Spring 2012

Effects of a Cued Break and Stretch Program On Computer Use Productivity and Hand Or Wrist Pain

Ruth R. Korecki
Regis University

Effects of a Cued Break and Stretch Program on Computer Use Productivity and Hand or Wrist Pain

Ruth R. Korecki

Submitted as Partial Fulfillment for the Doctor of Nursing Practice Degree

Regis University

April 9, 2012

Executive Summary

Capstone Project Title

Effects of a Cued Break and Stretch Program on Computer Use Productivity and Hand or Wrist Pain

Problem

Computer usage is commonplace in today's workplace environment. Over time, employees who use computer keyboards greater than six hours per day, five days per week risk developing a repetitive motion injury of the hands or wrists (U.S. Department of Labor, 2009). Could a computer program that cues a break and stretch activity every two hours increase stretching at the workstation, create a workplace environment of positive productivity and ultimately decrease hand or wrist pain? The population understudy is computer users, using an intervention a break and stretch computer program, for one month, with outcomes measured through pre and post questionnaires using the same group for comparison.

Purpose

The purpose of the capstone project was to examine the effects as defined above of an audio and visual computer program intervention that reminded employees using keyboards more than six hours per day, five days per week to break and stretch every two hours.

Goal

The goal of the project was to create employee awareness to the importance and benefits derived from breaking and stretching at their workstation.

Objectives

The objectives were to measure statistically and analyze clinically significant differences in scores on a pre and post questionnaire that operationalized a perception of positive productivity and perceptions of changes in hand or wrist pain.

Plan

Phase One: Conduct a review of the literature to identify a need, analyze potential theories to identify and clarify a problem statement and a recommended intervention, operationalize variables and find or develop an instrument to measure the defined variables. Phase Two: Formalize a proposal to answer the research question, seek approval of the research proposal by the Regis University Institutional Review Board (IRB), and the organization where the study would be conducted. Phase Three: Implement the project, collect and analyze data from participant's pre and post questionnaires using the SPSS program

Outcomes and Results

Twenty participants who used computer keyboards greater than six hours per day, five days per week agreed to voluntarily participate in the study and complete pre-intervention and post-intervention questionnaires. Participants on an average used the break and stretch computer program intervention at their workstation twice a day. Using percentages, 95% (N = 19) of participants perceived the program affected overall productivity positively. A paired-samples t-test indicated scores were slightly lower for hand or wrist pain post, one month after implementation of a break and stretch computer program (M = 1.53, SD = 0.51) than hand or wrist pain pre-intervention (M = 1.26, SD = 0.45), $t(19) = -1.75$ but this difference was not statistically significant (p = 0.048). One hundred percent (N = 20) were satisfied with the cued break and stretch computer program and would recommend the program to others.

I would like to acknowledge Dr. Leonard Trujillo, who so graciously gave me permission to use the *Stop and Stretch Questionnaire* (2006). He was an encouraging voice in the beginning of my capstone project when I initially put together my project plan for submission to the organization of interest. Daniel Puente is another individual I would like to acknowledge, who helped me with the statistical analysis of my capstone project. He took the time to check and calibrate the *t* test for validity.

Dr. Gilbert and Dr. Berg were both instrumental in helping me succeed in the Doctor of Nursing Practice Program at Regis University. They both made themselves available to the DNP students, even on weekends. I would also like to acknowledge Dr. Wimett who has been very patient with helping me accomplish the final critique of my capstone paper. Without the time, suggestions, and recommendations she has given me, I would not have persevered. There were many times I felt overwhelmed and anxious and she was my voice of encouragement.

I would like to also acknowledge my mother and siblings who have understood the limited time I have been able to spend with them during this journey. They have given me the encouragement to keep going and gave me the value of the importance of education. My son Tyrus has stood by me and has been a tremendous example to keep me going. Gini, a friend and colleague, was someone I was able to reach out to, when I needed to find a new organization for my capstone project. I would also like to acknowledge my friend Pat and Vicki who also had time to listen, support and encourage.

Table of Contents

List of Tables

List of Appendices

Effects of a Cued Break and Stretch Program on Computer Use Productivity and Hand or Wrist Pain

Computer technology provides numerous options for people of all ages. The computer is a tremendous tool for gathering information, looking for a job, or participating in a discussion with a colleague. With a few keystrokes on a computer you can be watching a movie, chatting with a friend, or planning your next vacation. People have become accustom to using a computer for both work and non-work related activities. According to the 2009 Current Population Survey of the U.S. Census Bureau, 73% of all U.S. households have computer internet access. This number has increased 6% from 2007. Computer games, on-line learning and, hospital charting are only some of the many ways computers are used.

With the present decade of increased computer use other problems have been created. Data obtained from the U.S. Bureau of Labor Statistics (2006) show approximately 1.5 billion dollars were spent on workplace repetitive motion injuries in the U.S. Work-related repetitive motion injuries involving days away from work accounted for 18% of all repetitive motion injuries, second only to production manufacturing repetitive motion injuries (U.S. Department of Labor, 2008). Sixty percent of this population’s injuries are related to typing or keystroke entry with 38% of cases involving thirty-one or more days away from work. Clearly, this population is at risk for decreased productivity in the workplace, due to developing a repetitive motion injury.

An occupational health setting provides an environment for a Doctor of Nursing Practice (DNP) to play a significant role in the identification and prevention of workplace injuries. According to Schadewald (2011), occupational health addresses risks and injuries related to a population’s employment, identifying interventions for prevention and control of potential injuries. Employees are essential to the success of an organization's business. A workplace injury can impact an organization's productivity and increase workers' compensation costs.

Problem Recognition and Variables Definition

Statement of Purpose

The purpose of the capstone project was to examine the effects of an audio and visual computer program intervention that reminded employees using keyboards more than six hours per day, five days per week to break and stretch every two hours, creating a workplace of positive productivity and ultimately a decrease in hand or wrist pain.

Problem Statement

A personal computer (PC) has become a common mechanical device used by employees in the workplace. Many companies require an employee to have a PC to be able to connect to the organization's network. Computer users are individuals whose primary job requires using computer keyboards more than six hours per day, five days per week. In 2008, according to the Bureau of Labor Statistics, computer operators held 110,000 jobs in the U.S. These individuals usually sit in the same position for extended periods of time, with static posture, and do frequent repetitive movements with their hands and wrists, stroking keys over and over. Over time, this population is at risk for a work-related repetitive motion injury. The injury is usually a musculoskeletal disorder with characteristics of pain in the hands or wrists. A collection of musculoskeletal disorders can eventually develop into cumulative trauma disorder (CTD) which can impact an individual's ability to perform the essential functions of the job. In 2010, employee musculoskeletal disorders (MSDs) that required time away from work accounted for 29 percent of all occupational workplace injuries and illnesses (U.S. Bureau of Labor Statistics, 2011). Workers who use computer keyboards more than six hours per day, five days per week are at risk to impact overall workplace productivity and can ultimately, develop pain in the hands or wrists.

Population, Intervention, Comparison, Outcome (PICO)

According to Tymkow (2011), evidence guides clinical practice. Clinical evidence is important to making good clinical decisions. Formulating a focused clinical question using Population, Intervention, Comparison, and Outcome (PICO) leads to improved processes, interventions, and outcomes (Melnyk, Fineout-Overholt, Stillwell, & Williamson, 2010). The PICO serves as the guide for evidence-based clinical research. For this evidence-based clinical research project the PICO is as follows:

Population. The population for this study included volunteers who used computer keyboards more than six hours per day, five days per week, and were willing to complete a pre and post questionnaire and participate in a stretch break every two hours.

Intervention. The intervention was a stretch break guided by an audio and visual computer program that reminded participants to break and stretch every two hours at their workstations. The program included illustrations for the stretches.

Comparison group. The comparison group was the same population prior to the intervention. It was business as usual.

Outcome. The anticipated results from a break stretch as cued by a computer program included a perceived effect on 1) positive productivity, and 2) ultimately, perceived decrease in hand or wrist pain.

Research Question

Could a break and stretch activity every two hours cued by a computer program at the workstation effect perceived positive productivity and ultimately, a perceived decrease in hand or wrist pain?

Project Significance

The emerging role of the DNP is to be able to take evidence from practice, identify potential risks or problems, and design interventions, treatment, and strategies to improve the quality and value of care for patients. In the occupational health setting the nursing role focuses on providing a safe and healthy work environment for the workplace population. This author views the DNP role in the occupational health setting as the employee advocate, facilitating interventions to prevent injuries in the workplace by being proactive. *The Essentials of Doctoral Education for Advanced Nursing Practice* refers to the DNP role as practice focused (American Association of Colleges of Nursing, 2006, para. 24). The DNP program provides an opportunity for the investigator to develop new skills and tools to improve the quality of care provided for workers in an occupational environment.

Theoretical Foundation

The population of interest was computer users in the workplace. The definition of a computer user is the participant who spends more than six hours per day, five days per week using a computer keyboard. Prevention is a means to decrease hand or wrist pain which can be accomplished by introducing an intervention (Long, 2007). Using Bandura's Theory of Self-Efficacy (2011), an intervention was introduced to evaluate if a cued break and stretch computer program would have an effect on a participant's perceived productivity, hence a decrease in perceived hand or wrist pain. The greater a participant's self-efficacy, the greater is their motivation to change and use the break and stretch computer program. The intervention, a bell sound with an illustrated stretch and repetition count appearing on the computer screen, cued the participant to break and stretch every two hours or 5,000 keystrokes throughout their work day for one month.

In nursing practice, interventions have been developed and tested using the theory of self-efficacy for managing chronic illnesses, productivity, health promotion, exercise, and disease management (Resnick, 2008). Bandura's Theory of Self-Efficacy (2011) is differentiated between two components: an individual's belief in their capabilities to accomplish a task and the expected outcome, the action if successfully accomplished. Ways to strengthen self-efficacy and expected outcomes are through experiences, role models, encouragement and persuasion, and structuring situations for success, alleviating stress reactions (Bandura, 2011).

Using the theory of self-efficacy for the project, the foundation was laid by educating the participants to the program, how the program worked, and the potential benefits of the program. Questions and concerns were addressed in meetings and individually to alleviate any misconceptions, anxiety, or concerns about the program. The commitment by recruited participants was to use the program for one month. Role models for the participants were the direct supervisor and manager who also participated in the program. Verbal encouragement was given from fellow participants, colleagues, and management throughout the program. The program was evaluated through pre and post intervention questionnaires. Using the self-efficacy theory, the anticipated outcome and behavior change was a perceived positive productivity and ultimately, a perceived decrease in hand or wrist pain for participants using the cued break and stretch computer program.

Literature Selection and Systematic Process Supporting the Problem

The idea for this capstone project began with the investigator's interest and clinical practice, an occupational setting, which included workers who have upper extremity repetitive motion injuries. As referenced from Healthy People 2020 (2010), one goal of the health promotion program is to promote healthy physical environments for all people.

The systematic review of the literature began with researching data from the following websites U.S. Bureau of Labor Statistics, National Institute for Occupational Safety and Health (NIOSH), and the Occupational Safety and Health Administration (OSHA) relating to workplace injuries and safety. The focus of the review was on repetitive motion injuries and their prevention. This review helped formulate the problem statement. Medline Plus, Cochrane, Cumulative Index to Nursing and Allied Health Literature (CINAHL), National Guideline Clearinghouse (NGC), and the Center for Disease Control (CDC) were other websites used to scan existing evidence related to repetitive motion injuries and their prevention as it applied to nursing practice, standards of care, and benchmarking.

The initial search for empirical studies regarding repetitive motion injuries (142 studies in CINAHL) prevention of repetitive motion injuries (42 studies in CINAHL) interventions to prevent repetitive motion injuries (six studies in CINAHL), and safety in the workplace (11 studies in CINAHL) were used to narrow the scope of the problem. Repetitive motion injuries was a broad category to research and required the search to be more specific addressing body part, population of interest, safety, and interventions. The search continued with key words such as: hands, wrists, shoulders, carpal tunnel syndrome, overuse, cumulative trauma disorder, tendinitis, pain, musculoskeletal until several themes continued to appear. With librarian help, the search produced a defined area of focus, repetitive motion injuries of the hand or wrist. Furthermore, the search continued with finding a preventive non-invasive participatory intervention. Words such as cumulative trauma disorder (21 studies in CINAHL), ergonomics in the workplace (five studies in CINAHL), risk factors for repetitive motion injuries (11 studies in CINAHL), training to prevent repetitive motion injuries (two studies in CINAHL), and education for preventing repetitive motion injuries (one study in CINAHL) were used to determine the appropriate workplace intervention for the population of interest. With the problem and an intervention chosen, the next step was to find a tool to measure the outcome of the intervention. A measurement tool, a self-report questionnaire from the study completed by Trujillo and Zeng (2006) was the tool selected for use. Permissions were received from the author. Simultaneously, theories and theorists were reviewed to find the best fit for the problem under study. Bandura's Theory of Self-Efficacy (2011) was chosen based on the relationship of self-efficacy and motivating a behavior change. Approximately thirty scholarly studies were chosen and used to support the capstone project (see Appendix A).

Scope of Evidence Summarized

Key concepts of the literature review showed that a successful and sustainable ergonomic intervention needed to be creative, have participation from the employees, and be combined with health and safety programs. Other key concepts included education, training, workplace design, self-efficacy, and proper body mechanics. These concepts have been shown from the literature review to have an impact on repetitive motion injuries and productivity. Upon completion of the systematic review of the literature, a problem with a problem statement, theorist, intervention, measurement tool, and a population of interest was decided for this capstone project.

Review of Evidence

Background of the Problem

A review of literature should support the need for an intervention or a practice or process improvement (Zaccagnini & White, 2011). The systematic review of the literature created the evidence for the background of the problem under study, repetitive motion injuries and productivity in the workplace. Categories were crafted from the relevant information from the literature review. Topics created, critiqued, and discussed were participatory ergonomics, designing creative ergonomic solutions, interventions and treatments, education and training, and risk factors. Steps to conducting a thorough systematic review include the “four Ps: Prepare, Proceed, Publicize, and Practice” (Rodgers, Williams, & Oman, 2011, p. 153).

Systematic Review: Participatory Ergonomics

Participatory ergonomics (Henning, Warren, Robertson, Faghri, & Cherniack, 2009) is vital to creating an integrated sustainable workplace safety and health promotion program for employees (p. 26-35). The key to the program is combining workplace safety interventions with health promotion (Henning et al.). Employee involvement in planning workplace interventions (Hignett, Wilson, & Morris, 2005) found improvements in productivity, employee and management communication, a reduction in risk factors, and creation of new processes and workplace designs. Reimels (1990) found that by involving hospital nurses in work-related decisions their sense of belonging, self-efficacy, and self-esteem increased. Employee ownership was another aspect to a successful workplace program (Henning et al.; Hignett et al.;

Reimels). Participatory ergonomics gives employees the opportunity to use their knowledge and experience to address ergonomic problems in their work areas (Hignett et. al.). Safety and health promotion programs tend to be successful in the beginning but start to overtime diminish. Therefore, a robust communication plan is essential to keep employees engaged and knowledgeable of what activities are occurring in the workplace. Finding a measurement tool to track the outcome of the programs gives credit and recognition to the success of the new programs and processes.

It is important to assess the worker's capabilities and work task when considering an ergonomic workplace intervention. Rempel, Star, Barr, Gibbons, and Janowitz (2009) profess that an ergonomically-designed intervention will decrease the risk of developing musculoskeletal disorders over time. The workstation design as it relates to nursing is an important factor when looking at preventing cumulative trauma disorders (Feiler & Stichler, 2011; Nielsen & Trinkoff, 2003). Shergill, McQuaid, and Rempel (2009) found that preventing repetitive motion injuries in the gastroenterology lab for gastroenterologist, workstation design such as the height of the exam table, monitor, and chair position was important to preventing injuries, adjusting the job to fit the individual.

