

The Prevalence of Work Related Musculoskeletal Disorders Among Workers Performing Industrial Repetitive Tasks in the Automotive Manufacturing Companies

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Abstract

Work related musculoskeletal disorders (WMSDs) is one of the major occupational injuries. WMSDs are associated with repetitive tasks. In the automotive industry, there are many jobs that still require workers to perform repetitive tasks and expose to the risk of injury due to WMSDs. The purpose of this study is to investigate the prevalence of WMSDs among workers performing industrial repetitive tasks in the automotive industry. The result is important to investigate the effect of WMSDs risk on the work productivity. This survey is the preliminary study to investigate the work productivity associated with WMSDs. The Standardized Nordic Musculoskeletal Questionnaires (NMQ) were distributed to the selected automotive manufacturing companies. The results found that the highest prevalence of MSDs for the last twelve months was on the neck (49.3%), followed by hand/wrist (48.0%) and shoulder (46.7%). The overall prevalence of MSDs among the workers was at a high rate (76.97%). In conclusion, the workers performing industrial repetitive tasks in the automotive manufacturing companies are exposed to the risk of WMSDs especially on the upper limb region that could lead to upper limb musculoskeletal disorders.

Keywords

Work related musculoskeletal disorders, repetitive task, automotive industry

1. Introduction

The process of parts manufacturing involved automation, semi-auto and manual repetitive tasks (assembly). The automation process had changed the manual assembly process from man to machine that could relieve the burden on the workers due to heavy lifting (Punnett, 1998). However, many jobs still cannot be automated and need to perform manually and involved repetitive tasks (Punnett, 1998; van Tulder et al., 2007). Studies found that the workers performing the industrial repetitive task are exposed to the risk of WMSDs problems (Moore and Wells, 2005; Chung et al., 2005; Kumar, 2001; Punnett & Wegman, 2004).

Musculoskeletal disorders (MSDs) are pain or discomfort of the muscles, nerves and tendons regions including other soft tissues (NIOSH, 1997). MSDs are the major work-related health issue among the industrial workers (Waters, 2004). The MSDs problems are associated with work related physical risk factors such as repetitiveness, work environment and psychosocial factors (Escorpizo, 2008). The WMSDs problems are the major complaints received from the workers performing repetitive task (Bernard, 1997; Linton & Kamwendo, 1989; Punnett & Wegman, 2004; Walker-Bone & Cooper, 2005) in various industries (Aghilinejad et al., 2012; Balogh, et al., 2009; de Looze et al., 2009; Gooyers & Stevenson, 2012).

WMSDs problems result in low worker productivity (Xu et al., 2012), causing approximately 34% of the annual lost time (Ontario Ministry of Labour, 2009). It is because workers are not only more likely to be injured due to work related musculoskeletal disorders but they also tend to slow down (Resnick and Zanotti, 1997). WMSDs contribute 7% of the overall productivity loss (presenteeism) (Medibank, 2011). Even though there are various studies which have discussed the effects of WMSDs on the work productivity, but few attempts have been made to investigate the relationship. The relationship is very important to reduce the risk of WMSDs and at the same time can optimize the work productivity.

Therefore, this survey is a preliminary study to investigate the work productivity associated with WMSDs. The prevalence of WMSDs problem among the workers performing industrial repetitive task in the automotive manufacturing companies is presented in this paper. The result of this will be used to further investigate the effect of the WMSDs pain or discomfort on the workers' productivity.

2. Method

The study was conducted in Malaysian automotive manufacturing companies. The Standard Nordic Musculoskeletal Questionnaire (NMQ) was used for this study. This questionnaire is a self report instrument. Self-report instrument was useful in collecting data related to workplace exposure to physical and psychosocial factors. This method is straightforward and applicable to a wide range of working condition (David, 2005). A total of 400 questionnaires were distributed to the assembly workers in the selected automotive manufacturing companies under plastic category, listed in the Malaysian Automotive Institute (MAI) database.

2.1 Selection of the companies

There are 183 companies listed in the MAI database. All the companies are the vendors for the automakers. The automakers appointed vendors and subcontracted the parts to them. Out of the 183 companies, 103 are under the category of Small Medium Enterprise (SME). There are more than half of the vendors under the category of Small Medium Enterprises (SME) (Mohamad, 2008). The SME companies with similar process and industrial repetitive tasks are preferred to ensure the similarity of tasks and exposure among the workers involved in this study. Based on the criteria, the companies under plastic category are selected. Most of the plastic parts involved assembly process and the parts are the main parts under category of body parts (Abdullah et al., 2008). There are 20 companies in the list and they produced parts such as trim clips, scuff plate, gear knob, garnish and etc.

