The Impact of Physical Therapy Delivered Ergonomics in the Workplace: A Narrative Review

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Abstract

With the emergence of work-related musculoskeletal injuries and the associated high cost of injured workers, physical therapists are in a unique position to help employers manage these concerns through injury prevention programs, education, ergonomics, on-site treatment to include exercise instruction and manual intervention, and return to work programs. The purpose of this literature review is to highlight the effectiveness a physical therapist can have on employee health and the prevention of work-related musculoskeletal disorders. In terms of results, when ergonomic interventions were applied, employers saw decreased injuries, increased productivity, decreased costs associated with direct and in-direct costs of work-related injuries, improvements in return-to-work performance, and decrease absenteeism in employees. However, as the interventions described in this report were generally found to be quite heterogeneous, it should also be recognized that general conclusions about the effectiveness of these interventions should be done with care. It is important to ensure that payers, employers and employees are aware of the crucial role physical therapists can play in occupational health. Physical therapists also need to advocate for their role in occupational health and offer expert care to workers in a non-traditional manner.

Keywords: *ergonomics, work-related musculoskeletal injuries, injury prevention, risk management.*

Introduction

The negative effects of musculoskeletal injuries in the workplace have been well documented and provide a clear understanding for the importance of providing thorough, preventive ergonomic training to all members of the workforce.[1-16] Physical therapists play a key role in the occupational health setting at preventing injuries through ergonomics training, workstation modifications, therapeutic exercise, and manual interventions.[17,18] With the emergence of work-related musculoskeletal injuries and the associated high cost of injured workers, physical therapists are in an opportunistic position to help employers manage these concerns through injury prevention programs, education, ergonomics, and return to work programs.[19]

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As established by Liberty Mutual Insurance, statistics have verified that both musculoskeletal disorders (MSDs) and workplace musculoskeletal disorders (WMSDs) have a tremendous economic burden. Their safety index for 2018 illustrates that overexertion injuries in the workplace accounted for 13.7 billion dollars in 2017.[21] Additional statistics from The Bureau of Labor Statistics show approximately 2.9 million non-fatal injuries in the private workplace industry in 2016. Of those injuries, 30% were classified as sprains, strains, and tears resulting from overexertion.[21]

The purpose of this literature review is to highlight the effectiveness a physical therapist can have on employee health and the prevention of work-related musculoskeletal disorders. This review will be divided

into four main parts: (a) the history of ergonomics from the inception of Occupational Safety and Health Administration (OSHA), (b) OSHA employee standards and workplace safety, (c) literature reviews, systematic reviews, and meta-analyses, and (d) conclusion. The aim of this literature review is to also provide the reader with scholarly research to show the effectiveness of physical therapy-delivered ergonomics and work-injury prevention, by focusing on higher levels of evidence seen through literature reviews, systematic reviews, and meta-analyses.

History of Ergonomics

Discussing the history of ergonomics first is germane to this report, as it investigates recordable injuries in the workplace and the effect ergonomics has on decreasing workplace injuries, as well as their negative effects. The study of ergonomics began in 1970 when (OSHA)was instituted in the United States of America. The primary focus at that time was on the responsibilities of companies toward their employees by establishing rules and guidelines that the employers would follow to warrant the safety of every working employee who worked for a particular company by mandating that certain actions be taken to ensure employees can be safe on the job. The main aim of the act was to improve the safety and physical working conditions in the United States for all employees. The progression of musculoskeletal injury prevention in the workplace is the next appropriate step to understanding the history of ergonomics.

OSHA Employee Standards

Currently, there are no mandated Occupational Safety and Health Administration (OSHA) standards for ergonomics and related musculoskeletal injury prevention in the workplace.[22] OSHA was officially established on April 28, 1971, with the goal and mission to ensure safe and healthy working conditions for men and women. The mission began by imposing standards and by providing training, outreach, education, and assistance for all workers. It was declared that every workers is entitled to safe and healthy working conditions, and that employers are responsible for handling unsafe work environments, sometimes leading to workers being free of work until working environments were safer and met the standards laid out for a safe workplace.[23] OSHA has standards that are divided into six domains: leverage and accountability, safety and health systems, employee rights, equal protection, framing, and infrastructure. Ergonomics and workplace safety aimed at injury prevention falls under safety and health systems.

