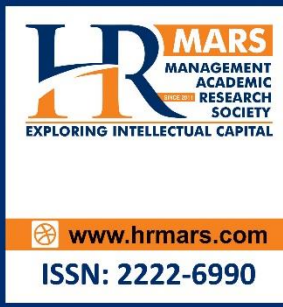




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Factors Influencing Perception of Work-Related Upper Limbs Disorders (WRULDs) among Malaysian Women Assembly Workers

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Abstract

Introduction: This paper attempts to discuss the contributions of individual factors toward the perception of Work Related Upper Limbs Disorders (WURLDs) among women assembly workers in a multi-national company producing latex products, based in Malaysia. **Methods:** A sample of 250 respondents have been selected to participate in this study. The methodology employed was developed from the risk management paradigm for the assessment, reduction and prevention of work-related stress. Repetitive work tasks in the factory environment were evaluated using a check list provided by Health and Safety Executive (UK). A questionnaire was designed, based on the information gathered from the focus group discussions and distributed to a sample of all assembly workers available at a particular time. Perception of physical pain was measured using the diagrammatical questionnaire in the form of a mannequin. Well-being was measured using the General Well-being Questionnaire (GWBQ). Pearson Correlation and Linear Regression analyses were used to determine the relationship between workers' background and the experience of physical pain. **Results:** Findings from the analyses show that age as well as education background is highly correlated with the experience of worn out hence resulting in report of pain among these workers. **Conclusion:** The paper exposes the implications of these findings for the design and management of such assembly work in Malaysia.

Keywords: Well-being; WURLDS, Worn Out, Age and Education

Introduction

In Malaysia, rapid economic development and industrialisation has created jobs for women within the labour-intensive industries such as electronics and textiles. Report by Labour Force Survey Report, Department of Statistics, Malaysia, shows the percentage of female labour force participate has increased to 55.2% from 47.8% in 1990 to 2018, which is an increase of 7.4% within 28 years. In manufacturing sector, the increment is from 16.9% in 2014 to 17.4% in 2018. Although it is a good sign for the economic growth of these countries, on the other hand it has also exported problems

related to repetitive work, i.e., Musculoskeletal Disorders (MSDs) of workers in those industries. The multiple roles of a women in job sector, household, as well as their role as a mother has put them in a very vital place hence their health and safety need to be of a concern. Some of these assembly workers are the bread winner for their family which makes this study is pertinent. The present paper is based on a study focuses on how individual factors like education background and age impact the report of upper-limb disorders (ULDs) among women assembly workers. ULDs is the term used to describe a large number of conditions in which pain arises in the upper-limb area. The experience of ULDs involves discomfort as well as pain, and the consequences of ULDs are often disability in some form (HSE, 2002). The term musculoskeletal disorders (MSDs) is also used. This is broader, and covers all disorders of the musculoskeletal system. Where the disorder is highly related to work context, the term work related musculoskeletal disorders (WRMSDs) is used.

Literature Review

The Industrial Revolution that emerged in Britain between 1760 and the mid-1830s fundamentally changed the pattern of work within society. By the late 1950s, mechanization and automation were widespread across Western Europe and North America. As a result, the physical intensity of industrial work was considerably reduced. However, the restriction of movement when performing repetitive work continued to affect some workers, resulting for them in considerable local muscular load (Onishi, 1998). Much of what then occurred was related to the introduction of new computer techniques into the workplace.

According to several studies, industries characterised by manual handling and repetitive work have traditionally demonstrated high rates of MSDs (Park et al. 2018; Kyaw Thu Soe et al. 2015; Alireza et al. 2009). There is currently much discussion regarding the issue of repetitive work, and one of the challenges that still remain to be completely resolved is the impact of repetitive work on workers' health. The significance of the outcomes of repetitive work was first identified by the father of occupational medicine, Ramazzini (1633-1714), who recognised the need to take measures to prevent disorders arising from repetitive motions and manual lifting. He also pointed out three principal causes of what is now known as repetitive strain injuries: fixed working positions, repetitive motions and psychological stress. His view on this issue was supported much later by experimental studies conducted to determine the effects of repetitive work (Antwi-Afari et al., 2017; Schultv et al., 2012; Deschata et al., 2009). According to Bevan (2015), the implementation of automation and mechanisation that increase the employee's speed of movement, especially on the production line, have had a negative impact on workers' well-being.

