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Ergonomics Within the Workplace: an Occupation Based Injury Prevention Program for Computer Users

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ERGONOMICS WITHIN THE WORKPLACE: AN OCCUPATION BASED INJURY PREVENTION PROGRAM FOR COMPUTER USERS

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Certification

We hereby certify that this Capstone project, submitted by Jessica Maxwell conforms to acceptable standards and is fully adequate in scope and quality to fulfill the project requirement for the Doctor of Occupational Therapy degree.

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This project, written by Jessica Maxwell under direction of Dr. Dana Howell and Dr. Renee Causey-Upton, Faculty Mentors, and approved by members of the project committee, has been presented and accepted in partial fulfillment of requirements for the degree of

DOCTOR OF OCCUPATIONAL THERAPY

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Executive Summary

The occurrence of work-related injuries is an ongoing factor that will continue to be a risk for computer workers. This is due to high computer usage and the problematic motions of repetition, forceful exertion, awkward posture, contact stress, and vibration; however, these injuries can be prevented. Implementation of ergonomic programs by occupational therapists (OTs) for computer workers promotes efficiency and productivity, employee perception of injury risk, and overall knowledge of ergonomics. This capstone project was developed to identify risk factors and promote the implementation of ergonomics for office workers. This mixed-methods study design utilized a pre/post survey, and two risk assessments, the VDT Workstation Checklist and the W1 Basic Screening Tool, to determine if ergonomic training would improve the employees' perceptions of risk for injury, and knowledge of ergonomics within the workplace.

The project was designed using the Person, Environment and Occupation (PEO) Model. The participants were selected from a convenience sampling method using an email with flyer attachment. The results were obtained from the pre/post surveys, the VDT Workstation Checklists, and the W1 Basic Screening tools and then analyzed and organized into charts/graphs. No perceived barriers were identified towards implementation of an evidence-based ergonomic program. The participants implemented ergonomic changes into their workstations, along with utilizing stretches, which improved their perceived work efficiency and overall health and wellness. The project results support the use of ergonomic programs for computer workers as an effective method for injury prevention.

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CERTIFICATION OF AUTHORSHIP

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Student's Signature: Jessica Maxwell

Date of Submission: 5/12/17

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SECTION ONE: NATURE OF PROJECT AND PROBLEM IDENTIFICATION

Introduction

In the United States (U.S.) in 2015, the Bureau of Labor Statistics (2016) recorded approximately 2.9 million nonfatal workplace injuries. In 2013, approximately 705,800 work-related injury cases were reported to the Bureau as a result of overexertion or repetitive motion (Bureau of Labor Statistics, 2016). The Bureau (2016) indicated that 92,576 of the reported individuals were injured due to repetitive motions related to grasping, typing and/or key entry. Work-related injuries have been on the rise. In 1996, there were more than 647,000 American workers who encountered serious work-related injuries due to poor body mechanics and repetitive motions (Kedlaya, 2014). In 2001, there were 1.5 million cases involving days away from work because of work-related injuries (Brody, Letourneau, & Poirier, 1990). In 2005, approximately 200,000 Americans suffered from work-related injuries due to inadequate design of their work environments (Goodman, Landis, George, McGuire, Shorter, Sieminiski, & Wilson, 2005). Arbesman, Lieberman, and Thomas (2011) noted "more than 4 million recordable cases of nonfatal work-related injuries occurred in 2007" (p. 10). These injuries caused employers to lose unfavorable amounts of revenue, with an estimated "$15-20 billion in workers' compensation costs and $45-60 billion in indirect costs" (Kedlaya, 2014, para 5). Poor workplace safety may result in occupational injuries, increased medical expenses for the employer, decreased productivity, and poor job satisfaction (Loisel et al., 2002). The need for prevention is significant, in order to decrease the amount of reported injuries by decreasing on-the-job risk factors.

As computer use has increased within the workplace, there has also been a corresponding rise in health issues due to overexertion and repetitive strains (Shikdar, Khadem, & Al-Harthy, 2008). This issue of work-related injuries will continue to occur within the workplace, especially for computer workers. Common injuries found among high-use computer workers include visual strain, carpal tunnel syndrome, and repetitive strain (Berner & Jacobs, 2002). The use of poor body mechanics during computer work tasks compromises the health and wellness of many workers, potentially causing musculoskeletal disorders such as carpal tunnel syndrome (Waersted et al., 2010). According to Bernaards, Ariens, and Hildebrandt (2006), neck pain and upper extremity symptoms were the most common injuries reported by computer workers who accumulated many work hours at the computer. High volumes of repetition, poor workstation design, poor lighting, and improper tools all contributed to the fatigue, discomfort, performance level, and injury of office workers (Shikdar, Khadem, & Al-Harthy, 2008). This results in occupational injuries, increased costs of workers' compensation pay and medical expenses, lost wages, job loss, decreased work productivity, decreased job satisfaction, and time-off (Kedlaya, 2014).

Shikdar and colleagues (2008) found there has been a significant correlation between workplace design and employee health and productivity. Gainer (2008) highlighted that claims cost in relation to computer use and upper extremity disorders was 80% higher than other worker's compensation claims. The problem of work-related injuries may result in hidden or indirect costs such as material damage, administrator's time, wage costs, production losses, and other intangible costs (Brody, Letourneau, & Poirier, 1990). In short, preventable work-related injuries among high computer-users have a steep cost to employers and workers. According to Goodman and his colleagues (2005), "ergonomic principles at the computer workstation may reduce the occurrence of work related injuries commonly associated with intensive computer use" (p. 53).

The Occupational Safety and Health Administration (OSHA) define ergonomics in its simplest form as "the study of work" (OSHA, 2000, p. 1). More explicitly, ergonomics is "the science of designing the job to fit the worker, rather than physically forcing the worker's body to fit the job" (OSHA, 2000, p. 1). Ergonomics involves examining how a person is performing their job, in order to prevent injury. Ergonomics also provides workplace and/or equipment modifications to increase efficiency, safety, comfort, and health (Gainer, 2008). Ergonomically designed office workstations can play a vital role in the health and wellness of workers. Professionals with a background in biomechanics, physiology, psychology, kinesiology, anthropometry, and/or industrial hygiene are key links to adapting tasks, tools, equipment, and workstations (OSHA, 2000). These specialists range from industrial engineers, ergonomists, occupational safety workers, to health professionals. Occupational therapists (OTs) are among those health professions who can aid in reducing physical stress and eliminating and/or reducing risk of work-related injuries. Occupational therapists may implement ergonomic programs for injury prevention due to the growth of high computer usage in office workers (Gainer, 2008).

Addressing work-related injuries can decrease risk of further injury, while also increasing knowledge of ergonomic safety and worker perception of their work productivity. These kinds of changes are appropriate for and can be initiated by an OT (Goodman et al., 2005). The profession focuses on "assisting people to engage in daily life activities that they find meaningful and purposeful" (AOTA, 2014, p. 610). Occupational therapy is a profession that has the capability of assessing all meaningful performance areas of occupation with clients. The performance areas assessed by OTs include activities of daily living (ADLs), instrumental activities of daily living (IADLs), education, play, leisure, social participation, and work (AOTA, 2014). Like many other health care professionals, OTs focus on providing services that are client-centered, delivered in an efficient and cost-effective manner, and supported by evidence (Arbesman, Lieberman, & Thomas, 2011). Within the context of work, many OTs have implemented programs in order to aid in preventative and efficient methods for client-centered practice. For example, a transitional return-to-work program, completed by Kaskutas, Gerg, Fick, and Dorsey (2012) was designed for OTs to aid individuals with illness and/or injury with their resumes, while also offering training of actual job tasks within rehabilitation environments. With this program, the OTs made recommendations to physicians detailing modified work for each person (Kaskutas, Gerg, Fick, & Dorsey, 2012).

The American Occupational Therapy Association's (AOTA) Work and Industry Special Interest Section (WISIS) committee developed a specific framework to describe the work and industry area of practice (Bade & Eckert, 2008). The framework states that "work is seen as a meaningful occupation that spans nearly all populations and practice settings" (Jaegers, Finch, Dorsey, & Ehrenfried, 2015, p. 1). Work is categorized as "an occupation, with multiple aspects including employment interests and pursuits, employment seeking and acquisition, job performance, retirement preparation and adjustment, volunteer exploration, and volunteer participation" (AOTA, 2014, p. 612). The basic areas of focus for work and industry practice include: evaluation and education, rehabilitation for returning to work, and injury prevention and ergonomics; health/wellness, preparation, accommodation, and adaptation (Jaegers, Finch, Dorsey, & Ehrenfried, 2015). The AOTA WISIS offers a list of ergonomic services that could be provided by an OT. These services include "anthropometric/biomechanical analysis, identification and elimination of accident and injury risk factors, job task analysis, work modifications, tool, worksheet, and equipment design and modification, education and training for managers and employees, and help comply with the American's with Disabilities Act," among others (Gainer, 2008, p. 5).

The profession of OT has been involved with injury prevention and treating musculoskeletal disorders since World War I and World War II (Bade & Eckert, 2008). Treatment of these injuries by OTs enabled soldiers to return to work after the war (Bade & Eckert, 2008). Work has always been a domain of occupational therapy; however, direct involvement of the profession with ergonomics has recently become more evident (Gainer, 2008). Both professions require knowledge of human anatomy and physiology, as well as being able to analyze, modify, and adapt environments and/or equipment (Gainer, 2008). Occupational therapists are "highly skilled in work rehabilitation, injury prevention, and ergonomic services" (Bade & Eckert, 2008, p. 5). Occupational therapists are knowledgeable of proper body mechanics, and may be educated in the ergonomics of "fitting a job to a person," making them more than capable of training others to successfully address change (Bade & Eckert, 2008; OSHA, n.d.).

Problem Statement

Although OTs are well equipped to address prevention of injury for office workers, minimal research has been done by OTs to assess preventable computer worker injuries and/or office settings. Berner and Jacobs (2002) expressed the need for more information regarding ergonomic programs and the health behaviors of the workers, stating "proper computer workstation ergonomics training is not readily available" (p. 193) for workers. Computer workers may have limited resources to improve their knowledge of preventing injury. Therefore, this study addressed work place safety and common risk factors of injuries among office workers who engage in computer work.

Purpose of the Project

The purpose of this descriptive study was to assess changes in employee knowledge related to the prevention of work place injury following a short ergonomic training program, and to assess the employees' risk factors, body mechanics, and working conditions.

The study was conducted by an OT within the Human Resources Department of a large manufacturing company, which employs computer workers. The employees work to recruit and replace employees, train staff, acquisitions, conduct interviews in person and by telephone, as well as maintain high levels of documentation. It was expected that some motions that would be seen among the office workers would include repetitive motions of the neck fingers/hand/wrist, and arms, contact stress, awkward postures, and force. It was also anticipated to see problems with the workers' physical setting, including poor seating, computer monitor setup, and use of workspace accessories.

This descriptive study design utilized a pre/post survey, the VDT Workstation Checklist, and the W1 Basic Screening Tool to determine if ergonomic training would improve the employees' perceptions of risk for injury, productivity perceptions, and knowledge of ergonomics within the workplace.

Project Objectives

This study 1) assessed the change in employee knowledge related to the prevention of work place injury through ergonomics and healthy practices (using a pre/post survey); 2) assessed the employees' risk factors and body mechanics of repetition, force, awkward posture, contact stress, and vibration while observing each participant performing their job duties (using the W1 Basic Screening Tool); and 3) assessed the employees' working conditions, seating, keyboard, monitor, and workspace (using the VDT Workstation Checklist). These findings will benefits the employees as well as the employer by offering insight to poor workstation design that could directly inhibit productivity and increase risk of injury.

Theoretical Frameworks

This study was based on the Person, Environment, and Occupation (PEO) model (Law, et al., 1996). According to the PEO model, there is a direct relationship between an individual's ability to engage in occupation, the occupation itself, and the environment. The inter-relationship between person, environment, and occupation means that challenges, constraints, and facilitators to one area may impact one or both of the other two areas. In this project, the PEO model provided a foundation for guiding the study design and worker interventions. The workers were assessed for injury prevention within their natural work environment while performing their work occupation. The researcher was able to demonstrate how OT intervention, in the form of ergonomic training and recommendations for improving the workspace, was focused on the person, the occupation, and the environment in order to optimize their occupational performance (Law, et al., 1996). The model was used to analyze how each component of the person, environment, and occupation were relatable.

Significance of the Study

Occupational therapists should increase involvement with ergonomics in the workplace. As OTs continue to make great strides within the workforce, the primary goal of supporting the health and participation of a person's life through engagement in occupation will be fulfilled (AOTA, 2014). The study portrayed the need for healthier and safer ergonomic work environments by the measurement of the outcomes of the program. The study also offered healthcare outcomes to promote health and wellness of workers, including injury prevention. Lastly, the study provided a baseline and a model for healthcare delivery for future studies.

Summary

In summary, this project of enhancing workplace safety offered great influence on the facility, workers, employer, as well as the OT profession. It is important to address the need for ergonomic design and body mechanics, in order to positively influence employee knowledge of ergonomics, perceptions of work productivity, and injury prevention. Using the PEO model assisted in shaping the project while, identifying the issues for computer workers. This mixed methods study promoted an opportunity to stimulate positive outcomes for computer workers. The study also offered the opportunity for OT to show increased involvement with ergonomics in the workplace, while meeting the needs of the workers. Addressing the high computer usage, body mechanics, and the ergonomic design of workstations was anticipated to positively influence the health and wellness of the workers.