The first employee standard aimed at preventing workplace injuries was the Right to Access Worker Medical and Exposure Records. This first step was important because it mandated that employers provide the worker and their doctors access to their medical records and exposure records, including injury logs with work-related musculoskeletal injuries so that the employee has an opportunity to seek care from a healthcare worker. By doing this task, the employer would be exposed if there was an abundance of injuries due to unsafe work environments.[22] The second employee standard aimed at musculoskeletal injury prevention was on July 1, 1991, when the state of California started the California Injury Prevention Program Rule. This rule was implemented and included written injury prevention techniques, including safe lifting and bending requirements, consistent breaks, safety meetings, and various other musculoskeletal injury prevention requirements.[24] More specifically related to ergonomics, California also adopted ergonomic standards on July 3, 1997. The ergonomic standards included: (a) work-related causation of repetitive motion injuries (RMIs), (b) identifying the cause of RMIs and job processes incurring the highest amount of recordable injuries, (c) medical requirements when someone is injured on the job, and (d) time requirements for reporting injuries to employers and for employers to report those injuries to OSHA.[24] Lastly on June 3, 2010, OSHA proposed an initiative to require employers to implement a systematic ergonomic program to help them uncover any safety and health hazards in their workplace and rectify them. California and Minnesota were the first two states to the lead the initiative by mandating this program within their respective states. Since that time, while there are another 13 states which have implemented the ergonomics standards, Pennsylvania is not one of them.[22] Since 2010, there have not been any additional OSHA employee standards relating to ergonomics and work-related injury prevention guidelines. This current report offers additional research supporting the need for

ergonomic standards that are nationally mandated for all 50 states.

Theoretical Framework

Because the goal is to find successful interventions that can be applied to a physical therapist's clinical practice, the knowledge translation theory was used for this investigation.[25] Knowledge translation theory is an appropriate theory for research in the healthcare field because the information that is acquired during the research process is now readily available for clinicians to use in their daily practice, regardless of the field. This theory applies concretely with the current study of retrospectively investigating OSHA data that looks at musculoskeletal injuries, productivity, absenteeism, and workers compensation premiums within the workplace before the consultation of ergonomics and after an ergonomics program or consultant has been implemented in the workplace. This theory is germane to the current report as physical therapists will then be able to take the results of this study and apply it while working in the field of occupational health. For physical the rapists that have decided to venture into small business development or entrepreneurialism, they will be able to use the results and outcomes of this report when speaking with employers about business opportunities. The knowledge translation theory is typically found in research involved in the healthcare field as it provides an efficient transition for the reader from the results and outcomes into daily clinical practice.[26] The following sections will discuss the current results of case studies, interventional studies, published literature reviews, systematic reviews, and meta-analyses.

Ergonomics and On-Site Physical Therapy in Literature Reviews, Systematic Reviews, andMeta-Analyses

The following section will review studies reducing workplace injuries through ergonomic measures where the primary healthcare provider was a physical therapist (Table 1). The next section will include three parts: (a) literature reviews, (b) systematic reviews, and (c) meta-analyses.