Carayon's balance theory of job design and stress is a comprehensive job stress model that incorporates work related upper limbs disorders (WRULDs) among a variety of health outcomes (Carayon et al., 1999). In this model, psychological and biological factors are integrated within an ergonomic framework to describe the risk of WRULDs or of MSDs. Within this theory, the organisational environment and psychosocial factors affect perceptions (Smith and Carayon, 1996) and in turn, perceptions drive the psycho physiological reactions that influence health. This model is particularly relevant to the current issues because it strongly suggests that work stress is part of the pathway to MSDs. Negative perceptions may thus lead to physical problems such as muscle tension. These problems may lead to inappropriate behaviour at work, such as using excessive force to accomplish a task or failing to rest when fatigued, which may result in health problems, including

WRULDs (Hagberg et al. 1995). Meanwhile, there is evidence from more recent studies that activities requiring repetitive movement and manual lifting affect both mental health and the physical aspects of well-being, such as WRULDs (Sergio & Congon, 2015; Kumar, 2004; Lundberg, 2002).

The problem of WRULDs affects not only blue-collar workers, who mainly work in assembly lines, but also those white-collar workers who are computer users (Luttmann et al., 2010; Kayode et al., 2015). Moom et al (2015); Halford & Cohen (2003), for example, suggest that computer use factors were significantly associated with self-report of MSDs, including WRULDs. Similarly, a cross-sectional study by Klussman et al (2017), suggested that WRULDs were related to high physical workload and directly dependent on visual display terminal use. Related to this issue, several studies (Cervero et al., 2016; Elliot, 2010) indicated that WRULDs could lead to a severe decline in workers' performance and productivity.

Meanwhile, a study carried out by Nafeesa et al (2018); Ferreira and Saldiva (2002), found that poor psychosocial factors were associated with WRULDs in computer-telephone interactive tasks. Other studies regarding postures and WRULDs have found that the association between decision latitude and constrained postures is an important link between psychosocial and physical stressors in the work place. Several experimental studies have suggested an association among psychosocial factors, repetitive work, WRULDs and stress (Ismail et al., 2016; Marjon et al., 2010).

In Malaysia, studies concerning repetitive work and its relation to physical pain and disorders have only recently been undertaken seriously and have largely concentrated on the physical work environment. Ghani et al (1995) undertook a joint study with a large company from Brussels, Belgium, known as the Centre for Ergonomic (CERGO) International to look into the effects of repetitive tasks under climatized and non-climatized working conditions among female workers in an electronics plant. According to this study, WRULDs were prevalent in both climatized and non-climatized plants. The study also suggested the possibility that psychosocial factors at work determined stress levels in the plants under study.

A study on repetitive work and WRULDs in Malaysia was conducted among 75 female workers in Kuala Lumpur (Hassim, 2008). It was a cross-sectional study on muscle fatigue and WRULDs among female telephone operators at a telecommunications centre in Kuala Lumpur. Results from the study showed that there was evidence of upper limb pain among female operators, which was attributed to the repetitiveness of their tasks.

Concerning the individual factors that leads towards physical pain and disorders, according to the US National Institute of Occupational Safety and Health (NIOSH) model of job stress and health, initially proposed by Hurrell and McLaney (1988), identifies several sources of stress in the work environment, including the physical environment, role conflict, role ambiguity, job control, interpersonal conflict, work load, responsibility for people, under-utilisation of abilities, cognitive demands and shift work. Individual and other situational factors can act as moderators to strengthen or weaken this influence.

With regard to women workers, despite the increasing proportion of them in this industry, much of the equipment used by them has been designed for men. This equipment is not best suited to be

used by women (Motamedzade & Moghimbeigi, 2011; Kalinkara et al., 2011). Dahlberg et al. (2004), revealed that women have to work more often and for longer periods with their hands above shoulder height than men.

It has also been found that women in general have lesser mean muscle strength, which is associated with greater vulnerability to biomechanical stress (Aptel Aublet-Cuvelier and Cnockaert., 2002). In the present case study, most of the equipment used by the workers in the company under investigation was transferred from the United States of America (USA) to Selangor, Malaysia following the closing down of the company, which previously operated in the USA. This information, together with the present situation (in which there is a large incidence of complaints of WRULDs) make addressing the issue of musculoskeletal disorders among women assembly workers vital to the government of Malaysia and essential in order to improve the situation. It was for this reason that the decision was made to choose Malaysia as representing a developing country for the present study.