SECTION TWO: REVIEW OF THE LITERATURE

This literature review includes information regarding ergonomics, its policy, and penalties for employers failing to abide based on the Occupational Safety and Health Administration (OSHA). The section also covers the profession of occupational therapy (OT) being involved with ergonomics, the history of the involvement, and the relation of the practice to ergonomics. Typical injuries, statistics, concerns related to excessively using the computer, and how this can lead to musculoskeletal disorders (MSDs) are expressed. The review also highlights the screening instruments used for the study and the model in which the study was based upon.

Ergonomics

Ergonomics is a multidisciplinary field consisting of professionals with diverse backgrounds and practices. Professionals involved with ergonomics range from psychology, kinesiology, engineering, and occupational and physical therapy backgrounds (Leyshon & Shaw, 2008). According to Leyshon and Shaw (2008), ergonomics is defined as "the study and process of designing and/or modifying tools, materials, equipment, work spaces, tasks, jobs, products, systems, and environments to match the abilities, limitations, and social needs of human beings in the workplace" (p. 49). It is predominantly geared towards preventing MSDs within the workplace (Leyshon & Shaw, 2008). The overarching goal of ergonomics is to "match the job to the worker instead of the worker to the job" (Gainer, 2008, p. 5). This ultimately results in worker efficiency, comfort and health, and safety (Gainer, 2008). In order to provide ergonomic training, the professionals have to have an understanding of both function and limitations of the human body, along with basic engineering principles (Gainer, 2008).

Standard Policy for Ergonomics Programs

OSHA formalized a standard policy for ergonomics programs. OSHA's standard "requires employers to respond to employee reports of work-related MSD's or signs and symptoms of MSD's that last seven days after you report them" (Porter, 2013, p. 29). Employers are required to give a copy of the OSHA standard and training within 14 days of hiring and 11 months for current employees (Siegel, 2001). Implementation of ergonomics programs depends upon actual verbal reports and/or signs and symptoms of MSDs of a worker (Siegel, 2001). If no one reports any signs/symptoms of MSDs, then the standard only requires that employers provide employees with basic information of how to recognize and report symptoms of MSDs (Siegel, 2001). This basic level of information must include what the common MSDs are along with their signs and symptoms and job functions associated with them (Siegel, 2001). The employer is responsible for determining if the reported MSD or signs/symptoms of a MSD is connected to the job (Porter, 2013). The employer is also responsible for providing the employee with the opportunity to contact a health care professional, at no cost and giving the employee work restrictions as needed (Porter, 2013). According to the standard, an employer's wages and benefits must be protected, while performing light duty work or on temporary absence while recovering (Porter, 2013). After MSDs are reported, the employer is required under the standard to assess the job using a Basic Screening Tool to determine if the position exposes the work to potential risk for injury (Porter, 2013). Employers may attempt fixing the issues themselves or hire an ergonomic consultant to assess and implement on-the-job safety.

Sanctions and Penalties

All general industries are mandated to abide by the standard rule of OSHA (Porter, 2013). OSHA has the authority to penalize any employer who violates the safety and health standards. This is done through a citation process (Siegel, 2001). Penalties range from zero categorized as "other than serious" violations to $7,000 per violation for "serious" violations, and up to $70,000 per violation for intentional or repeat violations (Siegel, 2001).

Occupational Therapy and Ergonomics

AOTA defines OT as "skilled treatment that helps individuals achieve independence in all facets of their lives" including skills of work functioning (Gainer, 2008, p. 5). The Occupational Therapy Practice Framework: Domain and Process describes the profession of OT as contributing "to promoting health and participation of people, organizations, and populations through engagement in occupation" (AOTA, 2014, p. 266). Although ergonomics is involved with many professions, OT proves to be very capable of providing successful ergonomic programs for work industries (Bade & Eckert, 2008). Occupational therapists have the capacity to be trained in providing effective preventative ergonomic programs for work industries due to their multifaceted background.

History of Occupational Therapy in Ergonomics

Occupational therapy has been involved with ergonomics in different capacities for many years, but there is still much room for growth. Occupational therapy's involvement with ergonomics relates to when OTs assisted in developing industrial rehabilitation programs within mental health settings in the early 1900's (Gainer, 2008). This occurred after physically and mentally injured soldiers participated in vocational rehabilitation and work-evaluation programs in preparation to return back to work after World War I and World War II (Gainer, 2008). During the 19^{th} century is when ergonomics and OT were named. The fields of ergonomics and

OT closely correlate in purpose, although they remain separate professions. Both professions require activity analysis, knowledge of disease processes, human physiology and kinesiology, as well as environment and equipment modification (Gainer, 2008).

Relating Occupational Therapy Scope of Practice to Ergonomics

In industrial settings "occupational therapists can work directly in the workplace as they help prevent injuries and help workers return to work after an injury" (Gainer, 2008, p. 6). Occupational therapy knowledge and expertise is strongly related to engagement in occupation, injury prevention, and how engaging in occupations can be used to affect human performance along with the effects of diseases and disabilities (AOTA, 2002). This correlates to the skills of an ergonomist as they too are knowledgeable in how human performance can be affected by diseases and disabilities while focusing on prevention.

The Practice Framework (AOTA, 2014) can be utilized to justify OT's involvement in ergonomics. The Framework highlights all performance areas of occupation, including the category of work. Occupation is defined as "goal-directed pursuits that typically extend over time, have meaning to the performance, and involve multiple tasks" (AOTA, 2014, p. 628 as cited by Christansen & Townsend, 2005, p. 548). Work is defined as "activities needed for engaging in remunerative employment or volunteer activities" (AOTA, 2014, p. 676 as cited by Mosey, 1996, p. 341). This domain of work includes job performance (AOTA, 2014). The Framework also identifies intervention approaches which are a focus of the OT profession. These approaches include health promotion, remediation/restoration, maintenance, compensation/adaptation, and disability prevention (AOTA, 2014).

Context is also "recognized in the occupational therapy service delivery process as an important underlying influence on the process of service delivery" (Harvison, 2003, p.3).

According to the Framework, the context of a client highly influences their performance and the practitioner's ability to deliver the appropriate services (Harvison, 2003). The Framework also highlights that OT's focus is on aiding individuals to engage in daily life activities or occupations that are meaningful and purposeful to them (AOTA, 2014). With working individuals, it is well within the scope of OT to implement performance changes that support their work engagement. The domain of OT supports the engagement in meaningful occupations that links to affecting the overall health, life satisfaction, and well-being of individuals (AOTA, 2014). Occupational therapists are educated on understanding engagement from a holistic perspective as all aspects of performance are addressed through intervention, such as physical and cognitive (AOTA, 2014). This can contribute to the knowledge and skills used when addressing work environments and the needs of workers. Occupational therapists are experts in addressing performance issues with a person's ability to engage in occupations (AOTA, 2014).

Typical Injuries Associated with Computer Work

Computer workers are susceptible to working in awkward body postures and performing the same or similar tasks in repetition. Repetitive motions can be defined as performing an activity over and over again or doing something repeatedly for a period of time (Merriam-Webster, 2017). Performing tasks in repetition often lead to MSDs and/or damage to tendons, ligaments, nerves, or joints (OSHA, n.d.). Awkward body postures can be defined as positions of the body including limbs, back, and joints deviating from the neutral position while performing job tasks (Environmental Health & Safety, 1995). According to the Environmental Health and Safety Association (1995) "Awkward posture is the primary ergonomic risk factor to which employees are exposed when the height of working surfaces is not correct" (p. 1). An example an of awkward posture would be bending or twisting the torso, neck, wrist, or back from low or distant locations (OSHA, n.d.). Maintaining a static posture for prolonged periods of time can cause pooling of blood as well as muscle fatigue and stress (OSHA, n.d.). These postures and motions can cause stress on the muscles and tendons of the body, leading to injury or MSDs (OSHA, n.d.).

The OSHA standard defines MSDs as a "disorder of the muscles, nerves, tendons, ligaments, joints, cartilage, blood vessels, or spinal discs affecting the neck, shoulder, elbow, forearm, wrist, hand, abdomen (hernia only), back, knee, ankle, and foot" (Siegel, 2001, p. 5). MSDs exclude injuries arising from tripping, slipping, falling, blunt trauma, and motor vehicle accidents (Siegel, 2001). OSHA identifies examples of MSDs which include ligament sprains, spinal disc degeneration, muscle strains and tears, joint and tendon inflammation, and pinched nerves (Siegel, 2001). Common symptoms of MSD's include pain, cramping, stiffness, burning, tingling, and numbness (Porter, 2013).

Computer Workers

The use of computer technology and users are modernizing the U.S. workplaces and their use will continue to rise in the future (Ortiz-Hernandez, Tamez-Gonzalez, Martinez-Alcantara, & Mendez-Ramirez, 2003). For example, in 2016, more than 88% of the U.S. population used computers (Bureau of Labor Statistics, 2016). In 2013, more than 86% used computers at work (Bureau of Labor Statistics, 2013). This percentage doubled since the year 2000, when approximately 43% used computers at work (Bureau of Labor Statistics, 2000). The cost of claims in relation to computer usage and upper extremity injuries are 80% higher than other workers' compensation claims (Gainer, 2008).

According to the United States Census Bureau in 2005, "77 million Americans used computers each day for data entry and data processing at work accounting for 55.5% of total employment" (Bureau of Labor, 2005, p. 2). As the population continues to grow with computer users, research shows that musculoskeletal injuries will increase secondary to improper computer postures and prolonged use for static periods of time. In 2000, there were over 240 thousand workplace injuries reported within the United States, not including the individuals who leisurely use personal computers within their homes (Berner & Jacobs, 2002).

According to Middlesworth (2015), the average adult spends 50-70% of the work day sitting which can link to serious health challenges and costs. The author also found that MSDs represent approximately one-third of all injury costs within U.S. businesses (Middlesworth, 2015). Middlesworth (2015) proposed the importance of implementing office ergonomics programs in order to reduce the amount of injuries and costs seen within U.S. businesses. The findings of a study revealed that computer users increased their risk of developing MSDs due to the increase of mouse use, prolonged periods of sitting, psychosocial factors, and inadequate and/or uncomfortable sitting postures (Hernandez, Tamez-Gonzalez, Martinez-Alcantara, & Mendez-Ramirez, 2003).

Occupational therapy researchers Berner and Jacobs (2002) performed a pilot study using self-reports through an anonymous Internet survey. The survey revealed that over 70% of the 55 respondents experienced symptoms secondary to excessive computer use. These participants ranged from ages 21 to 65 and spent an average of 5.3 hours during a typical workday at the computer. The study also reported that even though 60% of the respondents had previous exposure to workstation ergonomics information, "less than 10% reported implementing their knowledge of computer workstation ergonomics in their tasks" (Berner & Jacobs, 2002, p. 193).

In the late 1990s, problems of psychosocial issues secondary to high computer use became prevalent (Smith, 2002). Prolonged computer usage has also been associated with contributing to both mental and physical health problems; however, there has been very little done for work conditions to improve psychosocial work environments for computer users (Smith, 2002).

Some studies have been conducted demonstrating some benefits of implementing ergonomics within the workforce. One study done at a university in the western part of the U.S. by Van de Bittner (2008) found that ergonomic interventions decreased time loss during work by 75% along with a 55% reduction in costs from work related injuries. Another study done by Gainer (2008) showed a benefit of an overall prevention program within a local company in North Little Rock. The health of employees increased as related to a dramatic decrease shown in overall costs of workers compensation (Gainer, 2008).

Health Concerns Related to Excessive Computer Use

Many health concerns are related to excessive computer usage. Some issues and complaints include excessive fatigue, headaches, stress, eye strain and irritation; muscle pain, blurred vision, and arm, back, and neck pain (Jensen, Finsen, Soggard, & Christensen, 2002). A research article by Jensen and colleagues (2002) showed that these symptoms can result from complications with the equipment, office environment, work stations, or job design, and/or from a combination of these.

Using a computer characterized by repetitive movements may always put workers at risk for musculoskeletal symptoms (Jensen, Finsen, Soggard, & Christensen, 2002). A study involving 11 Danish companies with 3,475 participating subjects found that full-time computer workers had symptoms associated with their necks, shoulders, and hand/wrists (Jensen, Finsen, Soggard, & Christensen, 2002). The authors also found that all work tasks involving using the computer experienced a higher frequency of movements resulting in more injuries than those who worked at desks without computers (Jensen, Finsen, Soggard, & Christensen, 2002). Another study done by Gerr, Monteilh, and Marcus (2006) identified a correlation between upper extremity symptoms and disorders and hours of computer use per day. The researchers found that many computer workers place the keyboard above elbow level, have increased amounts of head rotation, and repetition of moving hands and arms resulting in links between high reports of symptoms and disorders and prolonged computer usage over two hours (Gerr, Monteilh, & Marcus, 2006).

Musculoskeletal Disorders

Musculoskeletal disorders affect the muscles, blood vessels, nerves, tendons, and ligaments (OSHA, n.d.). Reoccurring MSD injuries for office workers often include tension neck syndrome, carpal tunnel syndrome, and low back pain (Siegel, 2001). Other common disorders include trigger finger, tendinitis, rotator cuff, muscle strains, low back injuries, and bursitis (OSHA, n.d.). These injuries are typically triggered by repetition, contact stress, force, and awkward postures (Siegel, 2001). For example, working with the elbow in a bent position for prolonged periods of time can irritate the nerves and tendons of the forearm leading to epicondylitis (OSHA, n.d). Work related MSDs are among the most frequently reported causes of lost work time (OSHA, n.d.). Overall, MSDs related to work account for 29% of all U.S. injuries within the work place (Eerd et al., 2015). In Ontario, Canada, MSDs accounted for $3.3 billion in costs and $12 billion in direct and indirect costs for employers (Leyshon & Shaw, 2008). Of the reported workers with MSDs, many end up with chronic disabilities as a result (Leyshon & Shaw, 2008). A study revealed neck and shoulder symptoms had a significant impact on computer workers who worked greater than 6 hours per work day (Klussmann, Gebhardt, Liebers, & Rieger, 2008).

