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CATEGORISATION OF PEOPLE WITH PHYSICAL DISABILITIES TO HELP WORK IN INDUSTRY

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Abstract

People with disabilities (PWDs) account for about 15% of the world population, and they need to be provided with opportunities for comfortable living. There are reported models to categorise PWDs, but none support to identify their capabilities and limitations. This has limited their employability with their residual capabilities depriving them of an independent life. Literature suggests a multi-dimensional model to enable them to be employed. Thus, the aim of this research was to categorise people with physical disabilities (PPDs) based on their capabilities for performing work activities in industry. First, typical manual work-tasks in industry were identified from work activities prescribed in Pre-determined Motion Time Systems (PMTS). Then, Ranges of Motion (ROM) associated with each of the body regions were captured and refined using a walkthrough and interview approach with Consultant Orthopaedic Surgeons (n = 6) and Prothetists and Orthotists (n = 3). Body regions and joints both in the upper and lower extremities required for performing work activities in industry were identified. Finally, ROM required for performing PMTS activities were mapped by selecting a sample of PPDs (n = 92). This categorisation is expected to be used by potential employers to recruit PPDs based on their residual capabilities to perform work-tasks, identify training needs of PPDs and to decide on assistive devices and special facilities to help them independently carry out work activities. Further research is needed to use the categorisation in an industrial setting to evaluate its feasibility as a tool to help recruitment of PPDs.

Keywords: People with physical disabilities, range of motion, employment

INTRODUCTION

People with disabilities (PWDs) constitute 15% of the world population (Guimarães, 2015, WDR, 2011 and Mirrales et al., 2007). Literature suggests that PWDs are willing to work if they are recruited to organisations (Newton et al., 2007). Citing from previous research (Chen and He, 1997), two-thirds of PWDs desire to work if appropriate job opportunities are available. Thus, it is clear that PWDs need to be provided with necessary support and guidance to work effectively (Abeykoon et al., 2013 and Chi et al., 2004).

Disabilities modify activities of the daily lives of the PWDs, but do not destroy their ability to work (Doyle, 1987) and therefore discussions have been in existence since mid-20th century regarding employment of PWDs (Aytac et al., 2012). However, literature reveals that neither employers nor the PPDs know their potential contribution to organisations since both parties do not have a thorough idea of capabilities and limitations of PWDs (Chen & He, 1997 citing Tompkins, 1993). By reviewing previous research, Chi et al. (2004) list the beliefs of colleagues and superiors about limited work performance ability of PWDs. For instance, people in wheelchairs are unproductive or lacked efficiency (Pointer and Kleiner, 1997); employment and training of PWDs is a tough task (Guimarães, 2015). Therefore, employment of PWDs in organisations has to be facilitated. In order to facilitate recruitment, the employers need to be able to identify capabilities and limitations of the recruits (Vincent-Onabajo and Malgwi 2015, Abeykoon et al., 2013). Guimarães (2015) also stresses that it is important to understand

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the interaction between PWDs and the elements of work systems.

With the intention of improving the chances of employing PWDs in industry, models to categorise PWDs, namely, medical model, social model and stigma model (Sairam, 2008 and Thanem, 2008) have been researched. Rejecting the above three models, embodied model (Thanem, 2008) is identified as useful for accommodating disability in diversity management research since this recognises bodily aspects of disability in workplace. There are also employment models for PWDs in practice: subsidised, sheltered, designated and supported (Skedinger and Widerstedt, 2007 and Barnes, 1992). These are further categorised into seven models of employing PWDs (Aytac et al., 2012): quota system, sheltered workshops, self-study method, employment of the disabled without the obligation of employers, working at home, cooperative working method and employment in selected jobs where only disabled people are employed. However, none of the aforementioned models support to identify their capabilities and limitations in performing industrial activities. Furthermore, there is the common notion that the cost and energy spent on vocational training have a negative impact despite the education and training being provided for PWDs leading towards employability (Yusof et al., 2014). These have limited their employability depriving them of an independent life.

With the intention of improving the ability of a portion of PWDs to work in industry, this research study aims to categorise people with physical disabilities (PPDs) based on their capabilities and limitations to perform manual work-activities in industry. The objectives were to: identify typical manual work-activities prevalent in industry, determine body regions/joints and the ranges of motion (ROM) required to perform the manual work-activities, and to categorise PPDs with respect to their ability to perform the manual work-activities.