Systematic Review: Designing Creative Ergonomic Solutions

Creativity can be an important trigger to designing an ergonomic intervention. The General Model of Creative Process designed by Zeng, Proctor, and Salvendy (2010), industrial engineers and psychologists, placed creativity as the focal point of their ergonomic model (p. 503-525). Once a problem is identified, the process model follows phases of analysis, ideation, evaluation, and implementation (Zeng et al.). When designing ergonomic solutions for an organization, a creative and collaborative team includes physical therapy, safety, management, employees, and occupational health. Teamwork can make a change successful and sustainable.

Systematic Review: Interventions and Treatments

There are conservative non-surgical interventions and treatments that can be implemented for prevention and treatment of work-related repetitive motion injuries. According to Trujillo and Zeng (2006), initiating a *Stop and Stretch* software program for data entry workers showed a decrease in wrist pain and had a positive effect on productivity. A study done by Henning, Jacques, Kissel, Sullivan, and Alteras-Webb (1997) found that short stretch breaks were an effective way to improve productivity. Stretching at the workstation (da Costa & Vieira, 2008) demonstrated some benefit from stretching for preventing work-related repetitive motion injuries.

Short-term benefits were found to reduce hand and wrist pain after eight weeks of yoga (O'Connor, Marshall, & Massy-Westropp, 2009; Piazzini et al, 2007). Vitamin B6 as an effective form of treatment for hand and wrist pain continues to be debated and in some studies has been found to be ineffective (Holm & Moody, 2003; O'Connor et al.; Piazzini et al., 2007). Splinting at night, twenty four hours a day, or at work was found to be an effective treatment for hand or wrist pain (Manente, Torrieri, Diblasio, Staniscia, Romano, & Uncini, 2001; O'Connor et al.; Piazzini et al.; Walker, Metzler, Cifu, & Swartz, 2000; Werner, Franzblau, & Gell, 2005). Neural gliding techniques for the treatment of carpal tunnel syndrome as found in McKeon and Yancosek's (2008) review is another alternative treatment for hand and wrist pain. Collins, Wolf, Bell, and Evanoff (2004) found an intervention, mechanical lift, with an injury prevention program was effective in prevention of musculoskeletal injuries.

Systematic Review: Education and Training

Several studies have found that education and training has a positive effect on work-related repetitive motion injuries (Collins, Wolf, Bell, & Evanoff, 2004; da Costa & Vieira, 2008; Long, 2007; Omer, Ozcan, Karan, & Ketenci, 2003/2004). Dortch and Trombly's (1990) study showed that at-risk repetitive motion movements decreased after an education program. Lowe (2007), a physical therapist, found that an educational stretching program can increase employee morale and productivity. Trained instructors and monitoring compliance are keys to a successful workplace stretching program (Hess & Hecker, 2003). Long (2007) recommends starting with a job analysis followed by training and education to prevent workplace injuries. Employee training, education on proper body mechanics, and exercise programs for a population of computer users was found to be an effective intervention for prevention of cumulative trauma disorder (Omer et al., 2003/2004).

Systematic Review: Self-Efficacy and Productivity

According to Bandura (2011), a person's self-efficacy impacts an individual's well-being and sense of accomplishment. The greater an individual's self-efficacy, the greater the ability to make a successful change. Burton, Connerty, Schultz, and Edington (2001) found that by initiating a workplace asthma management program for employees with asthma who had reduced job productivity, self-efficacy increased, improving worker productivity. Productivity for post traumatic brain injury patients increased based on an individual's perceived self-efficacy and life satisfaction (Cicerone & Azulay, 2007). Strategies for changing behaviors, decreasing illnesses, lifestyle changes, and increasing productivity are a few of the modifiable areas the theory of self-efficacy has been used and studied (Burten et al., 2001; Cicerone & Azulay; Daniels, 2004).

Systematic Review: Risk Factors

Risk factors for developing repetitive motion injuries were discussed and evaluated in the literature review. Lifestyle activities, age, gender, shift length, body mass index, and previous injuries (Brown & Thomas, 2003; Dembe, Erickson, Delbos, & Banks, 2005; Maghsoudipour, Moghimi, Dehghaan, & Rahimpanah, 2008) were risk factors discussed related to repetitive motion injuries. Risk factors are not a focus of this capstone project.

The literature review supported the problem statement and the why of this capstone project. Studies were reviewed, critiqued and selected to support the problem. After completion of the review of literature, the next step was to use the supporting evidence to develop a project plan and evaluation for the population of interest.

Project Plan and Evaluation

Market and Risk Analysis: Strengths, Weaknesses, Opportunities, Threats (SWOT)

A market and risk analysis begins with a thorough assessment. An environmental assessment was done using a Strengths, Weaknesses, Opportunities, and Threats (SWOT) analysis (see Appendix B). The internal organizational assessment captures strengths and weaknesses, whereas, the external marketplace assessment captures the opportunities and threats. Key strengths of the project were strong management support, a program that used a participatory ergonomic intervention, and minimal cost to the organization. Weaknesses included the small population sample and self-report questionnaires. The self-monitored program also created the potential for a non-compliant user. Opportunities of the project were a potential cost benefit with a decrease in repetitive motion injuries. An employee focused intervention showed the organization cares, with a potential to create an environment of positive productivity and ultimately a decrease in hand or wrist pain. Threats included a trial of similar preventive interventions and programs in the past, competition with other in-house programs, and the economy. Tymkow (2011) affirms the DNP is positioned to propose evidence-based recommendations to decrease costs and improve quality, documentation, and outcomes.

Driving and Restraining Forces

The foremost driving force for the success of the capstone project was management buy-in. Without support from management, the project is defeated before it begins. A successful project intervention requires a collaborative team (Ash & Miller, 2011) which included the manager of employee health and wellness, physical therapist, and the population of interest's direct supervisor. An organization centered on prevention and being proactive helps to create a safe and healthy work environment for all employees. Therefore, an environment for an intervention to be successful was created. In order to eliminate biases and maintain objectivity, a different site from the author's clinical practice was chosen for the project. After discussions with the stakeholders of the interested project site, the decision was made to design a project using an intervention addressing participants who use computer keyboards more than six hours per day, five days per week. The objective was to implement a creative participatory non-invasive intervention which targeted the population of interest. The intervention had to be unique due to previously implemented interventions for the study population.

Restraining forces included the small population size. The total number of participants who use computer keyboards more than six hours per day, five days per week was approximately forty employees. The job is the frontline to the organization's customers, which includes continuous conversation, and using computer keyboards. Health issues and problems of the population of interest could impact and compromise the outcome of the project. These other participant issues were not a part of this project.

Need

The population of interest works five days a week, eight hours per day, forty hours per week, Monday through Friday. During the course of the day, the population use computer keyboards more than six hours per day, five days per week with two fifteen minute breaks and a thirty minute lunch. Evidence from the literature review as previously discussed supports the population of interest is at risk for decreased productivity and developing a work-related repetitive motion injury. The participants of the population of interest seeking physical therapy treatment for a work-related injury were excluded from the study.

Project Team and Stakeholders

The point of contact for the capstone project was the manager of employee health and wellness, who manages interventions as it relates to the health and safety of the organization's work environment. Other resources included the direct manager and supervisor of the population and their encouragement and support for the population of interest who were participating in the project. A dedicated information systems specialist was assigned to download the software to each participant's computer and provide needed support. The director of human resources provided the monetary approval for the computer software program and participant support. Sustainability of the program was closely monitored by the participant's supervisor and the manager of employee health and wellness. Endorsement of the project came from the physical therapist and management of the organization.

Stakeholders by definition are individuals who will be affected by the project (Zaccagnini & White, 2011). The stakeholders for the capstone project are illustrated in Appendix C. Employee Health and Wellness was the project sponsor for the organization, and the project team consisted of an information technology specialist, the director of human resources, a physical therapist, and the manager for the target population.

Internal stakeholders were the direct supervisor of the participants, the department manager, director and vice president of the business area, the physical therapist, participants in the project, human resources, and the project team. The focus of the internal stakeholders was to provide a quality, cost effective, participatory preventive intervention to impact productivity and ultimately decrease hand or wrist pain. Leveraging support and participation from in-house stakeholders set the stage for developing and implementing a successful collaborative program. Fostering collaboration and working together as a team, created a win-win situation for all parties. The program was further strengthened by communicating milestones and updates as the project progressed. External stakeholders included the organization's insurers, other organizations who employ computer users, occupational health nurses, workers within the organization, and the supplier of the computer software program.

Cost-Benefit Analysis

A cost benefit analysis sells the project to the sponsor and management of the organization (Zaccagnini & White, 2011). The costs and benefits of a project are substantiated by an analysis. A cost-benefit analysis is illustrated in Appendix D. Monitoring the cost effectiveness of the intervention and program and providing an evidence-based preventive program was a benefit derived from the project. A participant's quality of life can potentially be enhanced by teaching an individual how to self-manage hand or wrist pain experienced with repetitive motion work, even if it means taking a stretch break twice a day at the workstation. Feedback and results from the program supports the organizational benefit gained from a preventive health program. The scientific evidence gleaned from the project creates a global perspective for future research in the occupational health environment.

Values

According to Kruschke and Stoeckel (2011), values are an organization's guiding principles. The values of the project included prevention, safety, productivity, and individual ownership. Core values of the organization under study which exemplify the project values include innovation, quality, commitment, caring, and employee safety and well-being.

Vision

A vision formulates an image of the future (Kruschke & Stoeckel, 2011). The vision of the project was to create a safe, healthy, and productive workforce and environment for participants who use computer keyboards more than six hours per day, five days per week. Safety, well-being, caring, and commitment are values of the organization under study supporting the vision of the project.

Mission

A mission statement focuses on current activities, and supports the purpose of the project (Zaccagnini & White, 2011). The mission statement for the project was perceived positive productivity and ultimately a decrease in hand or wrist pain for participants who use computer keyboards greater than six hours per day, five days per week using a cued break and stretch program. Excellence, innovation, and quality are markers of the organization's mission, which reinforce the project's mission statement. An evidence-based intervention supports excellence and innovation.

Goal

According to Zaccagnini and White (2011), goals are broad statements of what the expected outcome of the project will be. From goals, comes the development of objectives. The goal of the project was to create employee awareness to the importance and benefits derived from breaking and stretching at their workstation, with an expected outcome of perceived positive productivity and ultimately a decrease in hand or wrist pain.

Objectives

Objectives are measureable, specific, and achievable means by which goals are met (Kruschke & Stoeckel, 2011). Utilizing the pre and post intervention questionnaires, objective number one was to evaluate if computer users perceived an increase in positive productivity taking a break stretch cued by a computer program every two hours after using the program for one month. This was evaluated through question number seven on the post intervention questionnaire (Did the break and exercise/stretch program effect your overall productivity positively or negatively?). Objective number two was to evaluate if the computer users perceived a difference in hand or wrist pain after one month of using the cued break and stretch program. Information was gleaned from question number four (Have you ever experienced pain or numbness in your wrists or hands while using the computer? If yes, did you notice a difference after participating in the break and exercise/stretch program?) using the pre and post intervention questionnaires.

Logic Model

According to Earp and Ennett (1991), we need to "fix our focus" (p. 166) when developing a conceptual model and focus on the endpoint. The visual for the Logic Model discussed is referenced in Appendix E. One benchmark target that was instrumental in identifying the elements of this project was the study done by Trujillo and Zeng (2006). According to Tymkow (2011), the first core principle of evidence-based practice is to identify a problem to formulate a question identified and defined by the population, intervention, comparison, and outcome (PICO) question (p. 66).

A project plan was developed based on the Logic Model illustrated in Appendix E. The Workplace Health Model (2011) from the U. S. Centers for Disease Control (CDC) was referenced for the project plan and Logic Model. Variables of interest were defined after developing the Logic Model. Assessment, planning, implementation, and evaluation are essential tools, to evaluate an evidence-based practice problem, as referenced in the Logic Model to achieve outcomes for improved quality patient care.

Appropriate for objectives. The Logic Model begins with inputs such as, the population of interest. This population includes participants who use computer keyboards greater than six hours per day, five days per week in the workplace. According to the University of Waterloo Institute for Work & Health, a participatory ergonomic health and safety process model works well for workplace safety and health (as cited in Wells et al., 2003, para. 2). The intervention referenced in the Logic Model as activities is a cued break and stretch computer software program. Participants were cued to break and stretch every two hours or 5,000 keystrokes with illustrations of stretches with a focus on prevention of hand or wrist pain.

Results of the project are represented as the outputs of the Logic Model. Outcomes of the Logic Model are advance practice nursing outcome measures which are to evaluate the effect of an intervention, an audio and visual computer program with a reminder to break and stretch, to determine if there was a perceived effect on overall positive productivity, ultimately a perceived decrease in hand or wrist pain.

The variables of interest were the break and stretch computer software program as the independent variable (intervention), and perceived positive productivity, and ultimately, a perceived decrease in hand or wrist pain, the dependent variables (outcome) (see Appendix F). An intervention was selected that would be non-invasive and participatory.

Appropriate for research design. A systematic review of the literature was done which focused on interventions for upper extremity repetitive motion injuries of the hands or wrists. There were multiple interventions and risk factors identified and discussed which included injections, wrist splints, oral medications, occupational therapy (Piazzini et al., 2006), risk factors such as body mass index (Pollack et al., 2007), hours worked (Anderson et al., 2002), ergonomic measures (Feiler & Stichler, 2011), and exercises (Medina & Yancosek, 2008). The investigator found an evidence-based, non-invasive intervention and a measurement tool to explore with participants who use computer keyboards greater than six hours per day, five days per week to determine if their productivity could be positively affected and ultimately a decrease in hand or wrist pain. A project plan with a defined timeframe (see Appendix G) and a budget (see Appendix H) was developed, presented, and approved by the organization of interest.

A computer break and stretch software program was the intervention previewed by the investigator and determined to be the best fit for the project and the organization of interest. The program cued participants who use computer keyboards greater than six hours per day, five days per week to break and stretch. Each recruited participant received an upload of the program to their computer.

The measurement instrument for the project data collection was a questionnaire titled *Stop and Stretch Questionnaire* (Trujillo & Zeng, 2006, p. 121). Permission was received from the first author to use the questionnaire survey tool (see Appendix I). Modifications were made to the questionnaire to fit the population of interest and their environment with approval from the instrument author. A pre-intervention questionnaire was added using the first four questions of the post-intervention questionnaire (see Appendix J). The pre-intervention questionnaire had a total of four questions, and the post-intervention questionnaire had a total of thirteen questions. Trujillo and Zeng validated the original instrument prior to their study which was published in 2006. Initially, Trujillo developed the computer program, *Stop and Stretch* software; and the questionnaire was utilized to elicit feedback from data entry workers as to their perceptions and satisfaction of the software program.

Population and Sample Size

An appropriate sample size for the project was determined using a computer sample size calculator. A 95% confidence level was chosen. The population size was 25, with a sample size of 20, a confidence level of 95%, and a 50% level of accuracy which computed a confidence interval of ten. Furthermore, using a confidence interval of ten, a confidence level of 95%, and a population of 25 calculated the needed sample size to be 20. With a confidence interval of ten, and a sample size of 20, the confidence interval falls between ten and thirty. A convenience sample of 25 participants who use computer keyboards greater than six hours per day, five days per week were recruited. Five participants were eliminated due to not completing a pre-questionnaire prior to the computer program being uploaded to their computers. That resulted in an ultimate study sample size of 20 participants.

