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Association between Ergonomics Awareness and Risk Factors of Musculoskeletal Disorders (MSD) among Office Workers in Telecommunication industry: A ROSA Analysis

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Abstract
In recent years, there has been emerging attention regarding Work-related Musculoskeletal Disorder (WMSD) among office workers that can pose damaging effects on health and productivity of workers. The purpose of this study is to determine the relationship between ergonomics awareness and practice of ergonomics in terms of working posture and work station design among telecommunication personnel in Malaysia using Rapid Office Strain Assessment (ROSA) as an assessment tool for work posture in office. Among 75 questionnaires distributed to office workers, 57 had responded and their posture and workstations were analysed with ROSA. While majority of the respondents complained of low back pain (LBP) (47.4%), shoulder pain (40.4%), and neck pain (33.3%), 89.5% of workers said that they have awareness on ergonomics through training provided by the employer. However, following the multiple-choice questions (MCQ) majority (24.56%) of respondents had average score of 9 over 15. None of respondents scored full marks. In determining relationship between awareness and practice of ergonomics, there is poor significant relationship between awareness and ergonomics practice based on variables of ROSA (chair, back support, monitor, mouse and keyboard). Similarly, in determining the association between awareness and risk of exposure to Musculoskeletal Disorder (MSD), there is poor significant relationship between these two with Spearman Rho of 0.045. Based on the results, awareness does relate to the practice of ergonomics in office, but the use of ROSA as a tool to assess work posture and workstation design is yet to be explored by other researchers in the future.

Keywords: Work-related Musculoskeletal Disorder (WMSD), ergonomics, ergonomics awareness, Risk Factors, ROSA

1. Introduction

Musculoskeletal issues affecting workers have become a growing subject of interest among ergonomics researchers and specialist as increased trend of MSD cases have been reported due to various factors including prolonged exposure to awkward postures, repetitive movements and manual handling tasks [1]. According to the

Social Security Organization (SOCSO) Malaysia, reported cases of work-related Musculoskeletal Disease had increased from 517 cases in year 2013 to 657 cases in year 2014.

Among other, risk for developing Musculoskeletal Disease include working with computer at workplace. According to a report by National Institute of Occupational Safety and Health (NIOSH) Malaysia, 61.4% of workforces are highly dependent on use of computers and this may greatly contribute to the number of Musculoskeletal Disease cases in office. An effective ergonomics program should comprised of 4 important areas which are training, workstation analysis, hazard prevention and control and medical management . Furthermore, according to Tingley [2], ergonomics should be perceived as preventive and loss control, not curative or clinical treatment. Given the importance of training as an initial step towards providing awareness and improving worker's habits, this study aims to identify whether awareness through ergonomics training is significantly associated with best work practice among employees in office setting of the telecommunication industry.

2. Literature Review

2.1 Musculoskeletal Disorder (MSDs)

In recent years, there has been emerging attention regarding Work-related Musculoskeletal Disorder (WMSD) among office workers [3] that can pose damaging effects on health and productivity of workers [4]. Musculoskeletal Disorder as defined by Harrington [5] is the injuries and disorder of nerves, muscles, tendons, ligaments, joints and spinal disc. It accounts for more than one-third of all occupational injuries and illnesses that may result in numerous working day lost.

2.2 Risk factors of MSDs

According to Mahmud [6] there are three factors that could predict the risk of developing MSDs which are individual, ergonomics and psychosocial factors. Choobineh [7] reported that among office workers, MSDs is higher in those who have a high work strain, high muscle tension, had previous MSDs in the neck and shoulder and use mouse and keyboard continuously. Previous research established that the most frequently reported musculoskeletal complaints were related to neck, lower and upper back, wrist and shoulders with the most prevalence group are women.[8, 1, 9, 10] . Although the prevalence of musculoskeletal complaints between genders is significant, but age differences between the genders were not evidenced [8]. Another study had established the relationship between MSDs and physical office environment which found the significant ergonomics risk among office workers include awkward or static body posture and improper location of equipment during computer usage [11].