In relation to perception, it is highly influenced by cultural context. Regarding pain, Helman (2007) argues that it is, in one form or another, an inseparable part of everyday life. Normal physiological changes such as pregnancy, childbirth, or menstruation, as well as injury or disease, are more than merely neurophysiological events, but also involve social, psychological, and cultural factors. Helman stated three important factors, which should be considered in studies on pain (in this case associated with WRULDs). The three factors are 1) not all social or cultural groups may respond to pain in exactly the same way; 2) how people perceive and respond to pain, both in themselves and in others, can be influenced by their cultural and social background; and 3) how, and whether, people communicate their pain to health professionals and to others, can also be influenced by social and cultural factors.

Hence it is suggested that cultural factors might have a different effect on the experience and report of WRULDs among assembly workers in Malaysia. Nevertheless, each case of pain should always be assessed individually, and one should avoid using generalisations or stereotypes in predicting how a person from a particular social, cultural or religious background will respond to being in pain.

Research Methodology

This research was conducted by invitation from the occupational health nurse of the company due to high number of physical disorders such as Carpal Tunnel Syndrome (CTS) being diagnosed by the Occupational Health Doctor at that particular company. The respondents were female assembly workers from Company B. They were involved in the manufacturing of barrier protection goods. Their main job was either stripping or cuffing a variety of gloves. At the time of the study, there were about 600 females working on a three-shift rota. All workers were invited to take part in the study, however, due to the company requirement, only those who are having a rest due to technical error such as machine breakdown were allowed to participate in this study. Final sample for this study is 250 women assembly workers from Company B. The figure in this study represents all respondents that were available during the three month data collection.

The respondents of the study completed a questionnaire that contained demographic data, well-being, and their physical health. The questionnaire contained two main sections – health profile and demographic background. Meanwhile, there are two components of health profile – work related

upper limbs disorders (WRULDs) and general; well being (GWB).

WRULDs involve both 1) objective and 2) subjective measurements. The first one was adopted from measurement developed by Atkins (1999) from the Institute of Work Health and Organisations. In this part, objective measurement referred to the exact amount of pain that the workers experienced. The questionnaire, known as Mannequin, consists of a diagrammatic representation of the upper limb area with an 11 point scale ranging from 0 (no pain) to 10 (extreme pain) to measure pain or discomfort. Participants were asked to put the exact number of pain that they considered as representing the pain that they feel. Whereas subjective measurement require the workers to describe in words about the pain that they were experiencing, that cause of the pain. In this case study, the result of Cronbach alpha for the 17 items was 0.83. In this study the term WRULD will reflect the perception of physical pain report by assembly workers.

On the other hand, General well-being (worn-out) questionnaire (GWBQ) consists of a list of 12 non-specific signs and symptoms of sub-optimal health (the report of symptoms relating to fatigue, cognitive confusion and emotional irritability). It is a context-independent measure of well-being that has been shown to be sensitive to fluctuations in well-being that strongly correlate with the emotional experience of stress at work (Cox & Gotts, 1987; Cox, 1990; Cox et al. 1983). The GWBQ is presented in the form of symptom checklist which is assessed by a five-point Likert Scale, coded from 0 (never) through 4 (always): the higher the participants score on the questionnaire, the 'poorer' their well-being. The time window of measurement is the preceding 6 months.

The scale was found to be reliable in terms of the present data set (Cronbach's alpha =0.83). Extensive reliability and validity data are available for the GWBQ (Cox et al. 1983). The GWBQ has been used in studies on a wide variety of different occupational groups (e.g. Cox et al. 2000). In this study, scores on the worn-out scale were used as a proxy variable for the experience of stress with which is usually strongly correlated. Where, in this paper, the author refers to the experience of stress, the measure taken is that of worn-out from the GWBQ. Occasionally, the author refers directly to that measure.