Literature Reviews

There have been three recent literature reviews that have investigated the effects of physical therapy delivered interventions on injuries in the workplace. First, Kim, Chong, and Hong[10] examined workstation modifications, postural training, ergonomic education, therapeutic exercises, and the effect on injuries. Thirty-six scholarly journals where a physical therapist was the primary provider of these interventions were included. Studies were excluded from the examination if their injuries were acute and did not occur at work. The researchers analyzed the studies and found that workstation modifications, ergonomic education, postural training, and therapeutic exercises had only short-term positive effects on the workers' pain and disability. The researchers concluded that ergonomics intervention and education amongst employees could be effective interventions for reducing injuries and pain. The researchers also concluded that there have not been enough high-quality, randomized control trials examining ergonomics on injuries and larger, more high-quality studies should be done to explore the effects of long-term outcomes.[10]

A second literature review was conducted by Chetty,[27] who investigated potential roles in the occupational health setting for physical therapists. There were 29 peer-reviewed studies included in this review, that were identified using BMJ journals, BioMed Central, PEDro, Google Scholar, PubMed, and Cinahl. EVIDEM framework was used to appraise the liability of the included studies. The researcher concluded that a physical therapist's role in occupational health could be multifactorial and include: (a) assisting human resources with case management, (b) pre-employment screenings, (c) ergonomic training, (d) on-site treatment of injured workers, (e) injury prevention techniques, and (f) return-to-work programs.

The last literature review investigated the role a physical therapist can have in the occupational health setting, specifically return-to-work programs[28]. The researchers used a stepwise process to identify studies that included a physical therapist providing the return-to-work training and coordination within each company to reduce injuries in the workplace. Researchers

identified 22 articles for inclusion using Medline and Cinahl search engines. The results of the 22 studies identified six domains in which physical therapists can assist in coordinating return-to-work performance: (a) workstation modifications and ergonomic training, (b) clinical screening of injured employees, (c) problem solving with each companies safety professionals, (d) workplace mediation between employees and employers, (e) knowledge of medical conditions within injured employees and (f) knowledge of costs associated with injuries in the workplace. The researchers concluded that physical therapists can play an essential role in coordinating return-to-work programs to reduce costs in the workplace.[28]

Systematic Reviews

There have been six recent systematic reviews that investigated the effects of physical therapists and ergonomics on overall injuries and costs in the workplace. First, a recent systematic review investigated the effectiveness of physical therapy delivered interventions to combat MSDs among employees with physically demanding work. A search was conducted in databases including PubMed and Web of Science Core Collection for English articles published from 1998 to 2018. The PICO question included randomized controlled trials (RCTs) and non-RCTs in which: (a) participants were adult workers with physically demanding work and MSDs (including specific and non-specific MSDs and musculoskeletal pain, symptoms, and discomfort), (b) ergonomic interventions were initiated and adapted in the physical demanding workplace, (c) a comparison group was included, and (d) an objective measure of musculoskeletal pain, symptoms, prevalence or discomfort was taken. The search of evidence from 54 highest and medium quality studies showed moderate evidence of a positive effect of physical exercise in combating injuries in the workplace. Within this domain, there was strong evidence of a positive effect of workplace strength training, which had the high statistical value. There was limited evidence for ergonomics and strong evidence for no benefit of participatory ergonomics, multifaceted interventions, and stress management. The review of studies did not reveal any negative results in the researched interventions combating MSDs. The authors concluded that implementing strength training at the workplace can reduce MSD among workers with physically demanding work environments and more quality research needs to be performed to identify a specific intervention that is best fit to reduce injuries in the workplace.[29]

Second, a systematic review investigating the effects of physical therapy delivered ergonomic interventions on pain and work-related musculoskeletal injuries in office workers was performed. The study was conducted based on the PICO format and included 15 randomized controlled trials where a physical therapist provided the ergonomic interventions to the employees. The inclusion criteria consisted of: (a) studies involving employees who work at a computer for 5 hours or more a day, (b) ergonomic interventions provided to employees involving computer workstations, (c) studies that included reducing work-related injuries as the researcher's primary outcome, and (d) RCTs. The results of this review showed that when physical therapy delivered ergonomic interventions were delivered to computer workers, they saw a statistically significant reduction in work-related injuries in the upper extremity, lower extremity, and spinal regions. The researchers noted that the primary limitation of these studies is a lack of studies investigating the long-term effects of ergonomic interventions. The researchers suggested that physical therapy delivered ergonomic interventions are effective in reducing work-related injuries amongst computer workers. More studies need to be performed to investigate the long-term effects of interventions and the relationship between ergonomics interventions on absenteeism and workplace productivity.[30]