Visual Problems

Many issues can derive from excessive amounts of static computer use. One issue that nearly 60 million people suffer from globally is computer vision syndrome or CVS (Ranasinghe, et al., 2016). CVS can result in a reduction of work productivity along with reduced quality of life for the worker (Ranasinghe et al., 2016). In a study sampling Sri Lankan computer workers, 2,210 office workers were selected to complete a self-administrated questionnaire in 2009 (Ranasinghe et al., 2016). The questionnaire documented any symptoms pertaining to CVS, associated factors, and socio-demographic information. As a result of the study, the researchers found that there were several independent variables that resulted in a high prevalence of CVS. According to the researchers, "female gender, longer duration of occupation, higher daily computer usage, pre-existing eye disease, not using a video-display terminal (VDT) filter, use of contact lenses, and higher ergonomics practices knowledge" were all associated with having a significance with the presence of CVS (Ranasinghe et al., 2016, p. 10).

Visual problems such as eye irritation and eye strain are amongst the most frequently reported complaints by computer operators (Ranasinghe et al., 2016). Visual symptoms can result from glare from the computer screen, improper lighting, and poor positioning (Ranasinghe et al., 2016). Consequently, many may need corrective lens in order to avoid headaches and eye strain (Ranasingh et al., 2016).

Fatigue and Musculoskeletal Problems

Work performed at computers may require sitting still for substantial periods of time and typically involves small frequent movements of the eyes, head, arms, and fingers (Ranasinghe et al., 2016). Holding a fixed posture over long periods of time may cause muscle fatigue that can eventually lead to muscle pain and injury (Ranasinghe et al., 2016). Computer operators are also subject to a potential risk of developing musculoskeletal disorders including carpal tunnel syndrome and tendonitis (Ranasinghe et al., 2016). According to Ranasinghe and colleagues (2016) "early symptoms of musculoskeletal disorders include pain and swelling, numbness and tingling (hands falling asleep), loss of strength, and reduced range of motion". If these symptoms are not treated early, they can result in loss of strength in affected area, permanent disability and/or chronic pain (Ranasinghe et al., 2016, p. 2).

Screening Instruments

VDT Workstation Checklist

The use of the VDT (Visual Display Terminal) Workstation Checklist is beneficial to this study as it offers the opportunity to assess all aspects of a computer desk, chair, computer, mouse, and posture. This checklist has been designed by OSHA to assist in evaluating what is needed for ergonomic workstations for computer users (Spiegel, 2002). The purpose of the checklist is to provide guidance in identifying workstations that may be modification and identifies how these stations can be redesigned (Spiegel, 2002). In a study conducted by Mehrparvar and his colleagues (2014) they were able to signify the ease and use of OSHA's VDT tool to prove a reduction in MSD complaints one month after intervention with office workers.

W1 Basic Screening Tool

The W1 Basic Screening Tool is provided by OSHA. It is a beneficial tool to use in order to gain insight on awkward postures, repetition, vibration and duration; force and other specific sections of computer workstations. This tool displays each primary MSD risk factor. It highlights whether or not a job poses the risk of potential MSDs (Spiegel, 2002).

Theoretical Model: Person, Environment, Occupation Model

The PEO model is an established conceptual model of practice, particularly within Canadian occupational therapy. This model offers a foundation for guiding the project and interventions. It is an inexpensive tool that provides a theoretical foundation for the study. PEO consists of person, environment, and occupation. Therapists are able to demonstrate how intervention is directed for the person, the occupation, and the environment in order to optimize occupational performance (Law, et al., 1996). It also exemplifies how each component relates to the other. The model can be used to analyze, theorize, and identify solutions to occupational performance issues and things restricting participation (Broome, Mckenna, Fleming, & Worrall, 2009). Researcher Carlsson found the model impactful while using during a methodological study of measuring how well environments facilitate occupational performance (Broome, Mckenna, Fleming, & Worrall, 2009). According to Law and his colleagues (2016) occupational performance results from a dynamic relationship between people, their occupations/roles, and the environments in which they work, play, and live. Additionally, using the tool ensures that the therapeutic relationship attends not only to the person, which health care systems can highlight, but also the environment and the occupation (Cramm, 2003).

Summary

In conclusion, this literature review provided evidence-based research studies and statistics of ergonomic, its linkage to the profession of OT, and common issues and concerns for workers who excessively utilize computers. The screening tools and model identified within the literature review were used as the source of completing and supporting the project. The literature and research found provided support for the concept of preventing and/or decreasing risks of on-the-job injuries for office workers using ergonomics. The research findings also provided evidence-based practice for OT's capability of implementing ergonomic programs within the work context. The next section will discuss the methods used for the project including the design of the project, setting, participants, ethical considerations, and outcome measures.

SECTION THREE: METHODS

Project Design

This mixed-methods study design utilized a pre/post survey, the VDT Workstation Checklist, and the W1 Basic Screening Tool to determine if ergonomic training would improve the employees' perceptions of risk for injury and knowledge of ergonomics within the workplace. The objectives of this capstone project were to:

1. Assess the change in employee knowledge related to the prevention of work place injury through ergonomics and healthy practices (using a pre/post survey).
2. Assess the employees' risk factors and body mechanics of repetition, force, awkward posture, contact stress, and vibration while observing each participant performing their job duties (using the W1 Basic Screening Tool).
3. Assess the employees' working conditions, seating, keyboard, monitor, and workspace (using the VDT Workstation Checklist).

The assessments, training, and in-service took place on March 3rd and April 3rd of 2017. The amount of days was based upon the estimated amount of all eligible workers participating.

Setting

The study was conducted by an occupational therapist within the Human Resources (HR) Department of a large manufacturing company in Birmingham, Al. This department consists of computer workers who perform at least six hours of computer documentation within an eight hour work schedule. The workers also work to recruit and replace employees, train staff, workman's compensation, as well as conduct interviews in person and by telephone. Due to the nature of their work, it was expected that the workers would commonly engage in repetitive motions of the neck, fingers/hand/wrist, and arms. They may also experience contact stress, awkward postures, and force. It was also expected to see poor seating, poor monitor setup, and poor use of workspace accessories. According to the Centers for Disease Control and Prevention's (CDC) National Institute for Occupational Safety and Health (NIOSH), work conditions and these problematic motions including prolonged flexed postures can lead to work-related injuries (Integrity HR, 2015). This site was selected because it did not yet incorporate ergonomic programs within the department and because the job duties highly rely on computer usage. This offers increased opportunity to observe and promote body mechanics and ergonomics within the department.

Recruitment of Participants

The entire HR department along with the senior vice president were initially contacted in January of 2017 to explain the purpose of the project and to recruit participants. The eligible participant population included approximately 26 computer workers of both male and female gender. The workers ranged from ages 25 to 65 years of age and worked within an 8 hour day shift at individually assigned desks. Job titles included director, receptionist, talent manager, workers compensation manager, safety coordinator, compliance director, talent acquisition specialists, and benefits representatives. The department also housed a project manager, benefits coordinator, system administrator, and health and productivity specialist.

To recruit participants, an initial contact was sent by email with an attached flyer to every eligible worker within the HR department (see Appendix A). This information was circulated by the department receptionist. The email explained the purpose of the study, the benefits, incentives, lack of hindrances of daily work tasks, and the anticipated dates of the study. It also explained that non-participants would not be treated any differently than those participating, nor would participating affect anyone's employment. After review of the email and flyer, it was requested that each individual respond with a “yes” or “no” regarding their acceptance or decline of participation. Those who responded “yes” to the email agreeing to participate were identified for the study. The researcher’s contact information was also extended for the opportunity for any questions or concerns.

Neither age, ethnicity, nor gender was an inclusionary factor. Any eligible participants that had scheduled days off during the days of the study were excluded. Any workers currently receiving workman’s compensation for a job related injury and/or any type of occupational or physical therapy were also excluded.

Ethical Considerations

Expedited institutional review board approval for this study was obtained from Eastern Kentucky University on February 22, 2017 (see Appendix B). The purpose of the project was fully disclosed and participants signed an informed consent letter prior to participating in the study. Participation in the assessment was voluntary, and there were no penalties for lack of participation. The primary researcher was responsible for seeking the informed consent of the participants (see Appendix C).

To avoid any potential risk related to confidentiality, no personal identification, such as name, birthday, or address was collected through the use of observation or survey. No images were taken of any employees. Each eligible participant was assigned a research number which was their only identifying marker on the surveys. It was explained to each potential participant, as well as to management, that no information would be revealed to the employer except in aggregate form. It was also expressed that management would not mandate their participation nor would anyone be treated differently for lack of participation.

This project was voluntary and presented minimal risks to the participants. Those possible risks included physical injury, while performing proposed stretches taught during body mechanics if done inappropriately. In order to minimize the potential risk of injury while performing stretching and body mechanics, the occupational therapy researcher first demonstrated each move slowly and with verbal description prior to the worker engaging. The risk of physical harm being done while an employee was stretching was deemed reasonable in relation to the anticipated benefit of increasing knowledge of ergonomics, decreasing risk of injury, increasing job satisfaction, and productivity.

The entire HR department was offered snack incentives each day of the study. All incentives were funded by the researcher. The participants did not hold any financial obligations towards the study.

Outcome Measures

Pre/post Survey

A pre/post survey containing basic demographic questions regarding age, previous injury, and time spent at work, as well as questions regarding initial understanding and knowledge of ergonomics, and knowledge related to the prevention of work place injury through ergonomics and healthy practices was developed by the researcher. The use of the pre/post surveys were used to obtain a baseline of each participant's perspectives on their individual workstations, perceptions of obtaining injuries on-the-job, and knowledge of ergonomics. With the pre/post survey, the researcher was able to compare the data in order to assess if a positive change occurred.

The survey was reviewed by two additional OTs knowledgeable in ergonomics prior to pilot study. The survey was pilot tested prior to the study, by administering to five OTs who perform computer-based work for at least three hours of their scheduled work day. They were chosen also due to their understanding of ergonomics. These researcher solicited their feedback about the content and form of the survey. Four out of five reviewers reviewed the surveys. The results of the pilot study revealed all questions were pertinent to the participants, were phrased clearly, and flowed well for easy completion. Three of the reviewers responded with no foreseen issues or changes needed; however, one reviewer recommended minimal changes. Those changes included adding an explanation of how to fill out the surveys at the top of the first page and breaking two part questions into individual questions. These recommendations were implemented prior to distributing the surveys to the participants. See Appendix D for the pre/post-survey.

W1 Basic Screening Tool

The W1 Basic Screening Tool, also provided by OSHA, proved to be beneficial in gaining insight on awkward postures, repetition, vibration and duration; force and other specific sections of computer workstations (Porter, 2013). This tool displayed each primary MSD risk factor, while highlighting if the job posed as a risk for potential MSD's. With this tool, the researcher was able to provide each participant feedback regarding poor body mechanics and recommendations for improvement. Please see Appendix E for the W1 Basic Screening Tool.

Video Display Terminal (VDT) Workstation Checklist

OSHA's VDT Workstation Checklist is a standardized assessment used to identify working conditions, seating, keyboard, monitor, and the workspace (Porter, 2013). It was deemed beneficial to this study as it offered a guideline to assess all aspects of a computer worker's workspace. It also posed as a reference to obtain data from each participant. With the use of this checklist, the researcher was able to provide pertinent feedback and suggestions on what was needed to improve the workstations ergonomically. Please see Appendix F for the VDT Workstation Checklist.

Evidence of Site Support

A letter of support by the vice president of the HR department, the notice of approval by the IRB, and the flyer/email for participant recruitment are attached. (Please see Appendix G).

Data Collection

All participants were separated throughout the HR department within their own workstations. Each worker selected a designated time in which their individualized assessments would take place. The pre-survey was distributed to each participant and administered prior to any training, education, or recommendations. This was done to obtain a baseline of knowledge from the participating workers. Pre-surveys were completed without the researcher present during day one of the project. Once all surveys were completed by the participants, the researcher (a licensed OT with certification in ergonomics) assessed each employee's work station and body mechanics individually, while the worker performed their daily job duties, using the W1 Basic Screening Tool and the VDT Workstation Checklist. Assessment time ranged from 15 to 20 minutes for each participant. During observation, the risk factors and body mechanics of repetition, force, awkward posture, contact stress, and vibration were assessed; as well as the working conditions, seating, keyboard, monitor, and workspace. Following assessments, workstation modifications were performed by the researcher ranging from 10 to 15 minutes per participant. During workstation modifications, training was provided including tips on body mechanics and stretches, ergo-breaks, and rearranging workstations and equipment recommendations.

Following all employee participant assessments, a 20 minute department in-service was held in a conference room to discuss aggregate findings, provide education on ergonomics, and review stretching to prevent injury. Suggestions on economic ergonomic changes and the opportunity for any positive or negative comments from the staff regarding ergonomic implementation were included. All participants were invited to attend.