METHODOLOGY

The study was carried out in three phases. In the first phase, typical manual work-activities were selected from methods-time measurement (MTM) 1 and MTM 2, which are commonly known as predetermined motion time systems (PMTS) (ILO, 1992, Mundel, 1981, and Barnes, 1968). They were then refined with 20 rounds of discussions with Industrial Engineers (n = 2).

In the second phase, body regions/joints and their ROM, which are useful for carrying out manual work-activities were identified through a literature review and then refined in 20 steps by consultant orthopaedic surgeons (n = 6), and prosthetists and orthotists (n = 3) who were selected using a snow-balling sampling approach. The set of body regions/joints and their ROM were evaluated at the end of each step by another consultant orthopaedic surgeon who acted as a moderator. The final document was observed for concurrence by all the participants.

After obtaining ethical clearance from the Medical Research Institute (MRI) of Sri Lanka, in the third phase, a pilot study was carried out using PPDs (n = 3) and minor adjustments were made to the study protocol. Then the full-scale study involving PPDs in their working age (18-55 years) who had both congenital and acquired physical disabilities having only non-progressive, orthopaedic and mobility impairments (n = 92) was carried out. In this study, anthropometric (using a set of Harpenden anthropometers) and ROM (using a JAMAR set of goniometers) data of disabled or deformed body regions (i.e. length discrepancy, limb loss, angular displacement and rotational displacement) were obtained. Deformity or disability conditions in both upper and lower extremities were identified and recorded. After recording the ROM of body regions/joints affected by the disabilities of all participants, they were categorised according to work-activities that can be performed despite the residual disability. This was performed through direct observations and unstructured interviews with the orthopaedic surgeon who acted as the moderator in phase 2 of the study.

RESULTS

According to MTM 1 classification, reach, move, turn, apply pressure, grasp, position, release and disengage were identified as manual work-activities performed by the upper extremity. From MTM 2, get, re-grasp and crank were added to the list of work-

activities. Grasp/get activity was further divided into no grip, power grip, precision grip and power and precise grip. Identified activities performed by the lower extremity were step climbing, step walking, ankle and foot motions (machine pedalling).

Ten body regions/joints in the upper extremity which are important to perform manual work-activities (i.e. shoulder, elbow, forearm, wrist, joints of thumb, index finger, middle finger, ring finger and little finger) were identified. The four body regions/joints identified in the lower extremity were hip, knee, ankle and foot.

In the sample of PPDs, there were 40% with disabilities in the upper extremity only. It was 39% for the disabilities in the lower extremity only. There were 29 PPDs with congenital and 46 PPDs with acquired disorders. The remaining 17 PPDs were amputees. Among the 92 participants, disabilities were found in 245 body regions/joints. The participants had 1819 instances of limited or no ROM useful for work.

Table 1 summarises the disabilities that were present among the sample of PPDs and lists the corresponding work-activities that can be performed with the residual disabilities. For instance, there were 17 subjects with deformities in the shoulder. None of them were able to perform any activity, which required the shoulder since they all have limited or no shoulder ROM. However, they were capable of performing manual work-activities that do not involve shoulder movement.

Table 1: Work capability analysis of study participants

Deformed body region/joint	No. of instances	Work capabilities (for upper extremity)
Shoulder	17	Turn, apply pressure, percussive, sustained, hammering/ tapping, cylindrical gripping, spherical grip, disc grasping, screw-driving, fingertip gripping, pinch gripping, key grip, complex (pen), claw grip, re-grasp, position, release and disengage.
Elbow	23	Percussive, sustained, hammering/ tapping, spherical grip, disc grasping, fingertip gripping, pinch gripping, complex (pen), re-grasp, crank, stirring, position, release and disengage.
Forearm	23	Percussive, sustained, hammering/ tapping, spherical grip, disc grasping, fingertip gripping, pinch gripping, complex (pen), claw grip, re-grasp, crank, stirring, position, release and disengage.
Wrist	30	Spherical grip, disc grasping, fingertip gripping, claw grip.
Thumb	35	Reach, move, turn, sustained.
Index finger	33	Reach, move, turn, apply pressure, release and disengage.
Middle finger	30	Reach, move, turn, apply pressure, disc grasping, pinch gripping, key grip, re-grasp, crank, stirring, release and disengage.
Ring finger	28	Reach, move, turn, apply pressure, disc grasping, screw-driving, shearing, fingertip gripping, pinch gripping, key grip, complex (pen), re-grasp, crank, stirring, release and disengage.
Little finger	25	Reach, move, turn, apply pressure, percussive, sustained, hammering/ tapping, spherical grip, disc grasping, screw-driving, shearing, fingertip gripping, pinch gripping, key grip, complex (pen), re-grasp, crank, stirring, release and disengage.
Lower extremity	36	Reach, move, turn, apply pressure, percussive, sustained, hammering/ tapping, cylindrical gripping, spherical grip, disc grasping, screw-driving, shearing, fingertip gripping, pinch gripping, key grip, complex (pen), claw grip, re-grasp, crank, stirring, position, release and disengage.

