

The Development of Bedridden Assisting Support Equipment (Base) To Reduce the Risk of Musculoskeletal Disorders among Nurses or Patient Handlers

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Abstract: This paper aims to identify the risk of work-related musculoskeletal disorders (WMSDs) among nurses or patient handlers and to develop the assisted equipment in order to reduce the risk. The survey questionnaires have been distributed to the nurses in two medical centers in Klang Valley. The results indicated that they are exposed to the risk of WMSDs and one of the tasks contributed to the risk is changing bedridden patient diapers. Based on the interview conducted, there is no equipment available that could be used to assist in diapers changing process, and all the participants agreed on the idea to develop the Bedridden Assisting Support Equipment (BASE). The BASE has been designed and developed with the combination of the mechanical element, counterbalance systems, and ergonomic tools. The BASE is successfully performed its intended function in reducing the physical effort of nurses or patient handlers to change patient's diapers which indirectly could reduce the risk of WMSDs. In addition, the BASE proved its effectiveness as only one person required when changing the diapers using BASE.

Keyword: WMSDs and one of BASE). The BASE has been designed

I. INTRODUCTION

The application of excessive force may harm the human body since it is one of the primary ergonomic risk factors. Many tasks require high force loads on the human body, regardless of the type of industry they work with, including in the medical industry. Muscles effort increased in response to high force requirements which could increase the risk of physical fatigue that leads to the risk of musculoskeletal disorders (MSD) (Middlesworth, 2017).

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Eliminating excessive force could reduce physical fatigue and the risk of musculoskeletal disorders (MSD) in medical personnel and/or patient handlers. Thus, using mechanical-assisted equipment and ergonomic tools could reduce the work effort and muscle exertions (Middlesworth, 2017) among them. Medical personnel and/or patient handlers at the hospital always facing difficulty in changing bedridden patient diapers. Method to change the patient's diapers is by turning the patient from left to right or vice versa, which is obviously non-ergonomics method that uses excessive force, and consequently, may cause discomfort to the patient handlers (Puspasari, 2014; Coelho et al, 2016). Due to this reason, it is important to have an assisted tool or equipment to ease the process of changing diapers of bedridden patient.

This paper aims to identify the risk of work-related musculoskeletal disorders among nurses and to develop Bedridden Assisting Support Equipment (BASE). The Bedridden Assisting Support Equipment (BASE) is an idea to reduce the excessive force used by the nurses and patient handlers while handling the bedridden patient. The idea is to reduce physical fatigue and the risk of musculoskeletal disorders (MSD) among them while managing the bedridden patients, especially when changing their diapers.

II. METHODOLOGY

Survey

A survey is conducted via interview and questionnaire focusing on how the nurses and caretakers change the bedridden patient diapers and the effects to their body such as discomfort and pain. The survey has been done at two medical centers in Klang Valley.

Subjects

Thirty subjects were involved in this study. The subjects were between the ages of 24 to 45 years old. All subjects were nurses who take care of the bedridden patient in the hospital.

Bedridden Assisting Support Equipment (BASE) Prototype Development

The BASE has been designed and the prototype was developed for evaluating purposes.

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The sketch of the BASE is depicted in Figure 1 and the prototype can be found in Figure 2.

