	2	11.76%	2	1	5.88%	2	
No	12	70.59%	1	14	82.35%	1	10	58.82%	1	15	88.24%	1	16	94.12%	1	
Total	17			17			17			17			17			
Female	Factors that hindered worker's comfort															
	Noise			Lack of Fresh Air			Dry Air			Temperature			Bad Smell			
	F	%	R	F	%	R	F	%	R	F	%	R	F	%	R	
Yes	90	76.92%	1	93	79.49%	1	77	65.81%	1	95	81.20%	1	73	62.39%	1	
No	27	23.08%	2	24	20.51%	2	40	34.19%	2	22	18.80%	2	44	37.61%	2	
Total	117			117			117			117			117			

Table 4.6 showed that the respondents were hindered by noise. 12 out of the 17 (70.59%) male respondents and 90 out of 117(76.92%) female respondents said that noise hindered their comfort.

Table 4.6 showed the number of respondents that was either hindered by lack of fresh air or not. 14 out of the 17 (82.35%) male respondents and 93 out of the 117 (79.49%) female respondents said that lack of fresh air hindered their comfort.

Table 4.6 shows the number of respondents that was either hindered by dry air or not. 10 out of the 17 (58.82%) male respondents said that dry air does not affect their comfort. On the other side, 77 out of the 117(65.81%) female respondents said that lack of fresh air hindered their comfort.

Table 4.6 shows the number of respondents that was either hindered by temperature or not. 15 out of the 17 (88.24%) male respondents said that temperature does not affect their comfort while 95 out of the 117 (81.20%) female respondents said that lack of fresh air affect their comfort.

Table 4.6 shows the number of respondents that was either hindered by bad smell or not. 16 out of the 17 (94.12%) male respondents said that bad smell does not affect their comfort while 73 out of the 117 (62.39%) female respondents said that bad smell affect their comfort.

Relationship in the worker’s duration of stay in the company and occurrence of work related musculoskeletal disorder

Table 4.7 Relationship of duration of stay and occurrence of WMSD’s

Correlation: Duration of stay, Neck(Y), Shoulder(Y), Upper Back (Y, Upper Arm(Y), ...

	Duration in term (X)		
		R1	0.260
		R2	0.119
Neck(Y)	0.260	R3	0.033
		R4	0.075
		R5	-0.011
Shoulder(Y)	0.119	R6	-0.050
		R7	-0.050
Upper Back(Y)	0.033	Ave R.	0.053714
Upper Arm(Y)	0.075	T-test	3.203746
		T-test	1.386845
		T-test	0.379554
Lower Back(Y)	-0.011	T-test	0.866559
		T-test	-0.1264
		T-test	-0.5759
Forearm(Y)	-0.050	T-test	-0.5759
		Ave	
Wrist(Y)	-0.050	T-Test	0.651217

Cell Contents: Pearson correlation

P-Value

Table 4.7 showed the relationship of duration of stay and occurrence of WMSD’s Using the application *Minitab*, the relationship of the two showed very weak or negligible relationship and since the computed value of 0.651217 is not greater than 1.96 at 0.05

level of significance, H_0 is accepted. The results showed that even though the respondents were new or just started working, the respondents still experienced the occurrence of work related musculoskeletal disorder because of the factors that hindered their work. Even there were new or have little duration of stay in the company, work related musculoskeletal disorder were still present because of the lack of proper working posture. The research team recommended actions to solve the factors that hindered comfort. If the company does not act, the workers will still be exposed to work related musculoskeletal disorder.

Is there a significant relationship in the occurrence of work related musculoskeletal disorder and their comfort?

Table 4.8 Relationship of work related musculoskeletal disorder and comfort

Correlation: Duration of stay, Neck(Y), Shoulder(Y),

Upper Back (Y, Upper Arm(Y)