Worn-out data was split into two: those participants who scored 25 or over (maximum score 48) were assigned to the 'poor well-being' group and those who scored 24 and below were considered as the 'good well-being' group. The reasons for dichotomization of the data were: 1) Scores of 25 and above logically indicate unacceptable levels of exhaustion (feeling worn-out) with participants sometimes, often or always experiencing most of the listed symptoms, and 2) the relationship between well-being and the experience of stress is unlikely to be complete, linear and exact (Kristensen, 1996; Zapf et al., 1996). According to Randall et al (2002), dichotomization is used in order to avoid making the possibly erroneous assumption that there is some precise (e.g. linear) relationship between work and well-being. Dichotomization of the worn-out score provided the necessarily broad indication of the likely impact of stress on well-being.

In this study, demographic background is consisting of education, age and tenure. Based on the current situation in the company, which is most of the younger workers have a high educational background, the authors' view that educational background could play a vital role in the relationship between feelings of being stress and repetitive work. In this study, educational background was measured by asking participants to provide their level of education. Their responses were categorised

as: 1= ²Standard 1 to 6, 2=Above standard 6 to ²(form 3, 3= Above form 3 to form 5 and 4= Above form 5. The categories were based on Malaysian education system.

The main reason for asking about tenure is to find out the relationship between the duration of time working at the department/factory and its potential impact on work-related upper limb disorders. It was noted that some epidemiological studies have shown that when daily exposure time exceeds four hours, the rates of WRULDs complaints increase in the shoulder/neck, particularly for seated tasks such as VDU operation (Cheng et al. 2019; Norashikin et al. 2014; Das & Gosh, 2011; Blatter and Bongers, 2002). The item was measured by asking participants to report their length of time at the department as well as at the factory. The results are in raw numbers (e.g. 6 years and 6 months). Other relevant demographic data asked in this section were marital status, age, race, weight, height, department as well as whether or not they have been seeking professional advice for their upper-limb disorders (if they have one).

Results of the Study

As discussed in previous section, all participants in this study were female assembly workers with a mean age of 27.6 (Standard deviation, SD= 8.7), and mean tenure of the participants was 4 years (SD=3.1). They represented four sections in the company: LE6 (31.9%), LE7 (15.5%), LE8 (8.8%) and BDP (44.5%). Among the respondents, only 77 (31.5%) of them had an education up to form three or lower (equivalent to GCSE or less) and 167 (66%) were educated to form five (which is equivalent to A levels), whereas only six respondents (2.5%) had a polytechnic degree or form six education background.

This finding of the study reveals that out of 250 workers 180 of them have experienced WRULDs in the last six months. Thus, the number of respondents who reported that they have experienced WRULDs over the previous six months was almost three quarters (72%).

From the General Well-Being Questionnaire (GWBQ) it was found that the majority of respondents (66%) scored between 1-24 on the GWBQ (worn-out), whereas the remaining (34%) scored 25 or over. The higher band of scores indicates unacceptable, poor well-being (see for example, Randall et al. 2002). The results can be compared with those from other comparable manual groups in the engineering sector in the UK (Randall et al. 2002). According to previous studies (Cox et al. 1996), 31% of refuse collectors, 35% of home helps, and 41% of school meal workers reported poor well-being (e.g., scored 25 or over in the GWBQ). These figures, as well as the 34% reported in the present sample, are high and are a cause for concern. Statistical analysis indicated that there is an association between worn-out and WRULDs. Overall, the well-being of the assembly workers in this company does not reach critical limits, however, about one third of them are worn-out to an unacceptable level.

Based on several established models of work-related musculoskeletal disorders (Cox et al., 2000a; Carayon et al., 1999; Hurrell and McLaney, 1988), a number of individual factors were included in the

* *Standard* = equivalent to year 1,2,3,4,5 and 6 in UK primary school

** *Form* = equivalent to high school level 8 onwards.

survey questionnaire. Means and standard deviations of the WRULDs, worn-out, age, education background, Body Mass Index (BMI) and tenure were calculated. The Pearson's correlations test (2-tailed) was applied in order to identify the relationships between these variables. The findings are presented in Table I .