The research team was the only sole obtainers of the data collected. Management and all employees were excluded from having access to the data unless given in aggregate form. Each eligible participant was assigned a research number which was their only identifying marker on the surveys. All informed consent forms were separated from the data and mailed to the researcher's faculty advisor to be maintained in a locked file cabinet. All other data was scanned and emailed with password protection to the faculty advisor for storage. All data scanned will be deleted from the computer within three years. The original hard-copies were destroyed by shredding. Once survey data was electronically inputted into a database, the original forms were destroyed by shredding as well.

After four weeks, the researcher returned to the department to assess if there had been any sustainability of the ergonomic changes. The researcher permitted four weeks between initial assessment, allowing time for the participants to purchase any recommended items and time for working with adjustments made to their workspaces. This was done by observing participants while performing job duties, re-administration of the post-survey, and re-administration of the VDT Workstation Checklist. This assessment only included those participants that made changes to their workstation or healthy habits. Re-assessment using the W1 Basic Screening Tool was not repeated as job requirements remained the same. The findings were analyzed with the previous data and placed into charts.

Data Analysis

The researcher calculated frequency and percentages using Microsoft Excel. The ordinal data was incorporated into charts to demonstrate the findings. A comparative method was used to summarize the collected qualitative data.

Validity

Validity was enriched during this capstone project through incorporation of a pre/post surveys, as well as through the use of the W1 Basic Screening Tool and the VDT Workstation Checklist. Participants were able to complete this program within their natural work environments, which minimized external validity threats (Nelson, 2006, p. 75). In order to address potential threats to validity, emails and flyers to eligible participants were distributed prior to the start of the study, as an attempt for obtaining a representative sample.

All findings made within this experiment were based solely on the subjective feedback of the workers and their experience prior to and post the intervention. This demonstrated the validity of the findings as they were not altered by the researcher. With the data being solely based on the perceptions of the workers, it was not certain that all subjective feedback was accurate in order to determine the true nature of the study. Some participants may not have answered with integrity and others may have had biased responses based on previous experiences. A potential stressor may be working with a manager who may not be hands on with the workers, in terms of adding any cost-effective changes that may be needed to maximize a prolonged effect of the project; however this proved to not be a stressor for this study.

SECTION FOUR: RESULTS AND DISCUSSION

This mixed-methods study aimed to determine if ergonomic training would improve the employee's perceptions of risk for injury and knowledge of ergonomics within the workplace by using a pre/post survey, the W1 Basic Screening Tool, and the VDT Workstation Checklist. The project explored changes that could be offered and/or recommended for the participants and their workstations. This section provides insight of the results found after implementation of the assessments.

Results

This capstone project identified that ergonomic training improved the employee's perceptions of their risk for injury and their knowledge of ergonomics within their office workspace. These changes were related to the changes self-made and/or maintained by the participants and identified using the pre/post surveys, the W1 Basic Screening Tool, and VDT Workstation Checklist. This section will identify the demographics and the results of each assessment in averages, frequency, and percentages.

Demographics

Fifteen office workers expressed interest in participating in the study; however, two participants did not meet the inclusion criteria. Both participants who were excluded were absent during the first day of assessment. The thirteen participants signed and returned the informed consents on day one of the assessment prior to intervention. Demographic data was gathered from each participant using the pre-survey form. Each participant was asked to select their age range, gender, number of years they worked as an office worker, and the number of hours they worked each day at the computer.

There were 10 female participants and 3 males. Four (N=4; 31%) of the participants ranged in age from 25-34 years old; two (N=2; 15%) of the participants ranged in age from 35-44 years old; three (N=3; 23%) of the participants ranged in age from 45-54 years old; and the last four (N=4; 31%) of the participants ranged in age from 55-64 years old. See Table 1 for a description of each participant.

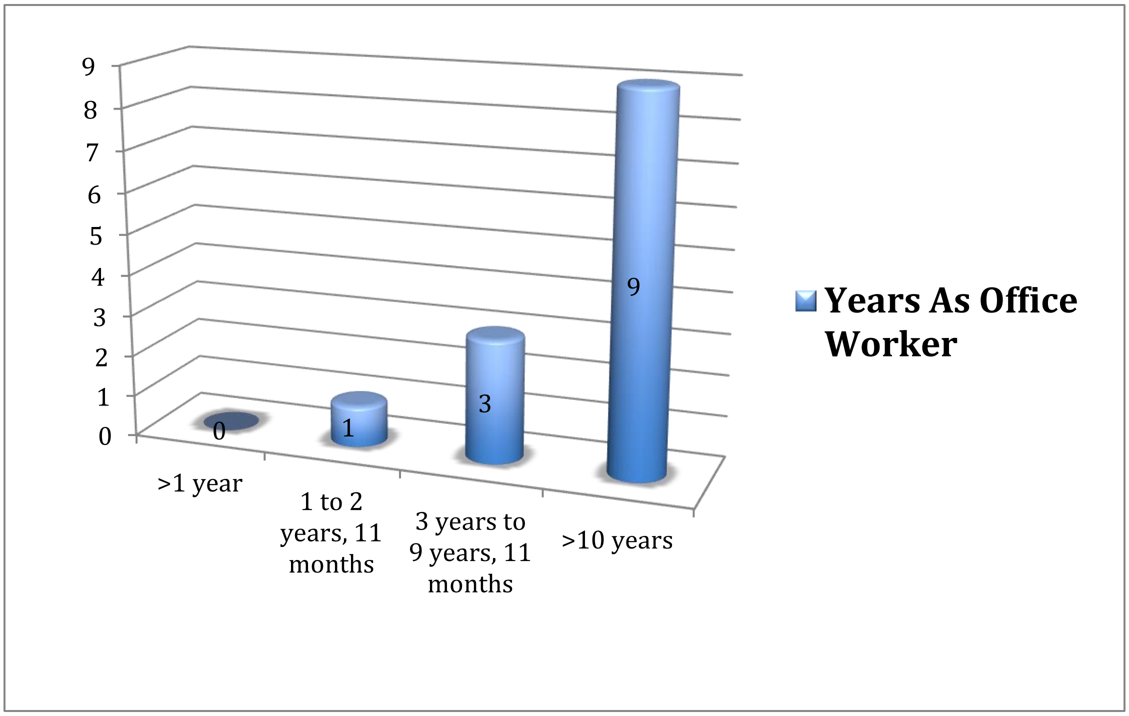
Table 1. Participant Demographics

Participant	**Gender**	**Total years performed work at a desk**	**Total hours of deskwork during a typical work day**	**Amount of ergonomics training in in the past 3 years**
P1*	F	>10 years	6 – 8 hours	5+ hours
P2	F	>10 years	6 – 8 hours	None
P3	F	3 – 4 years	6 – 8 hours	None
P4	F	>10 years	6 – 8 hours	None
P5	M	>10 years	>8 hours	None
P6	M	>10 years	6 – 8 hours	None
P7	F	>10 years	6 – 8 hours	None
P8	F	>10 years	6 – 8 hours	1 to 5 hours
P9	F	>10 years	6 – 8 hours	None
P10	F	3 – 4 years	>8 hours	None
P11	F	>10 years	6 – 8 hours	None
P12	F	1 – 3 years	6 – 8 hours	None
P13	M	3 – 4 years	6 – 8 hours	None

Note: *Participant 1 reported she was responsible for presenting facility training for annual safety and new hires as the safety coordinator.

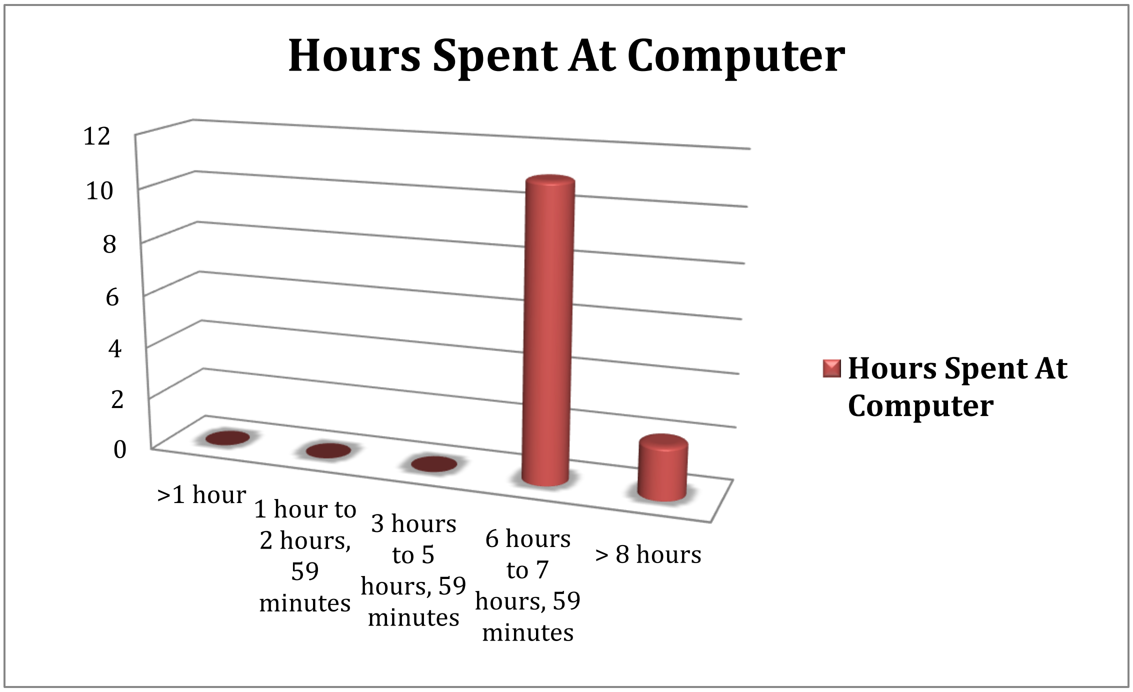
The majority of participants (N=9; 69%) performed work at a desk for more than 10 years. Three (N=3; 23%) performed work at a desk for 3-4 years, and one (N=1; 7%) reported 1-3 years. See Figure 1 for years primarily worked at a desk.

Figure 1. Years Performed Work at a Desk



A total of 11 participants (N=11; 85%) worked an average of 6 hours to 7 hours, 59 minutes each day. Two participants (N=2; 15%) worked more than 8 hours at the computer each day. See Figure 2 for hours each participant typically worked at a desk.

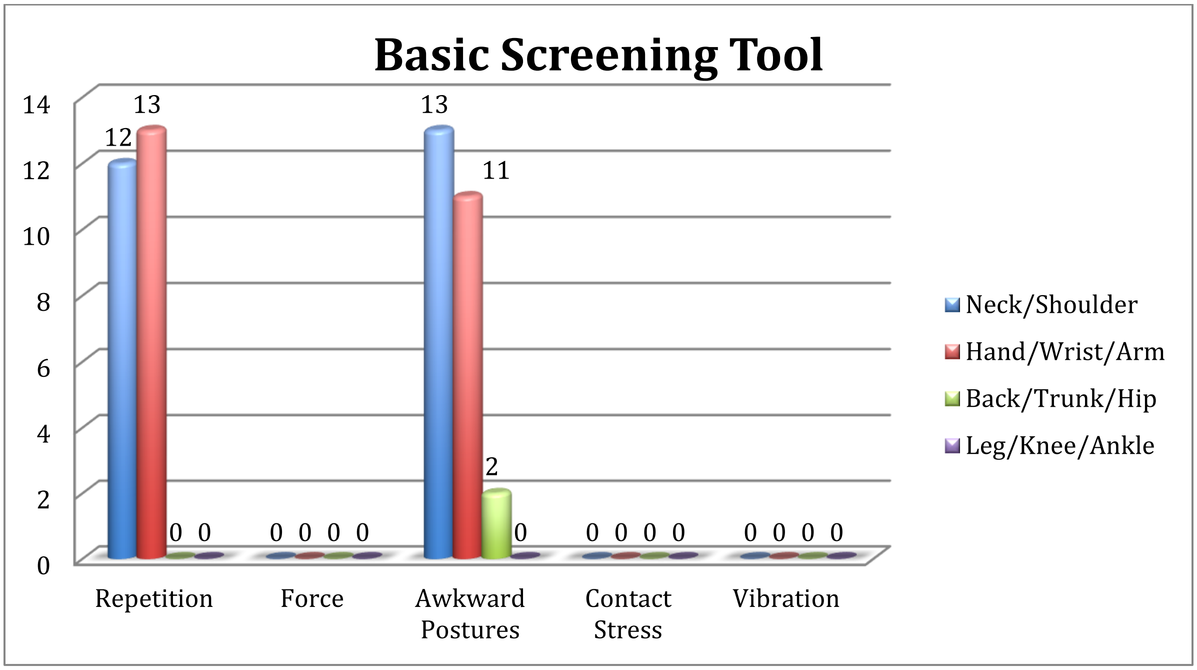
Figure 2. Typical Work Day Hours Spent at Computer Desk



Assessments

Participants were assessed for their risk of injury prior to training using the W1 Basic Screening Tool. The majority of participants' work involved repetitive motions and awkward postures involving the neck, shoulder, hand, and arm. Two participants also had awkward postures involving the back/ trunk/ hip. Although several of the participants had contact stress issues while resting hands on hard surfaces for long periods of time, they did not fall under the Basic Screening Tool category of contact stress. According to the Basic Screening Tool, the risk factor of contact stress is categorized as using the hand or knee as a hammer more than 10 times per hour for more than 2 hours total per day (Porter, 2013). See Figure 3 for the Basic Screening Tool assessment for the identification of the risk factors that could relate to an injury.