Third, a systematic review was performed on physical therapy delivered ergonomic interventions and its effect on upper extremity injuries, pain, and lost work time among employees in any workplace setting. The inclusion criteria for the study included: (a) studies involved a physical therapist delivering the ergonomic intervention, (b) any workplace setting where an employee worked, (c) interventions as long as a physical therapist delivered them, and (d) outcomes that included pain and upper extremity injuries only. There were 36 studies included, and there was a mixed level of

evidence for physical therapy delivered ergonomics. The researchers concluded that moderate evidence showed that physical therapy delivered ergonomics interventions and workstation modifications were better at decreasing upper extremity pain and injuries versus workstation modifications alone. Researchers suggested that more high-quality research needs to be performed to make strong evidence-based suggestions about workplace interventions.[9]

Fourth, Tompa et al.[16] investigated the cost-effectiveness of ergonomic interventions in the workplace. Studies were included in this review if they met the following criteria: (a) studies performed after 1990, and (b) studies needed to be published in peer-reviewed journals. Studies were excluded if: (a) they involved a developing country as the participant population, (b) they were within the military healthcare system, and (c) the interventions only looked at costs instead of including health consequences of ergonomic interventions. To improve the systematic review's quality assessment, the researchers evaluated studies included in both the healthcare sector or the manufacturing and warehouse sector. The authors concluded that ergonomic interventions were cost-effective in the manufacturing and warehouse industry versus the healthcare sector.

A fifth systematic review performed by Leyshon et al[11] investigated the effects that ergonomic interventions had on work-related injuries. The authors also examined how these studies could establish a sound baseline for future studies in this area. The review consisted of 8 articles, all considered high quality, peer-reviewed studies by the authors. The researchers concluded that studies involved in this review showed insufficient to moderate evidence of ergonomic interventions and their effect on injuries in the workplace. The researchers suggested that more high-quality research needs to be performed to set a quality baseline for future research.

Last, Skamagki et al[15] investigated the outcome of ergonomic interventions in the workplace on chronic work-related injuries. The review consisted of 8 studies with the following inclusion criteria: (a) chronic conditions occurring at work, (b) participants in each study were between 18-68 years of age, (c) participants were both males and females, (d) specific therapeutic exercises needed to be presented, and (e) articles were published from 2008 to 2018. Studies were excluded from this review if employees encountered acute injuries; only chronic work-related injuries were included in this study. The researchers concluded that therapeutic exercise, specifically strengthening exercises, can be useful in treating chronic work-related injuries. The primary limitation of this review was the low number of quality studies investigating chronic conditions. Further research needs to be performed to draw more definitive conclusions about the effect ergonomic interventions have on treating and preventing chronic injuries in the workplace.

Meta-Analyses

To date, there has only been one meta-analysis performed on the effects of ergonomics on injuries when the interventions were applied to the employees by a physical therapist. A meta-analysis conducted by Chen et al.[3] investigated how physical therapy delivered ergonomic interventions affected neck pain among office workers. Articles for this review were found through Medline, Cinahl, PEDro, and Central databases. Items included in this analysis were: (a) RCTs (b) ergonomic interventions completed at the worksite rather than off-site, (c) employees complaining of neck pain, and (d) a control group with no interventions. After an analysis of 35 studies, 27 studies met the inclusion criteria. The interventions included in this study consisted of therapeutic interventions, hands-on therapy, and ergonomic education. The researchers found moderate evidence for therapeutic exercise and hands-on treatment at reducing neck pain in office workers. Insufficient evidence was found for ergonomic interventions that only addressed neck pain. The authors include in their discussion that generalizing the results to the population is difficult due to current research being limited.

Table 1. Summaries of the scholarly reports that were included in the literature review.