Protection of Human Rights

Completion of the investigator's Collaborative Institutional Training Initiative Human Subject's training (CITI, 2011) training is documented in Appendix K. As noted in the CITI training, there are activities included in the study that do not meet the definition for research with human subjects. The intervention used for the study, the break and stretch program, is part of the participants' usual workplace activities. These studies fall into the exemption status from the Common Rule (CITI). As long as the information is not identifiable outside of the study, such as surveys, questionnaires, and interviews, the study is classified in the exempt category (CITI). This project was classified as exempt.

Approval of the Institutional Review Board (IRB) application was received from Regis University (see Appendix L). A letter of support to complete the project was received from the organization under study (see Appendix M).

All data were coded to protect participant's anonymity. No names were associated with the questionnaires. Each questionnaire had an assigned number identifier between the numbers one to thirty for both pre and post questionnaires. Participants kept track of their assigned pre-questionnaire number using the same number for their post questionnaire. Questionnaires with missing numbers were eliminated from the study. This was necessary since the study was a within-participants design. Means were computed at two points in time, pre intervention and post intervention. The participating group was the same subject's pre and post intervention.

Design Methodology, Measurement, and Setting

The population of interest consisted of 25 participants recruited from employees who spend greater than six hours per day, five days per week using computer keyboards in the workplace. All participants were full time employees. Demographics of the participants were collected for gender, computer user, and years on the job. Prior to the start of the program, two employee staff meetings were held with the investigator explaining the project with a description of the cued break and stretch computer program. An explanation was given regarding participation being voluntary and anonymous. The employees were asked if they would participate in the program. The recruited participants completed an anonymous informed consent approved through the Regis University IRB (see Appendix N). A self-report pre-intervention questionnaire (see Appendix J) was administered simultaneously with the informed consent. Once the informed consent and pre-questionnaire were completed, both were placed in a sealed security envelope and collected by the investigator.

After the consent to participate and the pre-intervention questionnaire were completed, the break and stretch software program was uploaded on each participant's computer by the assigned information technology (IT) specialist. At the same time an explanation with instructions and a demonstration of how to operate the computer program was completed. Based on current recommendations, the timer on the program was set by the IT specialist to go off every two hours or 5,000 keystrokes at which time, a bell would ring and an illustrated stretch would pop-up on the participant's computer screen, cueing the participant to break and stretch. Duration was set at ten repetitions per stretch, which equated to approximately two and one half minutes. Once completed, the participant would then hit the finish button and continue with their work. If the participant chose not to break, the no break at this time and the finish button were clicked and they continued data entry. The stretches rotated with each cued break focusing on different parts of the body which included neck, back, shoulders, and wrists. An illustration of each stretch was contained within the program for the participant's reference. A participant's general workstation, monitor, keyboard, and sitting considerations were also explained and illustrated with the program.

The on-site program coordinator monitored the process of the participants during the project. The computer program remained on the participant's computer for one month. At the end of one month, a self-report post-intervention questionnaire was administered by the on-site program coordinator to all participants. The post intervention questionnaire was completed, placed in a security envelope, sealed by the participant, and collected by the on-site program coordinator. The project investigator received the collected sealed envelopes from the on-site program coordinator. The questionnaires were secured in a locked cabinet.

The quantitative evidence-based study follows a similar study authored by Trujillo and Zeng (2006). Causality was inferred rather than tested. The intervention or cause, the break and stretch computer program was examined in relation to the effect or perceived positive productivity and perceived decrease in hand or wrist pain. According to Polit (2010), statistical analysis does not determine whether the independent variable caused or affected the dependent variable. Instead, inferences influence the research design. Individuals from the entire population were not excluded from participating in the program. Participants served as their own controls for the analysis. The study took place at the one site and not at multiple locations.

Instrumentation

Data were collected pre-intervention using a self-report questionnaire (see Appendix J). One month after the use of the break and stretch computer program, the participants completed a post intervention self-report questionnaire (see Appendix J).

Levels of measurement were nominal and interval. Number values and categories were assigned to the variables (see Appendix O). The interval data were collected using a four point Likert Scale.

Nominal measurement was captured in the following questions. Question number one defined gender and job title. Question number two, years on the job, was measured using a Likert scale ranked in five year increments. Question number three required a yes or no answer asking if stretches were done at the computer prior to the study. If the answer was yes, the number of times per day stretches were performed was coded again using a four point Likert scale. Nominal level data were measured for question number four, prior pain in the wrists or hands while using the computer as a yes or no answer followed with a yes or no answer if they were presently experiencing pain. Question number five referred to the number of times per day the break and stretch computer program was used, again measured with a four point Likert scale. To document perceptions of productivity, another four point Likert scale was used for question number seven.

A Likert scale was used for question number eight (perceived difficulty of the program, very easy to very hard), question number nine (perceived difficulty of the stretching instructions, very easy to very hard), question number ten (perceived usefulness of the illustrations, very helpful to not at all helpful), and question number eleven (overall perceived satisfaction with the program, very satisfied to very unsatisfied). Nominal level data were again measured for question number twelve asking if they would recommend the program to others requiring a yes or no answer. This information was captured to assess the usability of the tool for the cued break and stretch computer program.

Two questions asked for open-ended comments from the participants. Question number six asked if the program was not consistently used and why not; question number thirteen asked for comments. These data were captured for clarification of quantitative answers. Although not specifically analyzed for this study, the comments were reviewed and reflected on for potential future study.

The authors of the tool evaluated the instrument for clarity, ease of use, and to assure it met descriptive statistical test assumptions (L. Trujillo, personal communication, August 8, 2011). Face or criterion validity was not reported on the instrument by the authors. The instrument was reviewed by two Regis University faculty for face validity.

Data Collection

Data were collected using a pre-intervention questionnaire immediately before the break and stretch computer program was downloaded to each participant's computer with instructions of how to use the program. A post-intervention questionnaire was given to each participant one month after using the cued break and stretch computer program. The project data were analyzed and reported as an aggregate. A data analysis plan was developed (see Appendix P). A coding plan was devised to enter the data into the Statistical Package for the Social Sciences (SPSS) 20.0 (see Appendix O). Missing data were coded as a period in SPSS. If a question was skipped, it was coded as missing data. The questionnaire responses were input into an Excel spreadsheet which was reviewed by a statistician. Following the statistician's review, the data were uploaded into SPSS 20.0. The pre and post questionnaires were evaluated with the investigator performing the descriptive statistical analysis.

Project Findings and Results

Normality of the data were established using SPSS Shapiro-Wilk Test of Normality because of the small sample size (*N* = 20). A Shapiro-Wilk test indicated a normal distribution for both pre and post sets of data collected from the self-report questionnaires. The statistical measurement tool employed to measure the difference between the self-report questionnaires pre-intervention and post-intervention was a paired-samples *t*-test for interval level data. Descriptive statistics was used to report means, variability, percentages, and frequencies. Cronbach's alpha (0.70) was calculated to support reliability of the instrument used in the study.

Results: Demographics

Participants included 19 females and one male. As shown in Table 1, 70% (*N* = 14) of participants had five or less years on the job, 20% (*N* = 4) had six to ten years on the job, and 10% (*N* = 2) had eleven to 15 years on the job.

Table 1. *Years on the Job*

	Frequency	Percent	Valid Percent	Cumulative Percent
0-5	14	70.0	70.0	70.0
6-10	4	20.0	20.0	90.0
11-15	2	10.0	10.0	100.0
Total	20	100.0	100.0	

Note. SPSS 20.0 printout

Results: Objective Number One Perceived Productivity

Objective number one was to evaluate if a cued break and stretch computer program had an effect on participants perceived productivity that use computer keyboards greater than six hours per day, five days per week. Analysis of question number seven, effect on overall productivity, showed that 95% (*N* = 19), of participants perceived the cued break and stretch computer program had a positive or very positive effect on overall productivity (see Table 2). Five percent perceived a negative effect on overall productivity.

Table 2. *Productivity*

	Frequency	Percent	Valid Percent	Cumulative Percent
Very positive	5	25.0	25.0	25.0
Positive	14	70.0	70.0	95.0
Negatively	1	5.0	5.0	100.0
Total	20	100.0	100.0	

Note. SPSS 20.0 printout

Results: Objective Number Two Perceived Decrease Hand or Wrist Pain.

Objective number two was to evaluate if computer users perceived a difference in hand or wrist pain pre and post break and stretch program after one month of using the program. Table 3 documents that 85% (*N* = 17) had no hand or wrist pain prior to the intervention. Table 4 shows 70% (*N* = 14) of participants perceived pain in their hands or wrists while using the computer before the intervention. Furthermore, as indicated in Table 5, 45% (*N* = 9) of participants reported perceived pain in their hands or wrists while using the computer post intervention.

Table 3. *Pain Now Pre Intervention*

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	3	15.0	15.0	15.0
No	17	85.0	85.0	100.0
Total	20	100.0	100.0	

Note. SPSS 20.0 printout

Table 4. *Pain Pre Intervention*

	Frequency	Percent	Valid Percent	Cumulative Percent
Yes	14	70.0	70.0	70.0
No	6	30.0	30.0	100.0
Total	20	100.0	100.0	

Note. SPSS 20.0 printout

Table 5. *Pain Post Intervention*

		Frequency	Percent	Valid Percent	Cumulative Percent
	Yes	9	45.0	47.4	47.4
	No	10	50.0	52.6	100.0
	Total	19	95.0	100.0	
Missing	System	1	5.0		
Total		20	100.0		

Note. SPSS 20.0 printout

An analysis was done using a paired-samples *t*-test to determine if there was a perceived difference in participant's hand or wrist pain pre intervention and one month post intervention of the implementation of the break and stretch computer program. A paired-samples *t*-test indicated scores were slightly lower for hand or wrist pain post one month after implementation of a break and stretch computer program (M = 1.53, SD = 0.51) than hand or wrist pain pre intervention (M = 1.26, SD = 0.45), t (19) = -1.756 but this difference was not statistically significant (p = 0.048).

Results: Remaining Questions

Although, not directly related to the objectives of the study, the remaining questions (number three, five, eight, nine, ten, eleven, and twelve) did provide information that may be helpful for future studies. It was found that 25% (N = 5) of participants stretched at their workstation prior to the intervention being implemented and 75% (N = 15) of participants reported not doing any type of stretch prior to the intervention. Following the intervention, 100% (N = 20) of participants performed the stretches; furthermore, 80% (N = 16) performed stretches two to three times per day, and 20% of participants stretched greater than four times per day. Seventy-five percent (N = 15) of the participants found the break and stretch program was very easy to use, 20% (N = 4) easy to use, and only 5% (N = 1) found it hard to use. All participants reported the instructions for the stretches were very easy to follow (80%, N = 16) or easy to follow (20%, N = 4), and the illustrations of the program were very helpful (80%, N = 16) or helpful (20%, N = 4). Results demonstrate 60% (N = 12) of participants were satisfied with the break and stretch program and 40% (N = 8) were very satisfied. All participants stated they would recommend the break and stretch program to others. Comments received from open ended questions included a desire to continue with the program and a perceived positive physical difference in their hands and wrists.

Analysis: Demographics

Participants of the cued break and stretch computer program were predominantly female; therefore, it is difficult to generalize the findings to males. Because the number of years on the job for participants averaged less than two years with four participants having less than one year on the job, the results of the project may have been impacted with participants not having a long enough time using computer keyboards to develop hand or wrist pain.

Analysis: Objective Number One Perceived Productivity

Ninety-five percent of participant's productivity was reported as positively affected from using the break and stretch computer program; however, it is difficult to conclude if this was just perception or an actual increase in productivity since the measurement was self-report. The Hawthorne effect which by definition according to Chiesa and Hobbs (2008) can be "an influence that can occur when participants know they are being studied and change their behavior as a result" (p. 69). This effect may have been present as all participants were aware that an increase in productivity would be a desired outcome and therefore, might respond based on what they thought was expected of them, not wanting a negative outcome.

Analysis: Objective Number Two Perceived Decrease Hand or Wrist Pain.

The difference between pre and post questionnaire scores for hand or wrist pain were insignificant making it impossible to say the program had an impact on decreasing perceived hand or wrist pain. A documented response on the pre-questionnaire was that 15% (*N* = 3) of participants had hand or wrist pain at the time the intervention was initiated. Furthermore, the questionnaires were self-report so the pain was perceived by the participants, not objectively measured.

Analysis: Remaining Questions

Additional data collected included the average number of times participant's took a break and stretched at their workstation. The majority of participants 80% (*N* = 16) reported stretching twice a day. Based on this information, the participants did not use the break and stretch computer program as frequently as cued, which was set for every two hours or 5,000 keystrokes based on current recommendations. The participants did have an option to click the no break at this time prompt and continue to work. Why they chose to skip the break is not known and should be explored in another study. This avoidance of a break does not appear to be related to their satisfaction with the cued break and stretch computer program since all participants expressed satisfaction with the program. Participants also stated they would recommend the program to others, and they did increase the number of times per day they took a break and stretched after using the cued break and stretch program for one month. Participants reported rarely stretching at their workstation prior to using the cued break and stretch computer program. They also reported the cued break and stretch computer program was easy to use, the instructions easy to follow, and the illustrations were helpful. A few comments from various participants on the post questionnaire included a desire to continue with the program, and a positive physical difference in their hands and wrists.

Limitations, Recommendations, Implications for Change

Limitations

A limitation was certainly the lack of male participants (1 of 20) in the study. The small convenience sample in itself was a limitation. Effects of extraneous variables were not controlled and therefore, there was the danger of a Type 1 error as the small sample size lowered the power of the study to find a statistically significant difference pre and post test. However, the sample size was met based on the power analysis.

The self-report questionnaire instrument was also a limitation in concluding effect on positive productivity. Time and motion studies were not done which would have been a more objective way to measure positive productivity outcomes. The self-report nature of the instrument also allowed participants to skip questions or interpret a question in multiple ways.

Another limiting factor was the short duration of the study. Data were collected for only one month. Using the break and stretch program for a longer period of time and starting the program before pathology of the hand or wrist was present, might dramatically increase the expected outcomes of decreased or no hand or wrist pain. The positive productivity measurement was expected to be related to a decrease in hand or wrist pain but the short duration of the study did not allow for significant decreases in hand or wrist pain and therefore, the increased productivity was difficult to analyze or suggest a correlation to wrist or hand pain. The Hawthorne effect may also have increased this limitation. Participants may have responded differently due to the attention the program was receiving or to please the researcher in reporting positive productivity and decreased hand or wrist pain.

Not controlling for the number of years on the job was also a limiting factor. Five participants (25%) reported being on the job for only two years. Using computer keyboards more than six hours per day, five days per week for two years may not have been a long enough time to develop hand or wrist pain. Not recording age of the participants as part of the demographic information also made it impossible to determine if age had any correlation to findings regardless of number of years of computer keyboard use had an impact on hand or wrist pain.

Recommendations

Collecting data over a longer period of time, controlling for extraneous variables such as age, gender, and degree of pathology before and after the study, as well as using more objective measures such as time and motion studies to measure productivity and a more objective pain rating scale would provide more objective data and help eliminate possible Type 1 or Type 2 errors. Using a random sample and increasing the size of the sample population, while focusing specifically on a cross-section of all employees that meet the inclusion criteria, would also increase the power of the study and help avoid a Type 1 error and allow for correlations studies related to gender, age, established wrist and hand pain pre-study with outcomes of the intervention. Adding a control group would also increase ability of the study to find real differences. Another recommendation would be to combine a quantitative and qualitative study. Qualitative information would provide additional information from participants that are not easily measured from objective instruments.

If a questionnaire is used in future studies, it should be designed to capture more demographic information such as age and prior injuries. The organization’s workplace injury log for the population under study might also be of value to future studies. This injury log can provide supporting documentation to determine if repetitive motion injuries continue to be a problem even after using a cued break and stretch program. Cost savings, decreasing days away from work, and policies as they relate to repetitive motion injuries would be other objective measures to consider when attempting to measure impact of the intervention on productivity.