2.2 Nordic Musculoskeletal Questionnaire (NMQ)

The Standardized Nordic Musculoskeletal Questionnaire was developed from a project funded by the Nordic Council of Ministers (Kuorinka, 1987). The aim was to develop and test standardized questionnaires on general, low back and neck/shoulder musculoskeletal complaints for use in epidemiological studies. This questionnaire was not developed for clinical diagnosis (Finneran & O'Sullivan, 2010). The NMQ is repeatable, sensitive and useful as a screening and surveillance tool (Ohlsson et al., 1994; Palmer et al., 1999).

The questionnaire was designed to find out whether musculoskeletal troubles occur in a given population, and in which part of the body (Kuorinka, 1987). The completion of the questionnaire is guided by a human body (viewed from the back), divided into nine regions being the neck, shoulders, upper back, low back, elbows, wrist/hands, hips/thighs, knees and ankles. Among the questions asked were whether the respondents had experienced any musculoskeletal trouble in the last twelve months and in the last seven days.

The Standardized Nordic Musculoskeletal Questionnaire has been used extensively for a wide range of occupational groups to evaluate WMSDs problems in various industries (Aghilinejad et al., 2012; Alexopoulos et al., 2006; Choobineh al., 2007; Hamberg-van Reenen et al., 2008; Nordander et al., 2009; Zakerian & Subramaniam, 2009).

3. Results

3.1 Reliability of data

The NMQ was checked for the internal reliability. Cronbach's alpha was used for the reliability measurement. Cronbach's alpha can be used to determine the research instrument's internal reliability (Chua, 2008; Herman, 2004; Sekaran, 2006). Cronbach's alpha is the most commonly reported measure of internal reliability and the cronbach's alpha coefficient of 0.7 found in the research is acceptable (Pallant, 2001). In this study, the result of the pilot survey showed the value of cronbach's alpha is 0.89 (Table 1). The result indicated that the survey instrument has a high reliability.

Table 1. Reliability Measurement Using Cronbach's Alpha

Cronbach's Alpha	No of items
0.89	18

3.2 Demographic data

The demographic data of the respondents are shown in Table 2. All of the respondents are workers performing industrial repetitive tasks in the automotive manufacturing companies. The data show that 72.7% of the respondents are male and 27.3% are female. Based on the result of the respondents' age distribution, most of them are in the age between 25 – 44 years old (92.1%). In terms of experience, the highest percentage of respondents (39.5%) has working experience between 6 – 10 years. Respondents with experience more than 10 years are 25.7% and 24.3% respondents have 3 – 5 years experiences. In total there were 65.2% respondents with experience 6 years and above. Nevertheless, the respondents' working schedule for both normal and shift appears to be equal, that is 50% each.

Table 2. Demographic Data of the Respondents

Demographic Characteristics	Frequency	
	No. of Respondents	Percentage (%)
Gender		
Male	134	88.2
Female	18	11.8
	152	100.0
Age		
Less than 25 years old	5	3.3
25 – 34 years old	77	50.7
35 – 44 years old	63	41.4
45 – 54 years old	7	4.6
	152	100.0
Marital Status		
Married	134	88.2
Single	18	11.8
	152	100.0
Length of service		
1 – 2 years	16	10.5
3 – 5 years	37	24.3
6 – 10 years	60	39.5
More than 10 years	39	25.7
	152	100.0
Working Schedule		
Normal	76	50.0
Shift	76	50.0
	152	100.0

3.3 Work Related Musculoskeletal Disorders Symptoms

A total of 400 questionnaires was distributed to selected automotive manufacturing companies located in Klang Valley. In total 152 survey questionnaires were completed and returned. The data are sufficient for this study since sample size larger than 30 and less than 500 is appropriate for most research (Roscoe, 1975). Descriptive statistical method was used to analyze the data.

Table 3 shows the result of the MSDs prevalence among the workers for the last twelve months. The result indicates that musculoskeletal symptoms or pain ranged from 1.3% to 49.3 % for different body parts. It is found that 76.97% of the workers have symptoms or pain in any part of the body. The prevalence of musculoskeletal symptoms is highest for the neck (49.3%), followed by hand/wrist (48.0%), shoulder (46.7%), upper back (33.6%), lower back (21.7%), knee (15.8%), thigh/hip (14.5%), elbow 8.7% and ankle (1.3%).