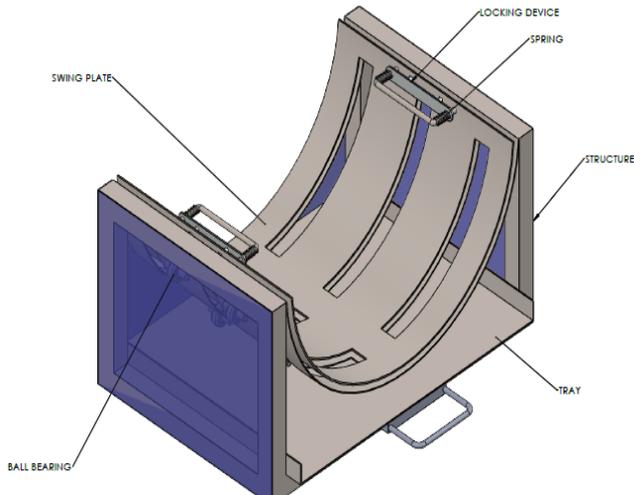


Fig. 1 The sketch of the BASE

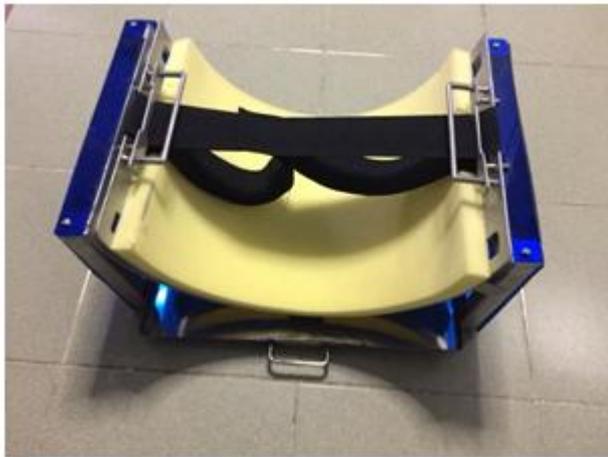


Fig. 2 The prototype of the BASE

Experimental Task

An experimental task has been performed to evaluate the effectiveness of using BASE while changing the patient's diaper. The BASE is placed under the patient's body, as shown in Figure 3. The process on how to use the BASE in the experimental task is shown in Figure 4, 5 and 6 respectively.

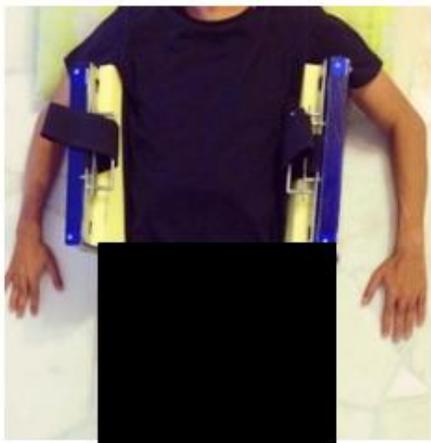


Fig. 3 The BASE is placed under the patient



Fig. 4 The strap is attached to the patient's body, to prevent the patient body from moving



Fig. 5 The swing plate is pushed to move the patient body to the other side



Fig. 6 When the equipment is locked in the intended position, the diapers changing process is initiated

Data Analysis

The results of the survey and experimental were compiled and analysed.

III. RESULTS AND DISCUSSION

Demographic Information

The demographic information in terms of gender and age population in this study is shown in Figure 7 and Figure 8 respectively.

The result shows that males are only 3% or 1 out of 30 subjects from both medical centers. In other words, the majority in the nursing career involved females than male which aligned with the statistics from Human Resources Division, Ministry of Health Malaysia that 97% of nursing profession comes from the female.

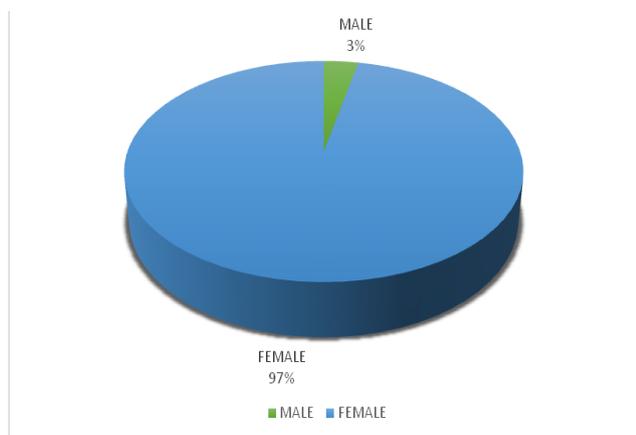


Fig. 7 The distribution of gender

Meanwhile, the range of age of the participants is from 24 – 45 years old. The 45-years-old nurse reported that she still doing changing patients’ diapers and this task exposed her to the risk factors such as excessive force and awkward posture.

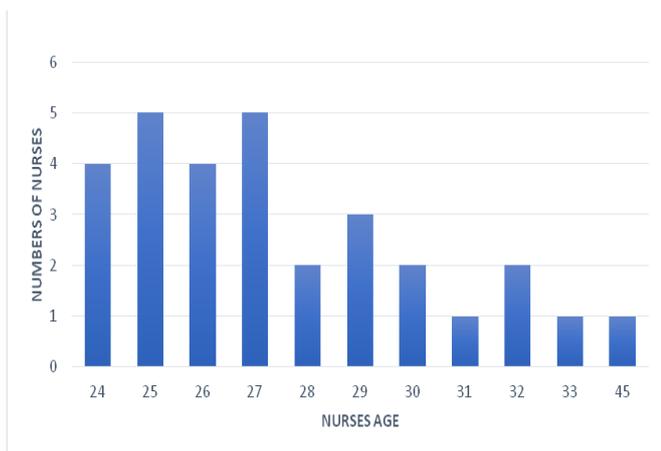


Fig. 8 The distribution of age of the nurses

Nurses Working Experience and Their Experience in Changing Patient Diapers

Majority of the nurses (about 47%) have 6 to 10 years experiences (refer Figure 9), and they all have experienced in changing the bedridden patient diapers. Based on the information obtained from the assessment, 57% of the nurses choose to have two nurses to complete the normal process of changing patient diapers. Meanwhile, 43% choose to have three nurses to complete the process of changing patient diapers. The results indicated the complexity and effort required in changing the patients’ diapers cannot be handled alone. The task required higher force, lead to pain and discomfort and may expose the nurses to the risk of musculoskeletal risk factors. The exposure to discomfort and body pain is the indicator of WMSDs risks.