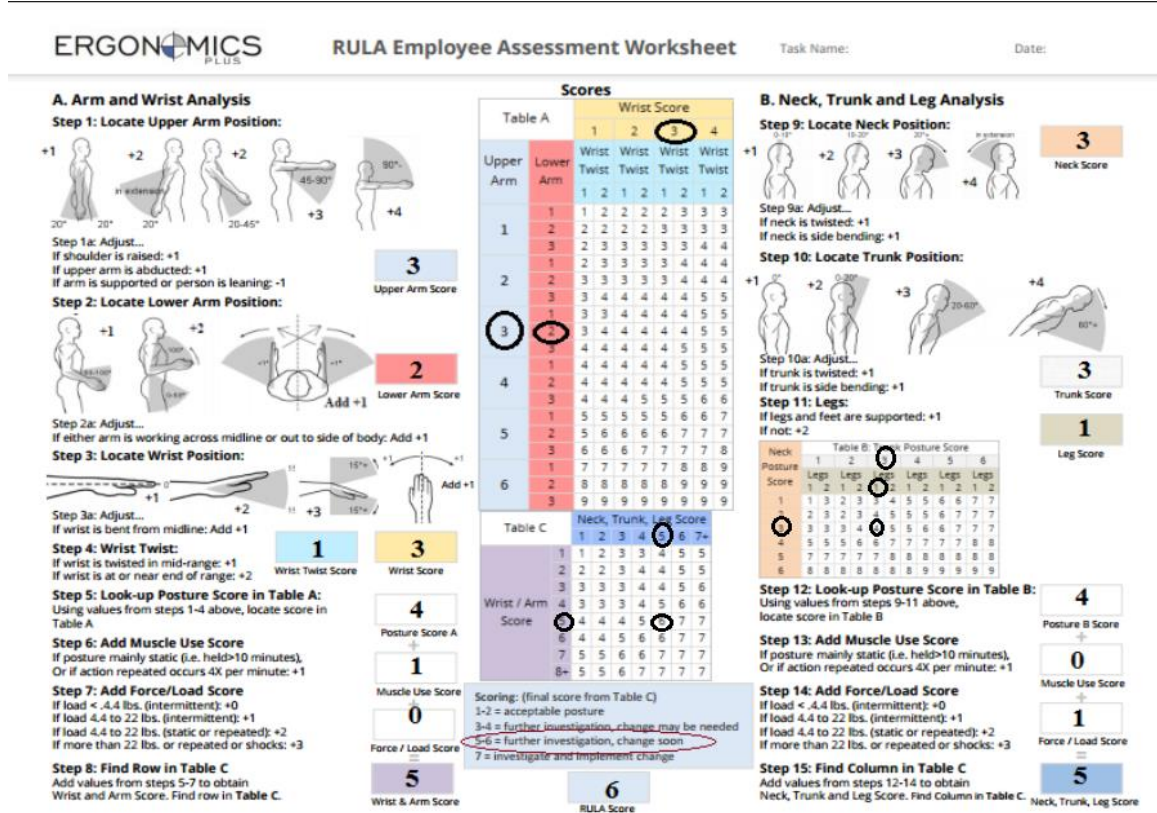
	Duration		
in term (X)		R1	-0.436
		R2	-0.428
Neck (Y)		R3	-0.600
-0.436		R4	-0.484
		R5	-0.436
Shoulder (Y)		R6	-0.425
-0.428		R7	-0.446
Upper Back (Y)			
-0.600		Ave R.	-0.465
Upper Arm (Y)		T-test	-6.185
-0.484		T-test	-6.02014
		T-test	-10.7711
Lower Back (Y)		T-test	-7.26187
-0.436		T-test	-6.185
		T-test	-5.95927

Forearm (Y)		
-0.425	T-test	-6.39652
Wrist (Y)		
-0.446	Ave T-Test	-6.96841
Cell Contents: Pearson correlation		

Table 4.8 showed the relationship of work related musculoskeletal disorder and comfort using the application *Minitab*. The relationship of the two showed moderate negative relationship since the computed value of $t = -6.96841$ is less than -1.96 at 0.05 level of significance, H_0 is rejected. The two factors have significant relationship. Even when the respondents do not feel uncomfortable, the occurrence of work related musculoskeletal disorder was still present or felt because the company does not have a proper working posture for the workers.