Implications for Change

As health care has evolved, so has occupational health. Professionals in the occupational health setting have the ability to assess risks and implement interventions to decrease the potential for a workplace injury, thus impacting healthcare costs and workforce productivity. According to van Dijk, Verbeek, Hoving, and Hulshof (2010), decisions in the occupational health environment need to be guided by evidence-based practice. Questionnaires or surveys in the workplace environment help guide and evaluate quality of services provided by health care providers in this environment. Results evaluate the needs of the workplace environment, thus areas for improvement can be identified such as changes to policies and processes. A project supported by evidence-based information validates the importance of the occupational health professional's role in the workplace environment.

This capstone project has implications for occupational health nurses. Organizations that have employees who use computer keyboards greater than six hours per day, five days per week may create positive changes in the workplace environment by implementing an intervention such as a break and stretch computer program, as suggested by the results of this capstone project. The capstone project demonstrated that a change occurred, with participants increasing the number of times they stretched at their workstation. If an individual recognizes the positive benefits derived from a change, the discovery can potentially be transferable to an individual's daily lifestyle. It is an assumption that employees who participated in the capstone project now have a better understanding and awareness of body mechanics and the importance of breaking and stretching at their workstation. Based on the capstone project results and recommendations, it is anticipated that the information can be applied to future studies and occupational health settings. Preventive interventions can have an impact on injuries in the workplace. An important outcome of a successful preventive intervention and implementation is translating evidence-based decision making into practice. Future plans would be to implement a similar program for other organizations.

References

American Association of Colleges of Nursing. (2006). *The essentials of doctoral education for advanced nursing practice.* Retrieved from http://www.aacn.nche.edu.

Anderson, J. H., Thomsen, J. F., Overgaard, E., Lassen, C. F., Brandt, L. P. A., Vilstrup, I., Kryger, A. I., & Mikkelsen, S. (2006). Computer use and carpal tunnel syndrome: A 1-year follow-up study. *Journal of the American Medical Association*, 289(22), 2963-9.

Ash, L., & Miller, C. (2011). Interprofessional collaboration for improving patient and population health. In M. E. Zaccagnini & K. W. White (Eds.), *The doctor of nursing practice essentials: A new model for advanced practice nursing* (pp. 61-136). Sudbury, MA: Jones & Bartlett.

Bandura, A. (2011). On the functional properties of perceived self-efficacy revisited. *Journal of Management*, 38(1), 9-44.

Brown, N., & Thomas, N. (2003). Exploring variables among medical center employees with injuries. *AAOHN Journal*, 51(11), 470-481.

Burton, W. N., Connerty, C. M., Schultz, A. B., Chen, C., & Edington, D. W. (2001). Bank One's worksite-based asthma disease management program. *Journal of Occupational and Environmental Medicine*, 43(2), 75-82.

Centers for Disease Control and Prevention. (2011). *Workplace Health Model*. Retrieved from http://www.cdc.gov/workplacehealthpromotion/model/long-descrip4.html

Chiesa, M., & Hobbs, S. (2008). Making sense of social research: How useful is the Hawthorne Effect? *European Journal of Social Psychology*, 38, 67-74. Doi:10.1002/ejsp.401

Cicerone, K. D., & Azulay, J. (2007). Perceived self-efficacy and life satisfaction after traumatic brain injury. *Journal of Head Trauma Rehabilitation,* 22(5), 257-266.

Collaborative Institutional Training Initiative. (2011). Retrieved from https://www.citiprogram.org/Default.asp

Collins, J. W., Wolf, L., Bell, J., & Evanoff, B. (2004). An evaluation of a "best practices" musculoskeletal injury prevention program in nursing homes. *Injury Prevention*, 10, 206-211. doi10.1136/ip.2004.005595

da Costa, B. R., & Vieira, E. R. (2008). Stretching to reduce work-related musculoskeletal disorders: A systematic review. *Journal of Rehabilitation Medicine,* 40, 321-328.

Daniels, J. F. (2004). *The relationship of health related hardiness, self-efficacy, and perceived health to the stage of motivational readiness for behavior change* (Doctoral dissertation, University of South Florida). Retrieved from http://web.ebscohost.com.dml.regis.edu/ehost/delivery

Dembe, A. E., Erickson, J. B., Delbos, R. G., & Banks, S. M. (2005). The impact of overtime and long work hours on occupational injuries and illnesses: New evidence from the United States. *Occupational and Environmental Medicine,* 62(9), 588-597.

Dortch, H. L., & Trombly, C. A. (1990). The effects of education on hand use with industrial workers in repetitive jobs. *The American Journal of Occupational Therapy,* 44(9), 777-782.

Earp, J. A. & Ennett, S. T. (1991). Conceptual models for health education research and practice. *Health Education Research: Theory & Practice,* 6(2), 163-171.

Feiler, J. L., & Stichler, F. F. (2011). Ergonomics in healthcare facility design, part 2. *Journal of Nursing Administration*, 41(3), 97-99.

Henning, R., Jacques, P., Kissel, V., Sullivan, A., & Alteras-Webb, S. (1997). Frequent short rest breaks from computer work: effects on productivity and well-being at two field sites. *Ergonomics,* 40(1), 78-91.

Henning, R., Warren, N., Roberston, M., Faghri, P., & Cherniack. (2009). Workplace health protection and promotion through participatory ergonomics: An integrated approach. *Public Health Reports,* 124(1), 26-35.

Hess, J. A., & Hecker, S. (2003). Workplace stretching programs: The rest of the story. *Applied Occupational and Environmental Hygiene,* 18(5), 331-338.

Hignett, S., Wilson, J., & Morris, W. (2005). Finding ergonomic solutions-participatory approaches. *Occupational Medicine,* 55, 200-207. doi: 10.1093/occmed/kqi084

Holm, G., & Moody, L. E. (2003). Carpal tunnel syndrome: Current theory, treatment, and the use of B6. *American Academy of Nurse Practitioners,* 15(1), 18-22.

Kruschke, C., & Stoeckel, P. (2011). *Module Six: The economics of health care.* Denver, CO: Regis University. Retrieved from https://worldclass.regis.edu/section/default.asp?id=InfoFingertips%5FDNP

Long, F. (2007 August/September). Positioning for a win: How ergonomic interventions are beating back the threat of repetitive strain injuries. Retrieved from rehabpub.com

Lowe, J. (2007). Do workplace stretching programs work? *Professional Case Management,* 12(5), 300-302.

Maghsoudipour, M., Moghimi, S., Dehghaan, F., & Rahimpanah, A. (2008). Association of occupational and non-occupational risk factors with the prevalence of work related carpal tunnel syndrome. *Journal of Occupational Rehabilitation,* 18, 152-156. doi:

10.1007/s10926-008-9125-4

Manente, G., Torriere, F., DiBlasio, F., Staniscia, T., Romano, R., & Uncini, A. (2001). An innovative hand brace for carpal tunnel syndrome: a randomized controlled trial. *Muscle Nerve,* 24(8), 1020-1025

McKeon Medina, J. M., & Yancosek, K. E. (2008). Neural gliding techniques for the treatment of carpal tunnel syndrome: A systematic review. *Journal of Sport Rehabilitation*, 17, 324-341.

Medina McKeon, M. J., & Yancosek, K. E. (2008). Neural gliding techniques for the treatment of carpal tunnel syndrome: A systematic review. *Journal of Sport Rehabilitation*, 17, 324-341.

Melnyk, B. V., Fineout-Overholt, E., Stillwell, S. B., & Williamson, K. M. (2010). The seven steps of evidence-based practice. *American Journal of Nursing*, 110(1), 51-53.

Nielsen, K., & Trinkoff, A. (2003). Applying ergonomics to nurse computer workstations. *Computer, Informatics, Nursing*, 21(3), 150-157.

O'Connor, D., Marshall, S. C., & Massy-Westropp, N. (2009). Non-surgical treatment (other than steroid injection) for carpal tunnel syndrome. *The Cochrane Review,* 1, doi: 10.1002/14651858.CD003219

Omer, S. R., Ozcan, E., Karan, A., & Ketenci, A. (2003/2004). Musculoskeletal system disorders in computer users: Effectiveness of training and exercise programs. *Journal of Back and Musculoskeletal Rehabilitation,* 17, 9-13.

Piazzini, D. B., Aprile, I., Ferrara, P. E., Bertolini, C., Rabini, L., Piantelli, S., & Padua, L. (2006). A systematic review of conservative treatment of carpal tunnel syndrome.

Clinical Rehabilitation, 21, 299-314.

Polit, D. F. (2010). Statistics and data analysis for nursing research (2nd ed.). Upper Saddle River, NJ: Pearson Education.

Pollack, K. M., Sorack, G. S., Slade, M. D., Cantley, L., Sircar, K., Taiwo, O., & Cullen, M. R. (2007). Association between body mass index and acute traumatic workplace injury in hourly manufacturing employees. *American Journal of Epidemiology*, 166(2), 204-211.

Reimels, E. M. (1990). *Selected antecedents of desire for participation in work-related decision-making among selected hospital employees* (Doctoral dissertation, University of South Carolina). Retrieved from http://web.ebscohost.com.dml.regis.edu/ehost/delivery

Rempel, D., Star, D., Barr, A., Gibbons, B., & Janowitz, I. (2009). A new method for overhead drilling. *Ergonomics*, 52(12), 1584-1589.

Resnick, B. (2008). Theory of self-efficacy. In M. J. Smith & P. R. Liehr (Eds.), *Middle range theory for nursing* (2nd ed., pp. 183-204). New York, NY: Springer

Rodgers, M. E., Williams, A, E., & Oman, K. S. (2011). Systems for defining and appraising evidence. In J. Houser & K. S. Oman (Eds.), *Evidence-based practice: An implementation guide for healthcare organizations* (pp. 139-150). Sudbury, MA: Jones & Bartlett.

Schadewald, D. M. (2011). Clinical prevention and population health for improving the nation's health. In M. E. Zaccagnini & K. W. White (Eds.), *The doctor of nursing practice essentials: A new model for advanced practice nursing* (pp. 273-315). Sudbury, MA: Jones & Bartlett.

Shergill, A., McQuaid, K., & Rempel, D. (2009). Ergonomics and GI endoscopy.

Gastrointestinal Endoscopy, 70(1), 145-153.

Trujillo, L., & Zeng, X. (2006). Data entry workers perceptions and satisfaction response to the "Stop and Stretch" software program. *Work*, 27, 111-121.

Tymkow, C. (2011). Clinical scholarship and evidence-based practice. In M. E. Zaccagnini & K. W. White (Eds.), *The doctor of nursing practice essentials: A new model for advanced practice nursing* (pp. 61-136). Sudbury, MA: Jones & Bartlett.

United States Census Bureau. (2009). *Current Population Survey.* Retrieved from http://www.census.gov

United States Department of Health and Human Services. (2011). *Healthy People 2020.* Retrieved from www.healthypeople.gov

United States Department of Labor. *Repetitive Motion Injuries.* Retrieved from http://www.dol.gov

van Dijk, F. J. H., Verbeek, J. H., Hoving, J. L., & Hulshof, T. J. A knowledge infrastructure for occupational safety and health. *Journal of Occupational and Environmental Medicine,* 52(12), 1262-1268.

Walker, W. C., Metzler, M., Cifu, D. X., & Swartz, Z. (2000). Neutral wrist splinting in carpal tunnel syndrome: A comparison of night-only versus full-time wear instructions. *Physical Medicine and Rehabilitation*, 81, 424-9.

Wells, R., Norman, R., Frazer, M., Laing, A., Cole, D., & Kerr, M. (2003). Participative ergonomic blueprint. *Institute for Work & Health.* Retrieved from www.iwh.on.ca.

Werner, R. A., Franzblau, A., & Gell, N. (2005). Randomized controlled trial of nocturnal splinting for active workers with symptoms of carpal tunnel syndrome. *Physical*

Medicine and Rehabilitation, 86, 1-7.

Zaccagnini, M. E., White, K. W., & (2011). A template for the DNP scholarly project. In M. E. & K. W. White (Eds.), *The doctor of nursing practice essentials: A new model for advanced practice nursing* (pp. 451-493). Sudbury, MA: Jones & Bartlett.

Zeng, L., Proctor, R. W., & Salvendy, G. (2010). Creativity in ergonomic design: a supplemental value-adding source for product and service development. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 52(4), 503-525. doi: 10.1177/0018720810376056

Appendix A

Systematic Review Evidence Table

Systematic Review Evidence Table Format [adapted with permission from Thompson, C. (2011). Sample evidence table format for a systematic review. In J. Houser & K. S. Oman (Eds.), *Evidence-based practice: An implementation guide for healthcare organizations* (p. 155). Sudbury, MA: Jones and Bartlett.]

Article Title and Journal	Health Risk Factors and Absenteeism Among University Employees *American Journal of Health Studies*	Computer Use and Carpal Tunnel Syndrome *JAMA*	The (cost) Effectiveness of a Lifestyle Physical Activity Intervention in Addition to a Work style Intervention on the Recovery from Neck and Upper Limb Symptoms in Computer Workers *BMC Musculoskeletal Disorders*	Exploring Variables Among Medical Center Employees with Injuries *AAOHN Journal*	An Evaluation of a "Best Practices: Musculoskeletal Injury Prevention Program in Nursing Homes *Injury Prevention*	Stretching to Reduce Work-Related Musculoskeletal Disorders: A Systematic Review *Journal of Rehabilitation Medicine*	Associations Between Work Schedule Characteristics and Occupational Injury and Illness *International Nurse Review*
Author/ Year	Adams, T. & Cowen, V. S. (2004)	Anderson, J. H., Thomsen, J. F., Overgaard, E., Lassen, C. F., Brandt, L. P., Vlistrup, I., Kryger, A. I., Mikkelsen, S. (2003)	Bernaards, C. Ariens, G. & Hildebrandt, V. (2006)	Brown, N. D., Thomas, N. I. (2003)	Collins, J. W., wolf, L., bell, J. & Evanoff, B. (2004)	da Costa, B.R., Vieira, E.R. (2008)	de Castro, A.B., Fujishiro, K., Rue, T., Tagalog, E. A., Samaco-Paquiz, L. P. G. & Gee, G.C. (2010)
Database and Key words	Medline: absenteeism, risk factors, illnesses	PubMed: carpal tunnel syndrome, computers, occupational exposure	PubMed: Work style, lifestyle, musculoskeletal disorders (MSD)	PubMed: age, gender, employment type, employment status, shift length, BMI	PubMed: OSHA, nursing home residents, best practices, musculoskeletal injuries	Medline: injury, stretching, work, prevention	PubMed: Occupational Health Nursing; The Philippines

Research Design	Retrospective study design was used for analysis of a sample of university employees. Binary logistic regression identified variables characteristic of high sick leave usage compared to low.	A one year follow-up study with questions conducted in 2000 & 2001 at 3500 workplaces in Denmark followed by a clinical interview on symptom distribution & frequency.	Randomized controlled trial with two intervention groups and a control group with an intervention period of six months and measurements at baseline & after 6 & 12 months of follow-up.	An exploratory design involving retrospective chart review of medical center employees looking at age, gender employment type & status, shift length, BMI, WC claims, health & wellness activities, loss of productivity costs	Pre-post intervention trial & cost benefit analysis at 6 nursing homes from 1/1995-12/2000. Intervention established 1/1998 and injury related costs 7 benefits, & severity were compared for 36 months pre-intervention & 36 months post-intervention	A literature search & evaluation to identify studies using stretches to prevent work-related MDS. Nine electronic databases were searched. Articles were screened by the authors and then full text publication pulled.	First 100 registered nurses attending the PNA National Convention in 10/2007 were given an anonymous self-administered survey. Surveys in English and participant names put in a drawing for a prize.
Level of Evidence	IV	I	II	I	I	II	V
Study Aim/ Purpose	The purpose of the study was to examine the relationships between health risk factors & absenteeism for non-academic university employees that participated in a voluntary health screening program.	To estimate the prevalence & incidence of possible CTS & evaluate the contribution of use of mouse devices & keyboards to the risk of CTS	A combined approach targeting work style & lifestyle physical activity This study is to look at the combined interventions & if there is positive findings.	WRI can be identified so interventions can be designed to decrease risk and produce a safer work environment. Looked at injuries to design programs	To conduct an intervention trial of a "best practice" of an MSK injury prevention program designed to safely lift physically dependent nursing home residents	To clarify the physiological effects & benefits & misconceptions about stretching as a potential way for reducing the rates of work-related MSD.	The study investigates how these work characteristics are associated with nurses' work-related injury and illness over and above long work hours.