Figure 3. Risks Identified using the Basic Screening Tool



The VDT Workstation Checklist was administered before education and training, and again four weeks later. By that time, participants had made substantive changes in their workstations. The pre and post findings from the VDT Workstation Checklist are shown in Table 2. Overall there was an improvement in all participants' working conditions identified on initial assessment. Only two areas that were noted on initial assessment, "Keyboard/input device platform(s) is stable and large enough to hold keyboard and input device", and "Workstation and equipment have sufficient adjustability so that the employee is able to be in a safe working posture and to make occasional changes in posture while performing VDT tasks," were found to have no change from pre to post. Results of the changes in each of the major areas of the VDT Workstation Checklist are shown in Figure 4.

Table 2. Results of Participant Assessment using VDT Workstation Checklist

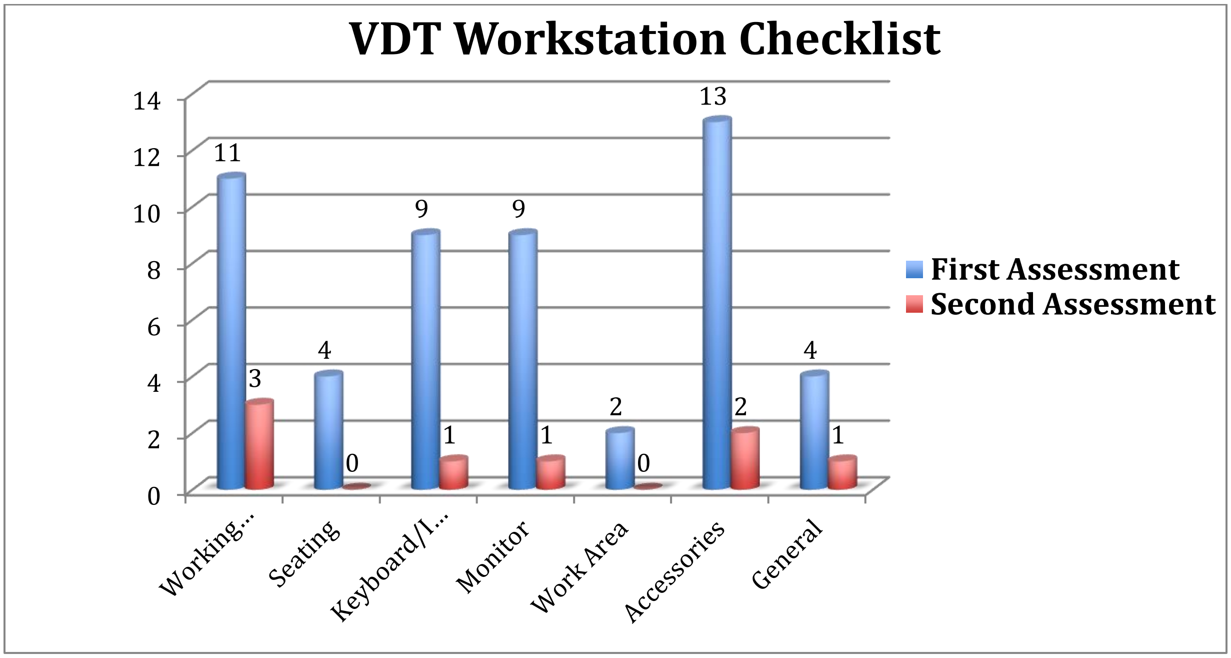
Working Conditions The workstation is designed or arranged for doing VDT tasks so it allows the employee's…	Initial (N=13)	Post (N=13)	Change
Head and **neck** to be about upright (not bent down/back).	9	2	-7
Head, neck and **trunk** to face forward (not twisted).	4	2	-2
Trunk to be about perpendicular to floor (not leaning forward/backward).	0	0	0
Shoulders and **upper arms** to be about perpendicular to floor (not stretched forward) and relaxed (not elevated).	2	0	-2
Upper arms and **elbows** to be close to body (not extended outward).	0	0	0
Forearms, wrists, and **hands** to be straight and parallel to floor (not pointing up/down).	2	0	-2
Wrists and **hands** to be straight (not bent up/down or sideways toward little finger).	6	1	-5
Thighs to be about parallel to floor and **lower legs** to be about perpendicular to floor.	0	0	0
Feet to rest flat on floor or be supported by a stable footrest.	6	0	-6
VDT tasks to be organized in a way that allows employee to vary VDT tasks with other work activities, or to take micro-breaks or recovery pauses while at the VDT workstation.	0	0	0
Seating The chair…			
Backrest provides support for employee's lower back (lumbar area).	1	0	-1
Seat width and **depth** accommodate specific employee (seatpan not too big/small).	1	0	-1
Seat front does not press against the back of employee's knees and lower legs (seatpan not too long).	2	0	-1
Seat has cushioning and is rounded/ has "waterfall" front (no sharp edge).	0	0	0
Armrests support both forearms while employee performs VDT tasks and do not interfere with movement.	2	0	-2
Keyboard/Input Device			

The keyboard/input device is designed or arranged for doing VDT tasks so that…			
Keyboard/input device platform(s) is stable and large enough to hold keyboard and input device.	1	1	0
Input device (mouse or trackball) is located right next to keyboard so it can be operated without reaching.	0	0	0
Input device is easy to activate and shape/size fits hand of specific employee (not too big/small).	0	0	0
Wrists and hands do not rest on sharp or hard edge.	8	0	-8
Monitor The monitor is designed or arranged for VDT tasks so that…			
Top line of screen is at or below eye level so employee is able to read it without bending head or neck down/back. (For employees with bifocals/trifocals, see next item).	6	1	-5
Employee with bifocals/trifocals is able to read screen without bending head or neck backward.	3	1	-2
Monitor distance allows employee to read screen without leaning head, neck, or trunk forward/backward.	6	1	-5
Monitor position is directly in front of employee so employee does not have to twist head or neck.	5	1	-4
No glare (e.g., from windows, lights) is present on the screen which might cause employee to assume an awkward posture to read screen.	3	0	-3
Work Area The work area is designed or arranged for doing VDT tasks so that…			
Thighs have clearance space between chair and VDT table/keyboard platform (thighs not trapped).	2	0	-2
Legs and feet have clearance space under VDT table so employee is able to get close enough to keyboard/input device.	0	0	0
Accessories			
Document holder, if provided, is stable and large enough to hold documents that are used.	6	0	-6
Document holder, if provided, is placed at about the same height and distance as monitor screen so there is little head movement when employee looks from document to screen.	8	2	-6
Wrist rest, if provided, is padded and free of sharp and square edges..	8	0	-8

Wrist rest if provided, allows employee to keep forearms, wrists, and hands straight and parallel to ground when using keyboard/input device.	7	0	-7
Telephone can be used with head upright (not bent) and shoulders relaxed (not elevated) if employee does VDT tasks at the same time.	1	0	-1
General			
Workstation and equipment have sufficient adjustability so that the employee is able to be in a safe working posture and to make occasional changes in posture while performing VDT tasks.	1	1	0
VDT workstation, equipment and accessories are maintained in serviceable condition and function properly.	3	0	-3

On pre-assessment, 12 of the 13 participants had physical changes made to their monitors, chairs, and keyboards. These changes included readjustment of monitors away from light sources and/or tilting up or down, changing chairs out or readjusting up or down, and tilting keyboards up or down and/or readjustment of lap trays. On post-assessment, all participants made changes to their workstations after ordering recommended equipment including wrist pads, mouse pads, lap trays, and document holders.

Figure 4. Number of Participants in Each Major Area of the VDT Workstation Checklist



Survey

The pre-survey findings indicated the initial need for ergonomic intervention for the participants; however, only three (N=3; 23%) participants on the pre-survey acknowledged that their workstations were set up for preventing work-related injuries, working comfortably, and working efficiently. Three (N=3; 23%) participants stated they were undecided. Seven (N=7; 53%) participants perceived their workstations were set up to prevent work-related injuries, eight (N=8; 61%) stated they either strongly agreed or agreed to their workstation being set up to work comfortably and nine (N=9; 69%) reported their workstation was set up to work efficiently.

The post-survey identified substantial changes regarding the perceptions of the participants towards their feelings of their workstations being set up to prevent work-related injuries, working comfortably, and working efficiently. On the post-survey, all (N=13; 100%) reported either strongly agree or agree that their workstations were set up to prevent work-related injuries. Twelve (N=12; 92%) of the participants selected that they strongly agreed or agreed to their workstation being set up to work comfortably, while all (N=13; 100%) acknowledged that their workstation was set up to work efficiently. The sole participant (N=1; 7%) who did not agree that their workstation was set-up to work comfortably reported that upper management was a barrier, because they would not agree to unbolt the computer from the walkway to allow more movement.

On the pre-survey, five (N=5; 38%) of the participants reported having no current pain or discomfort while working and/or after completing their daily job requirements. The other eight (N=8; 61%) participants reported having pain during the initial assessment. The pain they reported ranged in location from back, neck, legs, and arms. On the post-survey following the second assessment, eight (N=8; 61%) of the participants reported having no current pain or discomfort while working or after completion of job requirements. The other five (N=5; 38%) participants reported either having pain that had decreased since the pre-assessment or having chronic pain with chiropractic issues.

On the post-survey, the participants were asked if any changes were made to their workstations in order to decrease their risk of injury. Participants reported changes and additions with wrist pads, chairs, foot rest, mouse pads, lap trays, document holders, and elevating or lowering computer monitors. Some participants gave specific responses in the question of changes or planned changes:

> P1 stated, “Using my keyboard drawer correctly, raising my monitors, and doing some stretching did me a huge favor when I tried the first time; I instantly felt a difference”.

> P2 stated, “I now take breaks at least every two hours and my new wrist pad has made life a little easier”.

> P3 stated, “You gave me the push I needed to stop using my old chair that caused me so many issues and to finally get a new one; my back and neck thank me every time I sit down”.

These responses indicate a deeper understanding of the importance of proper equipment and its use along with its connections to decreasing injury. When asked about the supports within the workplace available for implementing ergonomic changes, all (N=13; 100%) reported management as the key factor. Management was labeled as open and reasonable to all accommodations to ensuring injury prevention. Although eight (N=8; 62%) of the participants stated that they had no barriers towards getting the equipment they need, the other five (N=5; 38%) gave more feedback of their personal issues and concerns:

> P1 stated, “Upper management wants my head to be seen over this wall so that people can see me, but this causes me to sit higher than my screen. They refuse to unbolt my computer making it difficult for me to make the needed changes.”
>
> P2 and P3 stated, “My desk area is too small.”
>
> P4 reported that her barrier to making changes is “her own ignorance.”

All participants reported that the project was helpful to them and that they learned a great deal. Three of the participants gave an explanation to their responses:

> P5 stated, “Yes, I have learned what positions positively affect me and vice versa. I now know to arrange my equipment and move my body rather than my neck.”
>
> P7 stated, “Yes, I already feel less strained in my neck due to raising monitors up about 2” on first encounter.”
>
> P10 stated, “Yes, the assessment noted poor alignment of my workstation causing stress in my neck.”

Bar graphs were used to compare the findings from the pre/post surveys for both assessments. The pre/post survey questions used for this comparison included:

1. I have a good understanding of ergonomics and what it entails (see Figure 5).
2. I feel my workstation is set-up to prevent work-related injuries (includes desk, computer, chair) (see Figure 6).
3. I feel my workstation is set up for me to work comfortably (see Figure 7).
4. I feel my workstation is set up for me to work efficiently (see Figure 8).
5. I currently have/experienced pain or discomfort within the last two weeks (See Figure 9).

Figure 5. Understanding of Ergonomics and What it Entails

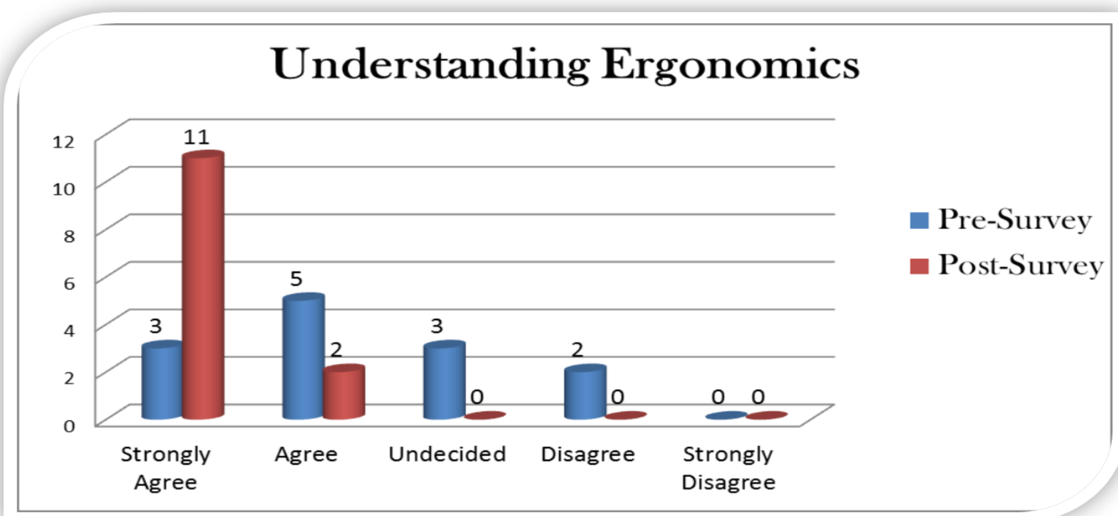


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Figure 6. Workstation Set-up to Prevent Injury