2.3 Ergonomics Training, Awareness and Practice

One method for reducing the prevalence of musculoskeletal disorder is through the provision of specialized ergonomics training and workstation modification [12]. Lewis, [13] suggested that office ergonomics training programs should be effective in order to reduce any MSDs symptoms. In a study to determine the effectiveness of training, [14] found a significant change in two workstations before and after training intervention. Additionally, there is an improvement in terms of severity of MSDs reported, also participants had reported that the training had helped and improved their workstation and work habit.

In a randomized controlled study by Harrington [14] they too found a significant improvement in terms of attitude and practice after the provision of ergonomics training to office workers. Following a follow-up survey, several of participants who took part in the survey claimed of reduced or eliminated pain and discomfort after the training. In another research, it was found that training only did not result in improved musculoskeletal symptoms but it should be intervened together with the provision of proper and adjustable equipment in order to achieve an improved musculoskeletal result. However, according to Amick Iii, [15] training do results in reduction of average pain level. Most of the studies focused on the effectiveness of training before and after the intervention. None of the studies discovered on the best approach to conduct the training as to pose a positive impact towards employee's awareness and practice of ergonomics at office.

2.4 Rapid Office Strain Assessment (ROSA)

Majority of studies been conducted have used the subjective assessment tools such as questionnaires to evaluate the effectiveness of ergonomics training programs. Apart from these tools, the observational and objective assessment tools such as RULA [16] and REBA can be used directly to assess the work posture at workplace. Recent studies had proved the use of a new assessment tool, Rapid Office Strain Assessment (ROSA) for quantifying risks related to working with computer in office setting [17,18]

3. Methodology

3.1 Research Design

A correlational study design was used to determine the association between awareness and practice of ergonomics of office workers at Telekom Malaysia Berhad (TM). The Joint Command Centre (JCC) division which has a total of 75 employees located at TM Kelana Jaya, TM Shah Alam, TM Setapak and TM Ampang Tasik was selected. A total of 75 structured questionnaires adapted from another research [2] were distributed to all employees from the Joint Command Centre (JCC) division to assess employee's level of awareness on office ergonomics. This questionnaire consists of 30 questions and is divided to 2 sections. Section one consists of 10 demographic questions including questions on age, gender, injury history, occupation history and training. Section two consists of 20 awareness questions, which 4 of them are multiple choice questions focusing on respondents' awareness about adjusting their workstation and work techniques and 1 open ended question asking on whether respondent had made any workstation or posture modification. Other 15 questions are multiple choice type of questions that cover respondents' awareness on work posture and work station design. To assess practice of ergonomics, the Rapid Office Strain Assessment (ROSA) will be used to evaluate respondent's workstation design and working posture. ROSA is a picture-based posture checklist that is used to quantify exposure to risk factors in the office [18]. Rosa with scores of more than 5 are deemed to be high risk and require considerations for corrective measures. All questionnaires and tools used had been tested for their validity and reliability from previous researches.

3.2 Data Collection Procedure

Permission was first obtained from the Safety and Health Officer of TM to conduct ergonomics research among ITNT TM staff. Consent form which contains information about the research was attached together with the questionnaire. Only willing respondents are allowed to participate in the research. Photos of working posture and workstation design were taken for ROSA analysis.

3.3 Technique of Data Analysis

All data collected was analysed using IBM SPSS Statistics software.