Population Studied/ Sample Size/ Criteria/ Power	Non-faculty and non-administrative sample of employees at a U.S. University	Questionnaire was sent to 9,480 members of a trade union (n=5658) follow up	Workers from 7 different Dutch companies with frequent long-term neck and upper limb symptoms of MSD. N=8000; n=466.	Sample - all employees with a single, first time WRI at the medical center from 1998-2000) (*n*=233). Denied claims were excluded.	A cohort of all nursing staff (n=1,28) in 6 nursing homes over a 6 year period of time	Literature review of studies with stretching in the workplace, multiple populations	A total of 690 surveys were returned (response rate=69%). Analysis excludes 21 persons currently not working as an RN and another 14 who did not identify being an RN. Sample=n=655 respondents.
Methods/ Study Appraisal/ Synthesis Methods	Total sick hours were collected for each employee over the 2 year period & matched to health screening records. A self-reported 135 health risk appraisal captured additional health and behavioral data (p=.05).	Cross-sectional comparison; 2 clinical follow-ups; one year follow-up	Randomization by using a computer, workers were pre-stratified by company & baseline sports participation assessed with a questionnaire pre & post measurements	Operational definitions of study variables were defined & divided into employment type and injuries	Pre-post intervention trial a MSK prevention program & cost benefit analysis	Authors extracted data independently & in duplicate, using a standardized form.	Cross-sectional study, questionnaire data were collected from a sample of 655 RNs in the Philippines. Multiple logistic regressions were used to assess associations of shift work and mandatory overtime with four work-related health outcomes.

Primary Outcome Measures and Results	Excess body weight and high stress levels appear to be strongly related with persons who use the greatest amount of sick leave. Association between specific health risks & absenteeism.	Onset of new symptoms in the 1 year follow-up was 5.5%. No association between use of a mouse device for more than 20hr/week and risk of possible CTS and no statistically significant association with keyboard use.	The 3 behaviors that impacted the outcome of MSD was an employee's body posture, workplace adjustment, sufficient breaks, and coping with high workload.	Standard deviation and Pearson Chi-Square used. Obese with a BMI >30, individuals with previous WC claims, full time workers on 8-12 hour shifts, individuals with lost time associated with their current claim, individuals who do not attend employee health & wellness activities.	Reduction in resident handling injury incidence & workers' compensation costs & lost work days	Studies were reviewed & their methodological quality was assessed using the PEDro scale reported to be a reliable tool.	95% CI: 1.04, 1.37) missing more than 2 days of work because of a work-related injury or illness (OR=1.25; 95% CI: 1.08, 1.44). Frequency of working overtime was associated with work related injuries.

Author Conclusions/ Implications, of Key Findings	Results suggest behavioral & clinical risk factors are predictive of high compared to low rates of absenteeism and that different risk factors are predictive of absenteeism for men & women.	Computer use does not pose a severe occupational hazard for developing symptoms of CTS.	The problem brought up that not all individuals care to be physically active and how do you change that behavior.	Characteristics of injured employees included advancing age, female gender, long working hours, increased BMI, history of prior back & upper extremity injuries, no health & wellness activities attendance, & lost time with injury	Success of a workplace injury prevention program with a cost savings	Studies provided mixed findings but demonstrated some beneficial effect of stretching in preventing work-related MSK disorders.	Findings suggest that non-day shifts and mandatory overtime may negatively impact nurses' health independent of working long hours
Strengths/ Limitations	Strengths: list of predictive variables that were expressed as continuous & categorical. Limitations: small sample size; unable to determine if absence was due to illness or other reason; cost	Strengths: Large study; questionnaire supported by 2 separate clinical interviews. Limitations: no diagnostic studies done; loss of participants at one year	Strengths: the large number of participants, and the countries good data of employee injury/illnesses. Limitations: Some data was obtained by self-reporting.	Strengths: personal characteristics & workplace issues are helpful to know; large number of variables. Limitations: no comparison group	Strengths: Large sample size; 6 year period Limitations: cost of lift equipment	Strengths: multiple databases searched, peer review, PEDro scale. Limitations: low methodological quality of the studies evaluated, no control groups, follow-up periods, no baseline	Strengths: large sample size; targeted an understudied population. Limitations: self-administered; a select group; measures were binary

Funding Source	Unknown	Unknown	Unknown	Unknown	Unknown	EWI Works, Edmonton, Alberta, Canada ERV is an employee of EWI Works	University of Washington School of Nursing, Department of Psychosocial and Community Health, and a Grant from Dr. de Castro and M. Rue from the National Center for Research
Comments	Addressed risk factors that can also influence work-related injuries	Repetitive motion study	Comparing those who exercise and those who do not risk of MSDs.	Variables offered good information	Prevention Program	Not a good study to show the benefits of stretching to reduce work-related MSK disorders	Work hours and work-related injuries
Article Title and Journal	The Impact of Overtime and Long work hours on Occupational Injuries and Illnesses: New Evidence from the United States *Occupational Environment Medicine*	Ergonomics in Healthcare Facility Design, Part 2: Support Areas *Journal of Nursing Administration*	Finding Ergonomic solutions-Participatory Approaches *Occupational Medicine*	Carpal Tunnel Syndrome: Current Theory, Treatment, and the Use of B6 *Journal of the American Academy of Nurse Practitioners*	Preventing Occupational Injuries: Women's' Perception of Risk from Musculoskeletal Exposures *AAOHN Journal*	Positioning for a Win: How Ergonomic Interventions are Beating Back the Threat of Repetitive Strain Injuries *Rehabilitation Management*	Association of Occupational and Non-occupational Risk Factors with the Prevalence of Work Related Carpal Tunnel Syndrome *Journal of occupational Rehabilitation*
Author/Year	Dembe, A. E., Erickson, J. B., Delbos, R. G. & Banks, S. M. (2005)	Feiler, J. L. & Stichler, J. F. (2011)	Hignett, S., Wilson, J. R. & Morris, W. (2005)	Holm, G. & Moody, L. E. (2003)	Landry, L. (2006)	Long, F. (2007)	Maghsoudipou M., Moghimi, S., Dehghaan, F. & Rahimpanah, A. (2008).

Database and Keywords	Medline: overtime, occupational injuries	CINAHL: Ergonomics, healthcare designs, nursing stations	PubMed: Oxford Journals Interventions; manual handling; musculoskeletal disorders; participatory ergonomics;	CINAHL pyridoxine, vitamin B6, carpal tunnel syndrome, Holm-Moody Carpal Tunnel Severity Scale	CINAHL: women's risk characteristics, stressors	PubMed: Ergonomic, interventions, repetitive strain injuries	Cochrane: carpal tunnel syndrome; repetitive manual work; electro diagnosis; force
Research Design	Meta-analysis of randomized controlled trials	A discussion of the importance of nurses taking leadership in the design of centralized nursing stations	Systematic review of randomized controlled trials	Selected research articles, texts, websites, spoke with experts, and the author's own clinical experience.	A cross-sectional study examined the relationship between women's demographic, occupational, risk characteristics, health & occupational stressors as predictors of their perceptions of injury risk to self & other women from occupational musculoskeletal exposures.	The article focuses on the importance of investing in work-related injury prevention. Making an investment upfront verses paying on the back end.	Meta-analysis of randomized controlled trials
Level of Evidence	I	VII	I	V	II	VII	I

Study Aim/ Purpose	To analyze the impact of overtime and extended working hours on the risk of occupational injuries and illnesses among a nationally represented sample of working adults from the United States.	Focuses on ergonomic designs for nursing stations and support areas that can prevent worker injury, looked at a decentralized nursing station.	Workers are given the opportunity & power to use their knowledge to address ergonomic problems relating to their own working activities	To present the current state of the science, assessment, and treatment of carpal tunnel syndrome, including the use of pyridoxine (B6)	Purpose was to explore the associations between demographic characteristics, occupational characteristics, health status, subjective risk characteristics, & the perception of risk of injury to self & other women from occupational MSK exposures.	The article focuses on doing a job analysis and designing interventions to reduce work-related injuries. Spend the money up front and find the root cause of an injury and then design an ergonomic intervention	To examine workers with a moderately high risk occupation to identify factors that influence the development of CTS in industrial workers
Population Studied/ Sample Size/Criteria / Power	Total of 110,236 job records analyzed 89,729 person years of accumulated working time. NLSY survey	N/A no population studied just a discussion of the ergonomic design of a nursing station	Review of data of workers from a range of industries & countries	Categories of anatomy, risk factors, etiologies, symptomology, diagnosis, & treatment.	Cross-sectional study included a random sample of women who were employed in the 12 months prior to survey administration (*N*=123, 27% response rate). A telephone survey consisting of 154 items was done	N/A The discussion is on ergonomic interventions and the strategy of prevention.	N=456; n=400 Workers from an industrial factory in Iran, selected from 2 factories

Methods/ Study Appraisal/ Synthesis Methods	Multivariate analytical technique used to analyze data	Looked at the design of the nursing stations from chairs to computer space, to telephone headsets, to adjustable document holders, centralized & decentralized nursing centers	Narrative review data came from 3 main databases for participatory ergonomics	A discussion of the diagnosis and treatment of CTS was done which included a discussion of the use of vitamin B6 in its treatment.	Randomly selected from a phone list of 9,000. An introductory letter was sent, a follow-up phone call 7-10 days later. Bivariate analyses of the dependent variables, either a *t*est or analysis of variance (ANOVA) was performed, (alpha=.10)	Article appraisal is finding what works and making changes in a work environment to prevent employee injuries.	Cross-sectional study randomly selected, questionnaires & NCV testing and diagnostics
Primary Outcome Measures and Results	Overtime consists of a 61% hazard rate for work-related injuries with 37% hazard rate for individuals working over 12 hours per day & 23% working 60 hours per week	Positive ergonomic solutions recommended for both the centralized nursing station and the decentralized nursing center.	Increased productivity, improved communication between staff & management, reduction in risk factors, development of new processes	Current treatment for carpal tunnel syndrome should include NSAIDs, nighttime splinting, ergonomic workstation review, and vitamin B6 200mg per day.	Household size, occupational exposure to repetitive hand motion, familiarity of the risk, & perception of injury risk to self-impacted a women's perception	Looking at the job and identifying the "why" and designing an injury prevention program to address the "why." Legal fees are also high when workers' comp. cases go to litigation.	Occupational factors: hands/wrists>30 degrees, 5.62 (0.56-55.6); history of cigarette smoking 4.68 (1.80-11.80); rapid movement of hands 4.44 (1.41-14.02); and use of vibrating tools 3.23 (1.46-7.15).

Author Conclusions/ Implications of Key Findings	Working long hours or many hours increased the risk for injuries & programs and scheduling need to be looked at	Healthcare facility design must balance the needs of patients and families with the needs of the staff for a safe, efficient work environment	Participatory ergonomics creates positive results relating to ergonomic solutions	Basic treatment of NSAIDs and nighttime splints seems universally accepted, much controversy remains. The use of vitamin B6 as a treatment is one such controversy requiring further investigation.	Exposure experiences & risk characteristics increase women's perceptions of risk from occupational MSK exposure	Ergonomic programs are undervalued. Belief there is always room for improvement. Get decision makers to embrace these programs.	Occupational factors: force exertion, bending/twisting of the hands, rapid movement of the hands & vibration are associated with CTS
Strengths/ Limitations	Strengths: Large sample size Limitations: secondary data; self-reported information	Strengths: supports the importance of ergonomic designs in healthcare facilities for support areas Limitations: a discussion with recommendations Not a scholarly paper.	Strengths: Employee involvement, cost savings, creates positive changes Limitations: complex & time investment	Strengths: Good information focusing in on CTS. Limitations: difficult to follow at times, no explanation of sample size, only a discussion	Strengths: focused on working women Limitations: No comparison group	Strengths: makes some good points about getting to the root cause, the "why." Limitations: not a scholarly article. Discussion only.	Strengths: Strong study, statistical data strong Limitations: number dropping out of the study; estimated number of subjects throughout the study
Funding Source	Grant from the Ethel F. Donaghue Women's Health Investigator Program at Yale; Alcoa, Inc.	Unknown	Unknown	Unknown	AAOHN Foundation	Unknown	Unknown

Comments	Overtime and long work hours as relates to injury/illness	Good workstation ergonomic solutions	Participatory ergonomics creates positive results	Vitamin B6	Addressing injury perceptions.	Good discussion and I like the idea of getting to the root cause and answering the question, "why."	Risk factors
Article Title and Journal	An Innovative Hand Brace for Carpal Tunnel Syndrome: A Randomized Controlled Trial *Muscle Nerve*	Neural Gliding Techniques for the Treatment of Carpal Tunnel Syndrome: A Systematic Review *Journal of Sport Rehabilitation*	Global Measure of Satisfaction with Psychosocial Work Conditions Verses Measure of Specific Aspects of Psychosocial Work Conditions in Explaining Sickness Absence *BMC Public Health*	Non-surgical Treatment (other than steroid injection) for Carpal Tunnel Syndrome (Review)	A Systematic Review of Conservative Treatment of Carpal Tunnel Syndrome *Clinical Rehabilitation*	Association between Body Mass Index and Acute Traumatic Workplace Injury in Hourly Manufacturing Employees *American Journal of Epidemiology*	Report of Written Testimony from: Linda Rosenstock, M. D., M.P.H, Director National Institute for Occupational Safety and Health Submitted to : The Subcommittee on workforce Protection
Author/Year	Manente, G, Torrieri, F., Di Blasio, F. Staniscia, T., Romano, F. & Uncini, A. (2001)	McKeon Medina, J. M. & Yancosek, K. E. (2008)	Munch-Hansen, T., Wieclaw, J., Agerbo, E., Wetergaar-Nielsen, N. & Bonde, J. (2008)	O'Connor, D., Marshall, S. C. & Massy-Westropp, N. (2009)	Piazzini, D. B., Aprile, I, Ferrara, P.E., Bertolini, C., Rabini, L., Piantelli, S. & Padua, L. (2006)	Pollack, K. M., Sorock, G. S., Slade, M. D., Cantley, L., Sircar, K., Taiwo, O. & Cullen, M. R. (2007)	Rosenstock, L. (May 21, 1997)

Database and Keywords	CINAHL: hand brace; carpal tunnel syndrome, randomized controlled trial	Cochrane: mobilization, decompression wrist	PubMed: psychological work conditions, predictors, absence	Cochrane Collaboration: yoga, splinting, ultrasound	Cochrane: local injections, oral therapies, physical therapies, therapeutic exercises, and splints	Oxford Journals PubMed: body mass index, obesity, overweight, risk factors, workplace, wounds & injuries	CDC: National Institute for Occupational Safety and Health (NIOSH), Bureau of Labor Statistics (BLS)
Research Design	Randomized controlled trial	Computerized search 8 patient orientated outcome measures were specifically chosen to reflect current clinical practice standards. Reported measures for at least one of the selected outcomes.	Meta-analysis of randomized controlled trails	Meta-analysis of randomized & quasi-randomized studies extracted & reviewed by two reviewers	Computer-aided search of MEDLINE and the Cochrane Collaboration was conducted for randomized controlled trials (RCTs) from January 1985-May 2006	Examined the distribution & odds of occupational injury among hourly employees of US aluminum manufacturing company by body mass index (weight (kg)/height (m) 2).	N/A
Level of Evidence	II	II	I	III	I	III	VII

