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Intervention by Participating Ergonomics to Enhance the Sustainability of Office Working Conditions

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Abstract

Objectives: The main objective of this study is to analyse the efficacy of a participatory ergonomics intervention in reducing the symptoms of musculoskeletal disorders (MSDs) among Hamilton Sundstrand Malaysia (HSM) office workers. Hence, it is important to analyse the level of ergonomic awareness and the current status of the MSD symptoms.Research methodology: The study used a mixed method research, it used questionnaires to collect the qualitative data and analyse along with the interviews for collecting the qualitative data and analysis of the data. The respondents were from the 5 departments within the company. These 5 departments included the Supply chain or procurement department, finance department, customer service department, engineering and the quality department.The target population for this study was 30 office workers. The data was analyzed using thematic analysis and paired t-Test analysis using the SPSS software. To study the efficacy of the ergonomics training module in reducing the MSD symptoms among the workers, the paired t-test method of analysis was used. Setting: The study was conducted at Hamilton Sundstrand Customer Service (M) Sdn. Bhd. (HSM).Findings: Before the implementation of the ergonomics training module the ergonomics awareness of the office employees was at a very low level. The higher rate of discomfort was reported at the neck (49%),lower back(54.3%) and upper back (52%). After the implementation of the training module, there was a increase in the awareness and the knowledge level of the office ergonomics which significantly reduced the MSD symptoms. The prevalence of MSDs symptoms has also decreased for some body parts; however, the neck continues to have one of the highest percentages of body parts experiencing pain, at 54.3%, followed by the right wrist (49.3%) and right shoulder (46.9%). The paired t-test yielded a t-value of 2.26 while the p-value was 0.043, which is less than 0.05. Therefore, the ergonomic training module was successfully implemented which resulted in the significant change in the MSDs within the departments. Conclusions: The findings of the study concluded that the main cause for musculoskeletal disorders (MSDs) is the poor office ergonomics at the workstation and a lack of ergonomic awareness. Ergonomic training can overcome these issues, as the intervention has effectively reduced the prevalence of MSDs among office workers. Workstation, Ergonomics, Office Workers, Intervention, Musculoskeletal Disorders.

Introduction

Background of the Company

Hamilton Sundstrand Customer Service (M) Sdn. Bhd. (HSM) is a subsidiary of Collins Aerospace that offers aircraft maintenance, repair, and overhaul (MRO) services to commercial airlines around the globe, specialising in Air Management System (AMS). The company was initially formed from the merger of Hamilton Standard and Sundstrand Corporation. It was established in 1991 and currently located in Kelang, Selangor. HSM includes support and repair shops, non-destructive testing, paint as well as products test cell. With the vast amount, of in-house capabilities, the company occupies about four acres of land to

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ensure the smooth running of their daily shop activities. The core business activities of the company involve around repair and overhaul of the aircraft's air pack system. Hence, the facility consists of four main repair shops or cells which are valves, starters, air cycle machines and heat exchangers. The company comprises of 100 direct employees and 40 indirect employees, separated by two different floors.

Problem Identification

The prevalence of work-related musculoskeletal disorder (MSDs) is constantly rising among office workers. Due to poor office ergonomics workstation setup, they started to develop MSDs symptoms such as pain and discomfort because of static and awkward posture, repetitive motions and forceful exertions [1]. The most common improper posture is resting their wrist on the edge of their workstation while typing on the keyboard. By repeating this position for a prolonged period can lead to nerve damage and develop a medical condition called carpal tunnel syndrome (CTS) [2]. Other awkward posture can be seen where the employees cradling the phone between their ear and shoulder while tilting their neck to one side. This can cause support muscles getting strained and repetitive injury can lead to the neck, shoulder, and upper back pain [3]. Apart from that, most companies provided their workers with similar workstation desks and ergonomics chair, however they did not train them on how to utilize the features and thus, missed out on the benefits that comes from using the chair [4]. As such, several of the department staffs have reported to have signs and symptoms associated with MSDs.

Literature Review

Importance of Participatory Ergonomics Intervention

Ergonomics intervention aim to enhance the fitting of work tasks for the employees. Ergonomics education is one of the well-documented ergonomics interventions and it is a strategy where an ergonomics expert educates the workers about the ergonomics principles, improve the knowledge of the workers on effective work behavior, MSDs risk factors and the prevention strategies. In ergonomics education program, there are two main objectives which is one, increased the office workers awareness on the risk factors and the second is to motivate them to make few good changes on their work behavior [5]. To further understand more about participatory ergonomics, it continuously involves the office workers in implementing and developing changes in the workplace to make some improvement on the productivity and lower risks to health and safety [6].