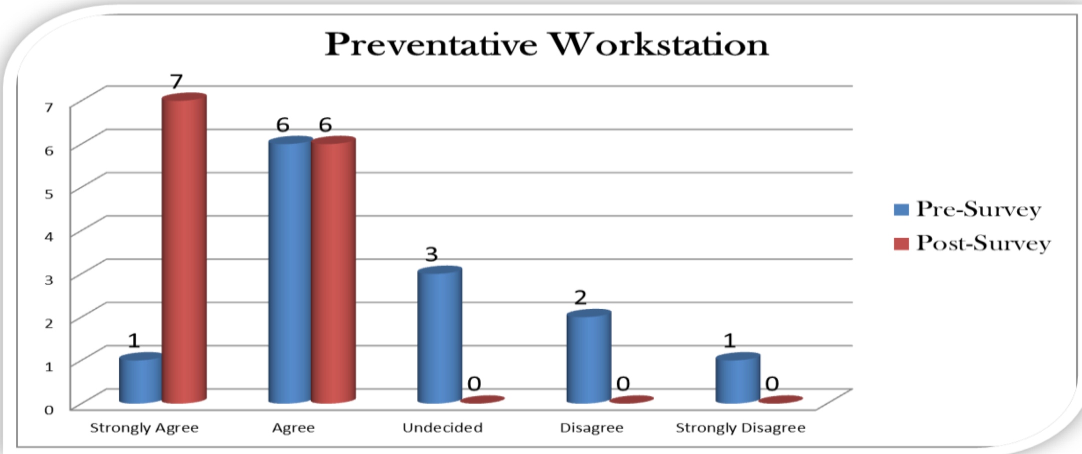


Figure 7. Workstation Set-up for Working Comfortably

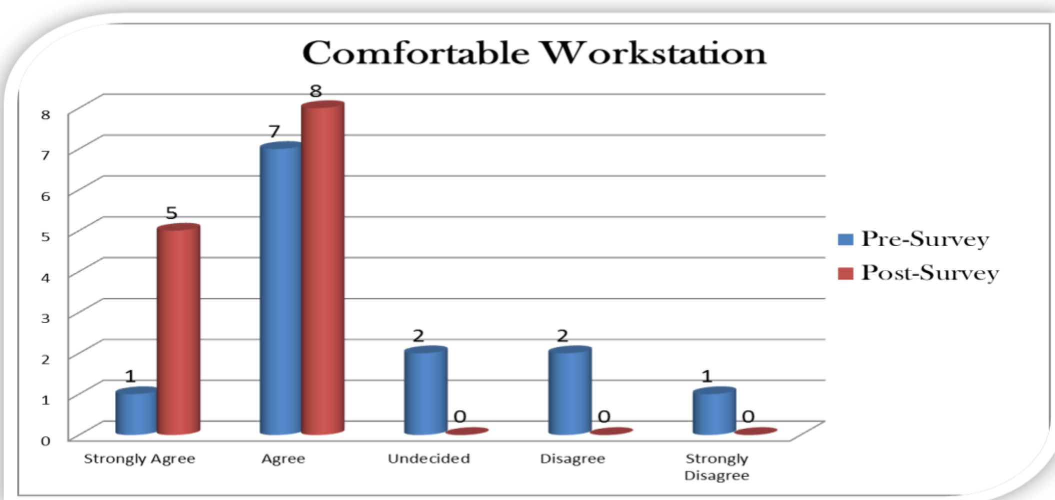


Figure 8. Workstation Set-up for Working Efficiently

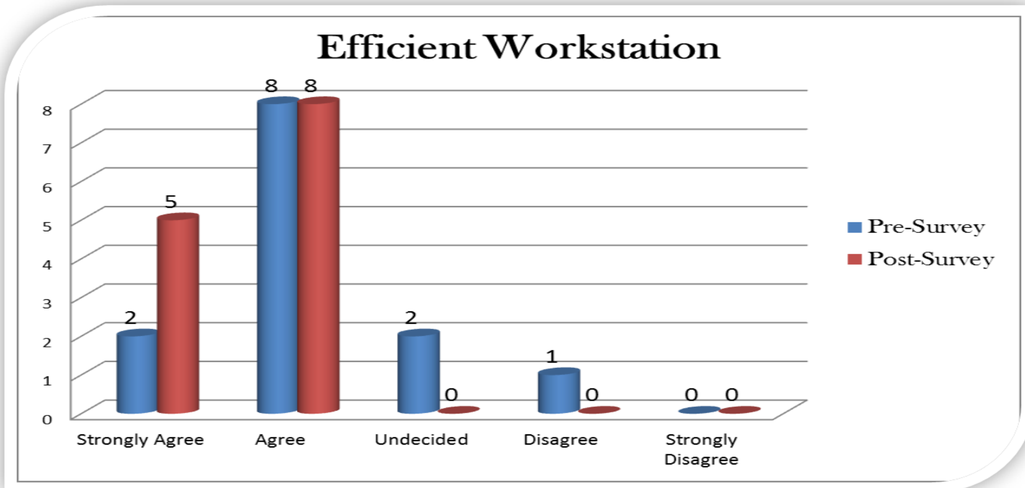
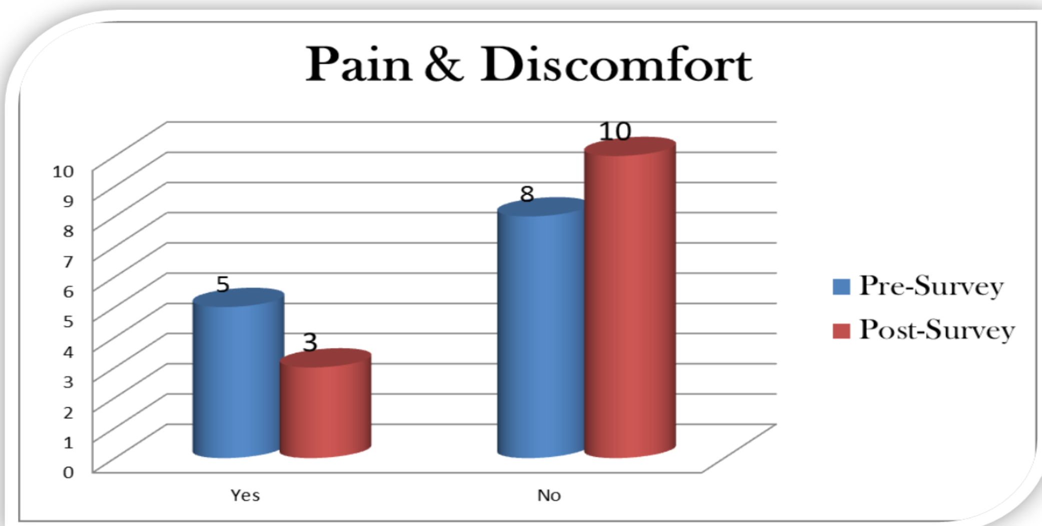


Figure 9. Currently Experience Pain while Working or after Completion of Daily Job Requirements



Note. During the second assessment post-survey, participants who stated yes to pain/discomfort within the last two weeks gave brief descriptions of why. The three of the four participants dealing with current pain/discomfort stems from chronic issues unrelated to the job. Amongst the pain/discomfort areas of the arms and back were issues with the neck with majority of the participants.

Participants were asked if they knew what ergonomics meant (per Likert scale), and then to define ergonomics (via write-in answer). For the question “I have a good understanding of ergonomics and what it entails," eight (N=8; 62%) participants reported a greater understanding. Two (P3 and P5; N=2; 15%) moved from "disagree" to "strongly agree." Three (P2, P4, P9; N=3; 23%) moved from "agree" to "strongly agree." Three (P6, P10, P11; N=3; 23%) moved from "undecided" to "strongly agree." Five (N=5; 38%) had no change. See Table 3 for comparison of definitions of participant's pre and post knowledge of ergonomics.

Table 3. Brief Definition of Understanding of Ergonomics

Participant	Pre-definition	Post-definition
P1	**Strongly Agree** "Frequent breaks to walk/stretch, where to place arms & height of chair/workstation; good posture"	**Strongly Agree** "Frequent breaks to walk/stretch, where to place arms & height of chair/workstation; good posture"
P2	**Agree** "Proper sitting/standing for long times"	**Strongly Agree** "Adjusting my workspace to suit me for long-term health purposes"
P3	**Disagree**	**Strong Agree** "The study of comfort, productivity, to ensure less workplace injury and bodily harm"
P4	**Agree** "Comfort design, functional design to help the human body, productivity, & reduce work related injuries in a workplace setting"	**Strongly Agree** "Adjusting my workplace setting to ensure that I remain injury free"
P5	**Disagree**	**Strongly Agree** "Fitting me to job"
P6	**Undecided**	**Strongly Agree** "Fitting the job to the person"
P7	**Agree** "To make sure your workstation is safe & efficient"	**Agree** "To make sure your workstation is safe & efficient"
P8	**Strongly Agree** "The objective of adapting the workplace to the worker"	**Strongly Agree** "The objective of adapting the workplace to the worker"
P9	**Agree** "Posture and desk set-up has a direct impact on health and productivity"	**Strongly Agree** "Arms should be at 90 degree angle; feet on floor; body should face work; avoid twisting neck; fit job to me"
P10	**Undecided**	**Strongly Agree**

		"Changing your environment around you to fit your body & prevent injury"
P11	**Undecided**	**Strongly Agree** "Making the work environment fit me and not me fitting the environment"
P12	**Agree** "Assessing human behavior and actions in an effort to improve efficiency & effectiveness"	**Agree** "Assessing human behavior and actions in an effort to improve efficiency & effectiveness"
P 13	**Strongly Agree** "A lot of patient positioning and lifting"	**Strongly Agree** "Understanding how my workspace needs to be tailored to me-prevent strain/injury"

Discussion

This project focused on three objectives, with the first being to assess the change in employee knowledge related to the prevention of work place injury through ergonomics and healthy practices (using a pre/post survey). Our study showed that minimal training (20 minutes of group education, plus short individualized training sessions) was effective in improving the workers' perceptions of efficiency, productivity, and risk of injury. The study also increased the knowledge of all participants in relation to ergonomics and injury prevention. Initially, eight of the thirteen participants reported having some understanding of ergonomics and were able to provide a short definition; however, only three of those definitions was accurate. Following the education, all 13 participants reported having a more accurate understanding of ergonomics and what it entails. Overall, they demonstrated an improved ability to define ergonomics, and their definitions contained more specific examples post-education. Berner and Jacobs (2002) also found that employees did not have a good understanding of ergonomics, finding that less than 10% reported implementing their previously learned knowledge of computer workstation ergonomics. Our intervention helped the participants gain an understanding of the importance of ergonomics, how modifications may help prevent future injury, and improve comfort and efficiency. All participants were also able to report preventative methods they used for injury prevention, such as using appropriate body mechanics, taking rest breaks, moving, and stretching. Previous literature has also identified that ergonomics can improve productivity, job satisfaction and risk of injury, such as Goodman et al. (2005), who found that an educational ergonomic program was successful in reducing injury in workers and increasing worker satisfaction. There is also evidence showing that making adjustments in computer workstations helps prevent MSDs. For instance, Van Eerd and his colleagues (2015) reported evidence from a systematic review that implementing stretching programs, workstation adjustments, and ergonomic training has positive effects.

Secondly, the project sought to assess the employees' risk factors and body mechanics of repetition, force, awkward posture, contact stress, and vibration while observing each participant performing their job duties (using the W1 Basic Screening Tool). During pre-assessment of all participants, the W1 Basic Screening Tool highlighted risk factors within the repetition and awkward postures categories. These risk factors were associated with 11 to 13 of the participants' neck/shoulder, hand/wrist/arm, and for two of the participants' back/trunk/hip body parts. Using this tool enabled the researcher to gain an understanding of the job's risk factors along with the association of which body parts, and found these employees to have significant risk of injury. Similarly, a study of 5,630 computer workers found that extended computer work was a factor associated with complaints related to the neck and shoulder (Kiss, Meester, Kruse, Chavee, & Braeckman, 2012). Assessment of risk is an important aspect of prevention of injury.

The final objective of this project was to assess the employees' working conditions, seating, keyboard, monitor, and workspace (using the VDT Workstation Checklist). On pre-assessment, this checklist showed that all categories of the VDT Workstation Checklist signified the need for modification of the participants' computer workstations, including areas such as seating, keyboard, monitor, work area, accessories, and the general safety of the workstations. On post-assessment, the VDT revealed that the majority of recommendations had been implemented. Overall, the study proved to be of benefit for decreasing the perceptions of risk of injury and increasing the workers' knowledge of ergonomics. Another study conducted by an OT and a physical therapist had similar results, finding that 74% of the ergonomic recommendations and at least 59% of the therapists' recommendations were implemented by the company (Goodman et al., 2005). The study also revealed that 85% of the workers reported satisfaction of the ergonomic interventions and also rated their job satisfaction at 70% (Goodman et al., 2005). The physical issues reported by the workers resolved by 81% reporting improvement after one year (Goodman et al., 2005). The program deemed that using preventative methods of education on ergonomics, workstation evaluations, and recommendations for changes can offer positive impact computer workers (Goodman et al., 2005).

Unlike previous research, this study demonstrated minimal to no barriers for implementation of ergonomics. For instance, McLean and Rickards (1998) expressed several barriers they found when attempting to implement ergonomic programs within the U.S., including financial concerns, management refusing to make certain changes, and issues with employees. This study, however, found that all participants were willing and cooperative. They all followed up with ordering and implementing the supplies recommended as they were able, and management was ranked most supportive from all participants. There were also no financial concerns reported regarding ordering equipment.