Study Aim/ Purpose	Developed a hand brace and studied its efficacy and tolerability in patients with CTS, conservative treatment.	To conduct a systematic review assessing the efficacy of neural gliding in comparison to alternative nonsurgical treatment for the management of CTS.	Investigates whether satisfaction with specific aspects of psychosocial work conditions	To evaluate alternatives other than surgery for carpal tunnel syndrome	To assess the effectiveness of conservative therapy in carpal tunnel syndrome	Administrative data from a large multisite manufacturer to determine whether increased BMI was an independent risk factor for workplace injury. BMIs were explored by nature of injury.	To show the magnitude and scope of the problem of work-related MSD and the role NIOSH plays. Definition of ergonomics.
Population Studied/ Sample Size/Criteria / Power	Had inclusion criteria & exclusion criteria for the study N=83.	The literature search resulted in 20 relevant studies. Six studies met inclusion criteria. The remaining 14 studies were excluded.	The participants were 13,437 employees from 698 public service workplaces in Aarhus County Denmark N=13,437.	Literature was selected from 7 data websites. Clinical trial data was selected and other independent data extracted. 21 trials involving 884 people	Study was a randomized controlled trial N=134 and n=33.	Height & weight data on 7,690 workers at 8 plants were extracted from medical records from annual physicals, and BMI index was categorized. 9,101 eligible employees met the study sample criteria. Final sample size (*N*=7,690).	U. S. population

Methods/ Study Appraisal/ Synthesis Methods	2 randomized groups. Used the Boston Carpal Tunnel Questionnaire score. One group wore the splint at night for 4 weeks & a non-treated control group	Criteria for inclusion: 1) written in English 2) examined the efficacy of neural gliding techniques for treatment of CTS 3) included at least one of the selected patient-oriented outcomes.	Analysis of variance & multiple linear regressions to compare the number of days sick & levels of satisfaction with work. Questionnaires were used.	Criteria included studies randomized or quasi-randomized in any language with a diagnosis of carpal tunnel syndrome who had not previously undergone surgery. All non-surgical considered except local steroid injection	Two reviewers independently selected the studies and performed data extraction using a standardized form. The Cochrane Back Review Group for systematic reviews was applied for methodological quality. Different treatment methods were grouped.	Multivariable logistic regression was used to model the odds of sustaining an injury over the entire study period. All p-values were two-tailed & were deemed statistically significant at the 0.05 level.	Written testimony
Primary Outcome Measures and Results	Treated group showed a reduction in BCTQ symptomatic score (from 2.75 to 1.54 at 4 weeks; P<0.0001) and functional score (from 1.89 to 1.48; P<0.0001) significant difference was found in EMG measurement	For all variables none were consistently favorable toward neural gliding over alternative treatment. Comparisons across studies revealed a possible trend toward improved outcomes with the use neural gliding.	Those with dissatisfaction with their work environment missed more days of work	CI of 95% for all data collected. The range varied depending on the results found in the studies. Oral steroids, splinting, ultrasound, yoga, and wrist mobilization provide short-term relief from CTS, but other modalities have not been shown to help.	33 RTCs were included in the review. Studies looked at steroid injections, Vitamin B6, ultrasound, laser, NSAID & diuretic, exercise, splints, & oral steroids	29% of the employees (*n*=2,221) sustained at least one injury. Approximately 85% of injured workers were classified as overweight or obese. Those with a BMI> 21 were more prone to a work-related injury	Defined the characteristics of an injury/illness - nature, body part, source & event

Author Conclusions/ Implications of Key Findings	Demonstrates that the designed hand brace was highly efficient in relieving symptoms and functional loss in CTS.	The efficacy of neural gliding is not clear. More research is necessary to determine the population that may respond optimally to this treatment	Unhappy with work & environment affects sick days taken	Short term benefits from modalities mentioned above with other non-surgical treatments no significant benefit	Evidence that NSAIDs, diuretics, yoga, laser & ultrasound are effective; Exercise therapy & botulin toxin B injections are ineffective.	Study shows an association between BMI and traumatic workplace injuries among manufacturing employees. Look at adding policies and programs that address weight reduction & maintenance for workplace safety strategies.	Costs for MSD are climbing and the MSD have increased fourteen fold since 1994.
Strengths/ Limitations	Strengths: design of the hand splint Limitations: long term effects, no comparison with a traditional splint, small sample size	Strengths: used several websites for literature search. Limitations: small number of articles found, limited research on this technique.	Strengths: Large sample size Limitations: predicting variable was weak	Strengths: Used multiple websites for the literature review with inclusion of clinical trials Limitations: small number of articles found	Strengths: good grading system Limitations: only 2 sites searched for studies so studies could have been missed, only English language	Strengths: large sample size, good statistical analysis & method Limitations: missing data, missing values for attrition	Strengths: discussed that certain work factors cause MSD and that MSDs are a major problem leading to adverse health & economic consequences Limitations: more information needed. Dated material.

Funding Source	Italian Ministry for Scientific and Technological Research	Unknown	Danish Work Environment Research Foundation	Unknown	Unknown	National Institute of Diabetes & Digestive & Kidney Diseases; NIOSH; Donaghue Foundation, Network on socioeconomic Status & Health of the John D. & Catherine T. MacArthur Foundation, Alcoa, Inc.	N/A
Comments	CTS are not just a U.S. problem. Brace is creative and a soft brace.	Good systematic Review.	Analysis good	Analysis good	Conservative treatment for carpal tunnel syndrome	Statistically sound	Good history.
Article Title and Journal	Ergonomics and GI endoscopy *GI Endoscopy*	Ergonomics in Healthcare Facility Design, Part 1: Patient Care Areas *Journal of Nursing Administration*	Sex Differences in Injury Patterns among Workers in Heavy Manufacturing *American Journal of Epidemiology*	Risk Profiles for Four Types of Work-Related Injury among Hospital Employees *AAOHN Journal*	Data Entry Workers Perceptions and Satisfaction Response to the "Stop and Stretch" Software Program *Work*	Occupational Health	Neutral Wrist Splinting in Carpal Tunnel Syndrome: A Comparison of Night-Only Versus Full-Time Wear Instructions *American congress of Physical Medicine and Rehabilitation*

Author/Year	Shergill, A., McQuaid, K. & Rempel, D. (2009)	Stichler, J. F. & Feiler, J. L. (2011)	Taiwo, O. A., Cantley, L. F., Slade, M. D., Pollack, K. M., Vegso, S., Fiellin, G. & Cullen, M. R. (2009)	Thomas, N. I., Brown, N. D., Hodges, L. C., Gandy, J., Lawson, L., Lord, J. E. & Williams, D. K. (2006)	Trujillo, L. & Zeng, X. (2006)	U.S. National Library of Medicine	Walker, W. C., Metzler M., Cifu, D. & Swartz, Z. (2000)
Database and Keywords	Medline: ergonomics, carpal tunnel, DeQuervain tenosynovitis, lateral epicondylitis	CINAHL : Ergonomics, Healthcare designs, patient areas	Cochrane: gender, women, wounds and injuries	PubMed: age, gender, employment type, employment status, BMI	CINAHL: computer software program, productivity, upper extremity, repetitive motion	Medline Plus National Institute of Health: treatment, rehabilitation	CINAHL: carpal tunnel syndrome, wrist splints, orthotics, nerve conduction
Research Design	Systematic review evaluated the ergonomics of endoscopy & focused on current video endoscopy technology. Review from 1990-October 2008	The study is a discussion on the importance of nurses taking leadership on the design of a patient room	Used human resources and incident surveillance data for the hourly population at 6 US aluminum smelters, injuries that occurred from January 1, 1996-December 21, 2005 were analyzed.	Retrospective case-control study using logistic regression	Questionnaire post intervention, screening prior to the study for participants. Investigator designed a computer software program to remind computer users to break & stretch for one month	Clinical practice guidelines	Randomized clinical trial with 6-week follow-up. The setting was the Veterans Administration Medical Center outpatient clinic.
Level of Evidence	V	VII	III	IV	IV	VII	II

Study Aim/ Purpose	To review the literature on the prevalence, risk factors, and potential mechanisms for upper extremity & neck injuries in endoscopists & propose general ergonomic guidelines to reduce these risks	Focuses on ergonomic designs for patient care and nurse safety and specifically the design of a patient room and storage areas in patient care areas.	To determine if female aluminum smelter workers have a higher risk of occupational injury compared with their male counterparts when performing the same job, namely the type of injury and severity of injury.	Examined risk factors for four types of work-related injuries in hospital employees	To determine the perceptions of a software program with a reminder to break and stretch for a group of computer users in the workplace & the outcomes gleaned from a post intervention questionnaire	Clinical practice guidelines	To compare the effects of night-only to full-time split wear instructions on symptoms, function, and impairment in carpal tunnel syndrome (CTS)
Population Studied/ Sample Size/Criteria / Power	N=23 articles and n=7 articles. The articles were reviewed by the primary investigator.	N/A Discussion on an ergonomic design of a patient room and storage area.	All hourly production employees of a US aluminum production corporation at the company's 6 aluminum smelters during the period from 1996-2005. 9,527 production employees worked a total of 58,722 person-years at the 6 smelters.	All employees charts for injured employees with lost-time claims from 1997-2002 (*n*=509); denied claims not included & randomly selected control group (*n*=1,541) was uninjured employees during the same time period (*N*=2050)	N=20 Computer users in the workplace. Criteria used for selection process for the study	N/A	Outpatients with untreated CTS were consecutively recruited from their electro diagnostics lab. Twenty-one patients (30 hands) were enrolled, and 17 patients (24 hands) completed the study. Interventions- night or daytime custom thermoplastic molded splints

Methods/ Study Appraisal/ Synthesis Methods	A descriptive analysis was done with a total of 7 articles. The literature search websites used were Medline, Google Scholar. Key words were used for the search with 23 articles identified.	Appraisal of the design of an ergonomic patient room and storage areas in patient care areas. The key is to decrease work-related injuries for nurses and the safety of patients.	Multivariate logistic regression adjusted for job, tenure, and age category was used to calculate odds rations and 95% CI for female versus male injury risk for all injuries, recordable injuries, and lost work time injuries.	Variables were tested to determine their bivariate relationship to WRI using contingency table analysis. CI for each of the four injury types	Frequencies, means, percentages, and cross-tabulation. Qualitative & quantitative data divided into each category. Questionnaire post intervention after one month using the program.	N/A	The two treatment groups differed in daytime wear as intended (x2 analysis, p=.004). Compliance for wearing the splints was low for both groups.
Primary Outcome Measures and Results	MSK disorders are increased for endoscopists, this is due to the risk factors of workstation design and forces exerted doing an endoscope. More prevalence of MSK complaints than any other specialist.	Ergonomic considerations are important during the design process to minimize the potential for employee injury. Mockup simulations are recommended.	Female workers in this industry have a greater risk for sustaining all forms of injury after adjustment for age, tenure, and standardized job category (odds ratio=1.365, 95% CI: 1.290, 1.445).	contact/assault = increased age, increased BMI= maintenance, custodial, & direct-caregiver employment types; repetitive motion injuries= increased BMI=clerical & custodial	50% noticed a difference after one month of use, 63% thought program had a positive effect on productivity & a 100% were satisfied with the program & thought the program was helpful	Clinical practice guidelines, research, trials	Sensory distal latency (mean=.28msec, standard deviation=.37, p=.004), symptom severity (mean=.64, SD=.46, p=.0001), and functional deficits (mean=.49, SD=.51, p=.0001).

Author Conclusions/ Implications of Key Findings	Risk factors for overuse injury are repetitive hand motion, high hand forces, and awkward wrist, shoulder, & neck postures. Tool design is another area to be addressed. Table, monitor, & positioning addressed	Nurse leaders need to be diligent in ensuring that ergonomic features are included in the design to provide optimal patient and provider outcomes after the facility is constructed.	The study provides evidence of sex disparity in occupational injury with female workers at higher risk compared with their male counterparts in a heavy manufacturing environment.	Risk Profiles are important for workplace safety & promoting health & wellness among workers. Repetitive motion injuries are related to increased BMI, exposure/ reaction/ contact/assault related to increasing age	Program was successful in that employees were satisfied with the program, found it helpful, noticed a change of symptoms and productivity	Information beneficial for practitioners in occupational health settings	Provides added scientific evidence to support the efficacy of neutral wrist splints in CTS and suggests that physiologic improvement is best with full-time splint wear instructions.
Strengths/ Limitations	Strengths: recommend solutions to decrease repetitive motion injuries. Limitations: limited number of studies, used only 2 search engines for literature search	Strengths: importance of nurse participation in the design of patient care areas. Limitations: discussion to create ideas and to encourage nurse involvement in the design of a healthcare facility.	Strengths: large sample size, first study to deal with this population, sets standards for future studies Limitations: disparity in injury rates, not statistically significant	Strengths: Identified need for training, health & wellness programs, & injury prevention program. Limitations: N/A	Strengths: preventive intervention, pre evaluation Limitations: small sample size	Strengths: clinical practice guidelines updated annually Limitations: N/A	Strengths: good supporting data and evidence Limitations: mostly men in the study lacked a nonintervention control group, single follow-up time.

Funding Source	Unknown	Unknown	Grant from the Ethel F. Donaghue Women's health Investigator Program at Yale; Alcoa, Inc.	CAVHS Department of Human Resources Management Services & AAOHN Foundation	Unknown	NIH	Unknown
Comments	Good ergonomic solutions that is able to be transferred to other settings.	Good ideas for ergonomics	Statistically sound with a large sample size. Looked at the concept of male/female differences in an occupational setting.	BMI > 25 to be a risk factor for injury/illness and restricted work days	Good preventive intervention for computer users	Information beneficial for practitioners in occupational health settings	Good data to support study.
Article Title and Journal	Hard Work Never Hurt Anyone - or Did It? A Review of Occupational Associations with Soft Tissue Muscular-skeletal Disorders of the Neck and Upper Limb *Occupational and Upper Limb Disorders*	Randomized Controlled Trial of Nocturnal Splinting for Active workers With Symptoms of Carpal Tunnel Syndrome *American Congress of Physical Medicine and Rehabilitation*	Forearm, Wrist, and Hand (acute & chronic), not including Carpal Tunnel Syndrome *National Guideline Clearinghouse*	Creativity in Ergonomic Design: A Supplemental Value-Adding Source for Product and Service Development *Human Factors*			
Author/Year	Walker-Bone, K, & Cooper, C. (2005)	Werner, R. A., Franzblau, A. & Gell, N. (2005)	Work Loss Data Institute (2008)	Zeng, L., Proctor, R. W. & Salvendy, G. (2010)			

Database and Keywords	PubMed: carpal tunnel syndrome; National Institute for Occupational Safety and Health; repetitive strain injury; upper limb disorders	CINAHL: carpal tunnel syndrome; randomized controlled trials; rehabilitation	National Guideline Government Clearinghouse: Work-related injuries; forearm; wrist; hand; acute; chronic	SAGE CINAHL: creative cognition, product/ service creativity, engineering design process			
Research Design	Systematic Review of literature focusing on epidemiologic surveys of neck or upper limb complaints. Search included Embase & Medline 1980-2001.	Randomized controlled trial	Comprehensive medical literature review with preference given to high quality systematic reviews, meta-analyses, clinical trials published since 1993, nationally recognized treatment guidelines from leading specialty societies.	Literature review was done to construct a conceptual model of creative product and service development			
Level of Evidence	V	II	I	IV			

Study Aim/ Purpose	Highlights the strengths and weaknesses of published reports, and identifying those issues that remain controversial	To determine whether nocturnal splinting of workers identified through active surveillance with symptoms consistent with carpal tunnel syndrome would improve function & medical care	To offer evidence-based step-by-step decision protocols for the assessment and treatment of workers' compensation conditions.	Investigates the role of creativity in ergonomic design and the generic process of developing creative products and services.			
Population Studied/ Sample Size/Criteria / Power	>2200 studies were found from the literature search so emphasis was placed on retrieved articles that furnished new information on the association between occupation & occupational exposures and the MSK disorders	Midwest auto assembly plant workers, N=161, n=112. Symptoms suggestive of CTS invited to participate in the study. 2,636 completed the survey. 161 agreed to participate, and 112 completed the study. 63 subjects were the treatment group and 49 were the control group.	Workers' with occupational injuries of the forearm, wrist, and hand (excluding carpal tunnel syndrome)	N/A			

Methods/ Study Appraisal/ Synthesis Methods	The literature search included searching for upper extremity regions, including the neck, and terms for specific diagnoses of disorders considered to be MSK ULDs. The search was further defined with > 2,200 studies found	Suggestive of CTS, the worker was eligible for the study. The individual symptom questionnaire was competed on a rolling basis during a one year period.	Validation was done by peer external group. Meta-analysis & systematic review. Use the AGREE method for selecting the evidence.	Reviewed relevant literature regarding creativity, creative cognition, and the engineering design process to appraise the role of creativity in ergonomic design a conceptual model of creative product and service developed			
Primary Outcome Measures and Results	Occupation may contribute to ULDs through psychosocial, as well as mechanical mechanisms. The question asked, is how best to design programs for the prevention of ULDs in the workplace.	Showed a significant difference in those splinted. Secondary analysis showed that more median nerve impairment at baseline was associated with less clinical improvement among controls but not among the splinted group.	Effectiveness of treatments in relieving pain, improving stability, and restoring normal function	Goal oriented and is initiated by active problem finding and problem formulating. This process is carried out in a recursive and dynamic way, facilitated by creative thinking strategies.			