3. Results

4.1 Demographic information

TABLE 3.2 Demographic Characteristics and Training Status

Characteristics	Mean	Std. Deviation	Groups	Frequency	%
Age (years old)	**1.81**	**.972**	**20-30**	**27**	**47.4**
			31-40	**20**	**35.1**
			41-50	**4**	**7**
			51-60	**6**	**10.5**
Gender	**1.58**	**.498**	**male**	**24**	**42.1**
			female	**33**	**57.9**
Years working at TM	**2.35**	**1.232**	**1-5 years**	**12**	**21.1**
			6-10 years	**30**	**52.6**
			11-15 years	**5**	**8.8**
			16-20 years	**3**	**5.3**
			>20 years	**7**	**12.3**
Received ergonomics training	**1.11**	**.310**	**yes**	**51**	**89.5**
			no	**6**	**10.5**
Who provided the training	**2.12**	**.709**	**Medical provider**	**5**	**8.8**
			Employer	**46**	**80.7**
			No training	**6**	**10.5**
Type of training received	**2.32**	**.929**	**Written material**	**0**	**0**
			Lecture/classroom/ one-on-one training	**51**	**89.5**
			Internet	**0**	**0**
			Other	**0**	**0**
			No training	**6**	**10.5**

From among 75 questionnaires been distributed, 57 responded and their posture and workstations been analysed with ROSA. The response rate was found to be 76%. Demographic information and training status of the study population is demonstrated in TABLE 4.1. For this study, majority of the respondents are female (57.9%) and aged between 20 to 30 years old (47.4%). The rest of the respondents are males (42.1%) and aged between 31 to 40 years old (35.1%), 51 to 60 years old (10.5%) and 41 to 50 years old (7%).

Among the respondents, most of them (52.6%) had worked in TM for 6 to 10 years and between 1 to 5 years (21.1%). Only 8.8% and 5.3% had worked for between 11 to 15 years and 16 to 20 years at TM. Other (12.3%) respondents claimed that they had worked with TM for more than 20 years. In determining whether the respondents had received any ergonomics training previously, majority (89.5%) of the respondents responded 'yes' while only 10.5% respondents did not receive any training at all. Among the respondents who received training, most of them (80.7%) claimed that they received the training by their employer and medical provider (8.8%). One-on-one training is the only type of training received by respondents (89.5%) from training provider.

4.2 Prevalence of Musculoskeletal Disorder (MSD) - complaint

The TABLE 4.2 below shows the frequency and percentage of MSDs complaints among office workers at JCC. Majority of workers (47.4%) with mean 1.53 had complaint of having Lower Back Pain (LBP), followed by shoulder pain (40.4%) (mean= 1.60) and neck pain (33.3%) (mean = 1.67). Only 3.5% (mean = 1.96) of workers complaint of feet and elbow pain while 7% (mean = 1.93) complaint of having pain at the hips and ankles.

TABLE 4.2: Frequency and Percentage of MSDs Complaints among Office Workers

Body Part	Frequency	%	Mean	Std. Deviation
Neck	19	33.3	1.67	.476
Shoulders	23	40.4	1.60	.495
Elbows	2	3.5	1.96	.186
Wrist	12	21.1	1.79	.411
Upperback	14	24.6	1.75	.434
Midback	13	21	1.77	.423
Lower Back	27	47.4	1.53	.504
Hips	4	7	1.93	.258
Legs	7	12.3	1.88	.331
Ankles	4	7	1.93	.258
Feet	2	3.5	1.96	.186
Others	0	0	2	.000

4.3 Awareness on work posture and work station design

TABLE 4.3 Frequency of respondents having awareness on work posture and work station design

Question	Mean	Std. Deviation	Answer	Frequency	%
Do you believe that you can prevent injury by changing the way you work	1.21	.619	yes no maybe	51 0 6	89.5 0 10.5
Are you willing to change the way you work	1.23	.627	yes no maybe	50 1 6	87.7 1.8 10.5
Are you aware of ways to adjust your chair or workstation to make it safer?	4.07	.799	unaware unaware of most ways somewhat aware aware of most ways fully aware	0 0 16 21 20	0 0 28.1 36.8 35.1
Are you aware of ways to change your work techniques to make it safer?	3.91	.837	unaware unaware of most ways somewhat aware aware of most ways fully aware	0 0 22 17 17	0 0 39.3 30.4 30.4
Is there anything you have already done or that you will do to your chair, workstation or work techniques to make it safer?	2.39	.861	yes No No response	14 7 36	24.6 12.3 63.2