Table I : Means and Correlations among Worn-out, Individual factors and WRULDs

| | Mean | SD | 1 | 2 | 3 | 4 | 5 | 6 |
|--------------|------|------|--------|------|--------|--------|-------|---|
| 1. WRULDs | 64.5 | 30.5 | | | | | | |
| 2. Worn-out | 20.7 | 6.9 | .29** | | | | | |
| 3. Age | 27.3 | 8.7 | -.19** | -.13 | | | | |
| 4. Education | 2.6 | .6 | .32** | .11 | -.17** | | | |
| 5. BMI | 23.1 | 5.1 | -.17** | -.08 | .41** | -.17** | | |
| 6. Tenure | 1.2 | .47 | -.12 | .01 | .70** | -.24** | .31** | |

*p<.05;**p<.01

Table I presents the correlational data for the individual variables. The results revealed a positive relationship between educational background and reports of WRULDs ($r=.317$; $p=0.01$). Negative correlation was found between age and BMI with WRULDs ($r=-.194$ and $r=-.170$; $p=0.01$). Tenure was not correlated to WRULDs, which indicates that skill and experience do not prevent the workers from experiencing WRULDs. The overall results imply that younger, educated worker with lower BMI (thinner) reported higher experience of WRULDs.

Further analyses were conducted in order to confirm the hypothesis regarding the role of individual factors in relation to WRULDs. Table II shows the result of the individual factors in relation to WRULDs after controlling for each other. The results indicated that only educational background is significantly related to the report of WRULDs (Beta =.27, $P<.001$).

Table II : Linear Regression analysis for individual factors and WRULDs

| Model | | Unstandardised Coefficients | | Standardised Coefficients | t | Sig. |
|-------|----------------------|-----------------------------|------------|---------------------------|-------|------|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 54.105 | 14.459 | | 3.74 | .00 |
| | BMI | -.632 | .414 | -.104 | -1.52 | .12 |
| | Age of respondent | -.300 | .258 | -.084 | -1.16 | .24 |
| | Education background | 12.617 | 3.117 | .271 | 4.04 | .00 |

Dependent Variable: WRULDs

The analysis shows that high educational background increases the report of experiencing WRULDs by the workers.

Discussions

From the above results, education background seems to play a strong role in the overall result regarding the report of experiencing WRULDs. Education, age, tenure and BMI were the individual factors that were tested. Although all of them (except tenure) correlated significantly with WRULDs, only education had significant effects on WRULDs after controlling for each other. The result shows that the higher the workers' education background, the more was the probability of them reporting WRULDs. Educational background was found to be an important personal characteristic influencing the experience and report of WRULDs.

From this finding, and on the basis of the overall observation of the workplace, there are possibilities that young and more educated workers with low BMI were trying to convey political issues in the work environment. This finding is based on the high report of the experienced of WRULDs among educated workers whereas confirmed cases were among those workers with lower education background. The direct effect of education background is easier to understand in terms of the report of the experience of WRULDs rather than the experience itself. In this study, it is found that the workers is also trying to give messages to the author that something needed to be done regarding the nature of the work in the organisation.

On the other hand, the older and more experienced workers appeared to be more concerned with the quality of the product. This (according to their views in one of the focus group discussions) could contribute to a negative image of the company and later on threaten their work and future. One of the latest audit reports showed that, the company had failed to comply with British and US health and safety regulations, and this unfortunately supported this concern.

Education appeared to be an important motivating factor for workers. In the authors' opinion, the political situation in the company did not allow workers to direct their concerns through the proper channels and this could be one of the reasons why quantitative results did not match with the actual situation in the company (quantitative results showed that young workers reported symptom of WRULDs more than older workers whereas in real situation older workers are the one who suffers from WRULDs).

Conclusions

When comparing the Malaysian result and the Western model such as Balance Theory of Job Design and Stress Model (Carayon et al. 1999) regarding the individual factors and report of pain, it was found that individual factors that evolve from Malaysian assembly workers which is young age and high education is purely due to cultural context in which these two factors would give different meaning in Western context, whereas in this particular study it shows dissatisfaction that the workers is trying to convey regarding the work as well as management of the organisation. The fact that tenure is not influencing report of WRULDs revealed something which needs to be researched in the future.

The challenge for this particular company and the industry in Malaysia in general, is to develop good work interventions that not only will reduce the risks of WRULDs but also contribute to a safe and healthy work environment. Based on the increasing number of WRULDs cases and report of WRULDs in this company, more in-depth research on risk factors and preventive measures are recommended.

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