Author Conclusions/ Implications of Key Findings	Prolonged abnormal posture and repetition contribute markedly to ULD. Psychosocial factors also need to evaluate in the workplace.	Results suggest a short course of nocturnal splinting may reduce wrist, hand, and/or finger discomfort among active workers with symptoms consistent with CTS.	Annual guidelines created. Procedure summary which provides a concise synopsis of effectiveness of each treatment method based on existing medical evidence. Each is hyperlinked to the studies, on which they are based, in abstract form.	Proposed that ergo design creativity can add supplemental value to products and service, which subsequently affects consumer behavior and helps organizations gain competitive advantage.			
Strengths/ Limitations	Strengths: brought in the issues of psychosocial exposures besides workplace risk factors. Limitations: not quality epidemiology studies	Strengths: Good study, data to support study Limitations: missing data in the logistic regression model may have biased the analysis.	Strengths: Unit evidence-based protocols for medical treatment. A quick reference for diagnosis and treatment guidelines & concise. Hyperlinked to the abstract that supports the treatment. Limitations: not all of the treatment recommendations are for everyone.	Strengths: constructed a conceptual model, creativity Limitations: needs more supporting evidence			

Funding Source	Unknown	United Auto Workers; General Motors National Joint Committee on Health and Safety	Work Loss Data Institute	Unknown			
Comments	Addresses quality of the present literature and psychosocial factors showing up in the literature.	Good study with human subjects and supporting data	Clinical guidelines	Useful model & concept			

Appendix B

Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis

Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis

Strengths

Preventative and ergonomic intervention
Decrease hand or wrist pain
Increase productivity
Minimal cost investment
Downloadable program for the computer
Audio and visual program
Management support
Risk identified
Awareness of proper body mechanics
Employee participation
Simple program

Weaknesses

Small population sample
Self-monitored program
Potential non-compliant user
Unable to document use & frequency
Self-report questionnaires
Plain graphic program

Opportunities

Shows the organization cares
New preventative intervention
DNP student does the research for free
Create positive productivity
Cost benefit
Long-term solution for repetitive motion injury
Decrease the number of repetitive motion injury

Threats

Similar preventative interventions
Previous programs
Competition with in-house programs
Economy

Appendix C

Project Team and Stakeholders

Project Team and Stakeholders

Project Sponsor: Manager of Employee Health and Wellness

Internal	**External**
Supervisor of the participants	Insurers
Department manager and director	Other organizations
Vice President of the business area	Interest groups
Physical therapist	Occupational health
Participants in the project	Other employees in the organization
Human resources	Occupational Health & Safety Administration
Project team members	Software supplier

Project Team: Information Technology Specialist, Director of Human Resources, Physical Therapist, and Manager of participants

Appendix D

Cost-Benefit Analysis of a Cued Break and Stretch Program

Cost-Benefit Analysis of a Cued Break and Stretch Program

Number of computer users	40
Salary of a computer user per year	$45,000
Percent of the organization's population	3.5%
Cost of a repetitive motion injury (without surgery)	$3,500

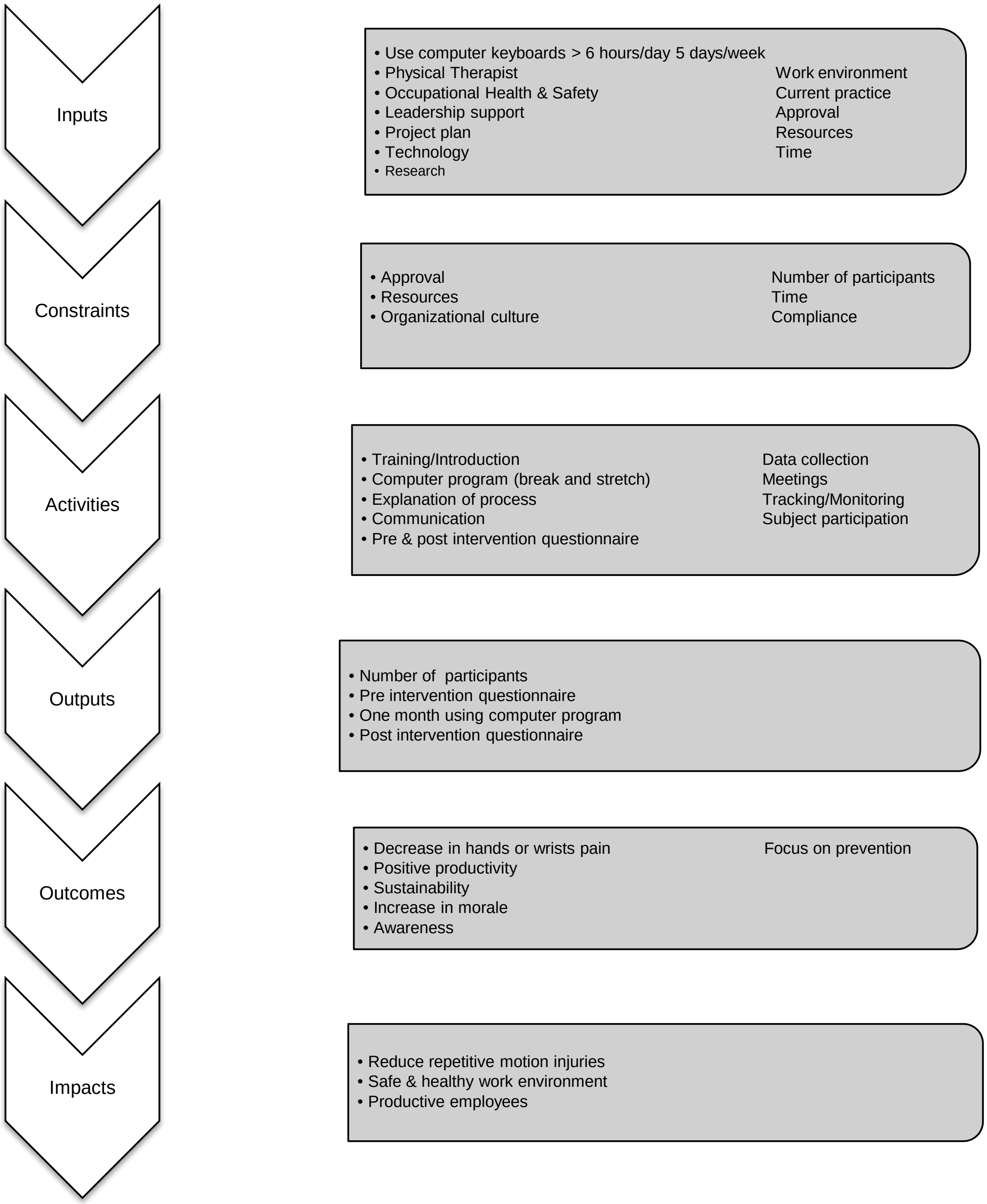
Labor Cost			
Direct	Advanced Practice Nurse – 4 hours		$190.00
	Project Sponsor – Manager Employee Health & Wellness–8 hours		$355.00
	Supervisor – 8 hours		$375.00
	Information Systems Specialist - 10 hours		$650.00
	Physical Therapist – 1 hour		$65.00
	Computer user time spent doing stretches per month		$192.00
Total Labor Cost			$1,827.00
Equipment Cost			
Direct	Computers with programs	part of the work station	
	Copier	part of the work station	
Total Equipment Cost			$0
External Consultant			
Direct	University professor – one hour		$150.00
Total External Consultant Cost			$150.00
Supplies Cost			
Direct	Paper – one ream		$ 25.00
	Folders – 25 at $.10/folder		$ 2.50
	Pens/Pencils – 25 at a $1.00/pen/pencil		$ 25.00
	Cartridge Ink		$125.00
Total Supplies Cost			$177.50
Travel Cost			
Direct	Three trips – 50 miles x 3		$ 25.00
Total Travel Cost			$25.00
Intervention Cost			

Direct	Questionnaires – pre and post		$ 15.00
	Software Program		$ 95.00
	Training – 10 minutes per participant		$100.00
Total Intervention Cost			$210.00
Business Space			
Indirect		owned by the company	$0
Total Business Space Cost			$0
Internet Access Cost			
Indirect		part of the workstation	$0
Total Internet Access Cost			$0
Information Technology (IT) Services Cost			
Indirect	IT support during one month period		$130.00
Total IT Services Cost			$130.00
Internal Communications Cost			
Indirect	30 minutes x 25		$293.00
Total Internal Communications Cost			$293.00
Total Cost of the Project – Direct and Indirect Costs			$2,812.50
Projected Savings (Benefit)		($3,500-$2,812.50) for one injury	$687.50
Potential Annual Cost Savings		($687.50 x 12 months)	$8,250.00

Appendix E

Logic Model for a Cued Break and Stretch Program

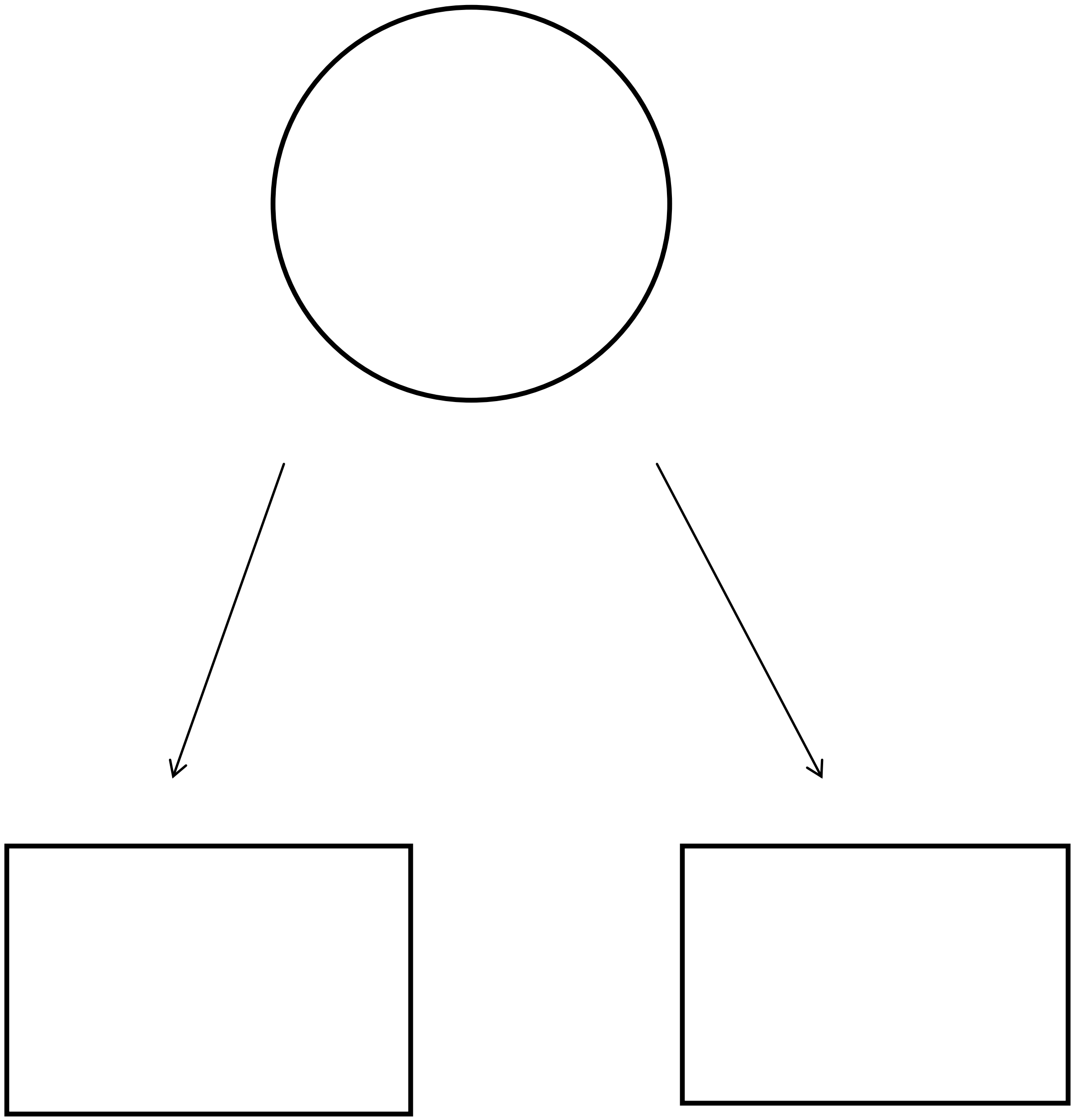
Logic Model for a Cued Break and Stretch Program



Appendix F

Variables of Interest

Variables of Interest



Appendix G

Timeframe

Timeframe

Problem Identification	**Start**	**Completion**
Repetitive motion injury	02/14/11	6/21/11
Problem Recognition		
Identify need	01/14/11	02/26/11
Problem statement	01/17/11	02/28/11
Literature review	01/28/11	04/18/11
Needs Assessment		
Identify population	08/27/11	09/13/11
Identify sponsor and stakeholders	08/27/11	09/17/11
Organizational assessment	09/13/11	09/17/11
Assess available resources	09/13/17	09/17/11
Desired outcomes	08/11/11	09/17/11
Team selection	09/17/11	09/29/11
Cost-benefit analysis	09/30/11	10/07/11
Define scope of project	09/17/11	09/29/11
Goals, Objectives, and Mission Statement		
Goals	09/29/11	10/21/11
Process/outcome objectives	09/29/11	09/14/11
Mission statement	10/14/11	10/14/11
Theoretical Underpinnings		
Theories to support project framework	10/28/10	09/14/11
Project Plan		
Proposal	05/06/11	09/17/11
Plan development	05/06/11	09/17/11
Milestones	04/24/11	10/21/11
Timeline	04/24/11	10/28/11
Budget	08/27/11	10/28/11
Planning for Evaluation		
Develop evaluation plan	05/06/11	09/14/11
Logic model developed	05/06/11	09/17/11
Implementation		
IRB approval	07/14/11	09/28/11
Threats and barriers	09/29/11	10/28/11
Monitor implementation phase	09/29/11	11/17/11
Project closure	10/03/11	11/18/11
Giving Meaning to the Data		
Qualitative data	05/06/11	02/29/12
Quantitative data	05/06/11	02/29/12
Utilizing and Reporting Results		
Written dissemination	Spring 2012	04/09/12
Oral dissemination	Spring 2012	04/09/12

Electronic dissemination Spring 2012 04/10/12

Adapted from Zaccagnini, M. E., & White, K. W. (2011). *The doctor of nursing practice essentials: A new model for advanced practice nursing.* Sudbury, MA: Jones & Bartlett, p. 498.