RESULTS OF RAPID UPPER LIMB ASSESSMENT

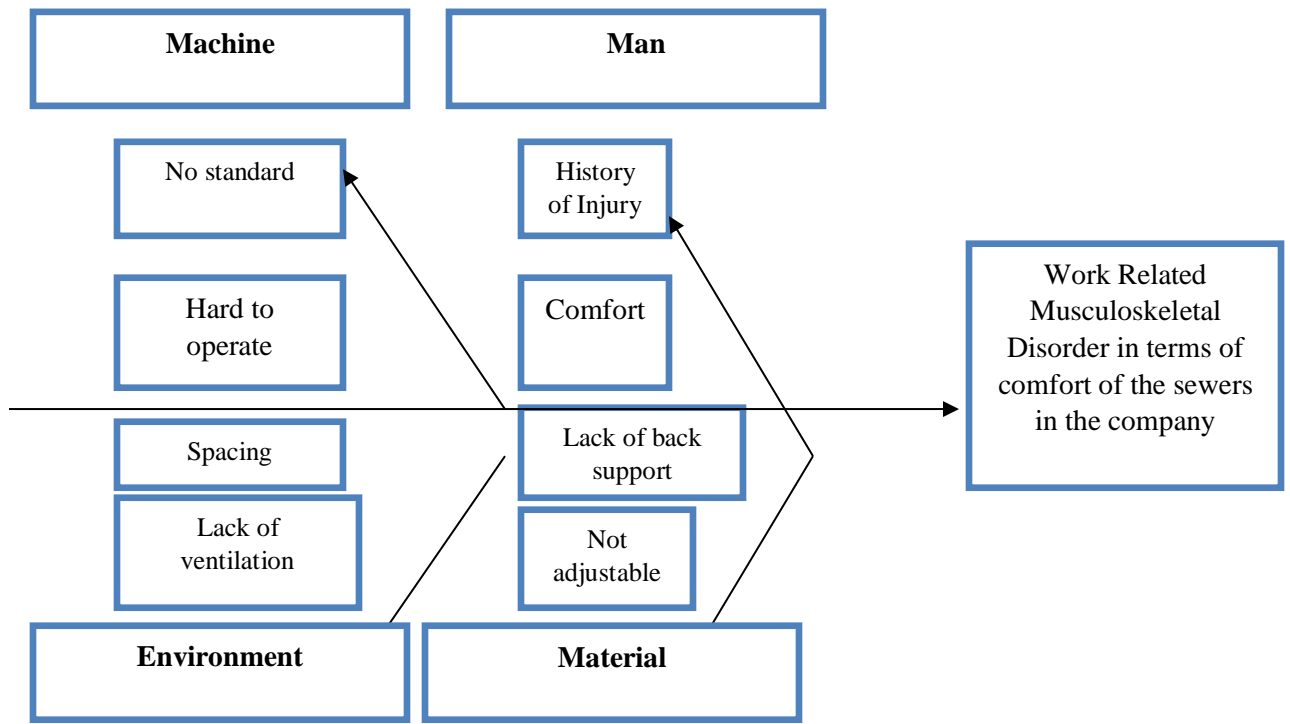
Figure 4.10 Results of Rapid Upper Limb Assessment



In figure 4.10 showed the scores of Upper Arm, Wrist, Arm and Neck, the results showed there was a need for further investigation and change soon. Almost all the operation in sewing was the same. After knowing there was a need for a change, the research team used verified questionnaire and learned what caused discomfort for the respondents.

FISHBONE DIAGRAM

Figure 4.11 Fishbone Diagram



The researcher observed that the machine has no standard size and the length of table for the workers. The machine was hard to operate that caused some of the respondents getting cut and obtained bruises. Some machine was hard to operate because oil was needed to be applied. It is important to always check or have maintenance for every machine to assure it is on a good working condition.

The survey results showed that the workers posted awkward postures that caused the occurrence of upper limb disorder. Another factor was the duration of work per day that mostly 2-3 times per week, the respondents exceed the prescribed working hour per day. Some of the respondents have acquired work related musculoskeletal disorder even before entering the company. The respondent got their WMSD's by working improperly and through awkward postures. Some respondents tended to slouch while working that

add to the pain they have experienced. Proper training and awareness can correct and lessen the occurrence of WMSD's.

The sewing area of the company lacks ventilation that caused irritation to the workers. The spacing of the area was too tight that made the respondents uncomfortable and led them to unproductive work. Excessive heat can be added to the fatigue that the respondents have experienced.

The current design of the work table and chair can be improved. The chair lack back support where it covered the neck to shoulder portion of the respondents. It was one of the reasons why the workers were less productive. The chair was stiff and hard to sit on for a long period. Some of the workers were not on the same level of the table. This caused numbness and tired arms.

SUMMARY OF FINDINGS

Results showed that most of the respondents work for the company for at least 4-6 months (43.28%), since the company just started last December 2015, it was natural that there were a few respondents that have 1 year or more than 1 year of tenure in the company. It also showed that most of the respondents were contractual. More than one third or 39.55% of the respondents age was 34-41 years old. The company did not have preference in terms of age and preferred skilled sewers rather than young and inexperienced sewers. Most of sewers were female with 117 or 87.31%. It was common since sewing was mostly the job suited for female workers. The researcher also learned that the female respondents sewed back when they were young while the male respondents learned to sew for them to find a job and to earn money.