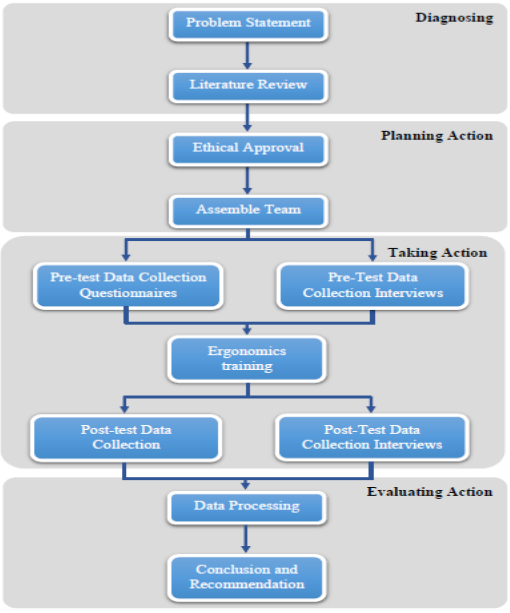
Psychosocial Risk Factors Among Office Workers

According to the Karasek Demand-Control theory, the combination of low decision latitude and high psychological demand can result in a variety of job-related stresses, including MSDs, mental disorders, and cardiovascular diseases. An office worker is at a high risk of injury, for instance, if their body requires them to adapt duties that exceed their physical limitations [7]. In addition, Smith & Sainfort (1989) developed a job stress model based on the theory of stress and balance. It is asserted that working conditions and other environmental factors outside of the workplace can contribute to an individual's stress load. This burden includes psychological, biomechanical, and physiological effects, such as pain perceptions, joint forces, and elevated blood pressure. If the workload exceeds a person's capacity, it can have a negative effect on the employees by causing strain. This is referred to as a mismatch between personal resources and environmental requirements. This strain is capable of causing severe MSDs [8] if prolonged exposure occurs.

Methodology

Action Research Framework

Figure 1: Action Research Framework.



Diagnosing

The study is desirable due to several of the HSM office staffs informed of experiencing discomfort and pain similar to symptoms of MSDs. Thus, the proposed research solution is to explore the prevalence of MSDs in the workplace and educate the office staff on occupational hazard to improve their working condition for the long-term. In order to proceed with the study and gather the research data, the researcher had collaborated with Environment, Health and Safety department and ergonomics committee to thoroughly plan the intervention to ensure a successful project.

Planning Action

Presently, Hamilton Sundstrand Customer Service (M) Sdn. Bhd. office workers are not trained or have any guidelines on the office ergonomics which could probably be the cause for them to practice poor working behaviors that can have detrimental effects on the workers' well-being at work. The following need for change has been informed to the employer and the desired future state is to reduce the prevalence of MSDs symptoms through participatory ergonomics education. The successfulness of participatory ergonomics approach requires involvement from the organizational members to develop a healthy workplace to reduce the incidence of MSDs [6]. Hence, the researcher had established a collaboration relationship with HSM ergonomics committee to assist in implementing and designing the ergonomics intervention. Both parties were working closely to administer the treatment throughout the entire process and ensuring the research objectives are achieved.

Taking Action

The data collection was separated into two phases which consists of pre-test and post-test data gathering.

The pre-test assessment which consisted of questionnaires and interviews were carried out and completed within the same day. Shortly after the completion of the pre-test questionnaire session, the researcher then proceeds to communicate to the participants that the pre-test interview assessment is conducted within the same day. The post-test data collection was being carried out after a period of 8 weeks since the last pre-test assessment performed by using similar respondents.