Appendix H

Budget and Resources

Budget and Resources

• Advanced Practice Nurse – 4 hours	$190.00
• Project Sponsor – Manager Employee Health & Wellness–8 hours	$355.00
• Supervisor – 8 hours	$375.00
• Information Systems Specialist - 10 hours	$650.00
• Physical Therapist – 1 hour	$65.00
• Paper – one ream	$ 25.00
• Folders – 25 at $.10/folder	$ 2.50
• Pens/Pencils – 25 at a $1.00/pen/pencil	$ 25.00
• Cartridge Ink	$125.00
• Three trips – 50 miles x 3	$ 25.00
• Questionnaires – pre and post	$ 15.00
• Software Program	$ 95.00
• Training – 10 minutes per participant	$100.00
• IT support during one month period	$130.00
Total Budget	$2,177.50

The cost for the computer program was expensed through the organization involved in the study. Other costs are documented in the cost-benefit analysis. Included in the budget and resources is the time spent by members within the organization to complete the project. Supplies for the project are documented in both the cost-benefit analysis and budget.

Appendix I

Approval to Use Measurement Tool

Approval to Use Measurement Tool

Sent: Monday, August 8, 2011 6:48:08 AM
Subject: Re: Stop and Stretch Questionnaire

Good Morning,
– yes feel free to use the survey tool.

Dr. Trujillo

Leonard G. Trujillo PhD, OTR/L, FAOTA
Associate Professor, Chair
Occupational Therapy Dept.
Health Science Building Rm 3305-E
Greenville, NC 27858-4353
trujillol@ecu.edu
Office 252.744.6195
Fax 252.744.6198

Appendix J

Pre and Post Intervention Questionnaires

Pre and Post Intervention Questionnaires

Stop and Stretch Questionnaire: Pre Program Intervention #______

The following questionnaire will be used to obtain your feedback after using the break and exercise/stretch program. By answering the following questions, you will help me to identify if the program has a positive effect. Please fill in the blank or circle your response.

I understand that the return of my completed questionnaire constitutes my informed consent to act as a Subject in this research. Please put a check on the line to indicate your agreement with this statement _________________

1. What is your specific job title? __________________________________ Gender____M_____F

2. How long have you held this job? _______________________________

3. Do you perform any stretches or exercises at your computer for your hands or wrists?

   Yes______ No______

   . a. If so, how many times a day do you stretch or exercise at your computer?

   _______0 times a day ______ 1 -2 times a day ________ 3 – 4 times a day _______ 5 times or more a day

4. Have you ever experienced pain or numbness in your wrists or hands while using the computer?

   Yes______ No______

   a. If so, do you have pain or numbness in your wrists or hands now while using the computer?

      Yes______ No______

Questionnaire adapted from “Data entry workers perceptions and satisfaction response to the “Stop and Stretch” software program,” by L. Trujillo, and X. Zeng, 2006, *Work*, 27, p. 121.

Stop and Stretch Questionnaire: Post One Month Program Intervention #_______

The following questionnaire will be used to obtain your feedback after using the break and exercise/stretch program. By answering the following questions, you will help me to identify if the program has a positive effect. Please fill in the blank or circle your response.

I understand that the return of my completed questionnaire constitutes my informed consent to act as a Subject in this research. Please put a check on the line to indicate your agreement with this statement _________________

1. What is your specific job title? __________________________________ Gender____M_____F

2. How long have you held this job? _______________________________

3. Did you perform any stretches or exercises at your computer for your hands or wrists prior to participating in this study?
   Yes______ No______

4. Have you ever experienced pain or numbness in your wrists or hands while using the computer? If yes, did you notice a difference after participating in the break and exercise/stretch program?
   Yes______ No______

5. How many times per day did you use the break and exercise/stretch program?

   How many times (average)? ______

6. If you did not use the break and exercise/stretch program consistently, Why not?

7. Did the break and exercise/stretch program effect your overall productivity positively or negatively?

Very Positive	Positive	Negatively	Very Negative
1	2	3	4

8. Was the break and exercise/stretch program easy to use?

Very Easy	Easy	Hard	Very Hard
1	2	3	4

9. Were the exercise instructions easy to follow?

Very Easy	Easy	Hard	Very Hard
1	2	3	4

10. Were the illustrations helpful in following the exercise?

Very Helpful	Helpful	Somewhat Helpful	Not at all Helpful
1	2	3	4

11. Overall, how satisfied were you with the break and exercise/stretch program?

Very Satisfied	Satisfied	Unsatisfied	Very Unsatisfied
1	2	3	4

12. Would you recommend the program to others?
    Yes_____ No______

13. Please add additional comments below:

Questionnaire adapted from “Data entry workers perceptions and satisfaction response to the “Stop and Stretch” software program,” by L. Trujillo, and X. Zeng, 2006, *Work*, 27, p. 121. Copyright 2006 by the IOS Press and the authors.

Appendix K

Collaborative Institutional Training Certificate

Collaborative Institutional Training Certificate

CITI Collaborative Institutional Training Initiative

Human Research Curriculum Completion Report
Printed on 6/5/2011

Learner: Ruth Korecki (username: K2012R)
Institution: Regis University
Contact Information Department: Nursing
Email: rkorecki@regis.edu

Social Behavioral Research Investigators and Key Personnel:

Stage 1. Basic Course Passed on 06/05/11 (Ref # 6126153)

Required Modules	Date Completed	
Introduction	06/04/11	no quiz
History and Ethical Principles - SBR	06/04/11	4/4 (100%)
The Regulations and The Social and Behavioral Sciences - SBR	06/04/11	5/5 (100%)
Assessing Risk in Social and Behavioral Sciences - SBR	06/04/11	5/5 (100%)
Informed Consent - SBR	06/05/11	5/5 (100%)
Privacy and Confidentiality - SBR	06/05/11	5/5 (100%)
Regis University	06/05/11	no quiz

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor, University of Miami

Director Office of Research Education CITI Course Coordinator

CITI Collaborative Institutional Training Initiative

Human Research Curriculum Completion Report
Printed on 1/19/2011

Learner: Lynn Wimett
Institution: Regis University
Contact Information Department: Nursing
Email: lwimett@regis.edu

Biomedical Research Investigators and Key Personnel:

Stage 1. Basic Course Passed on 01/19/11 (Ref # 5433267)

Required Modules	**Date Completed**	
Introduction	01/10/11	no quiz
History and Ethical Principles	01/10/11	7/7 (100%)
Basic Institutional Review Board (IRB) Regulations and Review Process	01/17/11	5/5 (100%)
Informed Consent	01/17/11	4/4 (100%)
Social and Behavioral Research for Biomedical Researchers	01/17/11	4/4 (100%)
Records-Based Research	01/17/11	2/2 (100%)
Genetic Research in Human Populations	01/17/11	2/2 (100%)
Research With Protected Populations - Vulnerable Subjects: An Overview	01/17/11	4/4 (100%)
Vulnerable Subjects - Research with Prisoners	01/17/11	4/4 (100%)
Vulnerable Subjects - Research	01/17/11	3/3 (100%)

Involving Minors		
Vulnerable Subjects - Research Involving Pregnant Women and Fetuses in Utero	01/17/11	3/3 (100%)
International Research	01/19/11	1/1 (100%)
Group Harms: Research With Culturally or Medically Vulnerable Groups	01/19/11	3/3 (100%)
FDA-Regulated Research	01/19/11	5/5 (100%)
Research and HIPAA Privacy Protections	01/19/11	11/11 (100%)
Workers as Research Subjects-A Vulnerable Population	01/19/11	4/4 (100%)
Conflicts of Interest in Research Involving Human Subjects	01/19/11	2/2 (100%)
Regis University	01/19/11	no quiz

For this Completion Report to be valid, the learner listed above must be affiliated with a CITI participating institution. Falsified information and unauthorized use of the CITI course site is unethical, and may be considered scientific misconduct by your institution.

Paul Braunschweiger Ph.D.
Professor, University of Miami
Director Office of Research Education
CITI Course Coordinator

Appendix L

Regis University Institutional Review Board Approval

Regis University Institutional Review Board Approval

REGIS UNIVERSITY

Academic Affairs
Academic Grants

3333 Regis Boulevard, H-4
Denver, Colorado 80221-1099

303-458-4206
303-964-3647 FAX
www.regis.edu

IRB – REGIS UNIVERSITY

September 29, 2011

Ruth Korecki
5922 S. Emporia Circle
Englewood, CO 80111

RE: IRB #: 11-276

Dear Ruth:

Your application to the Regis IRB for your project "Work-related Repetitive Motion Injuries/Illnesses Prevention" was approved on September 28, 2011.

If changes are made in the research plan that significantly alter the involvement of human subjects from that which was approved in the named application, the new research plan must be resubmitted to the Regis IRB for approval. Projects which continue beyond one year from their starting date require IRB continuation review. The continuation should be requested 30 days prior to the one year anniversary date of the approved project's start date.

In addition, it is the responsibility of the principal investigator to promptly report to the IRB any injuries to human subjects and/or any unanticipated problems within the scope of the approved research which may pose risks to human subjects. Lastly, it is the responsibility of the investigator to maintain signed consent documents for a period of three years after the conclusion of the research.

Sincerely,

Daniel Roysden, Ph.D.
Chair, Institutional Review Board

C: Dr. Lynn Wimett
Dr. Marcia Gilbert

A JESUIT UNIVERSITY

Appendix M

Letter from Organization to Complete the Project

Letter from Organization to Complete the Project

September 19, 2011

Dear Ms. Korecki,

Thank you very much for approaching our organization with an opportunity to enhance our office ergonomic program. As we discussed, we have several employees who spend a large portion of their workday at their desk, answering customer inquiries while on the telephone or keyboard. We are committed to enhancing our employee's health and wellness and welcome a more automated tool for ergonomic stretching.

I will make the appropriate communication, and then plan to test the software for a period of 30 days. We will collect the information in a manner that maintains confidentiality.

Good luck in your research efforts!

Best Regards,

Gini McMahan

Gini McMahan
Manager, Employee Health and Wellness

Appendix N

Consent to Participate

Consent to Participate

Date:

Stop and Stretch Program (Anonymous)

You are being invited to participate in a research study about using a computer program that will remind you to take a short break and stretch. This study is being conducted by Ruth Korecki and Dr. Lynn Wimett, from the Loretto Heights School of Nursing at Regis University. The study is being conducted as part of a capstone project for completion of a Post-Master's Doctor of Nursing Practice. .

OPTIONAL: You were selected as a possible participant in this study because of computer keyboarding greater than 6 hours per day at the workplace.

There are no known risks if you decide to participate in this research study other than the time lost in completing two surveys and the time to complete the stretch. There are no costs to you for participating in the study. The information you provide will be used to assess or evaluate the effect of a break and stretch program for computer users. The questionnaire will take about five minutes to complete. The information collected may not benefit you directly, but the information learned in this study should provide more general benefits. You may withdraw from the study at any time.

This survey is anonymous. Do not write your name on the survey. No one will be able to identify your name or link your name to any answers. Only the investigator and others authorized by regulation will have access to the surveys and no surveys will be linked to any names. Should the data be published, only aggregate data will be discussed. No individual information will be disclosed.

Records will be stored in a locked file cabinet. Only the investigator and others authorized by regulation will have access to the surveys. No survey will be linked to names. The data will be saved for three years and then shredded.

Your participation in this study is voluntary. Please return the consent form and pre-survey today by placing it in the envelope, sealing the envelope, and giving the envelope to your supervisor. You are free to decline to answer any particular question you do not wish to answer for any reason.

If you have any questions about the study, please contact Ruth Korecki by mail at 5922 S. Emporia Circle, by phone at (303) 355-3346, or by e-mail at rkorecki@regis.edu or Dr. Lynn Wimett at lwimett@regis.edu or by phone at 303-458-4063.

If you have any questions about your rights as a research subject or if you feel you have been placed at risk, you may contact the Regis University Institutional Review Board (IRB) by mail at Regis University, Office of Academic Grants, 447 Main, Mail Code H-4, 3333 Regis Blvd., by phone at (303) 346-4206, or by e-mail at irb@regis.edu.

Appendix O

Data Collection Plan

Data Collection Plan

Variable Name		**Description**		**Position**
Job		Computer User		1
		Other		2
Years on the job		0 to 5		1
		6 to 10		2
		11 to 15		3
		16 to 20		4
		21 to 25		5
		26 to 30		6
		31 to 35		7
		36 to 40		8
Gender		Male		1
		Female		2
Question ID Code		**Pre-Intervention**		**Position**
Question 3		Answer to: Do you perform any stretches or exercises at your computer for your hands or wrists?		Yes or No
Question 3a		Answer to: If so, how many times a day do you stretch or exercise at your computer?		0 - 0 times a day 1 - 1-2 times a day 2 - 3-4 times a day 3 - 5 times or more day

Question 4		Answer to: Have you ever experienced pain or numbness in your wrists or hands while using the computer?		Yes or No
Question 4a		Answer to: If so, do you have pain or numbness in your wrists or hands now while using the computer?		Comment:
Question ID Code		**Post Intervention**		**Position**
Question 3		Answer to: Do you perform any stretches or exercises at your computer for your hands or wrists?		Yes or No
Question 3a		Answer to: If so, how many times a day do you stretch or exercise at your computer?		0 - 0 times a day 1 - 1-2 times a day 2 - 3-4 times a day 3 - 5 times or more day
Question 4		Answer to: Have you ever experienced pain or numbness in your wrists or hands while using the computer?		Yes or No

Question 4a		Answer to: If so, do you have pain or numbness in your wrists or hands now while using the computer?		
Question 5		Answer to: How many times per day did you use the break and exercise/stretch program?		1 - 0-1 time 2 - 2-3 times 3 - 4-5 times 4 - 6-7 times 5 - greater than 8
Question 6		Answer to: If you did not use the break and exercise/stretch program consistently? Why not		Comments:
Question 7		Answer to: Did the break and exercise/stretch program effect your overall productivity positively or negatively?		1 - Very Positive 2 - Positive 3 - Negatively 4 - Very Negative
Question 8		Answer to: Was the break and exercise/stretch program easy to use?		1 - Very Easy 2 - Easy 3 - Hard 4 - Very Hard
Question 9		Answer to: Were the exercise instructions easy to follow?		1 - Very Easy 2 - Easy 3 - Hard 4 - Very Hard

Question 10		Answer to: Were the illustrations helpful in following the exercise?		1 - Very Helpful 2 - Helpful 3 - Somewhat Helpful 4 - Not at all Helpful
Question 11		Answer to: Overall, how satisfied were you with the break and exercise/stretch program?		1 - Very Satisfied 2 - Satisfied 3 - Unsatisfied 4 - Very Unsatisfied
Question 12		Answer to: Would you recommend the program to others?		Yes or No
Question 13		Comments		
Break and Exercise/Stretch Program		**Pre-Intervention Date:**		**Post Intervention Date:**
Sources				
Methods				
Sample				
Instrument				

Appendix P

Data Analysis Plan

Data Analysis Plan