Table 3. Musculoskeletal Symptoms in the last twelve months

Body Part	Frequency	Percentage (%)
Neck	75	49.3
Shoulder	71	46.7
Elbow	10	6.6
Hand/Wrist	73	48.0
Back (Upper)	51	33.6
Back (Lower)	33	21.7
Thigh/Hip	22	14.5
Knee	24	15.8
Ankle	2	1.3

4. Discussion

The overall prevalence of musculoskeletal discomfort among the workers for the last twelve months was at a high rate with 76.97% experience pain or symptoms on any body part. The symptoms reported are work-related and the prevalence of MSDs would increase over time due to cumulative exposure (Engström et al., 1999). Neck pain was found the highest symptoms followed by the hand/wrist, shoulder and upper back. The workers involved in this study performing industrial repetitive tasks (assembly of plastic parts). Neck and shoulder pain is associated with repetitive tasks (Cassou et al., 2002; Chee e al., 2004; Chiang et al., 1993).

The result of this study is found consistent with Hussain (2004). He found that 79% of assembly workers experience MSDs pain or symptoms on any body part. The highest prevalence of MSDs pain was found on the neck, followed by the shoulder and the hand/wrist. The workers in the study performed highly repetitive tasks and maintained static posture for up to an hour at a time. Other studies also showed that repetitive tasks have been found to be associated with WMSDs (Moore and Wells, 2005; Balogh et al., 2009; Bosch et al., 2009; Chee et al., 2004; Chung et al., 2005; Gooyers & Stevenson, 2012; Kumar, 2001; Punnett & Wegman, 2004; van Rijin et al., 2009).

The symptoms of neck and shoulder pain is also significantly related to the repetitive work under short cycle time and high job demand (Chiang et al., 1993). Short cycle time also increases the prevalence of hand and wrist injuries (Silverstein et al., 1986). The result of the survey found that the prevalence of MSDs pain on the hand/wrist is high with 48.0%. The result might relate to the short cycle time and the high production volume. In the automotive industry, the production volume is high most of the time (Baba et al., 2010).

Work pace is also associated with the frequency of repetitive movements and lead to the risk of developing MSDs (Andersen et al., 2003). In a repetitive task, the work-pace is usually not self-chosen, and the worker must follow a predetermined pace (Sundelin & Hagberg, 1992). With a higher work pace, levels of muscle activity are also higher and it produces a sign of muscle fatigue and MSDs risks (Selen et al., 2006; Visser, 2004). Muscle fatigue is a stage which the muscle is not able to sustain the required force or work output level (Ma et al., 2008). Muscle fatigue is one of the main reasons causing WMSDs in the industry. The accumulation of muscle fatigue will cause functional disability and resulted as musculoskeletal disorders (Ma et al., 2009). The WMSDs problem will affect productivity because workers are not only injured when they are fatigued but they also tend to slow down (Resnick and Zanotti, 1997). A general increase in the number of musculoskeletal disorder cases was associated with the decreased of work activity (Waters, 2004). The workers experienced pain or discomfort due to musculoskeletal disorders and still at work at a reduced capacity may reduce work productivity. The WMSDs problems result in low worker productivity (Xu et al., 2012).

Workers' productivity is an important variable in the discussion of WMSDs in the manufacturing industries. It has been used as a common subject for examination in the various studies on the musculoskeletal disorders affecting workers (Beaton & Kennedy, 2005; Hagberg et al., 2002; Lotters et al., 2005; Pransky et al., 2002). However, there is a lack of data linking workers' productivity with the reduction of WMSDs risk. The specific relationship between muscle fatigue development (one of the main reasons for WMSDs) and workers' productivity is also vague. Therefore, there is a need to investigate the relationship between the risk of WMSDs and discomfort, associated with muscle fatigue and workers' productivity. The result is very important to help the industries in designing their work to improve workers' productivity and at the same time reducing the risk of WMSDs. The result of this study will be used to further investigate the relationship between the WMSDs risk and work productivity among workers performing industrial repetitive tasks.

5. Conclusion

The results of this study showed that the overall prevalence of body pain is high (76.97%). The highest prevalence of MSDs for the last twelve months is on the neck, followed by hand/wrist, shoulder and upper back. Based on these results, the highest prevalence is in the upper limb region which can contribute to upper limb WMSDs. The results show that repetitive task is associated with the prevalence of MSDs pain and discomfort.

It can be concluded that the prevalence of WMSDs among workers performing industrial repetitive task in the automotive manufacturing companies occur at a high rate. The WMSDs problem may reduce workers' performance. The workers are present at work but functionally limited due to work-related musculoskeletal disorders (WMSDs). Further research will be conducted to investigate the relationship of WMSDs risk on the workers' productivity.

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