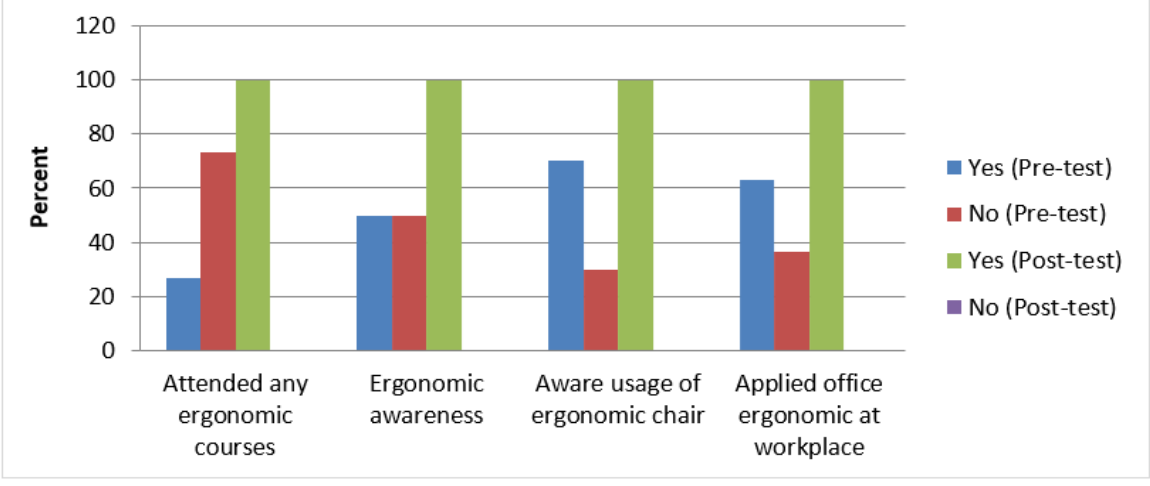
Evaluating Action

Statistical Package for the Social Sciences (SPSS) Version 25 was used to measure the mean scores, standard deviation, minimum and maximum values for the results of questionnaires and interviews in both the pre-intervention and post-intervention periods. The paired t-test was utilised to assess the efficacy of ergonomics training in reducing the symptoms of musculoskeletal disorders among office workers. The paired t-test compares the means of two related groups, the pre-test group and the post-test group, to determine whether there was a significant difference between the symptoms of musculoskeletal disorders experienced by office workers before and after receiving ergonomics training.

Analysis

Based on the pre-intervention results on the ergonomics knowledge and awareness, only half of the respondents are familiar and have the knowledge of ergonomics concepts (50.0%). According to the interview data collected, although 70% of the workers knew that the chair, they are currently using is an ergonomics chair, majority of them did not know how to fully utilize the chair as they are not being trained. Besides that, only 63.3% of the respondents stated that they applied the office ergonomic at their workplace. After the ergonomics training was done, the result obtained showed positive outcomes as all of the participants (100.0%) have become aware of the ergonomics principle, able to fully use the ergonomics chair as well as apply the office ergonomics at their workstation. Figure 2 illustrated the difference made between the pre-test and post-test to observe any improvement occurred.

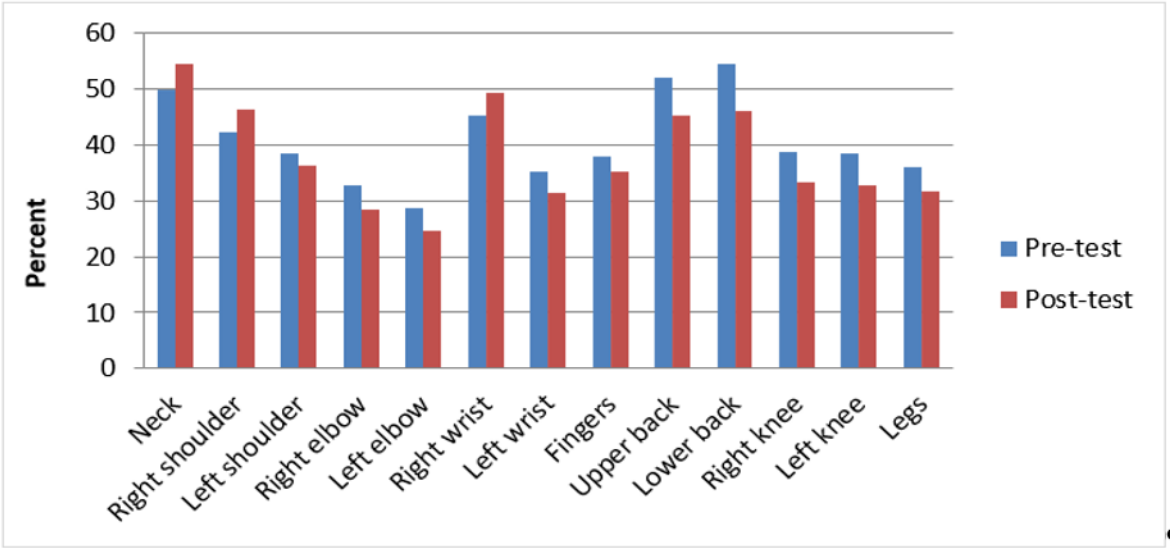
Figure 2: Graphical Results of Ergonomics Awareness Among the office Workers Between Pre-Test and Post-Test in the form of "Yes" and "No" Questions.



The participants were then asked to rate all body regions experiencing discomfort. Lower back (54.3%), upper back (52%) and neck (49.7%) were rated as the most problematic areas. After that, the presented

post-test results revealed some significant changes in the rate of body part discomfort, with the majority of locations presumably improving and only a few, including the neck, the right wrist, and the right shoulder, showing an increase. The three body regions with the highest proportion of individuals experiencing discomfort were the neck (54.3%), right wrist (49.3%), and right shoulder (46.6%). Before and after office ergonomics training, Figure 3 depicted the percentage of body parts where discomfort was present among office personnel.

Figure 3: Graphical Data on Rating the Body Part Where Discomfort Occurred During the Last Two Months Among the Office Workers Between Pre-Test and Post-Test.