Strengths

This project included participants who were very cooperative and expressed their excitement to participate. This made it easy for the researcher to request all needed documents, and increased the likelihood that each participant would perform and apply the recommended ergonomic changes. A research article entitled *Ergonomic and OT: Improving Workplace Productivity* suggested that “Employers sometimes hesitate to bring an ergonomics expert onboard to analyze their work site out of fear that implementing changes will be prohibitively expensive” (AOTA, 2014, p. 3). However, when assessing the necessary changes to improve the participants’ workstations, it was found that most changes needed were small and inexpensive. Management and the administrative assistant were very supportive for the researcher and towards ordering the recommended supplies in a timely fashion. This allowed a positive increase in the overall outcome of the project’s findings.

The researcher’s knowledge and certification in ergonomics allowed for ease and increased insight on identifying problem areas and making modifications. In order to provide ergonomic training, the professionals have to have an understanding of both function and limitations of the human body, along with basic engineering principles (Gainer, 2008). Holding a degree in OT also allowed the researcher an advantage on understanding analyzing tasks.

One reason that makes OT qualified to perform ergonomics consultations is their knowledge and education of breaking down tasks (AOTA, 2014).

Limitations

Although the project had several strengths, there were limitations. Limited research was found regarding the role of OT and ergonomics with the computer workers. The lack of evidence made it difficult to formulate a baseline for the project, but also demonstrated a need for OT involvement in this area of research.

The location of the project was a long distance from the researcher, which created challenges in data collection and communication with the site. Because of this, the researcher relied heavily on communication via email for recruitment. The setting of the project held a total of 24 office workers within the department; however, only 15 expressed initial interest. With face-to-face contact for initial recruitment, it is possible more eligible workers would have participated in the study.

Implications for Practice and Healthcare

This capstone project was designed to support the role of OT with computer workers. Improving computer workstation safety with the implementation of ergonomics education to prevent work-related injuries is shown to be a great need for computer workers. The study showed the need for an increase in OT involvement and for implementation of ergonomic programs. Given that this study used just one OT over the course of one day to implement cost-effective ergonomic modifications, incorporating OT within the ergonomic role is both beneficial and feasible. Occupational therapists are trained to perform activity analysis and to use available resources to benefit the client. Occupational therapists are also skilled in assisting individuals to achieve independence and satisfying lives (Gainer, 2008). According to Gainer (2008) “OTs are well prepared to help develop and implement effective prevention programs in a wide variety of settings” (p. 9). Occupational therapists increasing their involvement with ergonomic programs can offer more opportunities for cost-effective programs.

This study has identified that healthier and safer ergonomic work environments can positively impact the perceptions of the workers, and their ability to identify potential risks.

Including OT in ergonomic prevention and education programs may occur at many settings, from the hospital to the work environment. This can increase the follow-up of each person to ensure safe transition to return to work following injury, and ensuring they are physically capable of performing job tasks; as well as decreasing risk of obtaining an injury.

Future Research

We studied employee perceptions and risk factors, not including actual injuries of workers. The researcher plans to follow up with the HR department to determine if any of the participants have been diagnosed with an MSD, and to determine if more intervention is needed. Sustainability of the program may be an issue that needs to be examined. Future research could be conducted with more participants and in areas of work beyond computer use. Finally, the study could be repeated with a control group.

Summary

The implementation of an ergonomic training program was successful in promoting knowledge of ergonomics, along with improving the employee perceptions of risk for injury. The study aided in increasing the overall work safety of office workers and their feelings of comfort and efficiency over a four week period. Being able to identify barriers, supports, and assessment of risk factors enabled the researcher in obtaining a positive outcome. The participants learned how to self-assess their risk factors, proper use of body mechanics, and how to safely implement stretches. The results suggest that OTs implementing ergonomic training programs is an effective way to improve the quality of life work the workforce.

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Appendix A

Email for Obtaining Volunteers

To: Human Resource Department

My name is Jessica Maxwell and I am currently working on my capstone project within the occupational therapy doctoral program at Eastern Kentucky University. My capstone project is entitled Ergonomics Within the Workplace: An Occupation-Based Injury Prevention Program for Computer Workers. With my background as an occupational therapist and recently obtaining certification as an ergonomics assessment specialist; I feel hopeful that I will be able to provide you with a great opportunity for you and your colleagues. I am contacting you in request for your participation within my research study focusing on applying ergonomic changes within your personal workspace. The hope is to increase your knowledge of ergonomics, decrease your risk of job injuries, and increase your work productivity. Great tips on body mechanics and ways to prevent injury. The study will be conducted within your Human Resource Department. It will last approximately three days and will not hinder you from your daily work tasks. The anticipated dates are March 3rd, March 6th and March 10th of 2017.

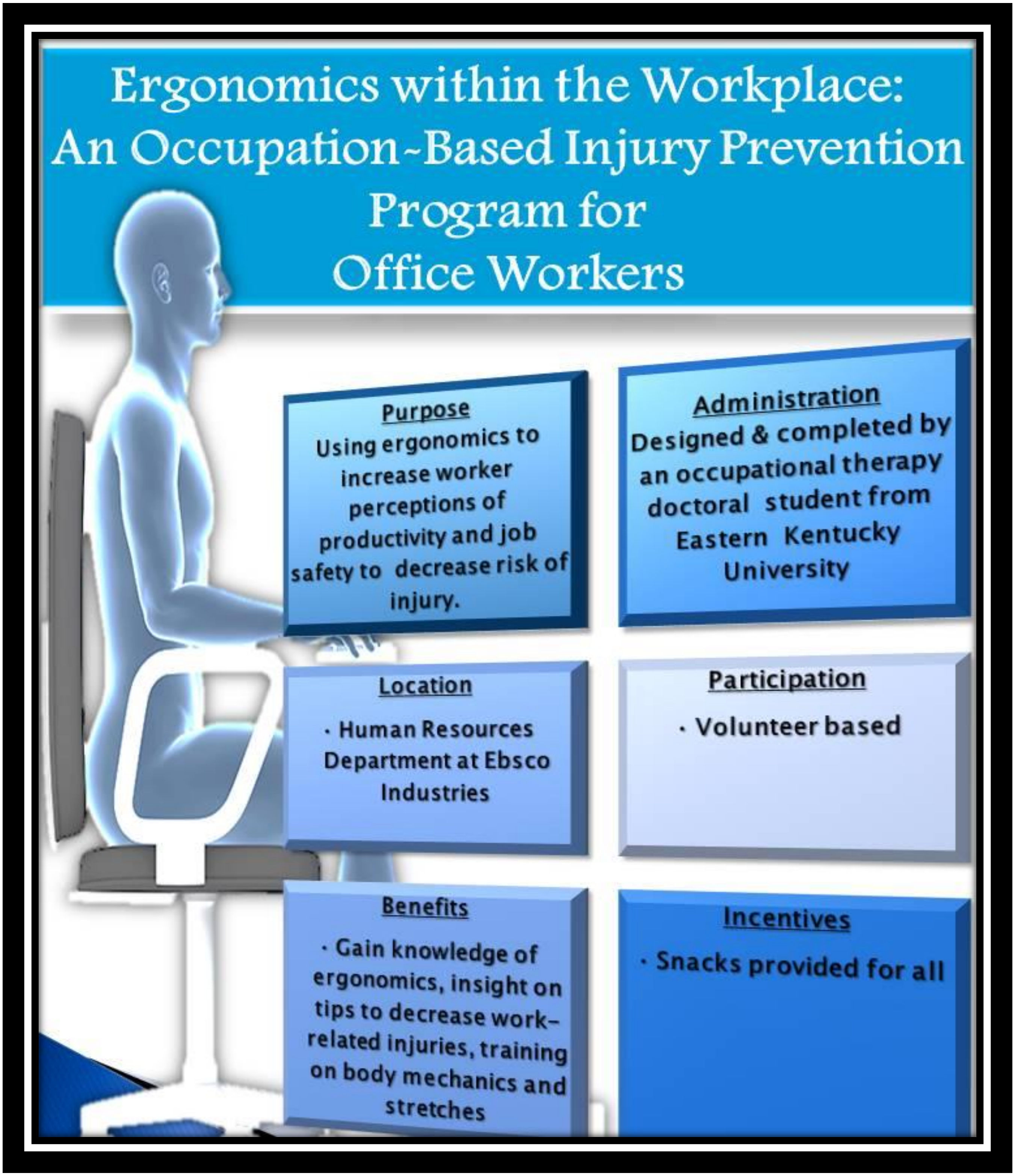
All data gathered will be excluded from everyone including management and/or other employees, unless in aggregate form. Participation or lack thereof, will not affect any job position as you will not be mandated to participate nor will you be treated any differently than those participating. All participation that is requested is voluntary. If you agree to participate now, you will have any opportunity to decline participation before or during the study. Attached is a flyer to review at your convenience. After your review, please feel free to respond with any questions, concerns, or simply requesting more information.

It would be appreciated if you will respond to this email with a “YES” or “NO” regarding your participation NO LATER THAN MARCH 1, 2017.

I hope to hear from you soon!

Best regards,

Jessica T. Maxwell, OTR/L, CEAS


Ergonomics within the Workplace:
An Occupation-Based Injury Prevention
Program for
Office Workers
Purpose
Using ergonomics to increase worker perceptions of productivity and job safety to decrease risk of injury.
Administration
Designed & completed by an occupational therapy doctoral student from Eastern Kentucky University
Location
· Human Resources Department at Ebsco Industries
Participation
· Volunteer based
Benefits
· Gain knowledge of ergonomics, insight on tips to decrease work-related injuries, training on body mechanics and stretches
Incentives
· Snacks provided for all

Appendix B

Graduate Education and Research
Division of Sponsored Programs
Institutional Review Board

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NOTICE OF IRB APPROVAL
Protocol Number: 000648

Institutional Review Board IRB00002836, DHHS FWA00003332

Review Type: ☐ Full ☒ Expedited

Approval Type: ☒ New ☐ Extension of Time ☐ Revision ☐ Continuing Review

Principal Investigator: **Jessica Maxwell** Faculty Advisor: **Dr. Dana Howell**

Project Title: **Ergonomics within the Workplace: An Occupation Based Injury Prevention Program for Office Workers**

Approval Date: **2/22/17** Expiration Date: **2/1/18**

Approved by: **Dr. Rachel Williams, IRB Member**

This document confirms that the Institutional Review Board (IRB) has approved the above referenced research project as outlined in the application submitted for IRB review with an immediate effective date.

Principal Investigator Responsibilities: It is the responsibility of the principal investigator to ensure that all investigators and staff associated with this study meet the training requirements for conducting research involving human subjects, follow the approved protocol, use only the approved forms, keep appropriate research records, and comply with applicable University policies and state and federal regulations.

Consent Forms: All subjects must receive a copy of the consent form as approved with the EKU IRB approval stamp. You may access your stamped consent forms by logging into your InfoReady Review account and selecting your approved application. Copies of the signed consent forms must be kept on file unless a waiver has been granted by the IRB.

Adverse Events: Any adverse or unexpected events that occur in conjunction with this study must be reported to the IRB within ten calendar days of the occurrence.

Research Records: Accurate and detailed research records must be maintained for a minimum of three years following the completion of the research and are subject to audit.

Changes to Approved Research Protocol: If changes to the approved research protocol become necessary, a description of those changes must be submitted for IRB review and approval prior to implementation. Some changes may be approved by expedited review while others may require full IRB review. Changes include, but are not limited to, those involving study personnel, consent forms, subjects, and procedures.

Annual IRB Continuing Review: This approval is valid through the expiration date noted above and is subject to continuing IRB review on an annual basis for as long as the study is active. It is the responsibility of the principal investigator to submit the annual continuing review request and receive approval prior to the anniversary date of the approval. Continuing reviews may be used to continue a project for up to three years from the original approval date, after which time a new application must be filed for IRB review and approval.

Final Report: Within 30 days from the expiration of the project, a final report must be filed with the IRB. A copy of the research results or an abstract from a resulting publication or presentation must be attached. If copies of significant new findings are provided to the research subjects, a copy must be also be provided to the IRB with the final report. Please log in to your InfoReady Review account, access your approved application, and click the option to submit a final report.

Other Provisions of Approval, if applicable: None

Please contact Sponsored Programs at 859-622-3636 or send email to lisa.royalty@eku.edu with questions about this approval or reporting requirements.

Kentucky UNBRIDLED SPIRIT

Appendix C

Consent to Participate in a Research Study

Ergonomics within the Workplace: An Occupation-Based Injury Prevention Program for Office Workers

Why am I being asked to participate in this research?

You are being requested to participate in a research study about ergonomics within the workplace for office workers, because you work within an office doing administrative type work. If you choose to take part in this study, you will be one of approximately 26 people to do so.

Who is doing the study?

The individual in charge of this study is Jessica Maxwell who is an occupational therapist and doctoral student with Eastern Kentucky University's online program.

What is the purpose of the study?

The hope for this study is to demonstrate how ergonomics intervention can positively impact the workers job performance, perception of productivity, and perceptions of risk of injury.

Where is the study going to take place and how long will it last?

The research study will be conducted at Ebsco Industries Human Resources Department for an anticipated three days; however, you will only be participating for two. The pre- & post-surveys should take less than 5 minutes each to complete. The assessments of your individual workstation is expected to take approximately 15-20 minutes. The inservice on the final day should take approximately 30 minutes. Your total participation time is expected to be 45-50 minutes.

What will I be asked to do?