Question 11 to question 15 focuses on the awareness of respondents on their own work posture and work station design. The responds are recorded as **Table 4.3** above. In determining whether the respondents believe that they can prevent injuries by changing their way of work, majority (89.5%) responded yes while other 10.5% thought that 'maybe' injuries can be prevented by changing their way of work. In relation to this, most of the respondent (87.7%) claimed that they are willing to change the way they work, while 10.5% and 1.8% claimed that they maybe and not willing to change their way of work.

To determine the worker's awareness on adjusting or changing their chair and workstation, 36.8% responded that they are aware of most ways and 28.1% are somewhat aware of ways to change their chair and workstation. The rest of the population (35.1%) claimed that they are fully aware on ways for adjustment and change. Similarly, when being asked on whether the workers are aware of ways to change their work techniques

to make it safer, majority (39.3%) are somewhat aware and 30.4% of respondents are both aware of most ways and fully aware of ways to change their work techniques. For these questions, none of the respondents claimed of unawareness on ways to change their chair, workstation and work techniques.

Although most of the questions above had a positive respond in terms of awareness, majority of the respondents (63.2%) did not respond to the question of whether they had done or will do anything to their workstation or work techniques to make it safer. 12.3% claimed that they will not or have not done anything to make their work station and work techniques better. However, 24.6% claimed that they had done something such as adjusting their monitor, keyboard and chair and requested the employer to change and re-design their work station and tools.

4.4 Relationship between awareness and risk of exposure of Musculosketal Disease (MSD)

The mean for ROSA final score and Risk of exposure of MSDs are 4.51 and 7.825 respectively. Both has standard deviation of 1.151 and 1.882 respectively. Among 57 respondents who participated in this study, 29 of them has a high risk of Musculoskeletal Disorder (MSDs) with 16 of them having score of 6, 12 respondents scored 7 and 1 respondent scored 8. 15 of the respondents have medium risk for MSDs with the score of 5. The remaining respondents scored below than 5 which is considered as low risk. For risks above than 5, attention for corrective measures is required.

TABLE 4.4 Relationship between awareness and risk of MSDs

			ROSA final score	Awareness score
Spearman's rho	ROSA final score	Correlation	1.000	.045
		Coefficient Sig. (2-tailed)	.	.741
		N	57	57
	Awareness score	Correlation	.045	1.000
		Coefficient Sig. (2-tailed)	.741	.
		N	57	57

*Correlation is significant at the 0.05 level (2-tailed)

In determining the relationship between awareness and risk of MSDs, a significant but weak relationship is analysed between the variables with Spearman's rho= 0.045

5. Discussion

Workplace well-being is growing and much effort is being made to promote the importance of inculcating a healthy and safe culture at workplace. In developing countries such as Malaysia, the Occupational Safety and Health (OSH) aspects especially ergonomics is always been taken for granted. Although with presence of regulations, guidelines, and interventions to improve the awareness of ergonomics among workers, injuries still occur and affecting the productivity of work in terms of increased absenteeism and increased medical cost related to MSDs.

With current advancement in technology and increasing use of computers, users need to aware of the proper posture, workstation setup and habits, which, if forgotten will result in multiple complications of MSDs.

Knowledge on ergonomics can be directed to improve the direct and indirect cost of MSDs in both organization and individual through the exhibition of best work practice at workplace. This study fills the gap in research on prevalence of musculoskeletal complaints among office workers. It also contributes to the understanding of effectiveness of ergonomics by bringing attention to the association between ergonomics awareness and practice of ergonomics at office, also the association between awareness and risk of work-related MSDs.