Using a paired t-test, a comparison was made between the pre-test and post-test on reducing MSD symptoms among office employees. The paired t-test resulted in a t-value of 2.26, which indicates that the difference between the sample data and the null hypothesis increases as it is greater than zero, while the p-value is 0.043, which is less than 0.05. Both the t-value and the p-value indicated positive deviations between the sample data and the null hypothesis. This demonstrated a significant difference in MSD symptoms among office employees following an ergonomics intervention. The null hypothesis that there is no significant difference between pre-intervention and post-intervention MSD symptoms among office workers is therefore rejected.

Discussion

Level of Ergonomics Awareness

In the pre-intervention results, lack of awareness and application of office ergonomics has been discovered among the office. This may due to most office workers did not realize that lack of ergonomics awareness can cause a range of serious health problems such as MSDs. Hence, it is suggested that the management put more effort to increase the ergonomics awareness among the office workers and the application of ergonomics should be practical to bring positive changes in the work habits. Education or training is the best option to initiate the awareness of ergonomics among the office workers as it can promote a culture of safety in the organization [9]. After the respondents had undergone ergonomics training, there was an improvement in terms of office ergonomics awareness and all the workers started to apply the ergonomics principle at their workstation. Participatory ergonomics training intends to help the office workers in

understanding the proper workstation setup and postures. Hence, it is very beneficial for the employees as they can apply the information of office ergonomics into their work environment [10].

The Prevalence of MSDs Before and After Intervention Among the Office Workers

The lower back is rated as the highest for body part where discomfort is present in the pre-test result. This could probably be due to prolonged static, awkward and constrained postures during the office work. Maintaining the same awkward position for a long period will slowly diminish the elasticity in soft tissues and increase the strain and pressure to the back of muscles and spinal discs [11]. Another reason might be unfamiliarity of ergonomics chair as the workers did not fully utilize the features throughout working hours. Fortunately, in post-test result, the lower back showed significant reduction. Based on the feedback by the respondents, all of them showed improvement in terms of less body aches and more comfortable at the workstation after they applied office ergonomics. For example, correctly make some adjustments on the ergonomics chair and took micro-breaks during the working hours to ease pain or discomfort. Thus, this showed how important the office ergonomics training is to the office workers as they often neglected their health by mainly focusing on their job which could lead to low productivity and creates serious health problems.

Besides that, the neck was also rated high in the pre-test outcomes and surprisingly stayed within the top highest rate even after the intervention. Based on the questionnaires and interviews data, most of the respondents used laptop more than the monitor screen to do their job and it is noticed that the position of the screen laptop was lower than their eye-level. This led to tilted and forward head posture which associated with an increased possibility of neck pain by putting pressure on the cervical spine and later causing muscle fatigue and tightness [12]. Besides that, the respondents also have the habits of having awkward posture when using telephone while keying as headphones are not provided. Holding the phone between the ear and shoulder while maintaining static position during a long phone call can heighten the tension in the shoulders [13]. This can be seen in the result where the rate of shoulder also increased after the ergonomics training.

Additionally, the rating of the right wrist during the post-test was also increased as compared to the pre-test results. Typing is another task that every office worker tackles daily and at the same time they can suffer from common injuries because of poor office ergonomics such as musculoskeletal injuries. Without any proper ergonomics workstation such as the keyboard tray, they can develop serious injuries such as carpal tunnel syndrome [9]. Although the office work environment does not generally involve some heavy lifting or twisting as industrial workplaces, it does involve countless repetitive movements on the hand, wrist and fingers. With the good ergonomics keyboard practices, it will be able to keep the workers productive and pain-free as the wrists are in comfortable and neutral positions [14,15,16,17].

Comparison of Pre-Test And Post-Test on the Effectiveness of Ergonomics Training

Paired t-test was used to compare the means between two related groups which are the pre-test groups and the post-test groups. Based on the results, the t-value obtained is 2.26, whereas for the p-value is 0.043. Both t-value and p-value showed that there is a significant difference between the sample data and null hypothesis, which ultimately reject the null hypothesis. Therefore, this shows that the office ergonomics training is indeed effective in reducing the MSDs among the office workers. This also represents the relative improvement in the ergonomics applications of the office workers in this study.

Conclusion

In conclusion, through the implementation of the ergonomics intervention, the employees were able to improve their working postures, work habits and make appropriate adjustment at the workstation to

lessen the pressure applied to the body which overall lead to significant reduction in MSDs among the office workers [18,19]. The intervention has a positive impact on the workers' MSDs as it can reduce the burden of the workers when performing specific job tasks. As such, the ergonomics training aimed at informing the office workers regarding the risk factors of the musculoskeletal injury as well as the changing behavior to reduce the risk [20, 21, 22] has been proven to be effective.

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