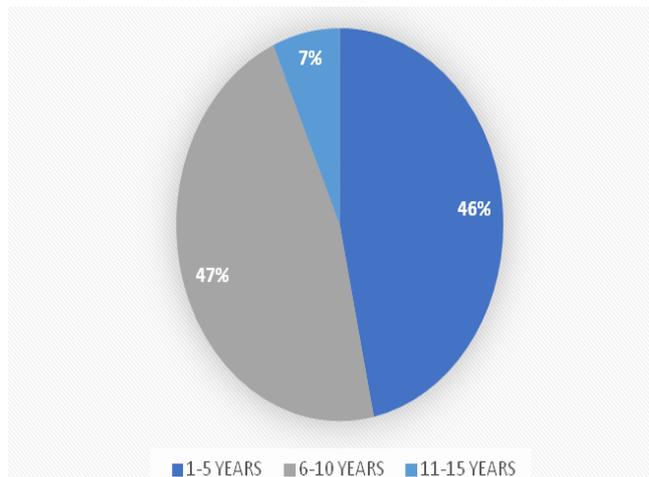


Fig. 9 The working experience of all the subjects

The Prevalence of Work-Related Musculoskeletal Disorders (WMSDs) Among Nurses

The result in Figure 10 showed that all nurses reported having pain or discomfort that lead to the WMSDs problem mostly on lower back pain followed by back pain. The results indicated that the working environment and the tasks performed including changing patient diapers could lead to body pain and discomfort.

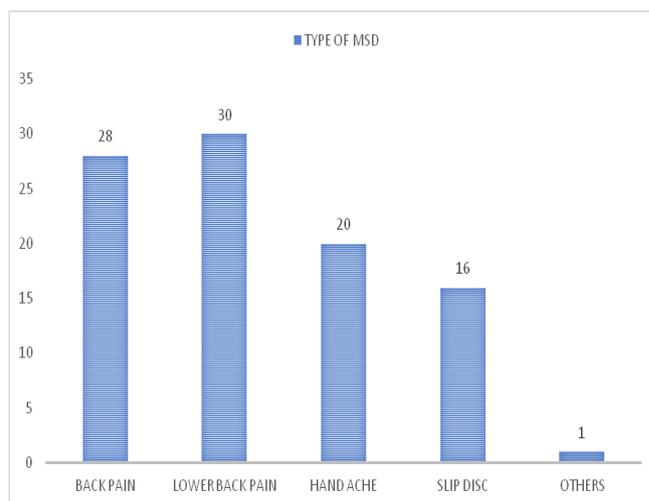


Fig. 10 The prevalence of WMSDs among nurses

BASE Prototype Development and Testing

The prototype of BASE has been testing via experimental task. The experimental task has been performed simulating the process of changing diapers involved the caretaker and the ‘patient’. The patient had been briefed regarding the purpose of the test and should give consent regarding the test. Both patient and caretaker are required to evaluate the comfortability and effectiveness of the device along and after the experimental process. Both patient and caretakers agreed that shorter time consumed to change diapers while using the BASE and non-existent of physiological disorder experienced by both. There is no pain or discomfort experienced by the patient and the caretakers during the task.

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The tray which is used to allocate one single-use diaper is functioned well and the diaper can be immediately placed and ready to be used by patient after being pulled out.

The BASE developed in this study is successfully performed its intended function in reducing the physical effort of nurses to change patient's diapers which indirectly could reduce the risk of WMSDs. In addition, the BASE proved its effectiveness as only one nurse required when changing the diapers using BASE. By using the element of mechanical counterbalance systems and ergonomic tools, the BASE mechanical structure also able to support the patient's body weight by transferring the assistive force/torque from actuators to the patients and help them regain the mobility. The results of this study could be used as a reference by the related industry to reduce the risks of WMSDs among nurses and patient handlers as well.

IV. CONCLUSION

Based on the results obtained from this study, it can be concluded that BASE is an efficient tool to be used by nurses or patient handlers in order to reduce the risk of risks WMSDs. The BASE provides advantages to ease nurses and patient handlers while changing the bedridden patient diapers. It could reduce the efforts and maintain ergonomics postures of the user as well.

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