You will be asked to complete pre- and post-surveys at the beginning and end of the program. You will also be asked to perform your daily job tasks, while being observed. You will be asked a few questions regarding your workstation, comfort, and previous or current injuries. On the anticipated third day, an inservice will be held with the request of your attendance. You will be asked to provide feedback on your overall impressions of the study.

What are the risks and benefits of taking part in this study?

There is minimal risk that you could obtain physical injury if performing proposed stretches taught during body mechanics if done inappropriately. You will be taught and demonstrations will be provided in order to decrease this risk.

By taking part in this study, you gain benefits of decreasing risk factors that could cause injuries to you while working. You will also gain insight on tips on ways to decrease these risks factors, while increasing your knowledge of ergonomics and potentially increasing your productivity.

Can my taking part in the study end early?

If you decide to participate in the study, you will still have the right to cease your participation at any point. You will not be treated differently than those still participating if you choose to stop.

What if I have questions?

Before deciding to participate, please feel free to ask any questions in person or contacting the researcher by email at jessica_maxwell9@mymail.eku.edu or by telephone at 205-907-7768. If you have any questions or concerns regarding your research volunteer rights, please contact the staff in the Division of Sponsored Programs at Eastern Kentucky University at 859-622-3636.

I have thoroughly read this document, understand its contents, have been given the opportunity to have my *questions answered, and agree to participate in this research study.*

Your completion of the survey will be considered as providing informed consent to participate in this study.

Very respectfully,

Jessica Maxwell, OTR/L, MS, CEAS

IRB Approval
000648
THIS FORM VALID
2/22/17 - 2/1/18

Appendix D

Pre-test Survey Form

***The purpose of this survey is to gather baseline data regarding basic demographic questions and your current knowledge and understanding of ergonomics. Please place a check mark, circle, and/or write your responses for the questions below.**

Participant #:

1. **My age range is:**

____18-24 ____25-34 ____35-44 ____45-54 ____55-64 ____65+

2. **I am:**

____Male ____Female

3. **I have primarily performed work at a desk for:**

____Less than 1 year

____1 year to 2 years, 11 months

____3 years to 9 years, 11 months

____more than 10 years

4. **During a typical work day, I work at my desk for:**

____ less than an hour

____1 hour to 2 hours, 59 minutes

____3 hours to 5 hours, 59 minutes

____6 hours to 7 hours, 59 minutes

____more than 8 hours

5. **I have a good understanding of ergonomics and what it entails.**

Strongly disagree Disagree Undecided Agree Strongly agree

6. Please provide brief definition of your understanding of ergonomics if you answered Agree or Strongly agree to question #5.

____

____

7. I feel my workstation (includes desk, computer/keyboard, chair) is set-up to prevent work-related injuries.

Strongly disagree Disagree Undecided Agree Strongly agree

8. I feel my workstation is set up for me to work comfortably.

Strongly disagree Disagree Undecided Agree Strongly agree

9. I feel my workstation is set up for me to work efficiently.

Strongly disagree Disagree Undecided Agree Strongly agree

10. In order to prevent work-related injuries, I currently (choose all that apply):

____Take rest breaks

____Move around in my chair

____Do nothing

____Stretch

____Stand

____Walk

____Adjust my workstation (includes desk, computer/keyboard, chair)

____Other (Please list)

11. I currently <u>have pain</u> or I have <u>experienced pain</u> within the last two weeks, while working and/or after completing my daily job requirements:

___Yes (answer 11a below) ___ No (skip to question 12)

11a. I currently experience pain in this/ these areas (choose all that apply):

___Back ___Arm(s) ___Leg(s) ___Ankle(s) ___Hand(s) ___Finger(s) ___Neck ___

12. I currently have <u>discomfort</u> or have <u>experienced discomfort</u> within the last two weeks, while working and/or after completing my daily job requirements:

___Yes (answer 11a below) ___ No (skip to question 12)

12.a. I currently experience discomfort in this/ these areas (choose all that apply):

___Back ___Arm(s) ___Leg(s) ___Ankle(s) ___Hand(s) ___Finger(s) ___Neck ___

13. In the past 3 years, I have received training and/or education related to ergonomics and preventing work place injury:

<u>I received: Training Education Neither training nor education</u>

13a. If you did receive training and/or education related to ergonomics in the past 3 years, how much?

___None ___1 to 5 hours ___ More than 5 hours

13b. If you have had training and/or education related to ergonomics and preventing work place injury, please briefly describe what you learned:

____

____

____

Thank you!

Post-test Survey Form

***The purpose of this survey is to gather outcome data regarding your current knowledge and understanding of ergonomics after the completion of education and training. Please place a check mark, circle, and/or write your responses for the questions below.**

Participant #:

1. **I have a good understanding of ergonomics and what it entails.**

   Strongly disagree Disagree Undecided Agree Strongly agree

2. **Please provide brief definition of your understanding of ergonomics if you answered Agree or Strongly agree to question #1.**

   ____

   ____

3. **I feel my workstation (includes desk, computer/keyboard, chair) is set-up to prevent work-related injuries.**

   Strongly disagree Disagree Undecided Agree Strongly agree

4. **I feel my workstation is set up for me to work comfortably.**

   Strongly disagree Disagree Undecided Agree Strongly agree

5. **I feel my workstation is set up for me to work efficiently.**

   Strongly disagree Disagree Undecided Agree Strongly agree

6. **In order to prevent work-related injuries, I currently (choose all that apply):**

   ____Take rest breaks

   ____Move around in my chair

   ____Do nothing

____Stretch

____Stand

____Walk

____Adjust my workstation (includes desk, computer/keyboard, chair)

____Other (Please list)

7. I currently experience pain while working and/or after completing my daily job requirements:

___Yes (answer 7a below) ___ No (skip to question 8)

7a. I currently experience pain in this/ these areas (choose all that apply):

___Neck ___Back ___Arm(s) ___Leg(s) ___Ankle(s) ___Hand(s) ___Finger(s)

8. I currently experience discomfort while working and/or after completing my daily job requirements:

___Yes (answer 8a below) ___ No (skip to question 9)

8a. I currently experience discomfort in this/ these areas (choose all that apply):

___Neck ___Back ___Arm(s) ___Leg(s) ___Ankle(s) ___Hand(s) ___Finger(s)

9. Please describe how the study's education, ergonomic training, and recommendations have affected your comfort and efficiency at work.

____

____

____

10. Please describe supports within your workplace that are available for implementing ergonomic changes in your workplace (management, therapist, personal etc).

____

____

____

11. Please describe barriers you have for implementing ergonomic changes in your workplace.

____

____

____

12. What changes do you plan to implement based on this ergonomics education? If you do not plan to implement changes, please explain why.

____

____

____

Thank you!

Appendix E

Table W-1 – Basic Screening Tool

You need only review risk factors for those areas of the body affected by the MSD Incident.

		Body Part Associated With MSD Incident			
Risk Factors This Standard Covers	**Performing job or task that involve:**	**Neck/ Shoulder**	**Hand/ Wrist/ Arm**	**Back/ Trunk/ Hip**	**Leg/ Knee/ Ankle**
Repetition	(1) Repeating the same motions every few seconds or repeating a cycle of motions involving the affected body part more than twice per minute for more than 2 consecutive hours in a workday.	☐	☐	☐	☐
	(2) Using an input device, such as a keyboard and/or mouse, in a steady manner for more than 4 hours total in a workday.	☐	☐		
Force	(3) Lifting more than 75 pounds at any one time; more than 55 pounds more than 10 times per day; or more than 25 pounds below the knees, above the shoulders, or at arm's length more than 25 times per day;	☐	☐	☐	☐
	(4) Pushing/pulling with more than 20 pounds of initial force (e.g., equivalent to pushing a 65 pound box across a tile floor or pushing a shopping cart with five 40 poundbags of dog food) for more than 2 hours total per day;	☐	☐	☐	☐
	(5) Pinching an unsupported object weighing 2 or more pounds per hand, or use of an equivalent pinching force (e.g., holding a small binder clip open) for more than 2 hours total per day;		☐		
	(6) Gripping an unsupported object weighing 10 pounds or more per hand, or use of an equivalent gripping force (e.g., crushing the sides of an aluminum soda can with one hand), for more than 2 hours total per day.		☐		

Appendix F

Appendix D-2 to §1910.900: VDT Workstation Checklist

Using this checklist is one, but not the only, way an employer can comply with the requirement to identify, analyze and control MSD hazards in VDT tasks. This checklist does not require that employees assume specific working postures in order for the employer to be in compliance. Rather, employers will be judged to be in compliance with paragraph (k) and (m) of OSHA's standard if they provide the employee with a VDT workstation is arranged or designed in a way that would pass this checklist.

If employee exposure does not meet the levels indicated by the Basic Screening Tool, you may STOP HERE.

WORKING CONDITIONS **The workstation is designed or arranged for doing VDT tasks so it allows the employee's . . .**	**Y**	**N**
A. Head and **neck** to be about upright (not bent down/back).		
B. Head, neck and **trunk** to face forward (not twisted).		
C. Trunk to be about perpendicular to floor (not leaning forward/backward).		
D. Shoulders and **upper arms** to be about perpendicular to floor (not stretched forward) and relaxed (not elevated).		
E. Upper arms and **elbows** to be close to body (not extended outward).		
F. Forearms, wrists, and **hands** to be straight and parallel to floor (not pointing up/down).		
G. Wrists and **hands** to be straight (not bent up/down or sideways toward little finger).		
H. Thighs to be about parallel to floor and **lower legs** to be about perpendicular to floor.		
I. Feet to rest flat on floor or be supported by a stable footrest.		
J. VDT tasks to be organized in a way that allows employee to vary VDT tasks with other work activities, or to take micro-breaks or recovery pauses while at the VDT workstation.		
SEATING **The chair . . .**	**Y**	**N**
1. Backrest provides support for employee's lower back (lumbar area).		
2. Seat width and **depth** accommodate specific employee (seatpan not too big/small).		
3. Seat front does not press against the back of employee's knees and lower legs (seatpan not too long).		
4. Seat has cushioning and is rounded/ has "waterfall" front (no sharp edge).		
5. Armrests support both forearms while employee performs VDT tasks and do not interfere with movement.		
KEYBOARD/INPUT DEVICE **The keyboard/input device is designed or arranged for doing VDT tasks so that . . .**	**Y**	**N**
6. Keyboard/input device platform(s) is stable and large enough to hold keyboard and input device.		
7. Input device (mouse or trackball) is located right next to keyboard so it can be		

operated without reaching.		
8. Input device is easy to activate and shape/size fits hand of specific employee (not too big/small).		
9. Wrists and **hands** do not rest on sharp or hard edge.		
MONITOR The monitor is designed or arranged for VDT tasks so that . . .	**Y**	**N**
10. Top line of screen is at or below eye level so employee is able to read it without bending head or neck down/back. (For employees with bifocals/trifocals, see next item.)		
11. Employee with bifocals/trifocals is able to read screen without bending head or neck backward.		
12. Monitor distance allows employee to read screen without leaning head, neck or trunk forward/backward.		
13. Monitor position is directly in front of employee so employee does not have to twist head or neck.		
14. No glare (e.g., from windows, lights) is present on the screen which might cause employee to assume an awkward posture to read screen.		
WORK AREA The work area is designed or arranged for doing VDT tasks so that . . .	**Y**	**N**
15. Thighs have clearance space between chair and VDT table/keyboard platform (thighs not trapped).		
16. Legs and **feet** have clearance space under VDT table so employee is able to get close enough to keyboard/input device.		
ACCESSORIES	**Y**	**N**
17. Document holder, if provided, is stable and large enough to hold documents that are used.		
18. Document holder, if provided, is placed at about the same height and distance as monitor screen so there is little head movement when employee looks from document to screen.		
19. Wrist rest, if provided, is padded and free of sharp and square edges.		
20. Wrist rest, if provided, allows employee to keep forearms, wrists and hands straight and parallel to ground when using keyboard/input device.		
21. Telephone can be used with head upright (not bent) and shoulders relaxed (not elevated) if employee does VDT tasks at the same time.		
GENERAL	**Y**	**N**
22. Workstation and equipment have sufficient adjustability so that the employee is able to be in a safe working posture and to make occasional changes in posture while performing VDT tasks.		
23. VDT Workstation, equipment and accessories are maintained in serviceable condition and function properly.		
PASSING SCORE = "YES" answer on all "working postures" items (A-J) and no more than two "NO" answers on remainder of checklist (1-23).		

Appendix G

EKU

EBSCO Industries: Human Resources Department

Letter of Support for Off-Campus Research

January 25, 2017

Institutional Review Board:

As an authorized representative of EBSCO Industries Human Resources Department, I grant approval for Jessica T. Maxwell to conduct research involving human subjects at my organization. I understand that the purpose of this research is based on injury prevention. I understand that the organization will be provided with ergonomics education and recommendations, body mechanics training, and safety techniques. I am aware that each staff member will be observed performing their daily job duties, including assessment of their personal desk areas, chairs, posture, and physical functioning.

I grant permission for this project to involve the staff members of the Human Resources Department and I have determined these individuals to be appropriate subjects for this research. I understand that they will be asked to provide information of any previous or current pain, discomfort, or injury as a result of their daily job duties. I also understand that they will be asked to complete pre- & posts tests based on their knowledge of the information being provided.

To support this research, I agree to inform staff members of the researcher's purpose prior to the assessment day, provide time for each staff member to participate, and arrange for the opportunity for an in-service to be held at an agreed upon date and time. An individual's participation, however, will be voluntary.

Sincerely,

Brian Wilson
Sr. Vice President of Corporate Human Resources
EBSCO Industries, Inc.