By further scrutinising collected data, it was found that out of the 92 PPDs that participated in the study, 16% were unable to perform any form of physical work-activities, which means that 84% were capable of performing one or more manual work-activities.

DISCUSSION

Currently both employers and employees with physical disability face difficulties in employment of PPDs. On one hand, the employers are not clear on mapping the available work-activities with capabilities and limitations of PPDs. On the other, PPDs do not know the work-activities that they can perform in industry. Supporting this, Guimarães (2015) explain that despite the attempts to employ PWDs in workplaces, employment percentage remains low. This research fills this gap by attempting to categorise a sample of PPDs based on their ability to perform typical manual work-activities.

There are two categories of physical disabilities identified as congenital and acquired (Bonnici et al., 2009 and Pointer and Kleiner, 1997). However, the effect of these to ROM necessary to carry out work is similar. Body movements of human anatomical regions/limbs occur around movable joints and each movable joint allows certain types of movements, which are useful in physical activities (Pandey and Pandey, 2009, Martini and Bartholomew, 2000, Hignett and McAtamney, 2000, Sanders and McCormick, 1993 and Schoenmarklin and Marras, 1993). ROM of joints and static anthropometric data are useful in determining work-space envelope (Chung and Wang, 2009 and Sanders and McCormick, 1993). This provides justification for considering people with both congenital and acquired disabilities together in this study.

Ten body regions were identified as essential for carrying out manual work-activities in the upper extremity and the limitations of a given participant was categorised based on the ROM. ROM is defined as the amount of movement through a particular plane that can occur. It dependents on the bone structure of the joint, amount of bulk (muscle or other tissue) near the joint, and elasticity of muscles, tendons and ligaments around the joint (Pandey and Pandey, 2009, Martini and Bartholomew, 2000, Hignett and McAtamney, 2000, Sanders and McCormick, 1993 and Schoenmarklin and Marras, 1993). Therefore, using ROM as an indicator of disability is justified.

It was sometimes difficult to identify body regions/joints of persons with congenital physical disability based on their deformity, limitations in angular rotation of bones and dislocation of joints. This was due to adaptation of the body to carry out manual tasks. Therefore, measurement of the muscle power on top of the ROM (James, 2007 and Florence et al., 1992) for cumulative assessment of anatomical movements of the human body in order to fully judge a disability can be important. However, obtaining the muscle power grading needs specialised knowledge and has practical difficulties. Thus, the parameters identified in this multi-dimensional model were only anthropometric information and ROM.

One other limitation of the study is the consideration of only PPDs. The assessment of the ability to engage in manual work of people with other forms of disabilities such as nervous, visual and auditory requires different test batteries and was considered as beyond the scope of this research. In addition, it was thought that employing people with other forms of disabilities to carry out manual work-activities can be dangerous and give rise to health and safety related issues.

CONCLUSION

In the current study to categorise people with physical disabilities, there were 63 subjects with acquired and 29 with congenital disabilities. Nine participants with congenital physical disabilities had disabilities in both upper and lower extremities. Out of 92 study participants, disabilities were found in 245 body regions/joints. Although they had 1819 limited or no ROM useful for work, they are able to carry out a part of typical work-activities in industry with their residual capabilities. The findings provide impetus for further research to formulate guidelines for the employers to identify and evaluate capabilities of people with physical disabilities in performing specific jobs. However, other parameters such as social and psychological factors of PPDs also need to be researched in order to verify their ability to engage in manual work-activities.

Out of the 92 participants, 84% were capable of performing one or more work-activities carried out by the upper extremity.

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