Result of Cornell Musculoskeletal Disorder Questionnaire for male showed that majority incurred 1-2 times/week in the neck at 52.94%, 3-4 times/week in the shoulder at 52.94%, once every day in the upper back at 58.82%, 1-2 times/week in the upper arm at 76.47%, once every day in the lower back at 76.47%, 1-2 times/week in the forearm at 76.47% and once every day in the wrist at 76.47%. As to the level of comfort, majority of the respondents experience moderate except for upper back and upper arm. As to interference, majority of the respondents answered slightly except in the forearm and wrist.

Result of Cornell Musculoskeletal Disorder Questionnaire for female showed that majority incurred once every day in all parts, neck, shoulder, upper back and arm, lower back, forearm and wrist. As to the level of comfort, majority of the respondents experience very in all parts, neck, shoulder, upper back and arm, lower back, forearm and wrist. As to interference, majority of the respondents answered substantially except in the neck and upper back.

As to the Factors that hindered worker's comfort in terms of noise, lack of fresh air, dry air, temperature and bad smell, more than 50% (58.82%-94.12%) male respondents answered no, while the female 62.39%-81.2% answered yes.

The relationship between the worker's duration of stay in the company and work related musculoskeletal disorder

58 out of 134 respondents worked for the company for 4-6 months while out of the 134 respondents, 8 have worked for more than 1 year. It is usual because the company just started operating last December 2015. The researcher learned through the verified questionnaire that during off, they don't usually have anything to do in general. Mostly

they took their rest day at home. The respondents said through furthered interview and questionnaire that they were posting awkward postures that resulted to upper limb disorder. Even though some of the respondents were new, the occurrence of work related musculoskeletal disorder was still present due to the awkward postures.

The relationship on the occurrence of work related musculoskeletal disorder and comfort (in terms of working posture).

The relationship of factors that hindered comfort and working postures, the relationship of the working postures and the factors (Noise, Lack of Air, Dry Air, Temperature and Bad Smell) showed very weak or negligible relationship. These factors, even though they hindered the respondents, it does not have a significant relationship. The researcher learned that the said factors hindered the respondent's work but it does not affect their working posture. The researcher observed that the design of the sewing table and chair was modifiable. The table and chair was not adjustable that made the respondents work awkwardly. The chair does not have back support that made the respondents slouch due to fatigue.

Based on the finding of this study, the researcher concluded that:

The XYZ International Inc., just started to operate last December 2015. The results of the survey showed that there were only few respondents that have more than 1 year of experience. Many of the respondents do not have a long tenure in the company. Based on further interview, the researcher learned that the company shuffles its workers every end of the contract. Also, thru furthered interview, some of the respondents do not like how the upper management treated them.

There is no doubt that working in a garment industry is quite challenging and hard. It often results to the prevalence of Work Related Musculoskeletal Disorder. Almost all respondents have experienced WMSD. The survey questionnaire showed more insight and understanding about the current situation of the workers. The company does not have a preference about the age of the worker instead the company preferred skilled worker. Sewing is a skilled job that requires patience, accuracy and knowledge. Therefore, the researcher concluded that the company preferred skilled workers rather than young workers.

There is no doubt that working in a garment industry, the sewers are mostly female but in the new era, male also learned sewing for providing money for their family or for themselves. All of the sewers in the company are all skilled and trained since one of the requirements of the company before hiring was that the applicant should be a skilled sewer. Through survey, the researcher learned that there are 117 female sewers out of 134 which resulted to 87%. The researcher concluded that female was still preferred over male since the female outnumbered the male in the sewing production area.

By using verified questionnaire (Cornell Musculoskeletal Disorder Questionnaire), the researcher learned that the neck and shoulder region were the two-body part with the highest discomfort. The respondents felt the discomfort due to lack of back support on the sewing table. Therefore, the researcher's solution was to improve the current design of the table and chair by making adding cushion for comfort and adjustable to cater all users.

There are a lot of factors that hinder workers that the company can control and can be improved to make the sewers comfortable. The researcher used a verified questionnaire and learned that the following factors noise, lack of fresh air, dry air and changes in temperature and bad smell affects or hindered the worker's comfort. The improvement of the ventilation in the company was one solution that can help improve the comfort of the workers. Excessive heat and lack of fresh air contributed to the fatigue the worker experienced. The working table and chair can be modified and made adjustable to satisfy the comfort of the workers. Therefore, the researcher concluded that improving the current ventilation and adding more open windows for air to enter will solve the lack of air problem inside the company. Designing an adjustable table and chair to cater all users. Lastly providing face mask to the workers to solve the problem for bad smells

The researcher concluded that there was a weak or negligible relationship between the duration of stay in the company and the occurrence of work related to musculoskeletal disorder. Some of the respondents, even though they just started working in the company, occurrence of work related musculoskeletal disorder was present. The reason why was there were no standards in terms of working postures. The researcher recommended ways to lessen the hindrances and the occurrence of work related musculoskeletal disorder by adapting the standards of the Department of Labor of the United States.