In determining prevalence of ergonomics awareness among office workers, most respondents self-claimed that they are mostly aware of the recommended work posture and workstation setup in office. This could be due to majority of the respondents claimed that they had received either lecture, classroom or one-on-one ergonomics training by their employers. Very few claimed of not receiving any ergonomics training. Although there is a positive self-claimed result on awareness, respondents did not responded on whether or not they had done anything to correct their workstation and work techniques. Here, two assumptions can be made. First is, the workstation had followed all the ergonomics best practice guideline and recommended work techniques had been adhered. Second, leaving a blank space can be interpreted as nothing had been done to the workstation or work technique. To overcome these assumptions issues in the future, questionnaires could be improvised by asking close ended questions as opposed to the subjective one.

Based on the MCQ questions results, most respondents have a score of 9/15 and none gets 12 marks and above. The highest score is 11 and scored by only 3 workers. This indicates an average prevalence of awareness among the office workers. In contrast to the above results, another research [6] to determine office ergonomics awareness among office workers found that workers have very low awareness about office ergonomics that results in high prevalence of MSD symptoms.

Looking at the prevalence of musculoskeletal complaints, most respondents complained of lower back, followed by shoulder, neck, upper back, wrists and legs. This finding contradicts with the research by [1, 8] which found that the most prevalence pain was neck, followed by lower back, upper back, wrist and shoulders. Similarly, in a study by Wu Shan [10] to determine the prevalence and risk of work-related Musculoskeletal Disorder among Chinese office workers found that the most commonly affected body part was the neck, while the low back was least commonly affected. This difference of results could be due to the sample size that is relatively smaller in this study or variance in workstation setting, sitting posture and work habits among employees in the studies.

Low Back Pain is highly related to prolonged working with computers and equipment, thus exposing workers to sustain in static and awkward body posture, prolonged sitting, reaching and repetitive hands or finger movement especially during mouse and keyboard use. These may lead to extreme physiological strain of the muscles, spinal disc and ligament which may contribute to Musculoskeletal Disorder (MSD)[19]. Soroush & Hassani [9] in their studies suggested that the most common factor for Musculoskelatal Discomfort and pain is lack of exercise such as running, walking, fitness and stretching exercise. Thus, they proposed that each employee need to be aware of the importance of task breaks and exercise that could help in reducing tension due to extensive computer use.

The association between awareness and risks of MSDs was found to be significant but poor based on Spearman Rho value, 0.045. This indicates a more thorough research need to be done as to identify the factors for this weak relationship. Up-to-date, there are limited studies involving ROSA to assess the association between ergonomics awareness and risk of exposure of MSD at office. However, several studies had been done using self-assessment questionnaires and training interventions proving that sufficient awareness would likely to reduce risk of MSD and costs related to MSD [20].

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7. Reference

[1] P. Janwantanakul, P. Pensri, V. Jiamjarasrangsri, & T. Sinsongsook, Prevalence of self-reported musculoskeletal symptoms among office workers. *Occupational Medicine (London), 58*(6), 436-438. doi: 10.1093/occmed/kqn072, 2008.

[2] S. Tingley, Ergonomics training and office employees' attitude, awareness, and knowledge. *Master's Theses*. San Jose State University, 2005.

[3] M. Robertson, B. C. Amick, K. DeRango, T. Rooney, L. Bazzani, R. Harrist, & A. Moore, The effects of an office ergonomics training and chair intervention on worker knowledge, behavior and musculoskeletal risk. *Applied Ergonomics, 40*(1), 124-135. doi: 10.1016/j.apergo.2007.12.009, 2009.

[4] M. Norashikin, T.K. Diana, M.Z. Raemy, & H. Siti Nurani, Ergonomic Training Reduces Musculoskeletal Disorders among Office Workers: Results from the 6-Month Follow-Up. *The Malaysian journal of medical sciences : MJMS, 18*(2), 16-26. 2011

[5] S. S. Harrington, & B.L. Walker, The effects of ergonomics training on the knowledge, attitudes, and practices of teleworkers. *Journal of safety research, 35*(1), 13-22, 2004.