Author	Year	Study Type and Sample Size	Intervention(s)	Measurable Outcomes	Results
Kim, Chun, & Hong	2013	Literature review including 36 scholarly articles	Postural training, ergonomics education, and workplace modification	NA	Ergonomic interventions are effective in treating WMSDs.
Chetty	2013	Literature review including 29 scholarly articles	Workplace assessments, ergonomics education, and strengthening exercises	Visual Analog Scale (VAS), Oswestry Low Back	Physical therapists can be effective in reducing injuries through ergonomics education, workplace assessments, and strengthening exercises.
Shaw et al.	2008	Literature review consisting of 22 studies	Return-To-Work programs and ergonomics education as it pertains to the physical therapist role in the industrial workplace	NA	Researchers concluded that the role of the physical therapist involves 5 domains: (a) ergonomic training and workstation assessment, (b) employee interviews, (c) discussion of issues amongst employees, (d) discussing health concerns with management,

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					and (e) medical and musculoskeletal expert.
Sundstrup, Seeberg, Bengtsen, & Andersen	2020	Systematic review consisting of 54 RCTs and non-RCTs	Ergonomics interventions	VAS	The authors concluded that implementing strength training at the workplace can reduce MSD among workers with physically demanding work environments
Etuknwa & Humphries	2018	Systematic review consisting of 13 studies	Ergonomics education and workplace assessments	NA; studies only outcome measure was tracking MSDs	Ergonomics training and education are effective in reducing WMSDs and MSDs. It also helps mitigate risk of development of a musculoskeletal injury.
Kennedy et al.	2009	Systematic review consisting of 36 scholarly articles	Ergonomics education and workstation adjustment	Disabilities of the Arm, Shoulder, and Hand (DASH), VAS, and posture	Strong evidence that work injury preventions programs reduced injuries
Tompa, et al.	2010	Systematic review consisting of 35 studies	Ergonomics education	Recorded injuries and associated direct and indirect cost of each injury	Moderate evidence to show that an implementation of an ergonomics

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					program is cost effective in the industrial workplace.
Leyshon et al.	2010	Systematic review consisting of 8 studies	Ergonomics education	Visual Analog Scale (VAS) and recordable injuries	Insufficient to moderate evidence showing ergonomics is an effective tool at decreasing WMSDs.
Skamagki et al.	2018	Systematic review consisting of 12 studies	Strengthening exercises and ergonomic education	Visual Analog Scale (VAS), Work Ability Index, Disabilities of the Arm, Shoulder, and Hand (DASH)	Strengthening exercises and ergonomics education can decrease pain and injuries in the workplace.
Chen et al.	2018	Meta-analysis consisting of 27 randomized control trials (RCT)	Ergonomics education, stretching, and strengthening exercises	Visual Analog Scale (VAS), Feeling State Questionnaire, Borg CR10, Health Questionnaire Pain Index	There was moderate evidence to show that ergonomics education in addition to strengthening and stretching reduce pain in office workers who were symptomatic.

Review Summary

This review examined the literature on ergonomics intervention delivered by physical therapists and the effects on injuries, absenteeism, presenteeism, ergonomics, the OSHA employee standards, case studies and intervention studies, and meta-analyses, systematic reviews, and literature reviews. Based on a systematic search of the research literature, 10 reviews were included in this review. It included three literature reviews, six systematic reviews, and one meta-analysis. All papers that were included in this review of the literature had a physical therapist deliver the ergonomic intervention.

In conclusion, when ergonomic interventions were applied, employers saw decreased injuries, increased productivity, decreased costs associated with direct and

in-direct costs of work-related injuries, improvements in return-to-work performance, and decreased absenteeism in employees. However, as the interventions described in this report were generally found to be quite heterogeneous, it should also be recognized that general conclusions about the effectiveness of these interventions should be done with care. It is important to ensure that payers, employers and employees are aware of the crucial role physical therapists can play in occupational health. Physical therapists also need to advocate for their role in occupational health and offer expert care to workers in a non-traditional manner.

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