The researcher concluded that there was a very weak or negligible relationship between the factors that hindered comfort and working postures. Even though that the said factors hindered their comfort, the main reason why the work related

musculoskeletal disorder occur was due to lack of back support. The respondents posed awkward postures because they do not have something to lean on during their work that contributed to work related musculoskeletal disorder in the long run. Shoulder and neck was the body part that was affected the most and what makes the respondents uncomfortable

Based on the findings the following are recommended:

The implementation of ***Work Readiness System***. It is a stretching program that aims to reduce the occurrence of work related musculoskeletal disorder and prevent the tightness of the body due to the nature of their work. This program or system will promote healthy lifestyle by exercising even if not present in the company. This program may be conducted before break time. A tutorial or a seminar briefing about the workplace wellness and stretching can be done to raise awareness so that the workers will know the purpose and importance of it. Make sure that the workers and management (top to bottom) will embrace and adapt the program to ensure the continuity so that the results can be achieved.

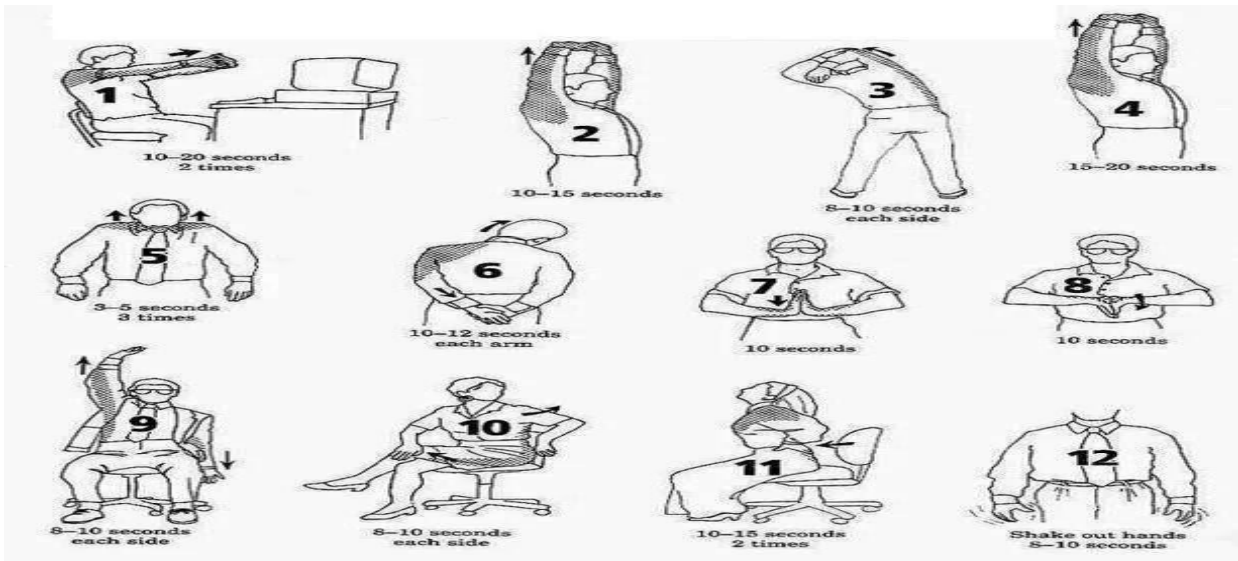


Figure 5.1: Stretching Exercise

Source: [https://s-media-cache-](https://s-media-cache-ak0.pinimg.com/736x/ca/b6/c3/cab6c3b9d3fa51307c785020a2020e2c.jpg)

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Add more windows so that the air can enter inside the company. Also, improve the current ventilation system especially during summer season where extreme heat is present. The company should provide ear plugs and face mask to solve the problem regarding bad smell and excessive noise. The current design of the table and chair can also be improved and can make it adjustable to cater all users.

Adapt the standards of the Occupational Safety and Health (OSHA) regarding the proper working position for sewing. This aimed to lessen the occurrence of work related musculoskeletal disorder.

Figure 5.2: Correct posture per Department of Labor of United States

Source: <https://www.osha.gov/SLTC/etools/sewing/sewingstationdesign.html>



Improve the current design of the sewing table and chair. The table and chair should be adjustable. The chair should also have cushion and back support. The respondents are working 8 hours without anything to lay or rest their back that resulted to improper working postures.

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