[6] M. Norashikin, T.K. Diana, & R. Heard, Office Ergonomics Awareness and Prevalence of Musculoskeletal Symptoms among Office Workers in the Universiti Teknologi Malaysia: A Cross-Sectional Study, 2011a

[7] C. Alireza, M. Majid, K. Maryam, M. Abbas, & P. Ahmad Heidari, The impact of ergonomics intervention on psychosocial factors and musculoskeletal symptoms among office workers. *International Journal of Industrial Ergonomics, 41*(6), 671-676. 2011

[8] J.D. Collins, & L. O'Sullivan, Musculoskeletal disorder prevalence and psychosocial risk exposures by age and gender in a cohort of office based employees in two academic institutions. *International Journal of Industrial Ergonomics, 46*, 85-97. doi: 10.1016/j.ergon.2014.12.013, 2015

[9] M. Soroush, & H. Hassani, Musculoskeletal complaints associated with computer use and its ergonomic risks for office workers of a medical sciences university, *Annals of Military & Health Sciences Research* Vol 13, No 1, Winter 2015

[10] W. Shanshan, H. Lihua, L. Jingyun, W. Jianxin, & W. Sheng, Visual display terminal use increases the prevalence and risk of work-related musculoskeletal disorders among Chinese office workers: a cross-sectional study. *Journal of occupational health, 54*(1), 34-43 %@ 1341-9145, 2012

[11] S. Esmaeilzadeh, E. Ozcan, & N. Capan, Effects of ergonomic intervention on work-related upper extremity musculoskeletal disorders among computer workers: a randomized controlled trial. *International archives of occupational and environmental health, 87*(1), 73-83. 2014

[12] M. Robertson, B. C. Amick, 3rd, K. DeRango, T. Rooney, L. Bazzani, R. Harrist, & A. Moore, The effects of an office ergonomics training and chair intervention on worker knowledge, behavior and musculoskeletal risk. *Appl Ergon, 40*(1), 124-135, 2009

[13] R. J. Lewis, M. Fogleman, D. Joseph, C. Eileen, & A. Daniel, Effectiveness of a VDT ergonomics training program. *International Journal of Industrial Ergonomics, 27*(2), 119-131 %@ 0169-814, 2001

[14] R. J. Lewis, K. Marianne, C. Ellen, A. Daniel, & C. Eileen, Musculoskeletal disorder worker compensation costs and injuries before and after an office ergonomics program. *International Journal of Industrial Ergonomics, 29*(2), 95-99. doi: http://dx.doi.org/10.1016/S0169-8141(01)00054-3, 2002

[15] B. C. Amick Iii, M.M. Robertson, K. DeRango, B. Lianna, M. Anne, T. Rooney & R. Harrist, Effect of office ergonomics intervention on reducing musculoskeletal symptoms. *Spine, 28*(24), 2706-2711 %@ 0362-2436. 2003

[16] Y. Rasoulzadeh, & R. Gholamnia, Effectiveness of an ergonomics training program on decreasing work-related musculoskeletal disorders risk among video display terminals users. *Health promotion perspectives, 2*(1), 89. 2012

[17] F. Ferasati, & M. Jalilian, Evaluation of WMSDs in VDT users with Rapid office strain assessment (ROSA) method. *Journal of Ergonomics, 1*(3), 65-74. 2014

[18] M. Sonne, L.V. Dino & D.M. Andrews, Development and evaluation of an office ergonomic risk checklist: ROSA–Rapid office strain assessment. *Applied ergonomics, 43*(1), 98-108. 2012
[19] C.M, Che Hazwani, Z. Safial Eqbal, & M.D Siti Zawiah, *Investigation on working postures and musculoskeletal disorders among office workers in Putrajaya.* Paper presented at the Advanced Engineering Forum. 2013
[20] M. Norashikin, T.K. Diana, M.D. Raemy, & H. Siti Nurani. Ergonomic training reduces musculoskeletal disorders among office workers: results from the 6-month follow-up. 2011